

# 2019 Future Transport: Smart Cities

Regulatory and  
Technological  
Innovation



roadsaustralia

# Introduction

Roads Australia (RA) is the peak body for roads within an integrated transport system. It brings industry, government and communities together to lead the evolution of Australia's roads, integrated transport and mobility networks.

RA's 150+ members include all of Australia's road agencies, major contractors and consultants, motoring clubs, service providers and other relevant industry groups. A list of RA Members is included as an Appendix to this Report.

RA led a delegation of senior industry and government leaders on a study visit to North America in July 2019. The delegation gained invaluable insights into collaborative approaches, strategies, innovative thinking and solutions that can be adopted to meet Australia's future transport and city planning challenges.

The visit built on previous study visits in 2018 and 2019 to Europe/United States and Asia which focused on the Driverless Revolution<sup>1</sup> and Cities for the Future<sup>2</sup> respectively.



The delegation was privileged to be given access to the highest-level government and industry players in the USA and Canada. This report reflects the deeper understanding we gained into the progress, challenges and emerging trends in regulatory and technological innovation for future transport and smart cities. Key findings highlight emerging developments and approaches that will clearly impact Australia, and for which Australian transport providers and communities need to prepare.



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# Key findings



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The future transport needs of Australia's growing population calls out for much improved collaborative effort.

- All levels of government, academia and industry will have to adapt their ways of thinking and be prepared to collaborate if we are to prepare the nation for the major transport changes on the horizon.

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Big changes are coming — is Australia ready?

- The transition to zero emission vehicles; the introduction of connected and autonomous vehicles; and greater use of mass data and interconnectedness to drive more efficient use of existing infrastructure will challenge us.

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It is time for a customer focussed end-to-end journey approach.

- The American public and private sectors are changing their thinking. Forward thinking transport agencies are increasingly looking at transport from the customer's perspective.

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Making connections is the key to mobility success.

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Smart Cities work together to share experiences.

- Collaboration between cities in the USA has accelerated learnings, with a focus on social impact and customer acceptance.

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- Micro-factories and small scale "bespoke" production techniques could see new vehicle technologies produced in Australia.

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# The future transport needs of Australia's growing population calls out for much improved collaborative effort.

All levels of government, academia and industry will have to adapt their ways of thinking and be prepared to collaborate if we are to prepare the nation for the major transport changes on the horizon.

The Roads Australia delegation saw some very productive transport research projects in North America, where universities are more active on the transport front. They engage with industry, government and each other in ways not seen in Australia. Universities encourage their professors to work with industry and to bring in business collaborations and partnerships.

The US federal Department of Transportation allocates around \$300 million annually for transport related research and development, with a pre-requisite for private-sector involvement. This seed funding is provided on condition that private partners and universities contribute the bulk of funds, with clear criteria for local and state level government involvement.

As a leading example, at the Carnegie Mellon University in Pittsburgh, the delegation heard that universities carrying out community 'test-bed' research works out well for transport. Smart City research at Carnegie Mellon's Metro Lab Network involves 50 university-city pairs across the country, sharing best practice, in collaboration with industry. With the support of

the governors and mayors of the Smart Belt Coalition<sup>3</sup>, universities working at a multi-state level assists industry in their efforts to convince the public that new vehicle technology is safe.

This approach provides cities and states with greater confidence to invest in new technologies, without the inherent compatibility and lack of scale concerns in other approaches.

Roads Australia recommends that the widespread collaboration seen in North America should be fostered in Australia, enabling inherent individual strengths to be increased by greater co-operation and less competition between universities

The delegation concluded that there were many opportunities for Australia's world-class universities to be more engaged in new transport technology research and development.

However, the current funding model for Australian universities promotes competition at the expense of collaboration, creating a potential barrier to research into transport technology.

In Australia, the Federal Government funding criteria should be modified to provide seeding money for transport research which is conditional on both attracting private funds and requiring involvement of more than one university, with encouragement for more industry and local city government involvement.





# Big changes are coming – is Australia ready?

The transition to zero emission vehicles; the introduction of connected and autonomous vehicles; and greater use of mass data and interconnectedness to drive more efficient use of existing infrastructure will challenge us.



*It has been said that the future rate of technology change will never be as slow as it is today!*

History shows that Australians are early adapters of new technology, accelerating its introduction and the displacement of earlier technologies. The study visit raised concern for delegates that government and industry are not as ready as the public to adopt new vehicle and transport innovations.

As we have seen from the introduction of disruptive business models such as ride-share, regulators can be caught short by ignoring or resisting change, rather than facilitating it by actively engaging with communities in the change process and embracing the opportunities offered.



RA Delegation and Elaine Chao,  
United States Secretary of Transportation



## **The days of traditional fuel taxes and excises are numbered.**

Every North American government organisation visited by the RA delegation, expressed concerns about shrinking fuel tax revenue and the implications for funding and maintaining infrastructure – a direct result of vehicles becoming more fuel-efficient and as more hybrid, electric and other zero emission vehicles enter the fleet. The system of funding roads through fuel taxes in North America is similar to that in Australia – so we face the same dilemma, with little evidence that there is a solution being developed that will be equitable for all road users.

In Vancouver, Canada and Contra Costa County, California, the delegation heard that local/city government authorities were allocating a portion of property and sales taxes to transport infrastructure investment. However, they also acknowledge that electric and other non-fossil fuel vehicles will cause a problem for revenue and a replacement for the important fuel tax component will have to be found – particularly in view of the long-term prospect of having 100 per cent zero emission vehicles.

Funding for infrastructure and providing new infrastructure to support new technologies were the key discussion points at a delegation meeting with US-based Australian officials and US transport industry leaders.

Australia's Deputy Head of Mission at the Australian Embassy, Katrina Cooper, joined a roundtable with Austrade, former Transport and Infrastructure Committee Chairman, The Hon William Shuster, former U.S. Secretary of Transportation, The Hon Rodney Slater, members from the mobility industry and the Roads Australia delegation for a briefing on US transport policy and issues.

Participants heard that the USA needs to spend more than \$1 trillion USD urgently to return key transport infrastructure to good repair. However, the Highway Trust Fund (set up in the 1950s from fuel levies, topped up by the Fixing America's Surface Transportation (FAST) Act funds) had not been raised in a quarter of a century – reducing funding by 40 to 50 per cent in real terms. Additionally, we learned that private sector (market) led proposals for funding, developing and operating infrastructure were constrained by policy uncertainty and as a result was a largely under-utilised alternative solution in the USA.

The American Road and Transportation Builders Association reinforced the belief that the USA would face a road-funding crisis in the next two years. They indicated that static funding at around \$44 billion USD per year would result in a shortfall of investment of \$15 billion by 2022, rising to \$23 billion per annum by 2026.

The overall impression from the delegation was that Australia's transport infrastructure was in much better shape than the US highway network, and that recent national and state government infrastructure spending commitments were likely to keep us ahead.

Roads Australia has long been an advocate for sensible transport reform. As outlined in the RA submission to the [2019 Commonwealth Budget](#)<sup>4</sup>, it is imperative that we move to a fairer, more efficient road pricing and investment model where road users pay according to where and when they travel. To be truly effective, road reform will ultimately have to apply to all vehicles, not just heavy vehicles.

