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National Road Transport Technology Strategy – draft for public consultation

October 2023

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Vision

This Strategy is the collective vision of Australia's Infrastructure and Transport Ministers for a **safer**, more **efficient**, **productive**, **sustainable** and **accessible** transport system for all Australians, through deployment and uptake of new road transport technologies to enhance social, environmental and economic well-being.

Infrastructure and Transport Ministers' Meeting

The Infrastructure and Transport Ministers' Meeting (ITMM) brings together Commonwealth, state and territory ministers with responsibility for infrastructure and transport. It provides a forum to enable national cooperation and consistency on enduring strategic issues and address issues requiring cross-border collaboration.

New road transport technologies like connected and automated vehicles (CAVs) are coming, and through this Strategy ITMM is making sure Australia is ready to maximise the benefits these technologies have to offer. ITMM recognises that technology adoption will be important for achieving transport outcomes into the future, and in supporting urban amenity and liveability objectives[1]. This Strategy builds on earlier work of ITMM and its predecessors including via the 2016 *National Policy Framework for Land Transport Technology*[2] and 2012 *Policy Framework for Intelligent Transport Systems in Australia*[3].

The term 'Australian governments' is used throughout this Strategy to mean Commonwealth, state and territory governments (i.e. those that are represented at ITMM).

Objective

The objective of this Strategy is for Australian governments to take a **nationally consistent approach to technology deployment where this is needed** to achieve the Strategy's vision.

The Strategy does this by setting out:

- the role of Australian governments in enabling technology development, deployment and uptake through policy leadership, regulatory stewardship and targeted investments, and
- guiding principles to help governments across all jurisdictions make consistent decisions on how to best support new road transport technologies.

By defining what governments will do, the Strategy **provides certainty about the policy environment for technology deployment**, to road managers, industry, road users and the research sector.

The Strategy will be implemented through four-year action plans that **identify the national priority steps Australian governments will take together** to prepare for the deployment of key technologies where a national approach would bring the greatest benefits.

State and territory strategies and roadmaps set out the **activities they are undertaking within their own jurisdictions** to facilitate technology deployment.

The diagram below illustrates the relationship between the actions in the action plans and achievement of the Strategy's vision. The actions aim to advance deployment of road transport technologies, to deliver transport system outcomes. These transport system outcomes in turn contribute to advancing societal outcomes.

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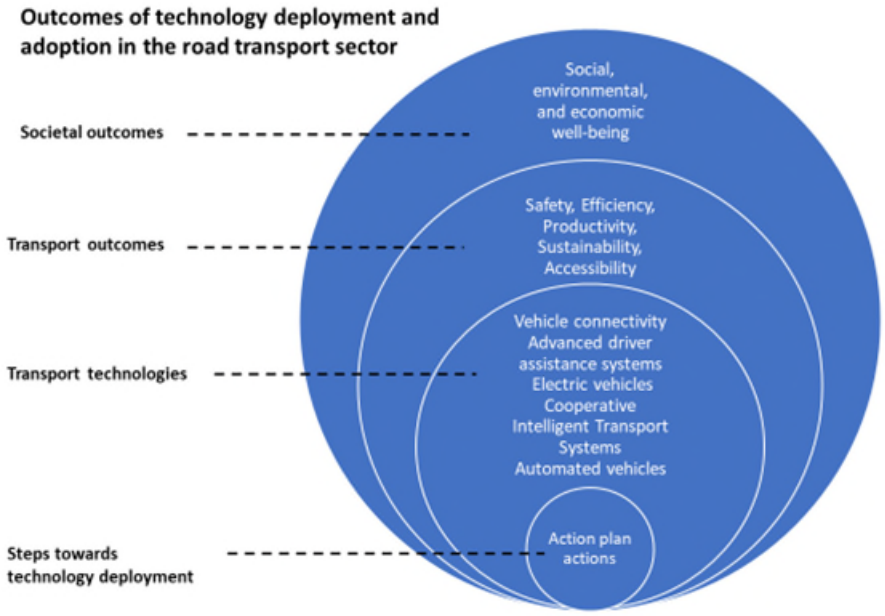
[1] Australian Transport Assessment and Planning Guidelines: 03 Urban amenity and liveability includes consideration of the relationship between amenity and liveability and transport and urban design.
[2] National_Policy_Framework_Land_Transport_Technology_and_Action_Plan_2020-2023.pdf (archive.org.au)
[3] Policy-Framework-for-Intelligent-Transport-Systems-in-Australia.pdf (itssa.org)


