Submission No 8

DRIVERLESS VEHICLES AND ROAD SAFETY

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SUBMISSION TO THE STAYSAFE (ROAD SAFETY) COMMITTEE OF NSW.

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We are law researchers based at the Law Futures Centre and Urban Research Program at Griffith University. We are conducting an ongoing research project looking at the legal and regulatory challenges of light driverless vehicles.

In what follows we directly address Terms of Reference (ToR) 1, 2, 4 and 5.

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

1.1 We strongly believe that driverless vehicles technologies will deliver improved road safety outcomes.

1.2 The problem with a human driven motor vehicle is the human driving it. Humans get distracted,[3] they get drowsy,[4] they lose concentration,[5] they fall asleep,[6] they make mistakes,[7] they get overwhelmed,[8] and they differ in experience and ability.[9] In humans, 'measures of attention, reaction time, memory, executive function, mental status, visual accuity, and

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[3] Brueckner Amy, 'Distracted Driving: How Technological Advancements Impede Highway Safety' (2011) 115 *Penn State Law Review* 709., 711.
[4] Queensland University of Technology, *State of the Road: Sleepiness and Fatigue*, Centre for Accident Research No (2015). 1.
[5] Kaarin J Anstey, Joanne Wood, Stephen Lord, Janine G Walker, 'Cognitive, sensory and physical factors enabling driving safety in older adults' [45] (2005) 25(1) *Clin Psychol Rev* 45., 46-48.
[6] Queensland University of Technology, *State of the Road: Sleepiness and Fatigue*, Centre for Accident Research No (2015). 1.
[7] Miller C O, 'The Design-Induced Part of the Human Error Problem in Aviation' (1976) 42 *Journal of Air Law and Commerce* 119., 120-121.
[8] Klaus Bengler, Klaus Dietmayer, Berthold Färber, Markus Maurer, Christoph Stiller, Hemann Winner, 'Three Decades of Driver Assistance Systems: Reviews and Future Perspectives' (Pt Ingram Publishing) (2014) (Winter) *IEEE Intelligent Transportation Systems Magazine* 6., 12.
[9] Kaarin J Anstey, Joanne Wood, Stephen Lord, Janine G Walker, 'Cognitive, sensory and physical factors enabling driving safety in older adults' [45] (2005) 25(1) *Clin Psychol Rev* 45., 46-59.

physical function variables were associated with driving outcome measures'.[10] Vehicle control by human beings leads to potential errors at every stage.[11] According to Miller, the human:

> [P]erceives, decides, and reacts (or responds) based on current stimuli with subsequent behaviour also being a function of both memory (short and long term) and psycho-physiological capability … everything the [hu]man perceives, be it through a sensing process or through his memory, is a source of potential error.[12]

1.3 Combine these 'sources of error' with the control of a motor vehicle, travelling at high speed, weighing on average well over 1500 kilograms,[13] and it seems a recipe for disaster. Put 16 million vehicles on the roads,[14] and disaster becomes almost inevitable. The familiarity of motor vehicle use and resultant accidents tends to blunt the social and economic costs of having a mechanised transport system based around individual humans piloting heavy vehicles at high speeds.

1.4 Driverless vehicles are a core anticipated element of cooperative intelligent transport systems (C-ITS). C-ITS is the term describing technology that allows vehicles to communicate with each other and other transport infrastructure.[15] The roll out of C-ITS within transport infrastructure and vehicles is already underway.[16] The *National Road Safety Strategy 2011-2020* which was agreed to by the Commonwealth and all States and Territories expressly includes C-ITS as key technologies for creating a safer Australian road transport system.[17] The National Transport Commission has released in December 2013 a final policy paper endorsing C-ITS.[18]

1.5 Motor vehicle manufacturers have been installing C-ITS enabling technologies as original equipment in vehicles for some time. The now widespread availability in new vehicles of safety and convenience technologies such as adaptive cruise control, lane change warning/assistance, self-parking functions, electronic stability control, automatic braking and digital connectivity with mobile telephone and GPS networks forms much of the hardware for C-ITS. Given this significant momentum on the roll out of C-ITS technologies it is a

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[10] Ibid., 45.
[11] Miller C O, 'The Design-Induced Part of the Human Error Problem in Aviation' (1976) 42 *Journal of Air Law and Commerce* 119., 125.
[12] Ibid., 125, *Emphasis altered*.
[13] Patrick Blain, *Steel Perspectives for the Automotive Industry*, Organisation Internationale des Constructeurs d'Automobile No (2012). 1, 9.
[14] Australian Bureau of Statistics, Motor Vehicle Census, Australia, 31 Jan 2015, http://www.abs.gov.au/ausstats/abs@.nsf/mf/9309.0, accessed 21 October 2015.
[15] National Transport Commission, *Cooperative Intelligent Transport Systems: Final Policy Paper*, National Transport Commission (2013), 3.
[16] Michigan Department of Transportation and Center for Automotive Research, *International Survey of Best Practices in Connected and Automated Vehicle Technologies: 2013 Update*, Michigan Department of Transportation and Centrer for Automotive Research (2013).
[17] Australian Transport Council, *National Road Safety Strategy 2011-2020*, Australian Transport Council (2011), 19.
[18] National Transport Commission, above n 1. This policy paper emerged out of a consultation process begun by an earlier discussion paper. National Transport Commission, *Smart Transport for a Growing Nation Project: Exploring the Opportunities for Reform: Discussion Paper*, National Transport Commission (2011).

small jump to go from C-ITS enabled vehicles to driverless vehicles. Nissan and General Motors have both pledged to release fully driverless cars to market by 2020[19] and Volkswagen has announced that the 2016 Audi A8 limousine will have quasi-driverless mode.[20]

1.6 This drive towards driverless vehicles is driven by a recognition that current human driven vehicles come with significant safety, economic and environmental costs. Humans make mistakes and have slower reaction times and cannot as effectively process immediate sensory data with broader level data as it is claimed intelligent systems can.[21] By addressing the limitations of human drivers, proponents for driverless vehicles promise improved safety outcomes for drivers and other road users.