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Roads Australia recommends that Australian governments urgently consider a transition away from the fuel based road user charging system currently in play.

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Any change would require examination of the related constitutional issues – where there is potential for road-user charges to be levied by state governments as an alternative to fuel excises collected by the Commonwealth.

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In Australia, there is an opportunity to leverage the advanced work by the NTC and state governments to pave the way for accelerated electric and zero emission vehicle penetration of the Australia market.

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### **Readiness for an autonomous and zero emission vehicle future is hindered by lack of inertia by legislators.**

A key concern raised in the USA was the political difficulty in getting legislators and city authorities to embrace new technologies. However, there were examples where local initiatives were setting an example for others to follow.

In contrast, our delegation reflected on the significant program of work on regulatory processes for the introduction of connected, automated and electric vehicles in Australia. In particular, it was highlighted that the suite of investigations that the Transport and Infrastructure Council had initiated through the National Transport Commission (NTC), were well ahead of the USA.

California is the exception in the USA by taking a lead in promoting the introduction of electric vehicles. For example, Contra Costa County in California has completed an electric vehicle readiness plan, with an outlook that shows shared autonomous vehicles as the way of the future for air quality and mobility. They believe this will help the ageing population and avoid the problem of having to “take the keys away” from elderly drivers.

Tesla's Daniel Wohl stressed to the delegation the importance of California's regulatory schemes of credits and debits on carbon. Tesla believes California is doing more than any other entity to accelerate sustainable transport, where the carbon credit and debit scheme in effect acts as a fuel tax because producers who pay into the scheme pass costs on to consumers.

The major national effort in electric vehicles in the USA is in the transition to electric buses. The National Highway Traffic Safety Administration (NHTSA) reported that there are five active American bus manufacturers, with over 6,000 electric buses already estimated to have been sold to date. These buses are seen to have the biggest potential for use in Mobility as a Service (MaaS) operations.

Government initiatives in Australia, such as the South Australian government consultation on development of an [electric vehicle strategy](#)<sup>5</sup>, which was supported by Roads Australia, are to be commended.

### **Hydrogen as an alternative fuel is gaining attention**

In the USA, the NHTSA and the US Department of Energy, together with four transit agencies, are in the early stages of experimenting with three different models of fuel cell buses. Recognising that Japan is well advanced in refuelling technology, NHTSA is also working with Japan to conduct demonstration projects in Michigan, New York and California.

NHTSA expects that deployment of alternative fuels in the USA will be gradual, and via the introduction of designated alternative fuel corridors to allow public engagement with new technologies. The global standard for hydrogen fuel, currently in development for expected release in 2021, should be a catalyst for further development.

However, a [CNBC report](#)<sup>6</sup> indicates that the momentum for hydrogen fuel cell vehicles is building in the USA. It reports that Toyota has found 5,000 buyers for the Mirai hydrogen fuel cell family car model since it was introduced in 2015. There are also around 1,100 Honda Clarity fuel cell vehicles on the road in the USA. Fuel station infrastructure has been recognised as an impediment to growth. There are currently 39 public hydrogen fuelling stations in California (with another 25 in development), plus a handful of stations operating in New York, New Jersey, Massachusetts, Connecticut and Rhode Island, with more in development.

In California, the State is spending more than \$2.5 billion USD in clean energy funds to accelerate sales of hydrogen and battery vehicles. This includes \$900 million earmarked to complete 200 hydrogen stations and 250,000 charging stations by 2025.

In Canada, the City of Vancouver is well advanced in the adoption of hydrogen as a fuel of the future. For the 2010 Winter Olympic Games in British Columbia, the Government added 20 fuel cell buses to Vancouver's transit network. This experimental venture ran until the end of the program in 2014. Canada's commitment to trialling sustainable future technologies has continued through the Department of [Natural Resources Green Infrastructure Fund](#)<sup>7</sup>, launched in 2017, to support the efforts of industry and government entities to deploy clean energy infrastructure solutions. In June 2018 the fund supported establishment of Canada's first retail hydrogen station in Vancouver, at an existing Shell service station.

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The early work on hydrogen in the US and Canada, including collaborations with Japan, reinforces Roads Australia's position that Australia can be a leader in hydrogen fuel development - the National Hydrogen Strategy is our opportunity to ensure we are positioned to grasp this opportunity

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The [Hydrogen Council](#)<sup>8</sup> is a global initiative of leading energy, transport and industry companies launched at the Davos World Economic Forum 2017. This growing coalition of CEOs has ambitions to: accelerate significant investment in the development and commercialisation of the hydrogen and fuel cell sectors; and to encourage key stakeholders and policy makers to increase their backing of hydrogen as part of the future energy mix.

The Hydrogen Council [Hydrogen Scaling Up](#)<sup>9</sup> report “vision for 2050” sees the hydrogen economy as a central pillar of the energy transformation required to limit global warming. The report proposes that the transportation sector, through hydrogen-powered fuel cell EVs (FCEVs) could combine with battery EVs to achieve a deep decarbonisation of all transportation segments. It believes FCEVs are best suited for long-range, heavier payload applications where trucks and buses (while accounting for only five per cent of all projected FCEVs in 2050) could potentially achieve more than 30 per cent of hydrogen's total transport sector CO<sub>2</sub> abatement potential.

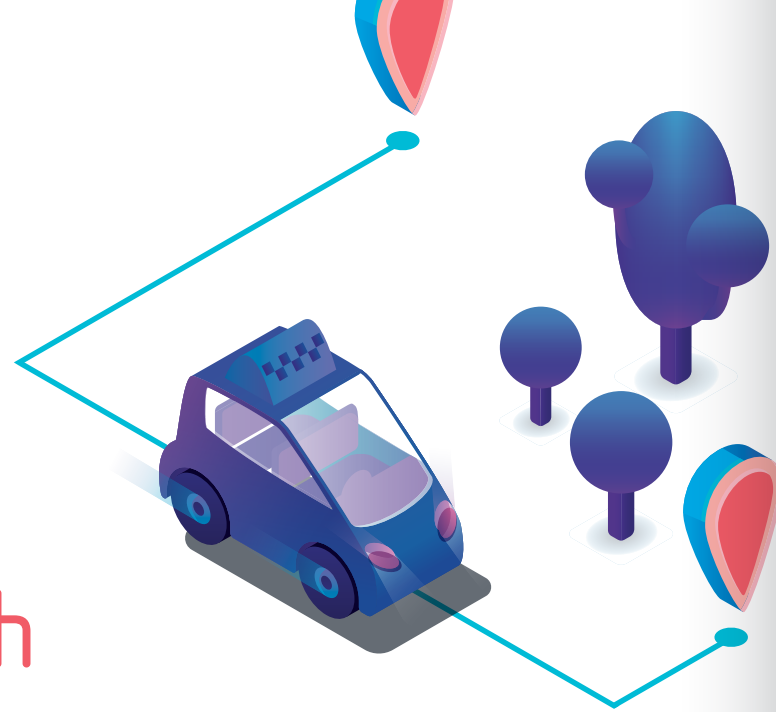
The report predicts that by 2030: one in 12 cars in Germany, Japan, South Korea, and California will be powered by hydrogen; with 10 to 15 million cars and 500,000 trucks worldwide hydrogen powered. The Council vision for 2050 sees up to 400 million passenger vehicles (~25 per cent), 5 million trucks (~30 per cent), and more than 15 million buses (~25 per cent) running on hydrogen, worldwide.

