Submission No 9

DRIVERLESS VEHICLES AND ROAD SAFETY

Name: Mr Ian Faulks

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Mr Greg Aplin MP
Chairman, Staysafe Committee
Parliament House
Macquarie Street
Sydney NSW 2000

Dear Chairman,

I am pleased to provide a submission to the Staysafe Committee inquiry into driverless vehicle technology in NSW.

I have raised some issues that the Committee would, in my view, need to consider.

I have attached a paper I have written on driverless vehicles and drunk driving.

I also note that I have ongoing research into attitudes towards driverless vehicles, and I would be happy to provide further information regarding this project on a confidential basis as the work is as yet unpublished.

Yours sincerely,

Ian Faulks

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Ian Faulks

[redacted]

Access my publications at http://www.researchgate.net/profile/Ian_Faulks/

Preamble

In February 2016, the Joint Standing Committee on Road Safety (the Staysafe Committee) announced an inquiry into driverless vehicle technology in NSW, with particular reference to:

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

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

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

5. Any other related matters.

At the time of the announcement, the Chairman of the Staysafe Committee commented,

> "While long considered science fiction, self-driving cars are being developed and tested right now, and predicted to be on roads in the next couple of years".

Mr Aplin cited a comment by Mr Gerard Waldron, from the ARRB Group, that Australia's $27 billion annual "road safety bill" could be reduced by up to 90 percent with the advent of driverless cars, and a similar remark by Professor Hussein Dia from Swinburne University of Technology that driverless car technology has the potential to reduce accidents by 90 percent. Their predictions appear optimistic – perhaps sensationally optimistic. Importantly, neither pundit referenced a timeframe for the implementation and penetration of technologies required for driverless vehicles.

The excitement of a potential 90 percent reduction in crashes and/or crash costs, was reflected in the Chairman's statement that

> "The potential road safety benefits are immense and the Staysafe Committee's inquiry will have a strong focus on establishing the basis for a regulatory framework which will facilitate and foster driverless vehicles technology to deliver improved road safety benefits to the NSW community".

The Chairmen announced that the Staysafe Committee would examine how prepared NSW road safety regulators are to meet the challenges brought by these technologies and what amendments to NSW road safety policies and regulations may be required.

Generally

The STAYSAFE Committee has set itself a very difficult challenge, that is, to thread a path in identifying policy implications and program opportunities offered by driverless vehicles, when the debate strongly splits between technology enthusiasts and technology pessimists.

Road safety research shows that there could be substantial benefits arising from the introduction of ITS technologies[1]. Intelligent Transport System (ITS) technologies are now recognised and accepted as offering the potential to effect radical improvements in the safety and efficiency of operation of road transport networks. Safety-related ITS technologies typically involve engineering systems built into the vehicle and/or the road that intervene when users suffer lapses of concentration, make unsafe decisions, or fail to detect a developing unsafe situation. There is a wide range of ITS safety features and products proposed, under development or available for motor vehicles that can assist in avoiding crashes or making them less severe.

Almost two decades ago, the late Peter Makeham, then the Director, Federal Office of Road Safety, in a paper discussing future road safety strategies and targets[2], opined that most major gains in road safety came from the implementation of measures that could reasonably have been assessed as unrealistic (on technical or political grounds) only a few years before they came into effect. Looking to the future, Makeham argued that ITS and other new technology options could have particular impact as speeding countermeasures through improved enforcement (e.g., digital imaging), the use of “intelligent” speed warning devices or speed limiters that were responsive to local speed limits, vehicle technology to allow platooning of vehicles on roadways, and the use of speed monitoring devices for insurance/fleet management purposes. Other ITS approaches identified as feasible by Makeham included the use of variable speed limit signs, synchronising traffic signals to traffic

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1 Paine, M.P., Magedara, N. & Faulks, I.J. (2008). Expediting the road safety benefits of intelligent vehicle technologies—Part 1: Main report. Report to the Transport Accident Commission of Victoria. Sydney, NSW: Vehicle Design & Research / Safety and Policy Analysis International.

2 Makeham P, 1997. "How many deaths and injuries will we choose to accept?" Keynote address to the 1997 Road Safety Research and Enforcement Conference, Hobart, Tasmania, 9-12 November 1997. In: Faulks IJ, Ed., 2002. STAYSAFE 59 – "On strategic planning for road safety improvements in New South Wales". Pages 85-92. Report 15/52 of the Joint Standing Committee on Road Safety. Sydney NSW: Parliament of New South Wales.

flows at the legal speed limit rather than a higher speed, as well as advanced traffic management, advanced traveller information, and advanced public transport systems.