1.7 Driver related factors (inattention, distraction, risk-taking, drugs and alcohol, inexperience) are the major cause of road accidents in Australia.[22] For 2011 the Centre for Road Safety determined that driver factors were present in 7,725 of accidents in New South Wales, while mechanical factors were only present in 886.[23] Road accidents remain a major killer and cause of injury in Australia. In 2012 there were 1,300 fatalities on Australian roads.[24] In the latest report by the Australian Institute of Health and Welfare, 53,406 Australian were hospitalised due to vehicle accidents in 2008-09[25] In Queensland in 2012 there were 280 fatalities and 6,328 hospitalisations due to road traffic accidents.[26] It is by

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[19] 'General Motors Hits the Accelerator on Driverless-car Technology', *The Australian* (Sydney), 29 August 2013 available at http://www.theaustralian.com.au/news/world/general-motors-hits-accelerator-on-self-driving-car-technology/story-e6frg6so-1226706500991?nk=4eebaeb7595fc4c5da2cb108e4970d2c (last accessed 27 April 2016); 'Nissan to Make Driverless Cars by 2020', *The Australian Financial Review* (Sydney), 28 August 2013 available at http://www.theaustralian.com.au/business/latest/nissan-to-make-driverless-cars-by-2020/story-e6frg90f-1226705460560 (last accessed 27 April 2016).

[20] Joshus Dowling, 'Automated Cars: Ready when you Are', *Carsguide*, *Courier Mail* (Brisbane), 11 January 2014, 3. See further Stephen P Wood et al, 'The Potential Regulatory Challenges of Increasingly Autonomous Vehicles' (2012) 52 *Santa Clara Law Review* 1423, 1428-1434; Jeffrey K Gurney, 'Sue My Car Not Me: Product Liablity and Accidents Involving Autonomous Vehicles' [2013] *Journal of Law, Technology and Policy* 247, 247-52.

[21] Thorsten Luettel, Michael Himmelsbach and Hans-Joachim Wuensche, 'Autonomous Ground Vehicles-Concepts and a Path to the Future' (2013) 100(Centennial-Issue) *Proceedings of the IEEE* 1831..;Dorothy J Glancy, 'Autonomous and Automated and Connected Cars - Oh My: First Generation Autonomous Cars in the Legal Ecosystem' (2015) 16(2) *Minnesota Journal of Law, Science and Technology* 619.

[22] Judy J Fleiter, Ioni M Lewis and Barry C Watson, 'Promoting a More Positive Traffic Safety Culture in Australia: Lessons Learnt and Future Directions' (2013) *Australasian College of Road Safety Conference* Adelaide, 6-8 November 2013.
November, 2013; Vanessa Beanland et al, 'Driver Inattention and Driver Distraction in Serious Casualty Crashes: Data from the Australian National Crash In-depth Study' (2013) 54 *Accident Analysis and Prevention* 99.

[23] Centre for Road Safety, *Road Traffic Crashes in New South Wales: Statistical Statement for the Year Ended 31 December 2011* Transport for New South Wales (2012), table 12.

[24] Transport and Regional Economics Bureau of Infrastructure, *Road Death Toll Australia Decemember 2012*, Bureau of Infrastructure, Transport and Regional Economics (2013).

[25] Australian Institute of Health and Welfare, Injury Research and Statistics Series, *Serious Injury due to Land Transport Accidents, Australia 2008-09*, Australian Institute of Health and Welfare No 67 (2012).

[26] Department of Transport and Main Roads, *Queensland Road Safety Action Plan 2013-2015*, Department of Transport and Main Roads (2013), 4.

offering the possibility of reducing driver factors as a cause of road accidents that is particularly motiving the development of the technologies.[27] 3

1.8 In Australia, the number of road fatalities has plateaued over the past decade at around 1300 people killed each year.[28] Additionally, almost 35,000 people sustained serious and life threatening injuries due to road accidents in 2012, with the trend steadily increasing.[29] The annual cost of motor vehicle collisions in Australia has been estimated at $27 billion.[30] Although the number of fatalities has levelled out, there has been a rise in the rate of serious and life-threatening injuries requiring hospitalisation over the same period.[31]

1.9 Improvements in road design,[32] public education campaigns,[33] and changes in driver attitude around dangerous driving practises, like speeding and drink driving,[34] and the inclusion of passive safety systems within vehicles,[35] have reduced but not eliminated accidents on the road.[36] In a context where one death, or one accident causing injury, is one too many on the roads,[37] the ongoing unacceptable social cost of the human driven vehicle system has led to calls for the implementation of safer vehicle systems in Australia.[38] Having significantly addressed the accident causing factors of road design, passive vehicle safety and preventable risky behaviour, accidents are still happening because of human fallibility.[39] In this context, the obvious next step is to eliminate the driver.[40]