Hydrogen applications for material handling have had the largest uptake so far. The [US Department of Energy](#)<sup>10</sup> reports that fuel-cell powered forklifts already outperform battery powered alternatives, resulting in more than 15,000 fuel cell forklifts operational in global warehouses in 2017, including major users such as Amazon and Walmart in the USA. A [Future of Hydrogen Report](#)<sup>11</sup> – *Seizing today's opportunities*, prepared by the International Energy Agency for the recent G20 meeting in Japan, highlighted 2019 as a critical year for hydrogen. With unprecedented momentum around the world, the report predicts that hydrogen is finally on a path to fulfilling its longstanding potential as a clean energy solution.

To this end, our delegation noted that Australia had significantly accelerated consideration of hydrogen for transport through the COAG Energy Council National Hydrogen Strategy development, [Hydrogen for Transport](#)<sup>12</sup> working group. The advancement of hydrogen as the potential future fuel of choice by the Japanese Government was a key finding from the Roads Australia 2018 Cities for the Future Report.



# It is time for a customer focussed end-to-end journey approach



The American public and private sectors are changing their thinking. Forward thinking transport agencies are increasingly looking at transport from the customer's perspective.

The Roads Australia delegation was impressed by the range of customer oriented thinking being exhibited in many of the transport authorities they visited. For example, the National Highway Traffic Safety Administration indicated that they are currently working with over 3,000 transit agencies across the USA, with a budget of \$150M USD, to conduct automated research demonstrations, integrated mobility (mobility on demand), and environmental and regional research. The key aim was to improve the quality of life for US citizens by looking at transport from the customer's perspective.

With respect to new vehicle technology and services:

- Planning must recognise that it is the customer who makes a journey. Providers of all the modes in that journey should co-operate, relate and form partnerships so that the customer journey is as seamless as possible.
- Mobility must be seen as a service for all, including the young, the elderly and people with disability.
- Mobility must be provided equitably because everyone has an interest in the efficient movement of people and freight. If people cannot get to and from places of health, education, retail and commerce, it eventually costs everyone.

Seamlessness can only be enhanced if providers work together to consider the human synergistic and technological assistance needed at interface points to facilitate connection without excessive waiting time. There is also a focus on advances in the design and security of payment systems that are easy to use, through mobile devices and apps, moving towards single payment options across the journey.

This approach was reinforced in Canada, where private company Cubic aims to have a single charge for the whole customer journey, including parking. Cubic develops public transport and fare reading and payments systems that integrate multiple back-end systems, rather than providers working in silos. The Mobility as a Service (MaaS) operation model is supported by building on existing technologies, layered to provide an overall solution.



3D printed vehicle at Local Motors, Washington

In Contra Costa County, engagement with the community has been dramatically increased by the introduction of telephone town hall meetings. This technology has improved the level and quality of response, compared to a conventional town hall meeting where typically 40 or so people, mainly with complaints, attend. The wide networking introduced in the County enables collection of a broader spectrum of ideas and valuable engagement. Without input from the community, they believe a lot of planning and environmental work is potentially wasted and construction is often impeded by community objection or lack of need. When people take ownership they take better care of the system and give better information.

There are many opportunities for Australian companies and transport providers to collaborate and harness and/or develop new technologies and applications for whole of journey information, optimisation and payments.



## New approaches, players and partnerships are emerging

The delegation saw cutting-edge developments in connected electric and autonomous vehicles by private and public-sector entities, and an enthusiasm for them because of their economic and environmental benefits. Newer information technology companies are playing a greater role in transport than ever before.

In North America, the role of government in transport is changing. Local and regional governments are taking a more active and integrating role. For example, Vancouver's city government agency, Translink, runs trains, buses, ferries and sky-trains as well as planning and constructing roads and railway lines.

Translink aims to reduce congestion, but has a challenge similar to Australian cities, with 57 per cent of journeys in Vancouver taken by car. However, active transport initiatives, such as the introduction of bicycle lanes, are becoming more accepted. Taking road space away from cars originally faced significant public discontent, however, five years after introduction the initiative is now accepted and working.

Faced with city population growth similar to major Australian cities, Vancouver, which expects to grow by one million people in the next two decades, recognises that it must make public transit easier. It is looking to information technology as a strong facilitator of change in travel mode preferences. Transport planners see the information being collected from every tap by a customer, as vital in system use analysis and forward planning decisions. The future potential for increasing customer travel information and options, and improving dynamic network operating control cannot be underestimated. The use of coordinated transport data control and management was highlighted by a high strategic focus in Asian countries in the RA Cities for the Future report<sup>2</sup>. City governments, like Vancouver, while not yet at the same level of public transport focus as leading Asian cities, are recognising the advantage of building strong capability in collection of data on the end-to-end customer journey.

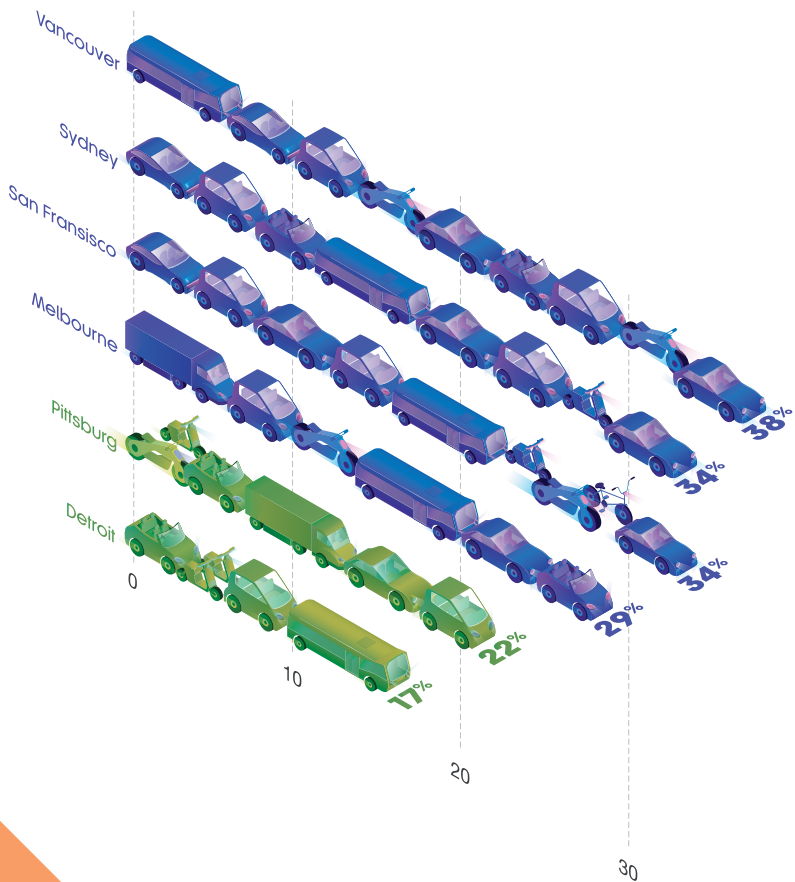


The strong message for Australia remains that access to data for all transport modes will be essential for managing demand and delivering customer focused services across an expanding range of mode choices.