Outcomes of technology deployment and adoption in the road transport sector
Societal outcomes
Transport outcomes
Transport technologies
Steps towards technology deployment
Social, environmental, and economic well-being
Safety, Efficiency, Productivity, Sustainability, Accessibility
Vehicle connectivity
Advanced driver assistance systems
Electric vehicles
Cooperative Intelligent Transport Systems
Automated vehicles
Action plan actions

Introduction

In August 2016, the then Transport and Infrastructure Council (now ITMM) released the *National Policy Framework for Land Transport Technology* (the Policy Framework). It outlines how governments worked together to foster an integrated policy approach to the development and adoption of emerging transport technologies. The Policy Framework was underpinned by a series of four-year action plans (the *National Land Transport Technology Action Plan* 2016-19 and 2020-23) outlining governments' short to medium term priorities.

Road transport is vital for facilitating connections between people, places, goods and services, and moving freight produced and/or consumed within Australia[4]. Deployment and uptake of road transport technologies can make transport safer and more efficient, productive, sustainable and accessible, which in turn enhances economic, environmental and societal well-being.

The road transport technology landscape is changing rapidly. Advances in sensor technology, automation, machine learning, connectivity, and data processing and analysis are being applied to road vehicles, infrastructure, and road management systems. Road vehicles are becoming increasingly connected, electric and automated. Enabling new technologies allows consumers to access the latest vehicles that are safer and have lower emissions.

The *National Road Transport Technology Strategy* (the Strategy) updates the 2016 Policy Framework to reflect these changes and explicitly focus on road transport including private and commercial road users, vehicles and digital and physical road infrastructure. The *2024-27 National CAV Action Plan* is the first action plan under the updated Strategy.

The main priority under the Strategy and 2024-27 Action Plan is advancing vehicle connectivity and automation, including their supporting infrastructure and systems, complementing initiatives to increase electric vehicle (EV) uptake (and therefore advance vehicle electrification). Progressing these technologies together maximises technical, environmental and consumer benefits.

The Strategy and 2024-27 Action Plan will guide work already underway to prepare for CAVs and related future mobility technologies and services. As technology continues to evolve, the Strategy and future action plans will support deployment and uptake of new technologies as they emerge.

Relationship to other strategies

This Strategy helps implement:

- the vehicle safety priority and CAVs enabling action in the *National Road Safety Strategy 2021-2030*[5]
- the 'Innovative solutions to meet freight demand' outcome and elements of Actions 1.3, 2.3, 3.4 and 4.1 of the *National Freight and Supply Chain Strategy*[6] and *National Action Plan*[7], and
- four of the seven Principles (Principles 1, 3, 5 and 7) of the *National Urban Freight Planning Principles*[8].

The Strategy also complements a range of state and territory transport strategies and roadmaps[9] by encouraging national consistency and integrated approaches across jurisdictions in deploying and adopting

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[4] National Freight and Supply Chain Strategy, August 2019, p. 10
[5] National Road Safety Strategy 2021-30, p. 16 and 24
[6] National Freight and Supply Chain Strategy, August 2019, p. 17
[7] National Freight and Supply Chain Strategy National Action Plan, August 2019, p. 9, 14, 20 and 22
[8] National Urban Freight Planning Principles, May 2021, p. 11, 14, 17 and 20
[9] For example, the NSW Future Transport Strategy 2056 and Roadmap 2021-2024; QLD Transport Strategy; VIC Future directions for transport and Our Strategic Plan 2022 - 2026 | Department of Transport; ACT Transport Strategy 2020; WA Department of Transport Strategic Intent 2022-25

road transport technologies. The state and territory strategies and roadmaps set out in more detail the particular plans and actions each has in place to prepare for, or roll out, new transport technologies.

This Strategy complements the *National Electric Vehicle Strategy* (NEVS)[10] by helping to advance vehicle connectivity and automation, so that these can progress alongside vehicle electrification. CAVs, depending on how they are deployed, can help deliver energy savings and potentially emissions reductions by addressing the human factors that contribute to inefficient driving.

