Australia’s future transport and mobility

Progress, policies and people

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Efficient transport systems are enablers of economic growth and social cohesion. However, a rapidly growing population is making Australia’s transport networks increasingly congested and ill-equipped to fulfil their central role.

In response to these challenges, governments have committed to historically high levels of investment in road and rail infrastructure. But is this going to be enough to achieve Australia’s vision of a transport network which helps to maintain and enhance prosperity and liveability?

Could the shift towards an on-demand, low carbon, connected, and autonomous transport future for Australia be part of the solution?

**Transport in transition**

New transport technologies such as autonomous vehicles (AVs) and drone taxis are on the horizon, and have the potential to transform our cities and lives in the decades to come. In the near term electric vehicles (EVs) are already here, and their adoption is expected to grow in the years ahead.

Some of the enabling technology and infrastructure such as a 5G mobile network, battery technology, connected ‘Internet of Things’ sensors, and Artificial Intelligence (AI) have now matured to a degree that can help support this transition.

These technologies are enabling the growth of Mobility as a Service (MaaS), in which consumers choose a mix of public transport, ride sharing and short-term vehicle hires, along with traditional, personal transport options, such as their own cars or electric bikes or scooters. More importantly, the integration of these previously siloed transport modes to create seamless trip solutions with a focus on customer experience is a game changer.

This transition will bring opportunities for governments, the private sector and most importantly citizens, including emissions reductions, reduced congestion, and helping mobility-constrained members of the community to become more mobile and to better participate in everyday life.

Along with the current infrastructure investment, these trends will play a major role in realising Australia’s vision, addressing the needs of the rapidly growing population, driving economic growth and enhancing social cohesion.
Policy imperatives

As with any period of change, governments have a vital role to play in laying out a long-term vision and policy and regulatory framework. Policymakers in Australia are increasingly focused on the complex and rapidly evolving transport sector.

Supported by the right policy settings, regulatory frameworks and community engagement, governments need to take proactive steps to help the travelling public make optimal use of transport networks and ensure safe and sustainable transition while minimising potential risks.

To inform these decisions, governments need more detailed analysis across issues including future demand, behavioural change and technology transition, as well as economic and environmental impacts – particularly in the areas of energy, planning and transport. Without this evidence base, we see at best many of the possible benefits not being fully realised, and at worst, negative outcomes being exacerbated.

In this report, we explore progress to date in Australia and outline KPMG’s views on the policy implications for a range of issues including energy markets, transport networks, community engagement and infrastructure planning.

While some of the trends and innovations are still in their early stages, we must act now to better understand their implications and capture the significant opportunities that these technological changes could present.

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What could future transport and mobility look like?

Victoria in 2046: a case study

“Automated and zero emissions vehicle technologies have the potential to be the biggest transformation to Victoria since the arrival of the car itself.”

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Impact of 100% uptake of AVs & EVs

Victorian Government vehicle-related revenues can fall by up to $12.8 billion per annum

Mixed transport technology usage of EVs and private and shared AVs

Impact of 100% uptake of AVs & EVs

Increase total electricity consumption by about 50%

$6.3 billion extra investment in generation and storage capacity required for Victoria

$23 billion extra investment required for the National Electricity Market (NEM)

Impact of 100% uptake of AVs & EVs

Transport network

Average speeds increase by 52% across the day and almost double during the morning peak (98%)

Average delays in the morning peak are 99.5% reduced

Congestion improvements occur across the network, but are seen most strongly in the inner city

Increased congestion: a 27% increase in average car trip times in the inner metro area

A 14% increase in average car trip distance

Energy market

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Average speeds increase by 52% across the day and almost double during the morning peak (98%)

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Increased congestion: a 27% increase in average car trip times in the inner metro area

A 14% increase in average car trip distance

Planning and city development

Impact of 100% uptake of AVs & EVs

Source: KPMG analysis and modelling undertaken for Infrastructure Victoria
Future mobility and transport in Australia – Where are we today?

Australia is making progress, particularly in the foundational areas of policy and regulation to help drive our transport and mobility future.

Here we outline some of the recent developments across policy, regulation, technology, infrastructure and AV research.

Setting long-term strategic visions
Many state and local governments have either published or are developing integrated transport and mobility strategic plans to guide their investments and support their long-term visions.

Select examples include:
- In March 2018 the New South Wales Government published its Future Transport Strategy 2056
- During 2018 the City of Melbourne engaged with the community across eight discussion papers to help it refresh it’s Transport Strategy to 2050
- Queensland Government is undertaking the Queensland Transport Strategy review.

Connected and automated vehicles
Australia has seen a marked acceleration in the development of AV legislation, infrastructure and investment, with the potential to become a global leader in AVs.

Australia ranked 15 out of 25 countries in KPMG’s Autonomous Vehicle Readiness Index 2019. Across the four pillars assessed in the index, Australia gained top marks for policy and legislation, significantly improved marks for infrastructure, and average scores for technology and innovation and for consumer acceptance.

Policy and legislation
Australia is strongly positioning itself for the safe deployment of AVs by developing a nationally consistent end-to-end regulatory framework. Indeed, Australia gained the top score on regulations supportive of AVs in KPMG’s Autonomous Vehicle Readiness Index 2019 and further developments are planned during 2019 and 2020.