Environmental and urban development issues are high on the agenda

Governments in North America, especially city governments, are looking at alternative ways to raise money for infrastructure investment. At the same time they are looking to new technologies in their efforts to discourage peak-time travel, and to reduce congestion through better use of existing infrastructure. This is similar to the increased awareness in Australia on the importance of being ready to develop, adapt and apply new technology to network management.

City traffic congestion level 2018 (TomTom)



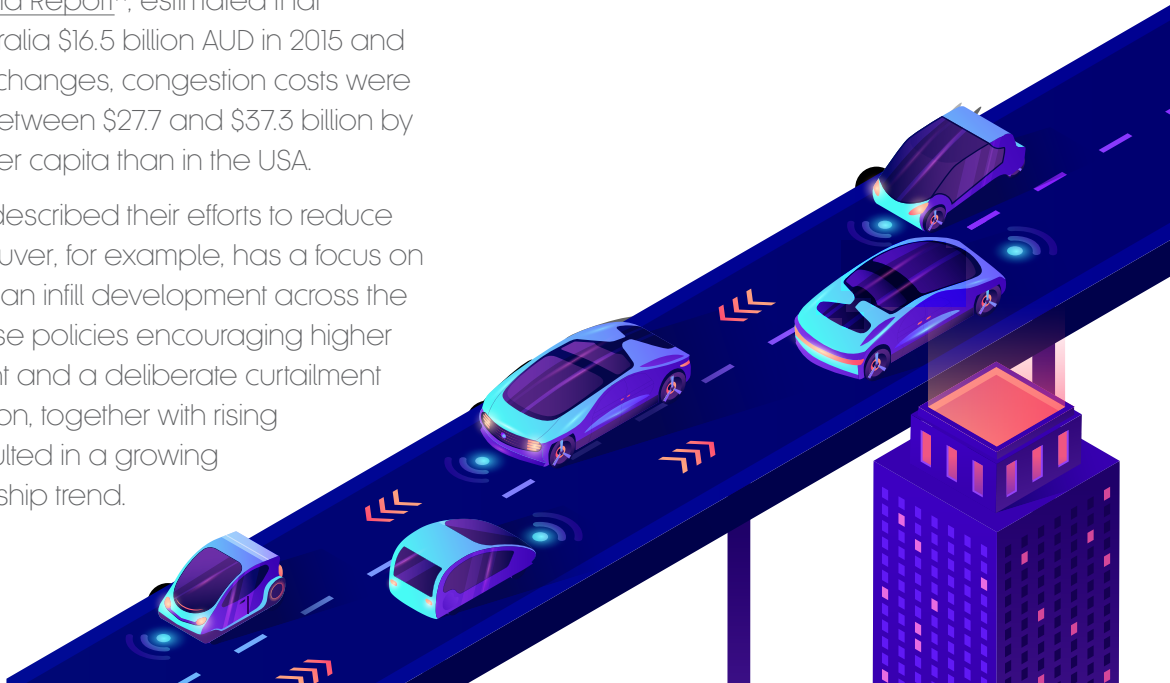
California, both as a state and through its municipal authorities, is pushing as quickly as possible towards 100 per cent low or zero-emission vehicles in a connected environment that will allow for autonomous vehicles.

Australia shares a common urban congestion problem with the USA, where it is growing as a major issue and is estimated to cost \$305 billion USD a year.

The TomTom Traffic Index<sup>13</sup> measures international city congestion levels as a percentage of extra travel time experienced by drivers across the entire year, compared to a baseline of travel times during uncongested, free-flow conditions. While not in the highest, 'red zone', of the TomTom index, some of the cities visited by the delegation appear with Sydney and Melbourne in the "yellow" (25 to 50 per cent) congested range. It is interesting to note the Pittsburgh and Detroit, both with active smart city programs, have significantly less comparative congestion.

The Australian Automobile Association 2018 Road Congestion in Australia Report<sup>14</sup>, estimated that congestion cost Australia \$16.5 billion AUD in 2015 and without major policy changes, congestion costs were predicted to reach between \$27.7 and \$37.3 billion by 2030. This is higher per capita than in the USA.

Several jurisdictions described their efforts to reduce urban sprawl. Vancouver, for example, has a focus on high density and urban infill development across the city. The city's land-use policies encouraging higher density development and a deliberate curtailment of freeway construction, together with rising fuel prices, have resulted in a growing public transport ridership trend.



Contra Costa County, in California has agreed with 21 of its municipalities not to approve development beyond a defined urban boundary, with penalties through fuel-tax allocation cuts to fund the extra infrastructure burden, for development approved outside the zone.

To meet community environmental concerns, Vancouver has the intention of converting TransLink's 1500 strong public transport bus fleet to electric operation, with the long-term aim to have 100 per cent renewable energy running all transport modes.

The National Highway Traffic Safety Administration reported on similar moves across the USA for buses to go electric. This is seen as an easier transition to EVs than for private cars because buses can be charged at the depot and distances between charges are a known quantity due to set routes. While installing of remote charging stations to expand the network for buses can be expensive, as was seen in Vancouver where a typical remote site costs C\$1m, passengers have indicated a preference for electric buses because they are smoother, quieter and have no fumes.

North America is certainly not as advanced as our Asian neighbours in the integration of transport and land-use planning, as seen in the 2018 Roads Australia study visit<sup>2</sup>. However, the cities visited by the 2019 delegation have commenced this important journey. A significant point of difference to Australia is the high involvement of city and municipal governments in taking a lead on these issues. While it is pleasing to see the development of a solid investment pipeline for public transport upgrades in Australia, more strategic engagement with city and large urban local government authorities is needed to integrate transport investment with land use and urban development planning.

The challenge remains for the three tiers of government in Australia to achieve much stronger collaboration in the integration of transport and land use planning.



# Making connections is the key to mobility success.

Mobility as a Service (MaaS) is emerging as a much more efficient way of moving people and freight and to help meet the transport needs of the young, elderly and disabled.

The Roads Australia delegation was impressed that the government authorities visited were placing less emphasis on cost of service and cost recovery, and more emphasis on overall customer value propositions. They emphasised that specific cost recovery for each transport leg may be counter-productive if the broader societal cost is greater – for example, if a person can't get cheaply and efficiently to his or her doctor's appointment or to engage in a commercial transaction.

Both private and public sector entities stressed to delegates the importance of safety and privacy in the development of autonomous and connected vehicles, but were equally concerned that over-regulation might stifle innovation.