There are also a number of other Commonwealth technology-related strategies that are guiding technology deployment and uptake across the Australian economy, including the *National Quantum Strategy*, [*National Robotics Strategy* and *National Cyber Security Strategy*], and these may therefore also support road transport technologies like CAVs, including Cooperative Intelligent Transport Systems (C-ITS). [11]

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[10] National Electric Vehicle Strategy, April 2023

[11] National Quantum Strategy, May 2023; [Note these are in development – insert links once published – 2023-2030 Australian Cyber Security Strategy (homeaffairs.gov.au); National Robotics Strategy discussion paper: have your say | Department of Industry, Science and Resources]

Context

Since 2016, road transport technologies and the features available to vehicle buyers have continued to develop and evolve. By 2031, embedded mobile connectivity is forecast to be in 93% of new passenger vehicles sold in Australia (and in 40% of the fleet), and C-ITS connectivity in 25% of new passenger vehicles.[12] Passenger vehicles capable of highly automated driving (early operational design domains) are forecast to enter the market from 2026, and form 2% of new car sales by 2031.[13] By 2050, 66% of new light vehicles sold (and 30% of the light vehicle fleet) are predicted to have Level 4 and 5 automation.[14]

A range of automated safety features have become standard in new light passenger vehicles (e.g. autonomous emergency braking, steering and lane centering systems, parking assistance and adaptive cruise control), and these are flowing through to other vehicle classes (such as buses and freight vehicles). Modern heavy vehicles are fitted with features like automated emergency braking, lane keeping systems and intelligent speed assistance.

Some of these features are part of Advanced Driver Assistance Systems (ADAS) – systems that can steer and accelerate/decelerate the vehicle. ADAS are increasingly offered in high-end vehicles, offering significant assistance while still requiring a human driver to remain in control of the vehicle. In future, automated vehicles (i.e. vehicles with an Automated Driving System (ADS)) are expected to enter the Australian market and operate without the need for a human driver to be in control of the dynamic driving task in some environments.

Embedded mobile connectivity is increasingly standard in new vehicles. Vehicle manufacturers are offering subscription services to vehicle owners for infotainment, and to activate optional features and provide over the air software updates for vehicle systems. Cloud connected services (provided by road managers and third parties via mobile phone apps and navigation units) and telematics services are delivering warnings and information to drivers on things like speed limits, congestion, hazards, and route and parking information to enable safer and more convenient journeys.

Intelligent Transport Systems (ITS) – the traffic management control and information systems that use integrated communications and data processing technologies to convey information to and from the roadside, including traffic lights – are becoming more sophisticated, making use of technology advances to improve road safety, efficiency and management. These are being enhanced by cooperative ITS, or C-ITS, which allow vehicles to communicate, and eventually cooperate, with each other, road infrastructure and other road users like pedestrians, by exchanging real-time safety warnings and other information about the road environment.

Australian governments are actively preparing for new technologies. All jurisdictions have agreed to develop an end-to-end regulatory framework for the safe commercial deployment of automated vehicles (AVs) in Australia, expected to commence by 2026. This will include a new national AV safety law (AVSL), AV in-service safety regulator, development of vehicle standards for AVs, and regulation of AV users through state and territory laws. Technology trials have also progressed in number and sophistication – all states and territories have trialed AVs, and Queensland, New South Wales and Victoria have also trialed C-ITS[15]. Governments have also made significant investments in research, including through iMOVE Australia and relevant Austroads program streams.

All Australian governments have a strong focus on reducing greenhouse gas emissions from road transport with the aim of achieving Australia's legislated target of net zero emissions by 2050. The NEVS[16] and state and

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[12] AP-R654-21 | Austroads, p. 27 & 28
[13] AP-R654-21 | Austroads, p. 17-19
[14] BITRE, Forecasting uptake of driver assistance technologies in Australia, December 2021, p. 12
[15] Australian and New Zealand Trials | Austroads
[16] National Electric Vehicle Strategy

territory EV initiatives[17] are helping to increase EV uptake. This is also supporting uptake of connectivity and automated safety features as new EVs entering the market (like new internal combustion engine vehicles) often come equipped with the latest communication and driver assistance technologies.

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[17] NSW Government's Electric Vehicle Strategy | NSW Government; Queensland's new Zero Emission Vehicle Strategy | Transport and motoring | Queensland Government (www.qld.gov.au); Zero emissions vehicles (energy.vic.gov.au); ACT's Zero Emissions Vehicles Strategy 2022-30; Premier of Tasmania - Tasmania's electric vehicle future charging ahead; Electric vehicles | Energy & Mining (energymining.sa.gov.au); Electric Vehicle Strategy | Western Australian Government (www.wa.gov.au); Electric vehicle strategy and implementation plan | Department of Infrastructure, Planning and Logistics

Role of governments

Australian governments are working together through this Strategy to support technology deployment where national approaches are needed. Governments want to work with industry, researchers and the broader community to progress the deployment and use of new road transport technologies where these can contribute to achieving the Strategy's vision. Each has a role to play in deployment and adoption.