In 2016, state and federal transport ministers agreed to a phased reform of current driving laws to enable fully autonomous vehicles from 2020. This reform is being led by the National Transport Commission (NTC).

In 2018, the NTC:
- Published a Consultation Regulation Impact Statement outlining key risks that need to be addressed to ensure the safe commercial deployment of AVs in Australia, as well as four options to address the risks.
- Published a policy paper on changing driving laws to support AVs. Transport ministers agreed to the recommendations, making a strong commitment to removing barriers to AVs through the development of a national law. The new law will allow an automated driving system to drive and ensure there is always a legal entity responsible when a system in an AV, rather than a human, is driving.
- Published a Decision Regulation Impact Statement outlining the appropriate safety assurance system for the first supply of AVs in Australia, which was subsequently endorsed by state and federal transport ministers.

At the state level, most governments have put AV legislation on the books including:
- South Australia: Motor Vehicles (Trials of Automotive Technologies) Amendment Bill 2016
- New South Wales: Automated Vehicle Trials and Innovation Bill in 2017

“All levels of government are working closely with industry to support automated vehicle deployment. Federal, state and territory governments are collaborating to develop the regulatory framework, expand trials and research infrastructure requirements.”

Dr Geoff Allan, Acting CEO, National Transport Commission

Office for Future Transport Technologies

Australia’s commitment to future mobility is further reflected in the establishment of the Office for Future Transport Technologies, a $9.7 million initiative to unify state and territory governments and agencies in delivering future transport technologies in a safe and responsible manner. Positioned within the Department of Infrastructure, the office’s mandate is to provide strategic leadership and support collaboration to ensure the safety of AVs and identify future infrastructure requirements to ensure cyber security safeguards are in place. The office is also working to support Australian businesses in realising potential opportunities.

Funding and trials

The House of Representatives Standing Committee on Industry, Innovation, Science and Resources recommended in 2017 that “the Commonwealth Government, in association with state and territory governments and local councils, consider funding of trials of automated vehicles with a public transport application, in both metropolitan areas and regional locations”.

Following the recommendation, public sector funding has been activated across Australia including:

- $10 million in New South Wales for AV trials
- $9 million in Victoria in grants for researchers and industry
- $1.35 million in Canberra to support AV trials in the Australian Capital Territory
- Continued funding in South Australia to fund innovation through its Future Mobility Fund Lab
- $9.7 million establishment of Federal Office for Future Transport Technologies
- In January 2019 Bosch was granted $2.3 million from the Connected and Automated Vehicle Trial Grants Program in Victoria and granted the state’s first Automated Driving System permit for on-road testing of highly automated driving systems.

Developments in trials include:

- The Western Australia government, in partnership with the RAC, is set to trial autonomous driverless taxis in Perth in 2019.
- The RAC with support from the WA State Government and the City of South Perth have continued testing of a fully automated bus in South Perth.
- The Olli shuttle and Matilda intelligent travel hub trial of driverless shuttle busses and interactive transportable hubs launched in Adelaide in January 2019.
- Cohda Wireless ran a test in Adelaide CBD.
- Lexus chose Queensland for connected vehicle testing, to start in 2019.
- In Queensland, the Cooperative and Automated Vehicle Initiative (CAVI) project began testing of cooperative and autonomous vehicles with the purpose of increasing road safety and reducing road deaths.
- The recently expanded University of Melbourne AIMES project, recently embedded sensors into an intersection to support speed management, intersection collision avoidance, and vulnerable road user protection.
- The La Trobe University Centre for Technology Infusion collaboration with VicRoads began piloting driverless shuttles on and around its campus.

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13 https://www.latrobe.edu.au/technology-infusion/autonobus
NSW began trials in 2017, and progressed to operating at Sydney Olympic park in Q3 2018 – with regional trials in Coffs Harbour in December 2018 and Armidale in January 2019.

The driverless train, part of the Sydney Metro project in NSW passed a major test in July 2018.

Enabling infrastructure, systems and technology
All levels of government are making progress in preparing transport and other enabling infrastructure for AVs.

At the federal level, the peak body Austroads has undertaken work to better understand the challenges and opportunities of AVs. It is focusing on supporting vehicles’ operations through machine-readable signage and road markings, open-data in the context of road-operator data, and more broadly, the opportunities for automated heavy vehicles in remote and regional areas.

In Queensland, the CAVI project includes digital road infrastructure enabling the testing of both vehicle-to-vehicle communication, and vehicle-to-infrastructure communication.

Outside government, Transurban, Australia’s largest toll road operator, has conducted trials of Connected and Autonomous and Vehicles (CAVs) in partnership with six vehicle manufacturers: Audi, BMW, Mazda, Mercedes, Tesla and Volvo. The first phase of testing targets partial automation, and subsequent phases will test highly automated vehicles. The trial, delivered in partnership with the Victorian Government, VicRoads and the RACV, has further added to the body of knowledge on the challenges and opportunities of AVs in Australia.

Electric vehicles and charging infrastructure
Enabling the move away from internal combustion to electric and other forms of zero emission technologies is a challenge being faced around the world.

In Australia, the availability of charging infrastructure for EVs had until recently been limited, constraining the ability of EVs and by implication many AVs (assuming that most AVs are likely to operate using electric battery technology), to travel longer distances.