## Mobility as a disability reducer

At the Robotics Institute at Carnegie Mellon University delegates discussed advances in thinking on accessibility. The Institute's research shows that traditional transport for people with disabilities costs up to 10 times that of regular transit rides. They believe the untapped demand for mobility would be huge if people could get a CAV and go places without a driver.

Carnegie Mellon University has been developing autonomous driving technology for more than 30 years, and the University's expertise and graduates have attracted a number of self-driving car companies to Pittsburgh. Argo AI was founded in 2016 by a team of Carnegie Mellon alumni and experts from across the industry.

In June 2019, Carnegie Mellon and Argo AI announced a five-year, \$15 million sponsored research partnership. The self-driving technology company will fund research into

advanced perception and next-generation decision-making algorithms for autonomous vehicles, to help self-driving vehicles to operate in a wide variety of real-world conditions, such as winter weather or construction zones.

There is solid evidence that mobility providers such as Uber and Lyft are responding to city government and society demands that they must serve people with disabilities, by development of applications that can be used by deaf and blind customers.

CAV developers also see the writing on the wall, and whether by regulation or fear of regulation, the likelihood is that more accessible CAVs will be developed to service the needs of people with disabilities, whether in wheelchairs, with impaired mobility or blind. The transition to driverless CAVs will include consideration of many factors, including provision of a remote presence – someone to talk to clients, or non-driving attendant.

## Mobility provider perspective

Global ride-share company Uber views mobility as a huge, complicated equation. There are one billion plus cars in the world, which spend on average 95 per cent of their time parked. So society is spending money on a lot of infrastructure to do nothing. Sixty per cent of private vehicle travel distance is by a single person, which is very inefficient.

Uber believes the future benefit of autonomous vehicles is in giving the public wider access to transport options, integrated with public transit – in effect moving our transport culture from single-occupant vehicle ownership to shared vehicles. "We do not see a future where privately owned vehicles are replaced by more expensive privately owned electric/self-driving vehicles. The fleet-based, mobility as a service model, will replace private vehicle ownership". There is potential for each shared vehicle to replace 10 privately owned cars.

The company believes the move to electric vehicles will help the environment through reduced emissions, combined with the inherent safety benefits from automated vehicles. As a Mobility as a Service option, EV/AV vehicles are also more efficient, because they can be on the road moving more people for a greater percentage of their time, and more equitable because they provide mobility for people who cannot afford and/or have no access to a car.

However, Uber highlights that the transition to autonomous vehicles will not be without challenges. AVs deal in absolutes, while human driving is much more nuanced. For example drivers of non-autonomous vehicles may be frustrated with the strict adherence of AVs to road laws, such as speed limits.

There has been a setback to Uber on-road testing since the fatal crash involving a trial vehicle in 2018. However, while trials have been gradually and methodically returning to public roads, the upside has been greater industry co-operation and information sharing with government on development of universal operating standards.

As a strong advocate for the academic/government collaborations with industry, such as the Pittsburgh example, Uber believes this approach will accelerate AV acceptance in the community. It highlights that it is easy to test a self-driving car on a highway or test track, but in reality vehicles have to work in complicated city environments. Pittsburgh's complicated network of tight turns, bridges, trees and messy streetscapes, combined with the opportunity to draw on some of the best robotic minds in the world at Carnegie Mellon University, makes it an ideal testing ground. Uber has discussed with Pittsburgh City the idea of 'calmed city streets' to provide a safer environment for its citizens and a more consistent environment for autonomous vehicles to operate.



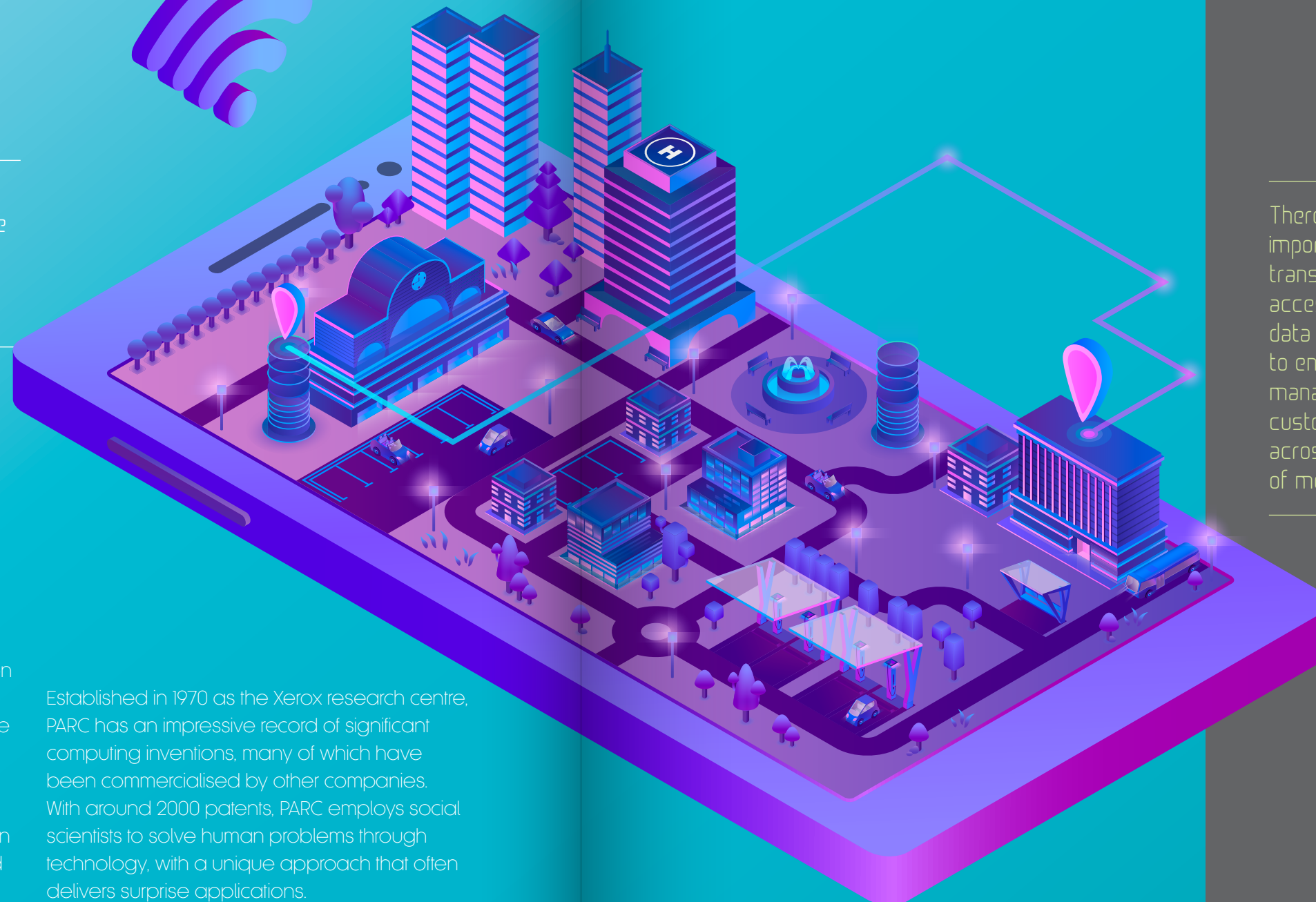


The challenge for all governments will be to strike the right balance between appropriate regulation and gaining societal advantage from emerging driverless Mobility as a Service operations.