Industry and the research sector develop new technologies – the research sector generates the scientific and other knowledge that underlies these technologies and helps governments and industry better understand how new technologies operate and their impacts, while industry innovates and brings new technologies to market on a commercial basis. Business and the broader community are able to drive demand for, and uptake of, new technologies where they have the trust, confidence, skills, awareness and opportunity to use them.

Governments provide a policy and regulatory environment for technology deployment and uptake, and invest when appropriate in supporting infrastructure, technology development and deployment. In performing their role, governments also support the roles of other sectors. Co-development, trials and co-investment are proven approaches for building the capacity of both government and industry.

The role of the Commonwealth, states and territories in supporting road transport technologies may be different. For example, where a national approach is required, the Commonwealth has a national policy leadership and coordination role; while the states and territories, where acting as road managers, may be more directly involved in technology deployment.

Australian governments may undertake one or more of the following roles to enable deployment and uptake of road transport technologies:

1. **Policy leadership**
    - providing clear policy statements to guide nationally consistent decisions by governments at all levels on technology deployments
    - facilitating collaboration between industry, government and researchers, and
    - raising awareness and educating business and the public on key aspects of new technologies (noting industry also has a role in educating users about the technologies they supply).
2. **Regulatory stewardship**
    - developing and maintaining a regulatory environment that balances enabling technology deployment with community expectations, including in relation to safety, security, privacy and accessibility
    - removing unnecessary regulatory barriers and ensuring regulation is appropriately technology neutral and adaptable to changing circumstances, and
    - undertaking evidence-based and consultative regulatory development.
3. **Targeted and coordinated investment where there is market failure or a clear public benefit (e.g. where it would benefit broader transport networks and transport users)**
    - making enabling investments e.g. investing in research, trials, skills development, supporting infrastructure or data streams, and
    - providing market leadership by investing directly in technology development and/or deployment e.g. procuring and deploying key technologies in line with the principles in this Strategy or encouraging early technology adoption through fleet procurement.

Principles guiding government action

Australian governments, through ITMM, have [agreed][18] to the following policy principles to guide nationally consistent decision-making across all jurisdictions to support deployment of new road transport technologies. A principles-based approach provides flexibility for jurisdictions, as differences between jurisdictions (including size, population density and geography) will impact decision-making.

These principles are intended to guide government action, both where it provides the environment for the private sector to deploy technology and/or where government is the deployer of technology.

Policy principles

1. **Improving transport outcomes:** Government decisions to support road transport technology deployment will be based on the capability of the technology/ies to improve safety, efficiency, productivity, sustainability and accessibility outcomes for transport users, the economy, environment and broader society as identified in the vision for this Strategy.
2. **Safe and secure operations:** Government decisions to support road transport technology deployment will be based on the ability to ensure the safe and secure deployment, operation and maintenance of these technologies in the Australian context. When systems fail they must fail safely.
3. **Nationally compatible deployment:** Where technologies will be deployed across jurisdictional borders, governments will take a national perspective on implementation recognising the impacts on other jurisdictions/operators, including by:
    a. identifying critical standards for harmonisation internationally and across jurisdictions – relevant international or regional standards should be adopted, unless there is a compelling reason for a unique Australian requirement, and
    b. ensuring systems and practices are compatible and interoperable to enable a seamless user experience across Australia.
4. **Evidence based, strategic and value for money investment:** Where government investment is identified as needed to support the deployment of new technologies, that investment will be evidence-based, consistent with long term strategic planning, and deliver value for money for the whole of life of the investment.
5. **Leveraging existing investments, market approaches and devices**: Where appropriate, planning for new technologies will leverage existing infrastructure and networks (private sector or government, including public transport), market approaches and consumer devices and equipment (such as smart phones) in order to encourage effective, efficient and equitable deployments.
6. **Encouraging competition and innovation:** Where feasible and appropriate, governments should avoid favouring particular technologies, applications and business models, and new technologies should be implemented in a way that supports appropriate data sharing in line with privacy and security requirements.
7. **Sustainable technology deployment:** Road transport technology deployment decisions should consider the whole of life sustainability impacts of the technology, including decommissioning and recycling at end of life.