However, since 2016, Australia has seen a significant increase in the availability of charging infrastructure with circumnavigation of the country by EV now possible. Key milestones have been:

- The completion of the Electric Superhighway in Queensland
- Increases in coverage in the South East with the Tesla Supercharger Network
- The RAC Electric Highway in WA
- The National Roads and Motorists’ Association committed $10 million to build one of Australia’s largest EV fast charging networks – free for members to cover 95% of member’s road trips.

Gaps in the Round Australia Electric Highway are being addressed by the Australian Electric Vehicle Association and Tesla Owners Club.

In January 2019, the NSW Government released its Electric and Hybrid Vehicle Plan which includes an electric or hybrid vehicle target of “10 per cent for new NSW Government general purpose passenger fleet cars from 2020/21” and to integrate “NSW’s first fully electric bus trial into a regular route service from July 2019.”

The NSW Electric and Hybrid Vehicle Plan includes initiatives to co-invest in fast chargers in regional NSW, and in commuter car parks. It focuses on adopting preferred charging standards, developing guidelines for installation of charging points in roadside service centres, and supporting EV charging through strategic land use planning guidelines.

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18 https://www.teslaowners.org.au/round-australia
Consumer acceptance

While the technology accelerates towards full vehicle automation, global consumer sentiment towards the technology has seen a marked decline. This decline, also evident in Australia, has been attributed to rising consumer awareness of potential risks as the technology is being developed and trialled.

Several governments and industry participants are conducting research to better understand how citizens feel about this next wave of transport technology including:

- The Queensland Government, as part of its CAVI, has undertaken a survey to understand public awareness of emerging vehicle technologies20.
- The NSW Government funded a research project with the University of Sydney looking into “three human factors critical to the successful deployment of automated vehicles”.
- Toll road operator EastLink undertakes an annual survey of attitudes of Victorian motorists to AVs.

Understanding future impact

Many states are also undertaking detailed analysis to understand the impacts of the shift to future mobility. Examples include:

Victoria

In October 2018, Infrastructure Victoria, an independent advisor to the Victorian Government, delivered 17 key recommendations for successful adoption and integration of autonomous and zero emission vehicles into Victoria31. Supported by KPMG analysis on transport network impact, energy impact and on government finances, the recommendations formed part of a major investigation into the implications of AVs and their infrastructure requirements.

Spanning policy, infrastructure and planning, the recommendations aim to future-proof Victoria’s infrastructure investments and may be considered as a blueprint for other states and territories. They include:

- Assessing current infrastructure against the unique needs of AVs
- Supporting future planning through the publication of updated planning guidelines
- Working with government and industry to promote the transition to AVs
- Establishing appropriate Information Communications Technology (ICT) infrastructure and ICT capabilities.

Further, the report has for the first time both identified and quantified the projected benefits of AVs to Victoria. Headline annual figures for Victoria in 2046 include:

- A reduction of 27 million tonnes of greenhouse gas emissions
- $706 million in health benefits
- 91% increase in Victoria’s road network efficiency
- $15 billion annual boost to economic growth.

“Infrastructure Victoria provided advice to government in 2018 on how it can best prepare the state for the vehicles of the future. In our recommendations we highlighted the importance of upgrades to mobile networks, line markings and energy networks, as well as some key short-term actions including integrating Mobility as a Service into the public transport mix and improving planning flexibility. While we don’t know quite when these vehicles will arrive on our roads, we can and should be ready.”

Michel Masson, CEO, Infrastructure Victoria

Queensland

In January 2019 Queensland’s Department of Transport and Main Roads (TMR) published a KPMG strategic options assessment on the impact of future mobility disruptions on the network22. This included Automated and Electric Vehicle technologies (AEVs), and the service models that could be adopted to deploy these technologies in the South East Queensland.

The report assessed a series of government actions that would help deliver outcomes in three potential future scenarios, including:

1. Privately-owned AEVs: AEVs have minimal effect on car ownership and the future fleet of AEVs are privately owned.
2. Door-to-door fleet AEVs: AEVs are deployed under a commercial fleet model, whereby fleet-owned vehicles compete with traditional public transport services.
3. Mobility as a Service: AEVs are deployed under a commercial fleet model that is integrated (through feeder services) with public transport services.

The objective of the strategic options assessment is to support TMR in identifying the most effective policy platform to facilitate the introduction of AVs onto the transport network and to ensure that the economic and social benefits of AEVs are maximised.
Electric vehicles - Is the energy market ready?

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With EVs moving towards common use, seamless integration will require the right energy resources to be available in the right places to match demand. Here we outline the impacts and explore what actions need to be taken to ensure there are no barriers to customers’ uptake of EVs so that the cost impact is managed and the benefits from EVs to the energy market are fully captured.

Demand and generation
KPMG analysis shows that a 100% uptake of EVs by 2046 in Victoria will:
- Increase total electricity consumption by about 50%.
- Mean existing generation capacity will not be able to absorb this extra consumption, and new generation capacity will be required, especially if the dispatchable capacity installed to meet peak demand is in the form of storage (or peaking gas plants which operate only a limited amount of time) and not base load generation.
- Need an estimated additional generation capacity of 12,669 MW, or 120% of the existing installed capacity of the Victorian system in an incentivised charging scenario. This increases to approximately 15,513 MW in a non-incentivised scenario.