### Mobility Research and Development

In California, the Roads Australia delegation visited the Navya headquarters and production facility. Navya is responding to an increasingly urbanised market, which it believes will drive the demand for Mobility as a Service and green transport solutions, to reduce congestion and emissions. The delegation was also treated to an inside insight into transport research in Silicon Valley, at Palo Alto Research Centre (PARC) and Neo4j, before visiting EV manufacturer Tesla.

Established in 1970 as the Xerox research centre, PARC has an impressive record of significant computing inventions, many of which have been commercialised by other companies. With around 2000 patents, PARC employs social scientists to solve human problems through technology, with a unique approach that often delivers surprise applications.



There has never been a more important time for Australian transport agencies to have access to customer travel data for all transport modes - to enhance demand management and to deliver customer focused services across an expanding range of mode choices.



In a project sponsored by the Victorian Government's public sector innovation fund, PARC is currently working with [VicTrack](#) on a Phase 2 trial of Moxi Fibre Optic Sensors. The project aims to optimise bridge maintenance and management costs by placing sensors on bridges to measure stress, strain and movement against various traffic loadings.

Neo4j, a Swedish start-up company, explained to the RA delegation how work with graphic databases can make use of masses of data to give insights into human behaviour and decision making.

These visits emphasised to the delegation the breadth of possibilities from the 4th Industrial revolution, where there is no doubt that automation, artificial intelligence and the analysis of mass information will have a dramatic impact on future transport.





# More collaboration is needed in infrastructure decisions.

Transport bodies are challenged by the infrastructure required to enable Automation benefits.

At the National Highway Traffic Safety Administration the delegation discussed the significant work to be done on how AVs will interpret the road environment. Lane markings, for example, might have to be wider or shorter and be better maintained. Road constructors will have to engage in more collaboration with vehicle developers to find out what infrastructure changes are needed to enhance the ability of AVs to interpret the environment.

There is a strong view in the USA that industry needs to set the standards for AVs to meet the safety requirements of regulators and the public. The role of regulators is to determine the threshold for safety. US administrators counselled that if you are relying on infrastructure to meet certain standards and be maintained to ensure AV safety in all circumstances, you are setting yourself up to fail. Autonomous vehicles will need to prove their technology is inherently safe, whatever the environment.

North American entities have an emphasis on trying to predict future transport expectations to inform project options and solution choices. When looking at infrastructure priorities, the delegation discussed the need to look at consequences of introducing new technologies so that new infrastructure can be future-proofed.

Planning should be directed at the interconnectedness of things, with greater community engagement and big picture thinking rather than a project by project approach.

This discussion raised concerns by the delegation that Australia may need to consider whether existing legislation passed in the 1980s and 1990s might inadvertently be inhibiting innovation in transport. The work by the NTC in reviewing regulatory issues relating to the introduction of AV/EV technology, combined with the review of associated national road laws is strongly supported. At a national level, this approach is well ahead of the relatively hands-off approach by US regulators.

While acknowledging that Australia has taken many positive steps in the autonomous journey, the lesson from North America is that the Federal Government needs to give more support to state efforts.

Roads Australia is concerned that state jurisdictions are required to do the heavy lifting on infrastructure readiness for AVs. Without strong national leadership, support and investment commitment, the burden on states will be too great and impede the roll-out of new, safer mobility solutions.

## Asset Data Capture

Rapid data capture of road assets and condition is seen as essential for US road owners to ready themselves for the onset of AVs. Drive-past capture technology is being used at cost of around \$40 USD per kilometre, in many cases replacing the need for expensive manual inspection.

Asset data capture company, Roadbotics, argues that replacing human inspection with artificial intelligence technology avoids the inherent frailties of limited human attention span. The captured data can be used to verify maintenance contractor delivery performance, to establish benchmark standards and to validate expenditure effectiveness.

While the technology offers a fast, low-cost baseline for pavement condition, it doesn't seek to replace the sophisticated and detailed road pavement diagnosis offered by engineering consultants or organisations such as the Australian Road Research Board.

Roads Australia sees lack of involvement by local government authorities in infrastructure readiness as a critical risk to transition to an autonomous vehicle future.



At Translink, the delegation heard that Vancouver is one of the first cities in North America to open its transport database. This means, for example, that trucking companies can log in and do their own route planning.

The delegation discussed the challenges facing Australian road authorities in capturing sufficient asset data to prepare for AV introduction. While State and Territory road authorities are well advanced and have processes in place similar to the US authorities, there is significant concern as to the readiness of local government road authorities.

Local Government Association<sup>16</sup> figures show that our approximately 550 local government councils are responsible for 75 per cent of the Australian road network. Our delegation is concerned that the local government road and street networks, combined with scarce resourcing to deal with the complexity of asset data capture, could be a major impediment to AV introduction in Australia.

# Regulators are struggling to understand the plateau in road safety improvement.

Emerging vehicle technologies offer hope of a next step in road safety improvement but e-commerce has introduced new hazards to be addressed

The delegation visit to the Federal Motor Carrier Safety Administration discussed the agency's concern with a recent increase in truck crashes in the USA, indicating that this could result in calls for more mandated rules by Congress. There has been an explosive growth in contract deliveries due to e-commerce, now estimated to represent 10 per cent of the US economy. This is seen as the likely cause of the trend in increased fatalities involving smaller trucks.

At the National Highway Traffic Safety Administration (NHTSA) the delegation discussed how autonomous vehicles will disrupt and challenge the human oriented regulations. The agency sees engagement with all technology development companies as essential in finding solutions to emerging issues and to help set standards.

NHTSA's work with over 3,000 transit agencies includes a number of behavioural change programs with the aim of addressing impaired driving from distraction, driver drowsiness and seat belt use. NHTSA's four key areas of current focus are all related specifically to automated vehicles.

**1 Current confusion as to what is an automated driving system.** SAE levels are great for engineers but are difficult for the public to interpret. Work is underway to better understand how to communicate so that the public better understand what is expected of them in the role of driver, particularly throughout the transition to fully-automated Level 5 vehicles.

**2 Vehicle assessment and assurance.** Recognises that the traditional way of assessing vehicles for use on US roads may not be practical for automated vehicles. Balancing regulatory assurance with industry validation responsibilities through seeking agnostic solutions to this challenge.

**3 Safety assessment tools and scenarios.** The methods of safety assessment for automated vehicles will need to be very sophisticated and be co-ordinated so that the right test is conducted in the right manner. There is concern that testing on a test track may not be adequate for the assurance system. The question, 'How can the system assess risk in an objective manner?' is guiding this work.

**4 Protect the occupant.** While the plan for automated vehicles is that they don't crash, the NHTSA continue to research the behavioural aspects of the driving task to progress their investigations. For example, 'What do humans do that an automated vehicle needs to replicate?', 'How do we train humans to drive an automated vehicle when needed?' and 'How do drivers deal with conservative automated vehicles and share the road in traffic?'