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[18] [Note the Strategy is in DRAFT form – Policy principles not yet agreed by governments]

8. **User-centric implementation:** New technologies should be designed, implemented and delivered in a way that meets the diverse needs of those using them (e.g. travelers with disability, older and younger travelers, those on low incomes, First Nations Australians, culturally and linguistically diverse people, those in regional and remote areas, pedestrians, cyclists and users of multiple transport modes), including in a way that is consistent and familiar, and protects user privacy and security.
9. **Adapting to future change**: New technologies should be implemented in a way that supports resilient, reliable and scalable solutions, backwards compatibility or equivalent functionality, future upgrades, and possible future transitions to other technology platforms.

Benefits and challenges of road transport technologies

Deployment and uptake of road transport technologies brings a range of potential benefits that contribute to economic, environmental and social well-being. For example, CAVs are estimated to provide $13 billion in social and economic value to the Australian community by 2050 by improving productivity, accessibility and safety, and reducing congestion and fuel use.[19]

Achieving the benefits will depend on how technologies and services are designed, deployed and adopted. Deployment and uptake of new technologies also presents challenges for governments and society that need to be managed in order to realise the benefits.

The Strategy provides policy guidance to support technology deployment decisions and harness the benefits of new technologies while also addressing the challenges of technological change.

Safety

Road transport technologies could reduce the number and severity of crashes. Consistent with the Safe System approach to road safety, vehicle technologies could reduce the likelihood and impact of human mistakes. CAVs could improve human decision-making by providing warning messages and alerts, and assistive technologies. For example, Lane Keeping Systems (an ADAS feature that warns the driver when the vehicle is leaving its lane and provides steering input to keep the vehicle in its lane) in light vehicles could reduce fatal and serious injury crashes resulting from unintentional lane departures by 22%.[20] In the future, vehicles with an ADS are expected to further improve safety by reducing the ability for human mistakes to contribute to crashes. C-ITS could also improve road safety by providing vehicles with information and warnings. For example, the *Ipswich Connected Vehicle Pilot Safety Evaluation* found that, at 100% C-ITS penetration, the eight C-ITS use cases investigated could reduce the rate of fatal and serious injury crashes by 13-20%.[21]

Road crashes are costly both in human and financial terms, with financial costs estimated to be $30 billion annually[22]. By 2050, CAVs are estimated to reduce crash costs Australia-wide by approximately $15 billion (this increases to $152 billion by 2070, with 8,000 lives saved).[23]

Safety is of paramount importance, and while CAVs can have safety benefits they may also present safety risks. For example, ADS are expected to rely on a complex integration of software and hardware to safely drive the vehicle. This may introduce new risks such as system related errors/decisions and potential human/machine interaction issues that may lead to crashes. Australian governments are working to harness the safety benefits and mitigate the safety risks of CAVs by developing a fit-for-purpose national regulatory framework for AVs to safely operate on Australia's roads, and via actions in the 2024-27 action plan to advance nationally consistent C-ITS deployment.

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[19] The CIE, Economic Impacts of Connected and Automated Vehicles (CAVs), December 2021, p. 3. There is still substantial uncertainty around CAV impacts, and policy responses can affect the level of costs and benefits as well as to whom these would accrue.

[20] The potential benefits of lane keep assist systems in Australian light vehicles (trb.org); Lane Keeping Systems for light vehicles | Department of Infrastructure, Transport, Regional Development, Communications and the Arts

[21] Ipswich Connected Vehicle Pilot Safety Evaluation: Summary Report, May 2022, p. iii, the use cases included in the crash reduction estimates were Road Works Warning, Back-of-Queue, Road Hazard Warning, Turning Warning for Vulnerable Road users, Advanced Red Light Warning, Slow-Stopped Vehicle, Electronic Emergency Brake Light and In-Vehicle Speed

[22] National Road Safety Strategy 2021-30, p. 6

[23] The CIE, Economic Impacts of Connected and Automated Vehicles (CAVs), December 2021, p. 3-4