Makeham recognised that there were many emerging ITS technologies with the potential for significant safety impacts, asking the question: "How much could new technology improve safety?" Perhaps, he said, we may get closer to the right answer by re-phrasing the question: "How much could be gained by drastically reducing the role of human errors and foibles in the causal chain of road crashes?" Of course, many, if not most, of the intelligent vehicle technologies are effective even if human error occurs. That is, the technologies are operative even if the driver is alcohol or drug impaired, fatigued, medically impaired or disabled, inexperienced, or otherwise functioning at less than optimal performance. Makeham also suggested that an issue in the viability of ITS could be the psychological price experienced by road users (and particularly drivers) that could be at least as important as the economic or cost impacts, and so he proposed an additional, cognate question: "As a driver, how much control and autonomy are you prepared to hand over to your car's computers?"

In a discussion of the potential of new technologies to affect road user safety during the life of the New South Wales Road Safety 2010 strategy, Peter Cairney argued that there were two forms of technological advance which were likely to have a major impact on road safety: ITS, and Geographic Information Systems (GIS)[3]. Although the full import of his prediction has not, to date, been borne out, the potential of ITS and GIS to influence and improve road safety would nevertheless remain strong. ITS applications of information and communications technology to the management of transport systems, with the objective of making the transport systems more efficient and safer, should, in the longer term, have a major effect in reducing congestion and improving traffic flow, in reducing emissions and other environmental impacts, and in reducing road crashes. Particular technologies identified by Cairney as likely to have considerable safety benefits included variable speed controls, adaptive cruise control, and collision avoidance technology.

Cairney argued that most advanced ITS technology will be developed by global consortia of major companies, regulated through international standards, and driven by the demand of the global marketplace. It would, therefore, be unlikely that an individual jurisdiction's road safety strategies would have a role in determining the nature or pace of these developments. However, road users within individual jurisdictions could, with appropriate policy and legislative frameworks in place, be early beneficiaries of ITS developments.

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[3] Cairney P, 1999. "Strategic directions for the Roads and Traffic Authority's road user safety program" In: Faulks IJ, Ed., 2002. STAYSAFE 59 – "On strategic planning for road safety improvements in New South Wales". Pages 117-158. Report 15/52 of the Joint Standing Committee on Road Safety. Sydney NSW: Parliament of New South Wales.

Over the past two decades, there have been significant advances in ITS. There are a wide range of safety features and products available for motor vehicles that can assist in avoiding crashes (active safety) or reducing the risk of serious injury in crashes (passive safety). Vehicle safety systems include new systems such as Congestion Assistant and Intersection Assistant as well as widely established systems such as the Electronic Stability Control (ESC), Anti Lock Braking Systems (ABS) and Brake Assistant, and various types of cruise control. Passive safety systems such as airbags, which aim to mitigate the consequences of an accident for those involved, are the most extensively deployed. But active and intervening systems, which avoid risks or assume individual driving tasks, are now also frequently a part of vehicle equipment. Most vehicle safety systems can be found in luxury and more expensive vehicles, but are often absent in smaller and cheaper cars.

Roads agencies are focused on ensuring that road transport systems will continue to function well in the future, that the systems will be safe, and economically and ecologically sustainable. Technical progress in automotive engineering has, in the main, focused on two competing branches: improving safety and reducing energy consumption. Advanced Driver Assistance Systems (ADAS) have been designed to improve safe in two distinct phases: the pre-crash phase, and the within crash phase. These two approaches have resulted in the development of connected systems of active and passive safety. Major development work is being undertaken for adaptive and cooperative technologies for intelligent vehicles, encompassing the design, development, and evaluation of novel driver assistance systems, knowledge and information technologies, and to find solutions for efficient traffic and congestion management, and Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication for future cooperative vehicle applications. Consideration is being given to a third factor, cost to the consumer.

There are challenges, as Western societies undergo significant demographic changes, especially with the increasing population elderly people and their desire to remain mobile and participate in road traffic. The question of e-security is important for automated transport systems, particularly for V2V and V2I interfaces.

But perhaps most critically, the human factors involved in the range of ITS, and particularly for driverless vehicles, remain to be adequately assessed and addressed. The Human Machine Interface (HMI) is now an essential area for research to improve our understanding of human capabilities.

Human factors

For the person in the vehicle, there are primary tasks involving a driver that are not necessarily reflected when a person is a passenger. For a driver, the essential tasks include:

- Wayfinding (navigation)
- Wayfinding (detection, identification and response to traffic controls – signage and signals)
- Steering
- Braking
- Lane positioning

For a passenger, the principal task is the use of occupant protection technology (i.e., the seat belt).

In a driverless vehicle, the person is a passenger under most circumstances, but may have to rapidly undergo a process of acquisition of situation awareness and vehicle control in the event of malfunction. It is already well established that there is an increase of reaction times of drivers in case of dysfunctional driver assistant systems.