Like Australia, U.S. road safety statistics are trending negatively after years of consistent decreases in fatalities and serious injuries. The NHTSA suspects human behavioural activities, such as distraction, are a major contributor to crashes. It believes there is a hard-core group of people who are not getting the message about driving under the influence of drugs and alcohol, which contributes to a third of deaths. There is also concern with the increase in bicycle and pedestrian deaths. Not wearing seat belts, also a key issue in Australia, is a contributor to around 50 per cent of fatalities. In a similar trend to Australia, US fatalities are 2.6 per 100,000 in urban areas compared to 12 per 100,000 in rural areas.

Contra Costa County believes the present measure of road safety performance (deaths per 100 million miles travelled) is a reactive measure that waits for the crashes before doing anything. It sees that the evolving 'big data' landscape will provide lead indicators such as near misses and skidding incidents, and allow for proactive intervention.

US regulators see the introduction of autonomous vehicles as the next step in road safety. While they are technology neutral, administrators have to make sure they are not behind the curve of technological development. Regulators believe companies should be working on the basis that the roads will be as

they are and their AVs will have to be good enough to cope with existing assets. Safety is number one, but administrators do not want to stand in the way of innovation. Governments in the US are focussed on creating a safety assurance framework for AV introduction - finding a balance to avoid prohibiting market entry by modifying existing regulatory standards so that they can apply new technologies. This will require a balance between adequate risk mitigation and cost and complexity of regulations.

The American Road and Transportation Builders Association (ARTBA) indicated that roadwork zones in the USA account for 65,000 crashes and 48,000 injuries (15,000 of them road workers), and nearly 800 deaths (135 of them road workers). The aim was to head towards zero deaths through their [Safety Certification for Transportation Project Professionals Program](#)<sup>17</sup>. An on-line safety centre has been established, with a large group of industry partners, with a focus on training candidates to attain the skills to identify temporary traffic control occupational, health and safety hazards, and to develop a safety planning culture and climate, with thorough incident investigation. Over 84 companies in 37 states have engaged this valuable service to date.

While Australia appears more advanced in its application of the safe system approach to road safety and traffic management and control around roadwork sites, it is recommended that Australian authorities should take a close interest in the [Safety Certification for Transportation Project Professionals Program](#)





# Smart Cities work together to share experiences.

Collaboration between cities in the USA has accelerated learnings, with a focus on social impact and customer acceptance.

The US Federal Government actively structures funding mechanisms to facilitate partnerships across industry, community, academia and governments. The aim is to bring diverse players from across the transport system together to drive a common goal to enable a safe, connected and automated future.

After the US Department of Transportation Smart City Challenge, the cities of Pittsburgh and Detroit emerged as ambitious cities with similar challenges, which stimulated participation in the [Smart Belt Coalition](#)<sup>18</sup> alongside their state counterparts, the private sector and academia.

The City of Pittsburgh participates as part of the Smart Cities Collaborative program which brings together 22 communities and cities to collaborate on the challenges related to implementing smart mobility policies and projects. The collaboration helps explore how emerging technologies and new mobility options can improve urban transportation, such as reshaping the use of the right-of-way and curb space and to ensure people and goods keep moving through Pittsburgh safely and efficiently.

## Better to say Smart Communities rather than Smart Cities.

The City of Detroit admits that for too long the developers of future urban mobility solutions and those charged with overseeing its implementation have been in separate rooms, if not planets! A strong economic development strategy and brand campaign is now driving change. The Michigan Centre for Economic Development recently hosted [DetroitMoves](#)<sup>19</sup>, a networking activity bringing mobility and technology providers together with government agencies to innovate.

The Detroit city vision is to bring the future of mobility to the people and to the streets of Detroit as a powerful component of the [smart economic stimulation strategy](#)<sup>20</sup> for a city in transformation.

This value proposition and branding is also a key strategy being implemented by the state of Michigan's Economic Development team to stimulate innovation in automated, electric, shared and connected transportation technology. [PlanetM](#)<sup>21</sup> is Michigan's mobility initiative which connects companies (small and large) to government, academic institutions and other companies in the "mobility ecosystem" — the people, places and resources dedicated to the evolution of transport mobility.

Also known as Motor City, Detroit's PlanetM office space is an open space, collaborative environment where new initiatives such as [Project Kinetic](#)<sup>22</sup> have developed. Bosch is one of the major global organisations already taking advantage of this collaborative environment.

The University of Michigan Transportation Research Institute (UMTRI) carries out world-leading research in state-of-the-art laboratories, investigating human to machine interfaces. This research aims to better understand how drivers (particularly vulnerable drivers, such as the elderly) learn and use automated vehicle technologies and systems. UMTRI has a large collection of naturalistic driving study data and one of the largest set of connected vehicle data in the world, assisting to inform manufacturers and policy makers to propel their pursuit to national AV deployment.

Australia has a lot to gain from mirroring the Michigan approach and the PlanetM model, and more generally the North American attitude to "Keep trialling". Trialling is undertaken with a give it a go attitude – "If it doesn't work, learn from it and move on to the next thing, without being scared of occasional failure on the way".

Finding new ways to learn, develop and exchange ideas internationally can support Australia in responding well to the opportunities that connected and automated vehicles provide. The recently signed [Memorandum of Understanding](#)<sup>23</sup> between the Australian Government and the State of Michigan is a great example.



Roads Australia recommends that the Federal Government, or an innovative state government, should consider establishing a facility based on the Michigan PlanetM model.





There is strong evidence that city and state governments that develop strong connections with their communities will have the edge in the development of smart city solutions.

In Pittsburgh, the delegation discussed how the battle for the kerbside is playing out as new mobility innovation hits the streets. This city (in consultation with the community) has developed the Complete Streets Plan to rethink mobility and transportation, with the aim of improving the quality of life for citizens across its 1,300 mile road network. The initiative is supported by a self-organised collective of last mile and alternate commute mobility providers who are working together to develop Pittsburgh's mobility tool kit<sup>24</sup>, and undertaking community-designed pilots to trial new urban mobility solutions.

The Pittsburgh model is an outstanding example of how micro-mobility is recognised as a fundamental component of a modern, urban transportation system. The city is exploring how to embrace an increased choice of mobility options to share existing infrastructure safely, while industry is working hand-in-hand to understand how existing infrastructure and urban mobility services might work best. While the engagement model ensures that citizens are able to design trials to understand the best way to adopt innovative first and last mile mobility options for their community needs.

Cities will need to adapt to their community's rapid adoption of new transport options. For example, electric scooter sharing company Bird, described to our delegation the huge growth in its electric-scooter use. While there have been acknowledged teething problems and varied acceptance in US cities, scooters are aimed at transforming urban mobility with safe, clean, affordable transport.

In one year shared electric scooter rides rose to 38.6 million from zero, surpassing bike share rides. Bird is now in 120 cities around the world. The growth trajectory is huge, meaning cities will have to rethink road design to accommodate more bike lanes – not just paint on the road, but rather protected bikeways. Bird believes that any city not thinking about changing its infrastructure would be falling behind.