Efficiency and productivity

Road transport technologies can improve the efficiency and productivity of existing infrastructure and transport networks. For example, ITS is used on motorways and other major roads to manage incidents and traffic flows via dynamic speed zones, active lane management and e-tolling. The enhanced connectivity and real-time information provided by C-ITS to drivers (and potentially directly to ADS in the future), could enable better route and end of journey planning and smoother traffic flows. The costs of congestion are large, forecast to be around $30 billion by 2030[24], and so small reductions can have a big impact. Microsimulation experiments done as part of iMOVE Australia research suggest C-ITS could reduce peak congestion in arterial corridors by 11%, and improve average peak hour travel speeds in Melbourne CBD by 10%.[25]

CAVs could improve transport efficiency and reduce congestion by, for example, enabling vehicles to travel closer together (this may also include platooning where a lead vehicle controls the speed and direction of 'follower' vehicles), and increase productivity by freeing up time individuals previously spent on driving for other, more productive activities. These benefits depend on how CAVs are deployed. For example, if they are deployed in a way that reduces shared and active transport use and encourages more journeys and vehicles on the road network then this may result in re-congestion which, in turn, impacts livability particularly in urban areas. This is something that will need to be managed as CAVs enter the market in greater numbers.

The data generated by road transport technologies and systems can be analysed in real-time to enable better responses to incidents and manage road network demand, as well as over the longer term to improve transport planning, investment and maintenance decision-making. For example, it can support evidence-based access decisions for heavy vehicles and help assess road network performance including understanding the impact of high productivity vehicles on the network e.g. on assets like bridges and pavements. This data is also important for developing digital twins (virtual representations of real-world assets, processes or systems) that can be used for predicting and planning for current and future road transport and infrastructure needs.

Australian governments are working together to advance C-ITS and develop a fit-for-purpose national regulatory framework for AVs, so that the productivity benefits of these technologies can be realised. Data sharing issues and digital twins are being considered through the relevant National Transport Commission and Austroads programs.

Sustainability

Transport is projected to be Australia's largest source of emissions by 2030. In 2020, Australia's transport emissions made up 19% of national emissions and are expected to grow to 2028 before declining to 2035[26]. Emissions from road transport comprise close to 85% of transport emissions[27] – cars and light commercial vehicles (such as vans and utes) are the two highest road transport emitters. Emissions from light vehicles are expected to decline from around 2027 as uptake of EVs and hybrids increases.[28] EV technologies are expected to make a significant contribution to achieving net zero emissions by 2050. Reducing exhaust pipe emissions also results in broader benefits including less pollution, with associated improvements in health outcomes.

The NEVS and state and territory EV initiatives are helping address road transport emissions. Other road transport technologies could also reduce emissions. For example, ITS, C-ITS and CAVs could smooth traffic flows and improve journey times thereby reducing fuel use and energy consumption, as could automated safety features like adaptive cruise control that maintain a constant driving speed. The emissions reduction impacts of these technologies will likely diminish as the proportion of EVs in the fleet increases, particularly if

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[24] BITRE, Information Sheet 74: Traffic and congestion cost trends for Australian capital cities, p. 1

[25] How soon is now? The convincing case for connected vehicles (imoveaustralia.com), based on traffic and network microsimulation experiments, at 30% and 20% C-ITS (V2V and V2I) penetration respectively

[26] Australia's emissions projections 2022, December 2022, p.35, noting that 2020 emissions were lower than previous years due to the COVID-19 pandemic

[27] Australia's emissions projections 2022, December 2022, p.37, Table 19 (2019 figures)

[28] Australia's emissions projections 2022, December 2022, p.35

renewable electricity is used for EV charging. Achieving these benefits also depends on how they are deployed. For example, if CAVs are not EVs and they are deployed in a way that re-congests the road network, this could increase energy use and therefore emissions. CAVs are estimated to result in fuel use reductions worth $6 billion and greenhouse gas emissions reductions worth $1 billion by 2050.[29]

Use of ITS, for example signal priority, can help achieve faster, more reliable and attractive mass transit like bus and light rail services on roads, with significantly lower environmental impacts per passenger than private vehicles. Similarly, emerging shared mobility (e.g. automated public transport and ride share capabilities, e-scooters, etc) and active travel options can also help improve transport sustainability by reducing reliance on private passenger vehicles and therefore fuel use and emissions. Mobility as a Service (MaaS), where a single technology platform is used to book and pay for multiple stages of a journey across multiple services and/or modalities, can make these options easier and more attractive to adopt.