Alternative drive technologies

The development of driverless vehicles will not take place in isolation from other aspects of the road transport system, and, indeed, from development is in other aspects of vehicle technologies. For example, it is likely that driverless vehicles may also utilise different alternative drive technology (hybrid cars, electric vehicles, and, ultimately, hydrogen fuelled vehicles).

Development of ANCAP testing and assessment protocols

It should be noted that driverless cars will also be new cars.

A particular challenge will be the need to develop specific testing protocols under the Australian New Car Assessment Program (ANCAP) for driverless vehicles. These testing protocols will need to be fully dynamic in nature, allowing for valid and reliable assessment and rating of a driverless vehicles and its complement of ITS technologies.

Crash and incident investigations

One project that might be recommended by the STAYSAFE Committee is for an enhancement of the capacity of the Centre for Road Safety and NSW Police to conduct crash and incident investigations into crashes, near-miss and other safety-related incidents involving driverless vehicles. The underpinning principles of crash investigation may have to be re-assessed to account for driverless vehicles: what are the causation factors for a crash involving a driverless vehicles? It may well be that a new crash information and reporting system will be required, and this will, it would seem, involve a significant investment in the downloading of vehicle performance data as evidence.

It seem probable that the introduction of driverless vehicles should also be associated with the development of a statewide capacity to acquire in-depth crash data (see, e.g., the German In-Depth Accident Study - GIDAS). The adoption of the format of iGLAD (Initiative for the Global Harmonization of Accident Data) would seem appropriate for the collection of detailed crash information and facilitate the assessment of active safety devices such as ABS, ESC, etc.. The crash investigation capability should be extended to allow for investigation of near-miss and other identified critical incidents.

Driverless vehicle and vehicle manufacturers

A strong working relationship with vehicle manufacturers is of particular importance, but at challenge is pending with the cessation of Australian light passenger vehicle manufacturing? It would seem to be very important for automotive OEMs manufacturing driverless vehicles to get feedback on their product performance on real roads for continuous improvement. Currently, every OEM has different, albeit similar, ways of collecting feedback on various performance parameters. Systematic crash and incident research is a way to generate standardised information related to safety performance of driverless vehicles from the time such vehicle use is mandated for NSW roads.

Applications

The STAYSAFE Committee may care to explore some specific applications of driverless vehicle technologies. These could include the platooning of heavy vehicles into autonomous or driverless convoys on major interstate roads, the potential offered by driverless vehicles for older drivers /road users, the use of unmanned vehicles for tasks in road maintenance and servicing

Legal liabilities – criminal (traffic) and civil

The STAYSAFE Committee would also have a major focus on the liabilities that arise in the case of driverless vehicles, but more generally for co-operative traffic and driver assistance systems. It would be useful to develop a legal analysis of different road traffic-related scenarios from a liability law point of view where autonomous vehicles, or co-operative systems with vehicle-to-vehicle or vehicle-to-infrastructure communication, are already in use or where their use is expected in the near future.

What would be the bases for a claim under liability law that may exist under the general law of torts, or product and manufacturer's liability, public liability law, or, indeed, road transport law?

Transportation security

The e-security of driverless vehicles from hacking has been raised, but there is no clear evidence to support this being a major concern at this time. That said, if the driverless vehicle is functioning as a fully connected vehicle in continuous contact or interfacing with road infrastructure (V2I), other vehicles (V2V), and, indeed, with a road transport management system, then this issue may evolve to be of critical importance.

Self-driving cars will not help the drinking driver

Ian J. Faulks, The Conversation, October 23, 2014 12.12pm AEDT

https://theconversation.com/self-driving-cars-will-not-help-the-drinking-driver-31747

DISCLOSURE STATEMENT

Ian J. Faulks MAP is a NRMA-ACT Road Safety Trust Research Scholar. He is affiliated with the Centre for Accident Research and Road Safety (CARRS-Q) at Queensland University of Technology and is an Honorary Associate with the Department of Psychology at Macquarie University. He is a member of the International Council on Alcohol, Drugs and Traffic Safety (ICADTS) and the Australasian College of Road Safety. He has previously received funding from the Transport Accident Commission in Victoria and the NSW Centre for Road Safety to investigate and review in-vehicle safety technologies. The assistance of Professor Andry Rakotonirainy, CARRS-Q, and Nicholas Clarke, ANCAP Australasia Ltd in the preparation of this article is gratefully acknowledged.

Is our car culture soon to come to an end? Jes/Flickr, CC BY-SA

There is an unexpected revolution underway in road safety. True, the highly visible community-wide programs continue, but behind the scenes there are major changes underway in how **safety will be managed within road transport systems**.