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[27] National Transport Commission, above n 1, 1-2; James M Anderson et al, *Autonomous Vehicle Technology: A Guide for Policymakers* (Rand Corporation, 2014), 12-16.
[28] National Transport Commission, *Cooperative Intelligent Transport Systems - Final Policy Paper* National Transport Commission No (2013). 1.
[29] Transport and Regional Economics Bureau of Infrastructure, *Road Trauma Australia 2014 Statistical Summary*, Bureau of Infrastructure, Transport and Regional Economics Department of Infrastructure and Regional Development No (2014). 1; National Transport Commission, *Cooperative Intelligent Transport Systems - Final Policy Paper* National Transport Commission No (2013). 2.
[30] National Transport Commission, *Cooperative Intelligent Transport Systems - Final Policy Paper* National Transport Commission No (2013). 1.
[31] Transport and Regional Economics Bureau of Infrastructure, *Impact of road trauma and measures to improve outcomes*, Department of Infrastructure and Regional Development No 140 (2014). 13.
[32] Jessica Edquist, Rudin-Brown, Christina M, Lenne', Michael G, *Road Design Factors and their Interaction with Speed Limits*, Monash University Accident Research Centre No (2009). 3-24.
[33] Australian Transport Safety Bureau, *Road Safety in Australia: A Publication Commemorating World Health Day 2004*, Australian Transport Safety Bureau No (2004). 38.
[34] Ibid. 125-126.
[35] See generally, Klaus Bengler, Klaus Dietmayer, Berthold Färber, Markus Maurer, Christoph Stiller, Hemann Winner, 'Three Decades of Driver Assistance Systems: Reviews and Future Perspectives' (Pt Ingram Publishing) (2014) (Winter) *IEEE Intelligent Transportation Systems Magazine* 6..
[36] Transport and Regional Economics Bureau of Infrastructure, *Impact of road trauma and measures to improve outcomes*, Department of Infrastructure and Regional Development No 140 (2014). 8-14.
[37] Australian Transport Safety Bureau, *Road Safety in Australia: A Publication Commemorating World Health Day 2004*, Australian Transport Safety Bureau No (2004). 8.
[38] National Transport Commission, *Cooperative Intelligent Transport Systems - Final Policy Paper* National Transport Commission No (2013). 1.
[39] Anna Devlin, Candappa, Nimmi, Corben, Bruce, Logan, David, *Designing Safer Roads to Accommodate Driver Error*, Curtin - Monash Accident Research Centre No (2011). 21.
[40] Dr. Sven A Beiker, 'Legal Aspects of Autonomous Driving: The need for a legal infrastructure that permits autonomous driving in public to maximize safety and consumer benefit.' [1145] (2012) 52 *Santa Clara Law Review* 1145., 1146.

1.10 Driverless vehicles remove the driver from the equation, and have the potential to perform, 'at safety levels significantly higher than human drivers'.[41] An driverless vehicle is defined as 'a vehicle that includes a set of technologies allowing it to perform complex mobility tasks with little or no human intervention'.[42] In the United States there has been extensive development of driverless vehicle technology,[43] and policy,[44] over the last several years. Legislators have now begun to prepare for the arrival of driverless vehicles, [45] with safety as their main concern.[46]

1.11 Proponents claim that driverless vehicles have the ability to, 'dramatically improve safety, efficiency and mobility' of transportation, [47] and to 'significantly reduce property damage, injuries, and casualties'.[48] It has been suggested that driverless vehicles will create a situation where, 'artificial intelligence acts on behalf of a human with life or death consequences'.[49] However, the automation of the motor vehicle is not sudden technological innovation,[50] but must be seen as the next step in a long technological process where, in the name of safety,[51] intelligent systems intervene between the driver's kinetic inputs into the control and the vehicles response.[52]

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[41] Klaus Bengler, Klaus Dietmayer, Berthold Färber, Markus Maurer, Christoph Stiller, Hemann Winner, 'Three Decades of Driver Assistance Systems: Reviews and Future Perspectives' (Pt Ingram Publishing) (2014) (Winter) *IEEE Intelligent Transportation Systems Magazine* 6., 10.

[42] Dana Sanchez, *Collective technologies: autonomous vehicles*, Australian Council of Learned Academies No (2015). 4.

[43] Andrew P Garza, '"Look Ma, No Hands!": Wrinkles and Wrecks in the Age of Autonomous Vehicles' [581] (2012) 46 *New England Law Review*.581, 587-588; Matthew & Lu Michaels Moore, Beverly, 'Autonomous Vehicles for Personal Transport: A Technology Assessment' (Pt SSRN) (2011) *Social Science Research Network*.1, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1865047, accessed 15 October 2015; Frank Douma & Ify Onyiah Adeel Lari, 'Self-Driving Vehicles and Policy Implications: Current Status of Autonomous Vehicle Development and Minnesota Policy Implications' [735] (2015) 16(2) *Minnesota Journal of Law Science & Technology* 735.735; Jamie Patrick Hopkins Sophia H. Duffy, 'Sit, Stay, Drive: The Future of Autonomous
Car Liability' [453] (2013) 16 *SMU Science and Technology Law Review* 453.453, 453-456.

[44] See generally, Andrew R Swanson, '"Somebody Grab the Wheel!": State Autonomous Vehicle Legislation and the Road to a National Regime' [1085] (2013-2014) 97(4) *Marquette Law Review*.1085.