Australian governments are working together to harness the sustainability benefits of road transport technologies through the vision and principles in this Strategy, specific actions on sustainability and MaaS in the 2024-27 Action Plan, and by working to support CAV, including C-ITS, deployment.

Accessibility

New road transport technologies could help transport systems meet the needs of all users, including those of older people and people with disability. For example, MaaS could provide easier transfers between multimodal services for transport users. AVs (e.g. shuttles, ride-share, taxis, private vehicles) could improve transport access for people unable to drive themselves and, in the case of on-demand services, provide access where and when required. They could also provide greater transport options for people in regional areas. Achieving the accessibility benefits will depend on how these technologies are deployed. For example, people with mobility issues may find it more difficult to access transport without a driver or steward present to assist, or if CAVs are deployed in a way that reduces gaps between vehicles making it more difficult for pedestrians to cross non-signalised streets. Accessibility will also depend on the design and operation of these future services, including the human-machine interface.[30]

Australian governments are working together to help deliver on the accessibility potential of road transport technologies through the vision and principles in this Strategy, and the actions on sound and haptic technologies in vehicles and accessibility guidance for CAVs in the 2024-27 Action Plan.

Security

New road technologies could present cyber security risks. For example, CAVs, including the communications to and from vehicles, may be susceptible to disruption from a range of sources. This could include service outages, technical failure, hacking or other cyber-attacks. Like safety, the security of new technologies is of primary importance.

Australian governments are addressing these issues through the vision and principles in this Strategy, and by having specific requirements in the AV regulatory framework to guard against third-party interference and an action in the 2024-27 Action Plan on options to manage the security of C-ITS communications.

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[29] The CIE, Economic Impacts of Connected and Automated Vehicles (CAVs), December 2021, p. 4, noting the report precedes the legislated 2050 next zero greenhouse gas (GHG) emissions target and the NEVS, therefore the forecasts of EV uptake used may underestimate EV uptake. A faster rate of uptake and use of renewable electricity would reduce the fuel and GHG emission reduction benefits of CAVs as calculated in the report. The fuel and emissions reduction costs are also based on the price of fuel per litre at July 2021 (i.e. 133.4 cents per litre) which is lower than current prices. A higher fuel price would increase the value of fuel savings from CAVs.

[30] Connected and automated vehicles: barriers and opportunities for people with disability, p. 4 and Older drivers: Advanced driving assistance technologies and AVs (imoveaustralia.com) [Note project underway – Link to report when published]

Data and privacy

New road transport technologies, including vehicles and surrounding infrastructure, are expected to generate large amounts of data, for example data on vehicle speed, heading, location, crash status – some of which could be personal data and present privacy risks. Much of this data is collected by the private sector (e.g. vehicle manufacturers) but this could potentially be shared more broadly, including with governments, for a range of beneficial purposes. Governments, including road managers, also hold useful data that could be shared under the right conditions. While access to, and use of, this data can inform and enhance government and private sector decision-making and service design, careful consideration must be given to balancing potential benefits (e.g. improved safety, productivity, innovation and competition), with appropriate privacy protections for individuals.

For example, vehicle manufacturers collect vehicle data to improve the features and services they offer and may also make data available to others, including third party service providers. C-ITS will rely on data from vehicles and road manager data to inform the safety and other messages it delivers to improve road user safety and road network productivity. Governments and the private sector will need to cooperate to share data with appropriate privacy protections to develop use cases that support C-ITS service delivery.

Australian governments are addressing these issues through the principles in this Strategy and the relevant National Transport Commission and Austroads programs.

Harmonisation, standards and interoperability

Road transport technologies, including data and associated systems, that need to operate across jurisdictions risk incompatibility and lack of interoperability if they are not based on common standards. Harmonisation helps with technology uptake, competition, efficiency and upgrade paths. For example, harmonisation in C-ITS deployments will be vital for getting a critical mass of compatible vehicles and infrastructure in Australia that can communicate with each other nationally to achieve the full benefits of C-ITS. This can be difficult to accomplish due to jurisdictional differences, including pre-existing ICT systems.

Technologies should be mature and proven. As a small market, Australia benefits from aligning technology and standards choices with larger markets. For example, Australia's vehicle standards are aligned with the United Nations Economic Commission for Europe (UNECE) World Forum for the Harmonisation of Vehicle Regulations.

National consistency is a key principle informing development of the national AV regulatory framework. Australian governments are working towards national consistency for C-ITS based on the [*Principles for a National Approach to C-ITS in Australia*][31], the vision and principles in this Strategy and through the C-ITS implementation plan actions in the 2024-27 Action Plan.

