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Autonomous Vehicles

A Transport Australia Society Discussion Paper

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Autonomous Vehicles

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Purpose

This document has been produced by the Transport Australia Society (TAS) of Engineers Australia (EA). It does not represent a formal position of Engineers Australia but is intended to guide discussions about autonomous vehicles.

TAS strongly supports initiatives to improve road safety and enhance transport network capacity to enable greater mobility of goods, services and people. Innovative and emerging technologies are fundamental in realising these transformative improvements.

This discussion paper provides insights and recommendations for the planning and integration of Connected Vehicles (CV), Automated Vehicles (AV) and Connected Automated Vehicles (CAV) in our transport systems and services.

Background and context

Most states are conducting CV, AV and CAV vendor run trials, which adhere to specific rules and guidelines. Regulatory and legislative reviews are being conducted in tandem. These trials cover heavy vehicle platooning[1] and automation, AV, CAV, CV / C-ITS and others. A list of current trials is available at https://www.austrade.gov.au/future-transport/connected-automated-vehicles/

Austroads Connected and Automated Vehicles Program is working closely with key government and industry stakeholders to establish the regulatory and operational frameworks required to support automated and connected vehicle technologies. They have published project outcomes and offer related webinars discussing those outcomes.

ARRB is a lead partner in the Australian and New Zealand Driverless Vehicle Initiative (ADVI), working in collaboration with other industry partners to deliver next generation mobility solutions in Australia and New Zealand.

Intelligent Transport Systems (ITS) Australia, promotes development and deployment of advanced technologies to deliver safe, more efficient and environmentally sustainable transport. ITS promotes and facilitates collaboration between industry, government, and academia in research, development and deployment of intelligent transport technologies.

In August 2016, the Transport and Infrastructure Council agreed to the National Policy Framework for Land Transport Technology and developed a National Transport Technology Action Plan (2016-2019).

The Policy Framework outlines a principles-based approach to facilitate the efficient, effective and consistent implementation and uptake of transport technology across Australia. (https://infrastructure.gov.au/transport/land-transport-technology/national-policy-framework-Land-transport-technology.aspx).

[1] Platooning is the practice of a number of trucks following one another closely, using connected vehicle to vehicle communication technology, where the lead truck is responsible for most of the driving work. Benefits include greater fuel efficiency, labour savings, financial and safety benefits but whilst there may be less incidents the magnitude of the incidents will increase. See Milford, Michael, *Truck platoons could soon be coming to Australia – but problems must be solved first,* November 2017.https://www.abc.net.au/news/2017-11-20/truck-platooning-could-be-coming-but-problems-need-solving/9171250

Status of CAV Technology

Most manufacturers have models that incorporate some aspects of Advanced Driver Assistance Systems (ADAS) technologies, also marketed as Intelligent Driver Assist Systems (IDAS) and applying different methods to address issues and challenges associated with these technologies.

Five levels of automated vehicles (AV) are defined as follows:[2]

0	Driver operated	No automation even when enhanced by active safety systems.
1	Driver assisted	Steering, acceleration and braking required for sustained period.
2	Partial automation	Driver is required to monitor the environment during auto mode and remains ready to drive.
3	Conditional automation	Driver is not required to monitor the environment but must remain alert and receptive to requests for manual intervention.
4	High automation	Driver is not required to monitor or operate the system but retains the option of manual control.
5	Full automation	Driver is never required to intervene, the vehicle is entirely driverless.

Governance, Policy and Regulation

The National Transport Commission (NTC) is an independent advisory body, responsible for the provision of ministerial advice, research and planning and has created a phased regulatory reform program.

The NTC aims to remove regulatory and legal barriers to automated vehicle technology and advises Australian governments on end-to-end regulation, embracing innovation and the safe deployment of automated vehicle technology.

NTC has released a series of policies, discussion papers and guidelines including:[3]

- Regulatory reforms for automated vehicles;
- Guidelines for trails of automated vehicles in Australia;
- National enforcement guidelines for automated vehicles and accompanying policy paper;
- Changing driving laws to support automated vehicles;
- Motor accident injury insurance and automated vehicles discussion paper;
- Safety assurance for automated driving systems- consultation regulatory impact statement;
- A 2020 roadmap of reform.

[2] Austroads RR AP-R551-17 Safety Benefits of Cooperative ITS and Automated Driving in Australia and New Zealand, 23 October 2017. https://austroads.com.au/resources/documents/supporting-documents/webinars/Austroads_Webinar-Safety_Benefits_of_Cooperative_ITS_and_Automated_Driving_in_Australia_and_New-Zealand.pdf

[3] Full list can be found online, National Transport Commission, Roads/Technology/Automated vehicles in Australia, https://www.ntc.gov.au/roads/technology/automated-vehicles-in-australia

NTC in conjunction with the Department of Infrastructure, Transport, Cities and Regional Development (the Department) are developing the regulatory and associated processes for entry of CAV into the Australian market.