If significant EV uptake is unmanaged and occurs in the relative near term, before dispatchable storage technologies like large scale batteries and pumped hydro become fully commercialised, then this could place increased pressure on proven technologies like gas fired generation to meet the increase in peak demand. This highlights the importance of ensuring that there are appropriate mechanisms in place and policy certainty to maintain reliability and promote efficient investment signals.

KPMG analysis suggests that a scenario of every driver having an electric vehicle would require up to $6.3 billion extra investment in generation and storage capacity for Victoria. Expanding this out to the National Energy Market (NEM), this suggests that EVs could cost up to $22.5 billion for the NEM as a whole. Our analysis found that over 20% could be saved by altering the charging behaviour through pricing incentives. This equates to $5 billion at the NEM level.

If generation and dispatchable capacity to serve EVs comes solely from renewable sources, this would require a substantial number of generation installations. For Victoria, in the absence of incentivised charging, we estimate that 234 new installations would be needed over the next 30 years. At the NEM level, this could equate up to 800 plus new installations across the east coast.

Distribution
Distribution networks could incur costs associated with managing the network security impacts and/or supporting electricity exports from EV batteries onto the grid, or with communication and associated trading technology to help support the capture of potential market benefits from EVs.

Further, as distribution capabilities and assets vary geographically, there will be localised impacts of EV charging, where the size, timing and particular location of isolated loads can have significant effects on network reliability as a whole. That is, the impact on the distribution networks are likely to vary significantly at the local ‘street level’. Another concern is that, unlike other items that impact distribution assets, the EV can move around the grid.

Going forward
EVs will have significant impacts on, and create new challenges for, the energy markets.

Government is likely to have a key role to play in managing the energy market impacts and facilitating the provision of charging infrastructure. This may take the form of subsidising charging infrastructure, providing infrastructure in areas the private sector neglects, supporting interoperability, and potentially in standards development.

Whilst the rate of EV uptake is uncertain, it is unlikely to be slow and linear. Rather, it is likely to follow an ‘s’ curve of consumer adoption, where at some point buying a traditional car no longer makes sense. At this point, EV adoption is anticipated to rapidly increase until the market is close to saturated.
Having a clear regulatory and policy framework in place for EVs before this happens will be key to ensuring that EVs are efficiently integrated into the evolving energy markets. The challenges identified need to be resolved in a predictable and robust manner to facilitate the investment and business models to get the appropriate infrastructure responses.

**Read the full report:** Electric vehicles – is the energy market ready?

**Further reading:** Fuelling the future: Preparing the downstream oil and gas industry for the mobility revolution, Andy Steinhubl, Principal, Strategy Lead, Energy & Natural Resources, KPMG in the US

Future fuels mix: The impact of the future transport fuels mix on the UK energy system, Simon Virley CB, Partner and UK Head of Energy & Natural Resources, KPMG in the UK

Ted Talks To: Electric Vehicles in India, Ted Surette, Global Sector Leader, Power & Utilities, KPMG Australia
Rethinking the impact of new vehicle technologies on transport networks

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KPMG analysis shows that while new vehicle technologies such as AVs, and EVs could unlock the capacity of existing transport infrastructure, they could also make congestion worse.

These technologies present opportunities to better utilise existing transport infrastructure and enhance our economic, social, environmental outcomes. However, as with all new technologies, their benefits are not guaranteed, and without the right evidence base to inform the policies and infrastructure decisions, there could be unintended consequences.

Data driven decision making

KPMG’s experts undertook a detailed analysis of the impact of AVs, and EVs on Greater Melbourne’s transport network. While the analysis focused on Greater Melbourne, key insights and policy implications could be equally relevant to other cities and regions.

Traditional approaches to transport modelling don’t allow us to properly assess the impact of new technologies on the wider transport network. With our cities growing at historic levels we urgently need new approaches that can model the impacts of changing citizen preferences as new technologies are adopted. Once we have better data on the impacts, we can develop smarter policies to maximise their benefits and minimise their downsides.

What will the impact be?

Under a scenario of a mixed fleet in 2046 of traditional cars, human-driven electric cars, private AVs and on-demand AVs:

- **Melbourne needs 2.2 million cars**, compared to 3.5 million with traditional cars, or 265,000 with all on-demand AVs.

- **22% of trips occur on public transport**, compared to just 14% if all cars are private AVs and 28% with all on-demand cars.

- **Average speeds are projected to increase by 52%** across the day and almost double during the morning peak (89% increase). **Average delays in the morning peak are 99.5% reduced** compared to when traditional cars are on the road. The network congestion improvements occur across the network, but are seen most strongly in the inner city.
How can we maximise the upsides and minimise the downsides?
A few of our recommended solutions to maximise the upsides and minimise the downsides of new vehicle technologies are summarised below.

- **Pricing or regulating empty running:** AVs help with congestion, but not if we send them home empty or just let them drive by themselves to avoid parking fees. Without regulating empty trips, Melbourne could face serious congestion. Discouraging people from empty running to avoid parking fees would help avoid this problem, especially in the inner city.