Supporting infrastructure

New road transport technologies will require supporting digital and physical infrastructure to operate effectively. As technology continues to develop, there is a challenge for governments to identify and understand what infrastructure will be required and when, and how to deliver this to ensure value for money. For example, physical infrastructure like lines and signs may need to be adjusted to accommodate CAVs however this will depend on the capability of vehicle sensors and connectivity which are still developing. Similarly, the extent to which CAVs will depend on connectivity to drive safely and cooperate with each other (as opposed to relying solely on sensors) is not yet clear, but connectivity is expected to enhance performance and service offerings. The particular infrastructure needs of different vehicle types, such as heavy vehicles, should also be considered.

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[31] [Note Principles not yet endorsed by governments – Link to Principles once published]

The infrastructure of other sectors, like telecommunications and electricity networks, are important enablers of road transport technologies. For example, vehicle connectivity and ITS make use of fixed and mobile communications networks to provide services. CAVs may need accurate satellite positioning information to maintain awareness of their location on the road. As connectivity, automation and electrification increasingly converge in vehicles, they will rely on electricity networks for charging.

Australia's large land mass and sparse population create cost and other challenges for deploying infrastructure in regional and remote areas. These should be considered when planning for new road transport technologies, noting that there are existing programs[32] to, for example, fund the rollout of fixed and mobile communications and EV charging infrastructure in these areas.

The Australian and New Zealand Governments have developed SouthPAN[33] to provide 10cm positioning accuracy across Australia and New Zealand. Further work is needed to determine how increased accuracy of positioning systems could help improve the operation of CAVs and other road transport technologies. Australian governments continue to work through the relevant Austroads programs to identify the digital and physical infrastructure needs of CAVs.

Equity

New road transport technologies offer significant improvements in safety, journey efficiency and convenience, sustainability, and accessibility for road users. There is a risk that these benefits may not be distributed (or be able to be accessed) equitably, particularly for some groups in society such as those on low incomes, people with disability, older and younger people, First Nations Australians, culturally and linguistically diverse people and those in regional and remote areas. Road transport is vital for accessing economic opportunities, health care and other services and social engagement. Equity issues should be considered when planning for technology deployments.

For example, access to improvements in vehicle safety may depend on the ability to pay to purchase a new vehicle but this may be mitigated to some extent by services that can be delivered via shared transport models or widely available consumer devices like smartphones. Connectivity, including C-ITS, can enable the exchange of safety messages and alerts between vehicles, road infrastructure and vulnerable road user devices (e.g. for pedestrians, cyclists and those on mobility scooters). CAVs could make transport more affordable by encouraging and making it easier to use cheaper shared transport models and public transport, or free options like walking and cycling. Depending on how CAVs are deployed, they could increase vehicle costs and diminish mass transit and active transport infrastructure (if resources are diverted away from these).

There is a link between equity and accessibility, for example, better vehicle and service design and CAV shared transport models could make access to transport more equitable for a range of vulnerable groups. Similarly, addressing sustainability issues can improve equity as vulnerable groups are more likely to be impacted by climate change. Australian governments are considering equity issues through the principles in this Strategy, and the actions on sound and haptic technologies in vehicles, accessibility guidance for CAVs and sustainable technology deployment in the 2024-27 Action Plan.

Disruption and change

New road transport technologies could disrupt established markets and businesses, impacting, among other things, safety, employment, skills requirements, competition, land use planning and government revenue. Technology transitions may be rapid or gradual (a gradual transition is expected for CAVs[34]) but gradual

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[32] Mobile Black Spot Program, Regional Connectivity Program, Better Connectivity Plan for Regional and Rural Australia and Driving the Nation Fund

[33] Southern Positioning Augmentation Network (SouthPAN) | Geoscience Australia

[34] The CIE, Economic Impacts of Connected and Automated Vehicles (CAVs), December 2021, p. 112

transitions may not preclude there being shocks for some firms or industries. For example, CAVs could potentially reduce the need for traditional driving skills, which may reduce costs for some industries but may create a need for reskilling and redeployment of drivers to other roles. CAVs may also reduce personal vehicle ownership, creating more demand for shared transport models and less demand for parking in city areas. Australian governments are considering the workforce implications of CAVs through an action in the 2024-27 Action Plan.