In July 2019, the NTC released the Automated Vehicle Programs which details the purpose, work completed and planned reforms

The general approach will be that original equipment manufacturers (OEM) will automatically have the right to enter the Australian market provided they meet international standards. Adherence to international standards will be evaluated through a self-certification process. However, Australian regulations will be required to inhibit the use of vehicles where malfunction or safety concerns arise after self-certification. It is envisaged there would be a national review body to assess self-certification from a public safety perspective.

Governments will not accept liability for the legal responsibilities of the original equipment modifiers (OEM) to supply safe products. Consumer incentivises OEMs to protect against personal damages and liability. Given that all OEMs are offshore, the NTC determined this technical and business model was most appropriate in the immediate future as the technology advances.

Challenges and Opportunities

Technology and Market Uptake, Driving Safety and Efficiency Improvements

The technology is progressing through the stages of automation, and a number of vehicles are on the road in stages 1, 2 and 3 of automation. Incremental progress towards full automation improves safety, decreases traffic congestion and builds public acceptance and confidence in automated vehicle systems.

The percentage of AV vehicles comprising the total fleet determines the AV market penetration rate. Ideally technological milestones and market penetration progress at a similar or simultaneous pace.

Dedicated CAV lanes and routes may support mass transit and a mixed fleet of driver operated and automated vehicles. Other interim measures may include:

- Large fleets can be made available by private companies due to economy of scale;
- Routes are pre-planned and localisation maps are embedded within the system only for those specific routes;
- Ensuring more options are available to get private vehicles out of the CBD and to encourage usage of parking space outside CBD (this is a government policy decision which involves pricing and regulation).

For public transport, approaches such as these will be easier to implement and less dependent on market penetration.

Automated technology requires further refinement of sensor and positioning systems, vehicle to vehicle communication, real time information integration, artificial intelligence and machine learning systems to ensure safe and swift response to all possible challenges and scenarios.

Intelligent transport system applications have capacity to assist with collision avoidance, hazard detection, vulnerable road user safety, in vehicle signage, road alert systems, post-crash notification systems, mobility and eco driving.

A key principle underpinning Australia's approach to deployment of AV/CAV technology is to enable interoperable, vendor neutral and open standards-based technology. This will be achieved through an internationally harmonised and domestically consistent approach to standards, as well as compliance monitoring and enforcement.

Data and Cybersecurity

Australian road agencies welcome the opportunity to support the data input needs of connected and automated vehicle trials and are providing Signal, Phase and Timing data (SPaT) to support current trials. Australian governments have made a commitment to an open-by-default approach to transport data, and other datasets can be made available on request. This means that all CAV data will be accessible by any authorised user. However, this does not mean all data will be readily accessible. Restrictions may still be placed on specific data as required.

Cyber security is recognised as critical to the safe and effective deployment of connected and automated vehicles. However, as successful connectivity relies on both OEM and roadside infrastructure owners sharing data, determining allocation of risk may prove challenging. Thorough analysis of the data flow value chain to determine the hierarchy of risk and responsibility is essential. Any public or private organisation deploying connected and automated vehicle technology and roadside infrastructure must be held accountable for cyber security from inception, to delivery and beyond.

Impacts on Driver Behaviour

A range of studies have demonstrated that the use of CAV can lead to improved driver behaviour, such as reduced speeds, greater adherence to stop signs, decreased driver stress and improved reaction time. However, significant risks remain such as driver misuse of system due to mistrust of technology, decreased vigilance due to overreliance on the system, loss of manual driving skills and potential failure to resume vehicle control when critical.

Conclusion

Australia is well positioned for the uptake of CAV. The roadmap for reform provides a clear path for facilitating the uptake of CAV and to achieving greater safety and efficiency.

Engineers Australia Transport Australia Society advocates for an expansion of the roadmap for reform across road, rail and freight networks for a further 20 years to 2040. Development of a progress evaluation summary, to reflect on what has been achieved so far and determine priorities to 2040 is also encouraged.

The primary focus has been on road transport but a legal and regulatory framework exists for automated rail, so migration to driverless vehicles in closed systems such as rail networks may prove a good place to start. Full automation of our rail transport networks may be achievable sooner than

automated road mass transit and public risk perception towards driverless vehicles may be tempered by a rail first approach.

Long term, integrated and collaborative planning is critical to the safe deployment of automated intelligent transport system technology as Australia's cities become increasingly populated, digitised, and connected. Early planning will also assist government at all levels to provide timely support for innovative technologies as they emerge.

Universities should play a major part with AV as most technologies incorporated within these AV & CV systems require a strong knowledge base in electronics engineering, communication systems, robotics, artificial intelligence, sensor technologies, Internet of Things, computer engineering, computer science, civil engineering, transport planning, transport and traffic management and smart city planning.


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