[45] Roseman Rachael, 'When Autonomous Vehicles Take Over the Road: Rethinking the Expansion of the Fourth Amendment in a Technology-Driven World' [1] (2013-2014) 20(1) *Richmond Journal of Law & Technology* 1.1, 11-14.

[46] Andrew R Swanson, '"Somebody Grab the Wheel!": State Autonomous Vehicle Legislation and the Road to a National Regime' [1085] (2013-2014) 97(4) *Marquette Law Review*.1085, 1108.

[47] Dr. Sven A Beiker, 'Legal Aspects of Autonomous Driving: The need for a legal infrastructure that permits autonomous driving in public to maximize safety and consumer benefit.' [1145] (2012) 52 *Santa Clara Law Review* 1145.1145, 1146.

[48] Ibid.1145, 1150.

[49] Ibid.1145, 1152.

[50] Kyle Graham, 'Of Frightened Horses and Autonomous Vehicles: Tort Law and its Assimilation of Innovations'ibid. 1241., 1242.

[51] Gary E Marchant and Rachel A Lindor, 'The Coming Collision Between Autonomous Vehicles and the Liability System' [1321]ibid. 1321.1321, 1330; see also, Klaus Bengler, Klaus Dietmayer, Berthold Färber, Markus Maurer, Christoph Stiller, Hemann Winner, 'Three Decades of Driver Assistance Systems: Reviews and Future Perspectives' (Pt Ingram Publishing) (2014) (Winter) *IEEE Intelligent Transportation Systems Magazine* 6..

[52] Klaus Bengler, Klaus Dietmayer, Berthold Färber, Markus Maurer, Christoph Stiller, Hemann Winner, 'Three Decades of Driver Assistance Systems: Reviews and Future Perspectives' (Pt Ingram Publishing) (2014) (Winter) *IEEE Intelligent Transportation Systems Magazine* 6., 7.

1.12 An example of how driverless vehicles will be safer than a human driven vehicle is crash avoidance. This builds upon existing C-ITS enabling technologies of forward collision avoidance technologies (FCAT)[53] to ideally make vehicles un-crash-able. A basic technical element of C-ITS is that each vehicle will broadcast a shortwave identification code concerning the vehicle's speed and direction (Figure 1).[54] This signal will be read by other vehicles and the transport infrastructure. In the C-ITS literature the communication between vehicles is called V2V communication; the communication between vehicles and infrastructure V2I.[55] If two C-ITS vehicles are approaching a blind intersection in such a manner that human drivers would not have sufficient visibility to avoid an accident, the V2V technologies would register the other vehicle before it is visible and alert the human driver of an imminent accident. If one of the vehicles was driverless the vehicle could take direct evasive action without human intervention.

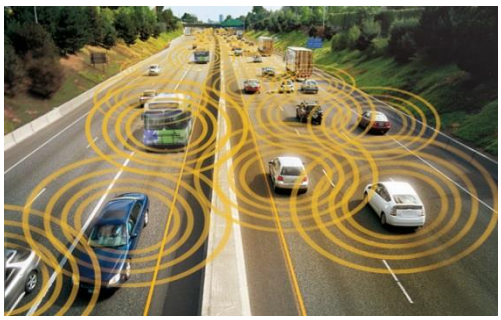

Figure 1: C-ITS Shortwave Broadcasting. Source US Department of Transport 2014[56]

1.13 Driverless vehicles are the next step in road safety. By bringing together active safety systems that replace human driving of a vehicle it is expected that the road toll and the frequency of accidents will significantly decline. This is not to suggest that this technology will be perfect. There will be errors and malfunctions in the working of the driverless hardware and software that will result in accidents. [57] The Victorian Inquest into the death of Melissa Ryan, while finding the VW was not liable for the failure of the gearbox, provides an example of how malfunctions with complex electronic-mechanical systems can result in fatalities.[58] By reducing the possibility for humans factors, that caused the overwhelming number of accidents, driverless vehicles will save lives and make NSW roads safer.

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[53] R W G Anderson et al, *Potential Benefits of Forward Collision Advoidance Technologies*, Centre for Automotive Safety Research No CASDR0106 (2012)..

[54] National Transport Commission, *Cooperative Intelligent Transport Systems: Final Policy Paper*, National Transport Commission No (2013)., 7.

[55] Michigan Department of Transportation and Center for Automotive Research, *Connected Vehicle Technology Local Govenment Delphi Study*, Michigan Department of Transportation and Centrer for Automotive Research No (2012)., 10.

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[57] Sophia H Duffy and Jamie Patrick Hopkins, 'Sit, Stay, Drive: The Future of Autonomous Car Liablity' (2013) 16(3) *SMU Science and Technology Law Review* 453..

[58] *Inquest into the Death of Melissa Ryan* [2013] 0418 / 2011.

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

2.1 We have focused on the impact of driverless vehicles on New South Wales' road rules in the *Road Rules 2014* (NSW).

2.2 Analysis of the impacts of driverless vehicles on road safety policies and regulations requires concepts of driverless vehicles technology. The National Transport Commission has recently suggested that this analysis in Australia should follow the SAE. The SAE sets out 5 levels of automation (see figure 2 below). In what follows we focus on the adaptability of the existing New South Wales road rules to level 3, 4 and 5 vehicles.