The self-driving car (or “autonomous vehicle”) has emerged with a practical suite of technologies for more **efficient, safer, and eco-friendly road travel**. This emergence has been rapid: for example, the **Australian National Road Safety Strategy 2011-2020** did not canvas the possibility of such technologies.

The technology is already here

Self-driving cars are now approved for use on roads in **several US states** and may soon be on **British roads**. Self-driving cars are able to **perform driving functions automatically**. These vehicles use integrated systems of cameras, lidar, radar, and other sensors, as well as **vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications** and **GPS navigation**. These systems monitor the road environment and respond to changing traffic situations, roadway and weather conditions, and navigate to a destination without intervention from the vehicle occupant.

From what was once regarded as a futurist concept, autonomous vehicles are emerging as commercially viable. While **fully self-driving cars** may well be a decade or more away, the components that are necessary for the development of such vehicles are **already in the marketplace**. These include electronic stability control, advanced braking systems, active lane keeping, as well as a **range of other in-vehicle safety technologies**. Trials are underway to better understand the integration of crash avoidance technologies with "**connected vehicles**" utilising V2V and V2I technologies.

So what can the automated car do to address the "**fatal five**" causes of road trauma: speeding, alcohol-impaired and drug-impaired driving, failure to wear a seatbelt, driving while fatigued, and driving while distracted?

The autonomous vehicle revolution will likely have its major effects on controlling transitory behaviours such as speeding and unsafe manoeuvres associated with driver lapses and errors, rather than impacting on driver impairment or intentional risky behaviour. A **seat belt interlock** will prevent vehicle occupants from travelling unrestrained. As well as addressing safety issues, aspects such as route planning to reduce or avoid congestion and **ecodriving** are likely to be addressed through autonomous technologies.

Drink driving

We all know that drink driving is a crime: random breath testing and years of public education campaigns have taught us that. But still tens of thousands of people across Australia get in their cars and drive after drinking. That behaviour is the cause of significant injury and harm. The **Australian National Road Safety Strategy 2011-2020** noted:

> *"… while drink driving behaviour has been contained to a small proportion of the driver (and rider) population, it continues to be a major cause of serious road trauma."*

Importantly, once intoxicated a person cannot decide to become un-drunk: the metabolism of alcohol takes time. Alcohol reduces inhibitory control, so even after one drink, decision-making as to the riskiness of driving after drinking may be altered in favour of driving. So decisions really need to be made whilst the blood alcohol level (**BAC**) is close to zero.

The current focus of drink driving countermeasures is to legislate for the use of **alcohol ignition interlocks by convicted drink driver offenders**. Additional measures include promotion of the use of personal breathalysers, education regarding standard drinks and the effects of alcohol, promotion of alternative transport options after drinking (e.g., designated drivers, or use of public transport), and requirements for drink drivers to attend traffic offender intervention programs.

Interlocks are a countermeasure typically used after a person has been convicted of drink driving. An interlock prevents subsequent re-offending, but doesn't stop the first instance of drink driving (which has to be detected by police).

Can self- driving cars help the drink driver?

Will self-driving vehicles address drink driving, and in particular, the first offence problem? On the face of it, perhaps yes, but only if the fitment of an alcohol ignition interlock is mandatory for all vehicles.

However, there is a major legal hurdle. Even if it is an autonomous vehicle, the alcohol-impaired person is still the driver. After all, actions need to be taken to start the vehicle, enter instructions regarding destination and route, and engage the self-driving function. These actions constitute driving, and if you're drunk, that's drink driving.

Moreover, there are serious issues concerning the possible situations where a driver in an autonomous vehicle needs to intervene due to an emergency or system malfunction. Any such intervention constitutes driving, and again, if you're drunk, that's drink driving.

It comes back to the central safety questions regarding self-driving cars. First, what are the risks when automation takes a driver's attention away from the continuous monitoring of what is happening on the road? And second, if there is a need to intervene, how do you get a driver's attention so that a risky situation can be avoided?

If you're alcohol-impaired and the controller of a self-driving car, these questions cannot be safely addressed.

Interlock devices are likely to stay

The best advice regarding alcohol use is simply "do not drive" whilst under the influence, and plan ahead to avoid doing so.

With new and integrated technologies such as self-driving cars, in future decades it may well be that **car culture** will fade away. A car will become a utilitarian device, simply necessary to support personal travel and the transport of goods, and no more than that.

But for drink driving, even in a world of autonomous cars, the solutions will remain with interlock devices to deter an alcohol-impaired person from driving, traffic enforcement to catch the drunken driver, and encouragement for the erstwhile drink driver to instead choose to become a passenger … in a cab, bus, or by travelling with a sober driver.