- **Encourage people to use on-demand AVs:** It’s critical to find ways to minimise waiting times, particularly in outer suburbs so that more people choose to use on-demand AVs. The more we use on-demand AVs, the more benefits we can unlock for our existing road infrastructure.

- **Ongoing investment in public transport:** KPMG’s analysis found that no matter what new vehicle technologies are introduced, public transport is key to ensuring growing populations can access employment, healthcare, education and other services. Access to areas with high capacity modes like rail is crucial to Melbourne’s knowledge economy and continued economic growth. Providing appealing public transport options also encourages use of on-demand AVs, with all the benefits described above.

Transport technology is critical for protecting Melbourne’s liveability. But the impacts of EVs summarised above are not unique to Melbourne. Any city in Australia and beyond can use key insights from KPMG’s analysis to help inform their transport plans and policies.

**Read the full report:** [Rethinking the impact of new vehicle technologies on transport networks](#)

**Further reading:** [Connectivity or congestion – Two visions for an autonomous future](#) [Autonomous Vehicle Readiness Index 2019](#)
The term MaaS has, until recently, referred solely to
the provision of on-demand mobility services such as
Uber, but a broader definition is emerging to encompass
the integration between private and public mobility
services, enabling customers to use whichever mode –
or modes – of travel that best meet their requirements,
in a seamless, fluid manner. When commercial benefits
to operators and policy benefits to authorities are added
to this seamless integration, MaaS becomes a highly
compelling opportunity and proposition.

MaaS in action
Cities such as Vienna and Helsinki are demonstrating
a new travel paradigm known as MaaS, which not only
enhances the user experience but which, if designed
in an appropriate manner, can be leveraged to achieve
key policy objectives such as economic growth and
resilience of the transport network.

In Helsinki, for example, citizens use the travel app
Whim to select their preferred mode of transport be
it train, bus, taxi, bike or tram. Where they need to
switch mode mid journey, the app enables them to
plan and, where necessary, adjust their route in real
time to minimise hassle and delay. Payment is also
handled by Whim either by pre-pay or a payment
card registered to an account.

Managing divergent interests
MaaS offers a joined-up approach to mobility.
In many ways, it’s interdependence for the greater
good. However, private mobility services operators/
providers and transport authorities nominally each
have different objectives, and so the task is to create
transparency, establish conditions in which the best
outcomes for each stakeholder – including the user
who is central to the service – is achieved.

Commercial operators seek to maximise their
financial returns, and include market disruptors such
as Uber and Via for example, while authorities are in
the business of delivering policy objectives such as
economic growth, space optimisation, social inclusion,
citizen health and well being. Other considerations
such as air quality, congestion management and
aesthetic impact also have to be taken into account.

Unlike private operators, authorities are required to
continue providing transport services even when they
are commercially unviable, to cater for demographic
segments who cannot afford on-demand services such
as Uber, and proactively to provide mobility to generate
economic growth (rather than enter the market in
response to economic growth). So although the arrival
of disruptors enhances choice for many, it makes the
task facing authorities harder, and may reduce mobility
services for poorer citizens, while harming efforts to
regenerate districts and regions.

Knowing where to start: KPMG’s MaaS
Requirements Index
KPMG’s MaaS Requirements Index, provides a
mechanism by which transport and local authorities,
operators and other mobility services providers can
understand the regulatory, commercial, governance and
technology operating models that will be required to
deliver strategic objectives for local and regional transport.

For instance, is a complex MaaS ecosystem an
operation that requires a large amount of regulation to
achieve policy goals and optimise the user experience,
or is the transport system more straightforward, and
in need of lighter-touch regulation?

Do transport authorities and agencies need to provide
their own on-demand mobility services to cater for
the needs of concessionary customers? How will
authorities and agencies move from where they are
now on the MaaS Index to where they need to be?

Currently, the Index identifies where the transport
authority and agency is, helps it to understand where
it should be, and where it could be in the future.
It provides a tool to help identify the correct balance
between the interests of customers, operators and
authorities. In doing so it can then help to configure
the range of mobility options for users to achieve the
objectives of each, at the same time recognising the
need for compromise on all sides.

Future versions will analyse the regulatory,
commercial, governance, payment and technology
scheme operating models, and what will be most
applicable under the different scheme configurations.
Lastly, if you’re interested as to where the transport authority and agency stands on the MaaS Index, here are five quick questions to consider:

1. What is the complexity of modal choice in your area
2. How easy is it to achieve key policy objectives, such as good air quality, reduced congestion, public health, economic growth and the avoidance of overcrowding?
3. What is the mix of public and private sector operators in your context? What is the balance of commercial, economic and policy objectives?
4. How seamless is journey planning and payment within your region and neighbouring regions? To what extent does inertia in payments and planning impact mobility choices?
5. What happens when things go wrong? Is your transport ecosystem resilient? If one mode fails, can others take up the slack? Does this apply to all customer segments?

Read the full report: *Reimagine places: Mobility as a Service* Ben Foulser, Associate Director, KPMG in the UK
As society switches to AVs, zero emission and EVs in the near future, Australian governments will lose a number of significant revenue streams. Understanding how this transition will take place and its impact on government finances will be critical to planning and delivering a range of public services in the future.