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**	-	

2.3 New South Wale's road rules are based on the model Australian Road Rules,[59] as maintained by the National Transport Commission. The rules are generally the same in each state and territory.[60]

2.4 The key principal in the *Road Rules* is that there is a person in control of a vehicle.

2.5 The *Road Rules* make a distinction between 'vehicles' and 'drivers.' Vehicles are defined as including motor vehicles, bicycles or animal-drawn vehicles.[61] What is a 'motor vehicle' is 'a vehicle (other than a bicycle) that is built to be propelled by a motor that forms part of the vehicle'.[62] In NSW, drive is defined as:

> in control of the steering, movement or propulsion of a vehicle, and (b) in relation to a trailer, draw or tow the trailer, and (c) ride a vehicle.[63]

Person' is not defined, though 'driver', 'rider' and 'pedestrian' and passenger are defined as 'persons' in the *Road Rules*.[64] New South Wales law provides little guidance on what or who is a 'person.' The *Interpretation Act 1987* (NSW) sheds no light on the previously unneeded to be articulated assumption that person in the Road Rules refers to a human.

2.6 The other material term is the verb 'drive/driving.' The *Road Transport Act 2013* (NSW) defines driving as including 'be in control of'.[65] This points to what might seem an obvious relationship that lies at the core of the *Road Rules*. The driver (human) is the active agent, 'in control of' (driving) a passive object (the vehicle).[66] This is exactly the relationship that underpins and is manifested by specific rules. The rules apply to the driver. For example Part 3 which establishes speed limits: 'A driver must not drive at a speed over the speed limit applying to the driver for the length of road where the driver is driving'[67] It is the driver who is the active agent. This is reinforced by r 348 that directly connects the vehicle's movements to the driver's doing.[68]

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[59] *Road Rules 2014* (NSW) ss 7, 9, 10.
[60] Paula Quinn, 'It's Green for Queensland's New Traffic Laws' (1999) 19(11) *Proctor* 14-16. Most Australian jurisdictions have enacted the model road rules directly. This means that the text of the rules and even their numbering is common between Queensland, Commonwealth, New South Wales, Victoria, Tasmania and South Australia. See *Australian Road Rules Regulations 2006* (Cth); *Australian Road Rules 2014* (SA); *Road Rules 2014* (NSW); *Road Safety Rules 2009* (Vic); *Road Rules 2009* (Tas). In the Australian Capital Territory and the Northern Territory the Australian Road Rules are expressly adopted by the *Road Transport (Safety and Traffic Management) Regulations 2000* (ACT) and the *Traffic Regulations 1999* (NT). The only jurisdiction where the road rules are not directly based on the Australian Road Rules is Western Australia. See *Road Traffic Code 2000* (WA).
[61] *Road Rules 2014* (NSW) Dictionary.
[62] *Road Rules 2014* (NSW) Dictionary.
[63] *Road Transport Act 2013* (NSW) s4.
[64] *Road Rules 2014* (NSW) rr 14-19; *Road Transport Act 2013 (NSW) s4*.
[65] *Road Transport Act 2013 (NSW) s4*.
[66] Douglas Brown, *Trafic Offences and Accidents* (LexisNexis Butterworths, 2006), 5.
[67] *Road Rules 2014* (NSW) r 20.
[68] *Road Rules 2014* (NSW) r 348.

2.7 The leading Australian authority on what amounts to being a driver driving is the Victorian decision of *Tink v Francis*.[69] Having indicated that it a question of fact, Young CJ explained that:

> The question whether a person in given circumstances is driving the car will often turn on the extent and degree to which the person was relying on the use of the driver's controls…The ordinary meaning to be attached to the word 'drives' when applied to a motor car should, I think, embrace the notion of some control of the propulsive force which, if operating, will cause the car to move.[70]

This decision authorises a pragmatic approach to determining the identity of the driver who is driving a vehicle which involves factual considerations relating to responsibility for the primary controls, the steering, the accelerator and the brake.[71]

2.8 In the context of a level 5 automatous vehicle where intelligent systems are controlling the primary controls it would mean that the underlying assumption in the *Road Rules* of human controlling a vehicle would be negated. Humans occupants in true driverless vehicles would be passengers and very little of the existing *Road Rules* would apply them except the provisions about seatbelts[72] and traveling in a part of the vehicle not designed for the carriage of passengers.[73] The 'driver', the entity that satisfies the definition of 'in control of' the primary controls would be the vehicle itself. As such it would be expected that the substantive content of the *Road Rules* would become directly programed into the vehicle. The *Road Rules* as they are currently now known, cease being laws directed to humans but become encoded as software dictating how driverless vehicles should navigate the transport network. Indeed, there is little reason in a fully mature automated traffic network for individual vehicles to behave according to the current *Road Rules*. In a network where there is constant communication between vehicles and the road infrastructure there would be no need for traffic lights, stop signs, giving way to the right, keeping to the left, or lane markings. Vehicles could be managed so that they seamlessly integrate into a constant flow of traffic and decisions about priority could be made continuously on vehicle metrics (speed, direction, and destination) and the immediate conditions, rather than the formal hierarchies and turn-taking in the underpin the current *Road Rules*.

2.9 Level 5 vehicles suggest the possible end of the *Road Rules* as they have been known. All the law and regulation around persons driving could be superseded. However, how level 3 and 4 vehicles would engage with the Road Rules is less clear. With such vehicles there would still be a 'driver' as anticipated by the Road Rules as a human occupying the driver's seat with direct responsibility for some of the primary controls, and/or supervising the vehicle and able to resume control of the vehicle. There are two issues.