# Advanced Manufacturing could change the landscape.

Micro-factories and small scale "bespoke" production techniques could see new vehicle technologies produced in Australia.

## Case Study - LOCAL MOTORS, OLLI

Founded in Phoenix, Local Motors is a community co-design technology company that aspires to give people the opportunity to design and drive their own transport. After many trials working with the community to develop useful transport vehicles, Local Motors introduced Olli, a crowd-sourced 3D printed, electric and automated shuttle.

This small, stubby, bread-box styled vehicle is made from recycled low-grade thermoplastic reinforced with carbon fibre. Currently, Olli is permitted to operate on state roads up to 25 miles per hour, however in current trials in Maryland, Local Motors have adopted to travel at 12 miles per hour.

While testing on this autonomous shuttle is still a work in progress, the key observation by our delegation was that the business model could be a major disrupter to traditional vehicle manufacturing. Local Motors presents an alternative approach, designing bespoke mobility vehicles that can be printed and constructed using a 3D printer in 44 hours. The model invites collaboration in local micro-factories the size of grocery stores with vehicles then sold directly to consumers.

The company believes it is conducting world-leading research into material strength and structures and anticipates opening between 50 and 100 micro-factories in the next decade. Each tool-less factory costs approximately USD\$20 million to build, a fraction of the cost of traditional assembly line automotive manufacturing. Indicative break-even production costs, based on crowd-sourced designed vehicle, the Rally Fighter, can be achieved after only 60 units.

There are many challenges for regulators to consider when assessing the safety and access for these vehicles, and to sufficiently demonstrate acceptance to meet public expectations. However the improved transport accessibility offered by this alternative manufacturing approach, makes it an imperative for regulators to work with industry to develop standards that do not impede progress.

Roads Australia believes that the "Olli" case study points to a significant pending disruption to traditional vehicle manufacturing scale and delivery timing. There is no reason why micro-factories and small scale "bespoke" production techniques could not see new vehicle technologies produced in Australia.



Roads Australia recommends that the Federal Government should develop a business case for the establishment of a small scale vehicle manufacturing Co-operative Research Centre (CRC).



# Summary of key findings and recommendations

## 1. The future transport needs of Australia's growing population calls out for much improved collaborative effort.

The widespread collaboration seen in North America should be fostered in Australia, enabling inherent individual strengths to be increased by greater co-operation and less competition between universities.

In Australia, the Federal Government funding criteria should be modified to provide seeding money for transport research which is conditional on both attracting private funds and requiring involvement of more than one university, with encouragement for more industry and local city government involvement.

## 2. Big changes are coming – is Australia ready?

Roads Australia recommends that Australian governments urgently consider a transition away from the fuel-based road user charging system currently in play.

In Australia, there is an opportunity to leverage the advanced work by the NTC and State Governments to pave the way for accelerated electric and zero emission vehicle penetration of the Australia market.

The early work on hydrogen in the US and Canada, including collaborations with Japan, reinforces Roads Australia's position that Australia can be a leader in hydrogen fuel development - the National Hydrogen Strategy is our opportunity to ensure we are positioned to grasp this opportunity.

## 3. It is time for a customer focussed end-to-end journey approach.

There are many opportunities for Australian companies and transport providers to collaborate and harness and/or develop new technologies and applications for whole of journey information, optimisation and payments.

The strong message for Australia remains that access to data for all transport modes will be essential for managing demand and delivering customer focused services across an expanding range of mode choices.

The challenge remains for the three tiers of government in Australia to achieve much stronger collaboration in the integration of transport and land use planning.



## 4. Making connections is the key to mobility success.

The challenge for all governments will be to strike the right balance between appropriate regulation and gaining societal advantage from emerging driverless Mobility as a Service operations.

There has never been a more important time for Australian transport agencies to have access to customer travel data for all transport modes - to enhance demand management and to deliver customer focused services across an expanding range of mode choices.

## 5. More collaboration is needed in infrastructure decisions.

Planning should be directed at the interconnectedness of things, with greater community engagement and big picture thinking rather than a project by project approach.

Roads Australia is concerned that state jurisdictions are required to do the heavy lifting on infrastructure readiness for AVs. Without strong national leadership, support and investment commitment, the burden on states will be too great and impede the roll-out of new, safer mobility solutions.

Lack of involvement by local government authorities in infrastructure readiness is a critical risk to smooth transition to an autonomous vehicle future.

## 6. Regulators are struggling to understand the plateau in road safety improvement.

While Australia appears more advanced in its application of the safe system approach to road safety and traffic management and control around roadwork sites, Australian authorities should take a close interest in the Safety Certification for Transportation Project Professionals Program.

## 7. Smart Cities work together to share experiences.

The Federal Government, or an innovative state government, should consider establishing a facility based on the Michigan PlanetM model.

There is strong evidence that city and state governments that develop strong connections with their communities will have the edge in the development of smart city solutions.

## 8. Advanced Manufacturing could change the landscape.

The Federal Government should develop a business case for the establishment of a small scale vehicle manufacturing Co-operative Research Centre (CRC).



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# References

1. RA Preparing for the Driverless Revolution Report 2017 [\[PDF\]](#)
2. RA Cities for the Future Report 2018 [\[PDF\]](#)
3. Smart Belt Coalition [\[Logo\]](#)
4. RA Commonwealth Budget Submission 2019/20 [\[PDF\]](#)
5. An Electric Vehicle Strategy for South Australia [\[PDF\]](#)
6. CNBC Powering the Future Report [\[Logo\]](#)
7. Natural Resources Canada Green Infrastructure Fund [\[Logo\]](#)
8. Hydrogen Council [\[Logo\]](#)
9. HC Hydrogen Scaling Up report [\[PDF\]](#)
10. US Department of Energy [\[PDF\]](#)
11. IEA Future of Hydrogen Report [\[PDF\]](#)
12. COAG Energy Council National Hydrogen Strategy [\[Logo\]](#)
13. TomTom Traffic Index 2018 [\[Logo\]](#)
14. AAA 2018 Road Congestion in Australia Report [\[PDF\]](#)
15. PARC/VicTrack [\[Logo\]](#)
16. Australian Local Government Association [\[Logo\]](#)
17. Safety Certification for Transportation Project Professionals Program [\[Logo\]](#)
18. Smart Belt Coalition Presentation [\[PDF\]](#)
19. Detroit Moves [\[Logo\]](#)
20. Michigan EDC [\[Logo\]](#)
21. PlanetM [\[Logo\]](#)
22. Center for Mobility Innovation [\[Logo\]](#)
23. Memorandum of Understanding Australia and Michigan [\[Logo\]](#)
24. Pittsburgh's mobility tool kit [\[Logo\]](#)



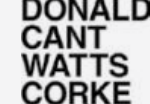
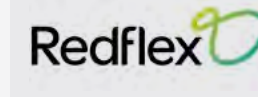
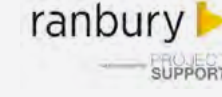
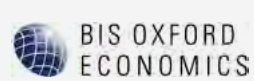
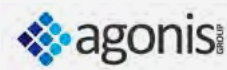
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