Government revenue is closely linked to vehicle ownership and usage

Australian governments generate a significant proportion of their revenue from vehicle-related fees and charges such as stamp duty, registration and driver licence fees, vehicle-related infringements and fuel excise. They also direct substantial expenditure to transport-related infrastructure, such as roads and public transport, and services, such as road safety enforcement.

In Victoria alone, estimated income derived from selected vehicle-related fees and charges totalled over $5 billion in FY15 or approximately 10% of all state government revenue.1,2 For the same period, local governments in Victoria collected an estimated $130 million in parking fee revenues, and the Commonwealth Government collected more than $2 billion in fuel excise from Victorian motorists.

Understanding the shift to new technologies

The impact on government finances will be influenced by the emergence of the AV/EV technologies, and the manner and extent to which these technologies are adopted and used by society. The key changes expected to impact government finances are:

- A potential shift from privately owned, single-use vehicles towards shared ownership models
- Changing transport related investment requirements for governments
- Improved road safety outcomes arising from developments in vehicle technology
- Increased compliance with traffic rules and regulations and reduced revenue from fines.

Broadly speaking, the nature of the financial impact of AV, zero emission and EV technologies will depend on whether consumers use these in a similar way that we use traditional vehicles (that is, as privately owned assets for personal single use), or whether new models of vehicle ownership and use will be adopted (for example, shared ownership models).

A future scenario dominated by shared use AVs will substantially reduce revenue from vehicle registration and driver licence fees, and infringement and parking related income.

Critically, the financial impact of these technologies on governments will progressively increase over time in line with uptake and changes in consumer behaviour. Governments will need to start considering the applicability of current revenue and expenditure arrangements, and examine their viability and the impact of changes to these current arrangements.

Impact on government finances

KPMG modelling undertaken for Infrastructure Victoria found that the emergence of AVs, zero emission and EVs and the resulting changes in consumer behaviour could negatively impact government finances in Victoria by up to $12.8 billion per annum by 2045-46. Extrapolated across Australia, the estimated negative impact on government finances may be as great as $50 billion per annum (depending on the assumed uptake scenario).3

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1 Includes registration fees, license fees, TAC premiums, vehicle stamp duty payments, infringement revenues, public transport farebox revenue and congestion charges


3 This estimate is based on an assumption that Victorian per capita revenues are representative of the whole of Australia, and the population projections contained in the Australian Bureau of Statistics dataset Population Projections, Australia, 2017 (base) – 2066
A range of scenarios for Victoria were modelled, including privately owned AVs, fleet style AVs, adoption of different technologies, as well as slow and fast adoption scenarios. The impact on key government revenue and expenditure categories is largely directionally consistent, but varies in magnitude across scenarios (see chart above). These categories are not intended to represent the full impact, but were considered to be most material and therefore requiring further analysis.

KPMG analysis indicates that the net negative impact on government finances in Victoria (including Victorian local governments, the Victorian Government and Commonwealth fuel excise revenue that indirectly flows to Victoria) across all scenarios ranges between $5.1 billion per annum by 2046 under a slower uptake scenario, and $12.8 billion per annum by 2046 for the fleet-style AV scenario.
Governments should encourage adoption but also reconsider their revenue models

The large-scale adoption of AVs, zero emission and EVs in Australia has the potential to change the lives of all Australians and offers an opportunity for governments and the wider community to realise significant economic, social and environmental benefits.

While these benefits and continuing technological improvements will drive increasing adoption, the analysis of the Victorian revenue impact shows it is likely to be highly disruptive to the existing revenue model underpinning road funding and maintenance and other government services. The analysis provides a point-in-time estimate of the financial impact under different scenarios, but in practice the impacts will materialise progressively as vehicle technologies evolve and adoption rates increase.

If the current revenue model remains unchanged following the adoption of these new technologies, governments will be increasingly resource constrained and less able to build and maintain roads and invest in other transport initiatives. Key revenue sources, such as fuel excise and vehicle registration were designed and implemented decades ago. While these charges have served Australia well, with the rapid changes occurring it is now time to consider options that will serve better for the next generation. New arrangements should aim to address the negative financial impacts while continuing to encourage the adoption of the new technologies to help secure the social, economic, and environmental benefits associated with their use.

Alternative funding models for governments such as distance or area-based vehicle charges are well documented, and should form part of the thinking for the future. These funding models would not only help to fill the revenue gap that will arise following the introduction of AVs, zero emission and EVs, but could also be used to improve road use efficiency by introducing a charge that better reflects the marginal public cost of road usage. These charges could also include price differentiation, with a higher charge on congested roads and a lower charge on underutilised and regional and rural roads.

Further reading

*Autonomous vehicles: The public policy imperative*
How shifting public perceptions about autonomous vehicles will save lives

Ben Ellis, Partner KPMG Australia
Renan Grace, Associate Director, KPMG Australia

Automated technology accelerates while consumer sentiment stalls

While the global automotive industry accelerates towards full automation, global consumer sentiment toward driverless vehicles has seen a marked decline, thanks to issues of consumer trust and rising awareness of the risks associated with AV technologies. The decline is also evident in Australia, with the KPMG Autonomous Vehicle Readiness Index 2019 reporting that since 2018 Australia has fallen three places to 12th overall for consumer sentiment.