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[69] [1983] 2 VR 17.
[70] Ibid 19 (Young CJ).
[71] Douglas Brown, *Trafic Offences and Accidents* (LexisNexis Butterworths, 2006), 5., 6.
[72] *Road Rules 2014* (NSW) r 264.
[73] *Road Rules 2014* (NSW) rr 268, 268-1, 268-2, 268-3, 268-4.

2.10 The first issue is where due to automation specific decisions about the vehicle are not attributable to the 'driver.' Take for instance a level 3 or 4 vehicle that executes an emergency stop due to an unexpected hazard. Such a situation would not be unusual; for example the vehicle is in congested traffic and has been placed into a 'traffic jam assist' driverless mode where the vehicle tracks the vehicle in front and if that vehicle brakes suddenly the driverless vehicle would halt. As a level 3 or 4 system the 'driver' would not be required to resume control of the vehicle and could have their entire attention on another activity. However, the sudden stop might have put the vehicle into a breach of the Road Rules; for example halted it in a blocked intersection. Regulation 128 concerning entering a blocked intersection is precise: 'A driver must not enter an intersection if the driver cannot drive through the intersection because the intersection, or a road beyond the intersection, is blocked.'[74] It is not the vehicle that is regulated, but the 'driver.' In this situation the human 'driver' was not driving the vehicle; they did not make the decision to 'drive through the intersection.' The entity that was 'in control of' the vehicle in making the decision to enter the blocked intersection was the vehicle itself. The vehicle cannot be assumed to the driver under the Road Rules as only 'persons' can be drivers.

2.11 The second issue is the reverse. It is a possibility that when a driver engages driverless functions they have breached r 297(1) of the *Road Rules*.[75] Rule 297(1) states that a 'driver must not drive a vehicle unless the driver has proper control of the vehicle.'[76] There is little guidance on what is 'proper control.' In *Mylrea v Nye* driving a vehicle into an area where the driver had no visibility was considered a failure to exercise proper control of the vehicle.[77]

2.12 Like other provisions of the *Road Rules* r 297(1) presents a pragmatic requirement determined by the specific facts. As such a driver in a level 3 or 4 vehicle operating in driverless mode might be seen as not in proper control of the vehicle as they might not be in physical contact with the primary controls or keeping the same level of attention on the road and surround traffic as would be required with a normal vehicle. Operating a level 3 and 4 driverless vehicle would mean that the 'driver' would not be exercising the same level of 'due care and attention' as a driver of a normal vehicle. If such interpretations are placed on r 297 then it could act as an obstacle to the use of level 3 and 4 driverless vehicles in New South Wales.

2.13 Another area where driverless vehicles might impact the *Road Rules* are the rules around driver distraction. Rule 300 deals directly with distraction by prohibiting the holding of mobile phone handsets by drivers while the vehicle is moving or stationary but not parked.[78] This provision is technologically limited in that it concerns only 'mobile phones.' It does not regulate distraction directly, instead the prohibited act is the physical action of holding a

[74] *Road Rules 2014* (NSW) r128.
[75] *Road Rules 2014* (NSW) r 297(1).
[76] *Road Rules 2014* (NSW) r128.
[77] *Mylrea v Nye* (1996) 24 MVR 561, 562 (Demack J). Some caution is needed with this decision as it was not directly on r 297 rather the comments on what amounts to 'proper control of a vehicle' were in the context of civil liability.
[78] *Road Rules 2014* (NSW) r 300(1).

phone by the driver while driving. It is an example of a technological dependent rule – by naming a specific technological object it faces future obsolescence when that object is superseded.[79] This means it does not cover distraction from C-ITS and driverless vehicle systems. It could be argued that distraction caused by C-ITS and driverless vehicle systems might be covered by r 297 in that it could be argued that a distracted driver is not in 'proper control' of the vehicle. Furthermore, where the consequences of a driver's distraction results in the vehicle becoming dangerous, criminal law provisions can be seen to apply.

2.14 This ignores that it might be safe for a driver to be distracted while in a driverless vehicles; particularly a level 4 or 5 vehicle. An attraction for drivers in adopting driverless vehicles is to allow them time to be distracted while the vehicle is in motion. Potentially, a driver in a level 5 vehicle reading a book or using a tablet computer is not in breach of r 297 but would be in breach of r 300 if they touched their phone handset. It does not seem consistent that using a tablet in a level 5 vehicle might be acceptable but a mobile phone is not.

2.15 In summary the roll out of Level 5 driverless vehicles possibly spells the end of the *Road Rules*. However, that is some way off (although see our comments regarding ToR 5). The more immediate concerns are the challenges posed by level 3 and 4 vehicles. There is an anomaly that action by a level 3 or 4 vehicle in driverless mode falls outside of the *Road Rules*. There is also the possibility that the 'proper control' of a vehicle provision in r 297 could be interpreted as prohibiting use of level 3 and 4 driverless functions.