Safety remains the public’s primary concern

A 2016 survey of Australian road users, led by Ben Ellis, Partner, Management Consulting, KPMG, found that safety was the most important factor in willingness to pay for AVs and in the usage of driverless cars. Other recent surveys of Australian consumers have similarly identified the importance of safety to the public.

The reporting of deaths associated with the testing or operation of AVs on public roads has likely contributed to the recent decline in consumer sentiment. In 2018, a pedestrian in Arizona was killed in an incident with a Level 3 conditionally AV, and in Mountain View, California the driver of a Level 3 AV died in an accident while the car was in ‘autopilot’ mode. These two incidents received substantial coverage in the mainstream media.

Autonomous vehicles could save over 1,000 Australian lives every year

Despite these incidents, AVs have the potential to drastically reduce the cost of road crashes to both human life and the economy. In 2016 alone, 1,296 people died on Australian roads. Of these crashes, approximately 80% occurred as a consequence of mistakes such as distraction, fatigue or excessive speed. In 2015 the cost of road trauma to the Australian economy was approximately $27 billion, over $2 billion more than the 2018 budget for infrastructure.

Infrastructure Victoria estimates that AVs could reduce crashes by up to 94%. If this decline were realised, it could save over 1,000 lives per year on Australian roads. In fact, partial vehicle automation features like emergency braking and electronic stability control are already contributing to a decline in road crashes in Australia.

Understanding consumer sentiment is a crucial first step

By addressing the decline in consumer sentiment, we have the opportunity to accelerate adoption of AVs in Australia. However, as a first step, we require further knowledge of consumers’ wants and needs.

This is already underway in several states. The Queensland Government, as part of its Cooperative and Automated Vehicle Initiative, undertook a survey to understand public awareness of emerging vehicle technologies. Toll road operator EastLink undertakes an annual survey of attitudes of Victorian motorists to AVs. Further, KPMG is currently undertaking a survey of consumers in relation to their perception of autonomous vehicles and their willingness to pay.

Each of these surveys will enhance transport agencies’ and operators’ understanding of the attitudes of the Australian public towards AVs.

Engagement is key to reversing the decline

The next step is to engage, educate and promote awareness of AV issues to the Australian public. A key means to achieve this, and to address consumer sentiment, is to involve the public in AV trials. To date, the majority of trials have been closed, with few conducted on public roads. Involving the community in trials will not only improve aspects of consumer sentiment, but feedback from Australian consumers can also be incorporated into the development process.

1 Autonomous Vehicle Readiness Index 2019, KPMG
2 Autonomous Vehicle Readiness Index 2019, KPMG
5 https://theconversation.com/we-asked-people-if-they-would-trust-driverless-cars-96013
The importance of consumer awareness for adoption of AVs has already been recognised by manufacturers and technology companies. Internationally, the Partners for Autonomous Vehicle Education (PAVE) organisation, supported by a variety of industry, non-profit and academic institutions, aims to inform the public and policymakers through awareness campaigns and public facing trials\(^\text{13}\).

Australian governments can also address consumer sentiment by taking an increasingly active role in the development of AV technology, innovation and policy. As active stakeholders, state and federal governments can continue to engage with technology companies and vehicle manufacturers to incorporate Australian values into the design process, and ensure that Australian standards and ideals are reflected.

**Western Australia leads the way with community engagement**

The WA RAC Intellicar trial serves as a case study for such engagements. In partnership with the WA Government, the RAC is trialling Level 4 highly autonomous ‘Intellicar’ cars on Perth’s roads. Stage Three of the trial, beginning in 2019, will allow the public to request an Intellicar robotaxi via a mobile application and to travel anywhere within a defined precinct – a significant development in AV trials moving from a fixed-routes to dynamic routing and navigation. Not only will this trial allow the public to experience AVs, it will also demonstrate the potential for future robotaxi services.

**How should we respond?**

There are a number of actions governments can take to help reverse the decline in consumer sentiment to ensure Australians can realise the benefits of AVs. KPMG recommends the following actions to policymakers:

- Continue to invest in surveys and community engagement to better understand the wants and needs of Australian consumers. Understanding consumer awareness and requirements is key to addressing negative and declining consumer sentiment. Providing additional funding or grants for trials which facilitate community engagement may also be beneficial.

- Take an increasingly active role as a stakeholder in the development of AV policy, technology and innovation to ensure Australian values are reflected. Through policy and regulation, the Government can ensure high standards of manufacturing and technology which reflect Australian values and the wants and needs of Australian consumers.

- Work to ensure Australian consumers are appropriately informed about emerging technologies to allow them to develop appropriate levels of trust and confidence. Public facing trials, such as the RAC WA Intellicar project serve as a template for such engagements in Australia and should be replicated across other major metropolitan areas.

**Further reading**

*KPMG Global Automotive Executive Survey 2019*

\(^{13}\text{https://pavecampaign.org/}\)
When we think of infrastructure, we picture tonnes of concrete or steel, rail lines, roads, power stations or hospitals. We imagine things built to stand the test of time.

However, the infrastructure assets we create are simply enablers to help our communities to survive and thrive. A road is an enabler of the mobility of people and goods, a hospital is an enabler for the provision of health services, and our power stations enable the creation of electricity that is the life blood of our society.

The demands of our society (including population growth, ageing, urbanisation and consumer behaviour), combined with the massive disruptive impacts of technology, mean that the ways we can meet these critical community needs, is significantly changing.

No longer can we assume that the way we have planned, invested and managed infrastructure in the past will meet the demands of the future. No longer can we assume that building more (roads, more hospitals etc.), is the best way to support the needs of our communities. Our uncertain world means that it is vital to continually reassess and rethink our approach.

Uncertainty and our roads

The future use of our roads provides a useful example of how changes are creating significant uncertainty.

Will the increasing population continue the relentless need for more and wider roads? Or will technological change, such as AVs mean that we need fewer vehicles – or at least use our roads much more efficiently?

Either of these future states are possible – but traditional approaches to dealing with one outcome are unlikely to the other – so a much more nuanced way of thinking is necessary.

The challenges for governments and investors

This environment of change and uncertainty presents significant challenges for governments and investors alike. While we have a critical need to invest or build today to meet the current (significant) needs of our communities, we cannot be certain we will receive the benefits over the next (typical investment horizon) 30-50 years.
With communities crying out for investment to meet their critical current needs, but an uncertain and highly volatile future, this requires governments and investors alike to:

- Re-think how we view and understand infrastructure assets and recognise that infrastructure is simply an enabler of critical community services, like mobility and health; and that new infrastructure assets are arising – such as data, and the use of data for better delivery of critical community services.
- Look beyond the predictable future and to envisage multiple possible futures – including completely different ways to meet the needs of our communities.
- Build awareness of the tidal wave of potential changes that are coming and ensure consideration of the impact these may have on what infrastructure we need and how we use it.
- Incorporate flexibility into every aspect of infrastructure planning and design – and agility into the way the community services are provided.
- Invest carefully so that our scare funds are directed to solutions that provide the best possible long-run outcomes, and so our investment community can continue to invest with confidence and in a manner that achieves the required returns.

Read the full article here: Rethinking infrastructure projects in an uncertain future

Further reading: Rethinking infrastructure planning – preparing for an unpredictable future
No U-turn - How autonomous vehicles will reshape our cities

Praveen Thakur, Partner, KPMG Australia
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For centuries, the dominant mode of transport has shaped our cities. We are now on the verge of a shift to a new dominant mode – the autonomous electric vehicle. More than any other single factor, this shift will define our cities’ development for decades to come.

If we respond pro-actively, autonomous ride sourcing has the potential to catalyse urban regeneration. If we do nothing, we risk exacerbating urban sprawl and endemic congestion. The difference between these scenarios is not inconsequential – the liveability, sustainability and productivity of our cities is at stake.

How transport shapes our cities
Throughout the history of cities, most urban dwellers have preferred to live within a short travel time from the urban core allowing them to take advantage of the diverse opportunities our cities offer.

Re-making Melbourne
The primary transport mode for Melburnians in the mid-19th century included walking, horses and carriages. Urban development in 1855 was therefore huddled within a short distance of Melbourne CBD.

After the industrial revolution trams and trains allowed the city to expand as development stretched along these new corridors enabling the development of Melbourne’s inner suburbs as we know them today.

The post-World War II era saw the rise of automobiles as the dominant transport mode. New highways and freeways enabled Melbourne to expand outwards again into new, low-density suburbs.

The autonomous era will result in competing pressures towards continued urban sprawl along freeways, whilst at the same time leading to urban consolidation in inner and middle suburbs.

Urban sprawl along freeway corridors
The autonomous era will increase the attractiveness of urban development along Melbourne’s long distance road corridors as AVs make long distance travel easier, cheaper and safer. By communicating with each other and/or the road infrastructure itself, AVs will maximise vehicle speed and flow. When all vehicles are autonomous, the capacity and speed of long distance freeway travel will increase markedly.

Inner city densification
With car sharing and ride sourcing, the fixed costs of car ownership are distributed among a large pool of users. Currently, these advantages are offset by the cost of a driver (ride sourcing), or the inconvenience of finding, booking and walking to a vehicle (car sharing). In the autonomous era, these disadvantages will no longer exist – indeed KPMG analysis suggests that an autonomous ride sourcing service could cut the annual cost of vehicle travel by nearly half.

For residents who choose to forego car ownership in the autonomous era, many will choose to live in the inner suburbs to optimise autonomous ride sourcing fares.

How should we respond?
Governments must begin taking action now to safeguard the liveability and productivity of our cities in the autonomous era. KPMG recommends the following actions to policy makers.

– Review existing planning schemes and controls to ensure they support urban consolidation that is appropriate from a societal perspective.
– Provide affordable housing in the inner and middle suburbs to encourage densification and take-up of ride sourcing services.
– Assess development plans to ensure new developments are consistent with the implications of the autonomous era.
– Invest in decision making tools for understanding the impact of autonomous and electric vehicles on land use. This can be achieved with land use transport interaction (LUTI) models.
– Implement road pricing reform as a matter of priority to manage demand for car travel, and as a policy lever to encourage ride sharing.
– Encourage an eventual transition from private ownership to ride sourcing and car sharing for daily travel through enabling policy and regulatory settings. This includes facilitating business models that provide these services. Governments must also ensure high quality alternatives to car travel are available, including public transport, walking and cycling.

Read the full article: No U-turn - How autonomous vehicles will reshape our cities
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