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

4.1 There has been some reform in Australia and overseas in adopting and adapting to driverless vehicle technology.

4.2 In Australia South Australia has introduced the *Motor Vehicles (Trials of Automotive Technologies) Amendment Bill 2015* (SA) to amend its *Motor Vehicles Act 1959* (SA). This reform does not deal with the private use of driverless vehicle technology on the public roads, rather it deals with trials and ensuring that experimental driverless vehicles are under the civil motor vehicle liability scheme.[80]

4.3 Nevada was the first jurisdiction in the United States to legislate for driverless vehicles in 2011.[81] This legislation, along with similar legislation enacted by Florida in 2012[82] and

[79] Lyria Bennett Moses, 'Recurring Dilemmas: The Law's Race to Keep Up with Technological Change' (2007) 7 *Journal of Law, Technology and Policy* 239, 270.
[80] *Motor Vehicles (Trials of Automotive Technologies) Amendment Bill 2015* (SA).
[81] A.B. 51 (Nev. 2011) *codified in* Nev. Rev. Stat. § 482A (2014); Danielle Lenth, 'Chapter 570: Paving the Way for Autonomous Vehicles' (2013) 44 *McGeorge Law Review* 787.
[82] H.B. 1207 Fla, 2012 Leg. (Fla. 2012), *codified in* Fla. Stat. Chs. 316, (2014).

California 2012[83]is, like the South Australian bill, addressed primarily to the development and testing of driverless vehicles on public roads.[84] The Nevada law expressly includes the requirement that there is a human occupant in the vehicle capable of assuming control[85], mandates that entities wishing to test driverless vehicles deposit a bond with the state[86], and specifies the issuing of special licence endorsements for operators of driverless vehicles.[87] What is clear from this legislation, and the similar laws passed by other US states, is that with the provisions regarding a human occupant there is a strong reluctance of the US legislatures to allow for level 5 vehicles.

4.4 Reform in Europe has been more limited. The UK government has announced driverless vehicle trials but no substantive legislative reform agenda has been publicised.[88] One of the issues for reform in this area in Europe is that most European nations have ratified the 1949 Geneva Convention of Road Traffic and the 1968 Vienna Convention on Road Traffic. The Geneva Convention specifies that vehicles should have a drivers who 'shall at all times be able to control their vehicles'[89] while the 1968 Vienna Convention requires that 'every moving vehicle shall have a driver' and the driver shall 'possess the necessary physical and mental ability and be in a fit physical and mental condition to drive.'[90] There has been some movement within Europe, spearheaded by the United Nations Economic Commission for Europe (UNECE) on a harmonised response to driverless vehicles; including possible amendments to the Road Traffic treaties.[91]

4.5 What these 'testing' reforms have identified was the need for a clearer set of definitions around driverless vehicles. The California legislation defines 'autonomous vehicles' as a vehicle equipped with 'autonomous technology' 'capable to drive a vehicle without the active physical control or monitoring by a human operator'[92] and level 1 vehicles are expressly excluded from the definition of driverless vehicle.[93] 'Human operator' is further defined as the person who is seated in the driver's seat, or if there is no person in the driver's seat,

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[83] S.B. 1298 (Cal. 2012) *codified in* Cal. Veh. Code div. 16.6, § 38750

[84] Bryant Walker Smith, 'Automated Vehicles are Probably Legal in the United States' (2014) 1*Texas A&M Law Review* 411, 500-8.

[85] Nev. Rev. Stat. § 482A.070 (2014).

[86] Ibid § 482A.060 (2014).

[87] Ibid § 482A.200 (2014).

[88] 'UK to allow driverless cars on public roads in January' 30 July 2014 available at http://www.bbc.com/news/technology-28551069 (last accessed 17 March 2016); Parliamentary Office of Science and Technology, 'Autonomous Road Vehicles' (September 2013) 443 *Postnote* 1; Department of Transport, 'Driverless Cars: Regulatory Testing Framework' https://www.gov.uk/government/consultations/driverless-cars-regulatory-testing-framework (last accessed 17 March 2016).

[89] *Convention on Road Traffic*, opened for signature 19 September 1949, 125 UNTS 3 (entered into force 26 March 1952) art 8(5).

[90] *Convention on Road Traffic*, opened for signature 8 November 1968, 1042 UNTS 17 (entered into force 21 May 1977) art 8(1), (3). See National Transport Commission, above n 6, 26.

[91] United Nations Economic Commission for Europe, *Road Map for Promoting ITS 20 Global Actions 2012 - 2020*, United Nations Economic Commission for Europe No (2012). Available at http://www.unece.org/fileadmin/DAM/trans/publications/ITS_for_Sustainable_Mobility_Road_Map.pdf (last accessed 17 March 2016).

[92] Cal. Veh. Code div. 16.6, §§ 38750(a)(1)(A).

[93] Ibid §§ 38750(a)(1)(B).

causes the driverless technology to engage.'[94] One particular reform adopted in Nevada has been the changing of the distraction by mobile phone rule to allow drivers in level 3 vehicles to use mobile phones while the vehicle is in driverless mode.[95]

4.6 The international experience does provide New South Wales with guidance for the adaption and adoption of driverless vehicles. First, the inclusion of the Californian definitions could address the problem in *Road Rules* of the relation between 'driver' and 'vehicle' for driverless vehicles. Californian law defines the person who engaged the driverless function as the 'human operator' and then includes the human operator in the definition of driver. Such a change could achieve two outcomes. The first is that it would allow a driver who engages driverless mode on a level 3 or 4 vehicle to be regarded as in control of the vehicle. This would avoid the strict application of r 297(1) that possibly prohibits the use of driverless functions of a level 3 or 4 vehicle. Second, it could remove the anomaly regarding a breach of the *Road Rules* by a level 3 or 4 driverless vehicle in that the human occupant, having engaged driverless mode, would still be deemed the 'driver.' This would ensure that the occupant retains sufficient awareness of the vehicles progress to intercede if the vehicle seems about to breach a road rule.

4.7 Distraction is an obvious issue for driverless vehicles. As vehicles increasingly become automated, the scope for a driver to safely be distracted – not giving their full and proper attention to the vehicle's primary control – increases. This is what Nevada recognised in exempting operators of level 3 and 4 vehicles from the equivalent of r 300.

4.8 However, no jurisdiction has yet come to a reckoning with level 5 driverless vehicles. The US reforms, by mandating a human occupant capable of gaining control of the vehicle, essentially prohibits level 5 automation. The South Australian bill does allow the testing of level 5 vehicles but only with specific Ministerial permission.[96] Potentially in New South Wales there is no immediate obstacle in the road law to having a level 5 vehicle on the roads. Formally vehicles and drivers are separate entities and there is no general provision that only allows vehicles with drivers on the roads. As there is no 'driver', as understood as a human in control of the vehicle, it is arguable that the *Road Rules* do not apply. This would be an untenable situation as common sense requires level 5 vehicles to act in a predictable manner in accordance with the substantive provisions of *Road Rules*. Adoption of the US definition of driver to include an operator who has put an driverless vehicle in motion could address this concern. In this circumstance the occupant would still be liable if the driverless vehicle breached the *Road Rules*. This would ensure that users of driverless vehicles will expect that the vehicle is programmed in accordance with the New South Wales law.

4.9 In summary dilemma of 'human control' for the *Road Rules* as we have identified in response to ToR 2 *can* be easily remedied at this preliminary adoption stage by following the US amendments. Adoption of this amendment would conceivably update the Australian Road Rules for driverless vehicle without any further widespread changes

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[94] Ibid §§ 38750(a)(4).
[95] Nev. Rev. Stat. § 482A.165(7).
[96] *Motor Vehicles (Trials of Automotive Technologies) Amendment Bill 2015* (SA) s 134D.

5. Other related matters.

5.1 Based on the exceptionally rapid development and deployment of technology, the availability for mass adoption of fully driverless vehicles is potentially closer than many commentators suggest. We suggest that the emergent period of quasi-driverless vehicles will be very limited. Potentially it would be better to focus on roll out of fully driverless vehicles, with a very narrow time period beginning now as the technology becomes commercialised – in which case the regulatory focus is on these vehicles as an exception to existing regulation. To a period of a mixed fleet where the issue would be having to deal with human driven and driverless vehicle interaction and the maintenance of human driven vehicle regulation and schemes in parallel to driverless vehicle regulation. Finishing with a mature driverless vehicle fleet where the norm would be driverless vehicle with human driven vehicles as an exception. Instead of levels of autonomy as a primary lens for thinking regulatory response, the focus should assume the apex technology of fully driverless and then look at the regulatory challenges and demand as driverless vehicles replace human driven vehicles.

5.2 One point that should be addressed is the projection for the intermediate period of needing to regulate and deal with a mixed fleet. Past research into the diffusion of motor vehicle technology has 30 years as the window for initial availability to market to 90%+ of the vehicle fleet with that technology.[97] This research tends to be based on the historical diffusion rates for seatbelts. We question the applicability of this research to estimates of the intermediate period of a mixed fleet. We believe that the significant reduction of the comparative cost of vehicles in Australia (compared to the 70s-90s when seatbelts diffused across the fleet) will lead to more rapid diffusion of driverless vehicles across the fleet; closer to 15-20 years rather than 30. A factor in this is that we have observed since 2010 very rapid deployment of quasi-driverless features, such as adaptive cruise control, auto-braking, and auto-parking, from prestige models to mainstream models. This trajectory suggests that even without mandatory legislation for new vehicles, driverless vehicle technology will rapidly become de jure for new vehicles.

5.3 Based on our research that has been following the development of driverless vehicle technology; we suggest the following timescale:

Period	Dates	Anticipated regulatory issues
Emergent period • Characterised by introduction of quasi-driverless features on high	2016-2020	• Facilitation of adoption through removal of legislative and regulatory barriers. • Increased clarity as to

[97] David Gargett, Mark Cregan and David Cosgrove, *The Spread of Technologies Through the Vehicle Fleet*, 34th Australasian Transport Research Forum (Adelaide).

end models • 2020-21 first fully driverless vehicle available in Australia		civil liability.
Mixed Fleet Period • Characterised by rapid diffusion of fully driverless function from high end to mainstream models 2020-2030. • Characterised by increasing novelty in vehicle layout with 'no human control' (vehicles without the familiar steering wheel and pedals) vehicles becoming increasingly available 2030-35. • Characterised by a decline of private vehicle ownership and the emergence of vehicle ride services where consumers buy access to rides in vehicles rather than own a vehicle. • Characterised by significant disruption in the taxi and related industries and the vehicle accident repair and related industries. • Characterised by changes to land use and urban planning as private ownership of vehicles decreases and the necessity for land reserved for	2020-2035	• Need to maintain human driven regimes in parallel to developing driverless vehicle regimes. • Introduction of an 'driverless vehicle only' licence with less requirements than a human driven vehicle licence. • Increased necessity to look at driverless and non-driverless vehicle interaction such as bicycles. • Roll out of intelligent transport infrastructure and need to address data and privacy issues. • Driverless vehicle regime will need to respond to 'no human control' vehicles • Liability compensation schemes would begin to cost human driven vehicles out of the market.

parking decreases.		
Mature Driverless Vehicle System • Characterised by a fully driverless vehicle fleet.	2035-	• Vestiges of human driven vehicle regulation repealed – especially Road Rules, licencing and individual fault based liability.