



THE FUTURE OF MOBILITY

August 2017

ABOUT TTF

The Tourism & Transport Forum (TTF) is a national, member-funded CEO forum advocating the public policy interests of leading corporations and institutions in the Australian tourism, transport and aviation sectors.

TTF is the only national multi-modal transport advocacy group in Australia and is committed to improving the quality of passenger transport across the country. Our key transport policy goals are to promote:

- the importance of investment by state and federal governments in transport infrastructure;
- the role of the private sector in the delivery of public transport services, particularly through franchising; and
- best practice in customer service, particularly through the use of new technology.

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EXECUTIVE SUMMARY

Futurist Ray Kurtweil said in 2001, “we won’t experience 100 years of progress in the 21st century – it will be more like 20,000 years of progress.” Given the progress we have already experienced, it is difficult to disagree with this statement.

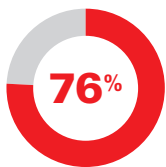
Having now witnessed the disruptive effect of technology on all aspects of everyday life, it begs the question: What does the future of transport look like? With the rapid rate of technological change and an unprecedented level of innovation occurring within the transport sector, this is a difficult question to answer. Technology has already transformed what is possible for transport in the last ten years. Ride-sharing, contactless payments and the provision of real time information about transport services are just a few examples of how technology has reshaped the way that we access mobility.

New technology will continue to rapidly transform all modes of transport. However the unpredictability of this transformation presents challenges, and subsequently opportunities for the sector. Autonomous vehicles and new service delivery models, driven by innovative technology and supported by the sharing economy, such as on-demand transport and Mobility as a Service (MaaS) will all play a growing role in addressing the mobility challenges of the future. However, these technologies in isolation will not be the silver bullet that solves all of our problems, rather they will form part of an integrated mobility network that must also include high frequency public transport services.

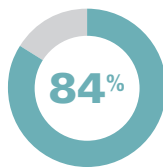
Experts view technology as the future of transport, but consumers are still to be convinced, with TTF research indicating that many prefer the status quo of private vehicle usage over on-demand public transport services. As governments and industry commit more time and resources to developing and implementing new technologies within the transport sector, they must also keep in mind that convenience and affordability will be the drivers of change, technology the vehicle.

There is no one answer to predicting what transport will look like in the next 10 years, let alone 100. What we do know is that change will be quick and it will be exhilarating.

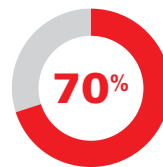
WHAT CONSUMERS THINK ABOUT THE FUTURE OF TRANSPORT



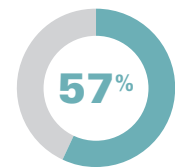
believe that they will still own a car in 10 years’ time.



of 18 to 25 year olds’ believe that they will still own a car in 10 years’ time compared to **57 per cent** of those aged 65+.



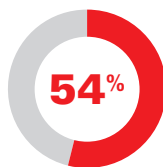
prefer that governments prioritise public transport infrastructure over road infrastructure.



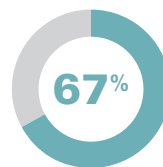
say cars are their preferred mode of transport. **31 per cent** favour public transport.



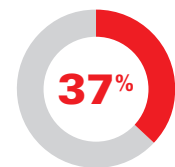
believe that their public transport services have improved in the last 5 years.



prefer fixed timetabled public transport services, compared to **9 per cent** who favour on-demand services.



can imagine a future where people or goods are transported by flying autonomous drones.



would be willing to use flying autonomous drones in the future.

INTRODUCTION

THE FUTURE OF MOBILITY IN AUSTRALIA

For decades, the way people commute to work in Australia has not changed. The majority drive or are driven in private vehicles, while most others use public transport delivered by buses, trains, trams and ferries. However, new technology is disrupting the way Australians travel to work and rapidly transforming what is possible. It is difficult to predict exactly what the future of mobility will look like, but it is clear that by 2030 the way we commute will look very different to how we travel today.

In recent years, technology and digital disruption have resulted in a significant shift in the way we travel from one place to another and how government and transport operators predict how we will use transport in the future. The rise of electric vehicles, driverless vehicles, and the use of smart phones to connect us to transport services are all real examples of how technology is continuing to change the way we travel and think about the future of mobility.

HOW TECHNOLOGY HAS RESHAPED THE WAY WE THINK ABOUT MOBILITY

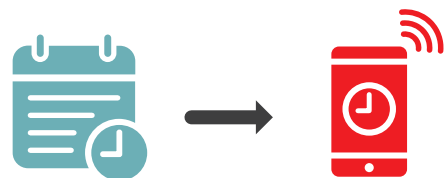
Ticketing

TTF consumer research indicates that 64 per cent of commuters prefer using a smart card i.e. Opal, Myki or Go Card to access their public transport services.



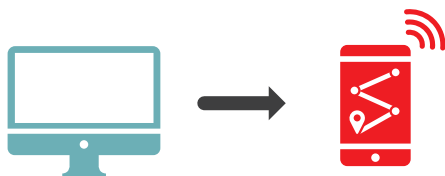
Timetables

64 per cent of people access their public transport schedules online, compared to 18 per cent who prefer printed or physical timetables.



Access to Information

55 per cent of commuters believe that smart phones and real time information have made public transport a more convenient form of travel.



Driverless vehicles

McKinsey estimates that by 2025 fully autonomous vehicles will make up 1-2 per cent of light vehicles on the road network.





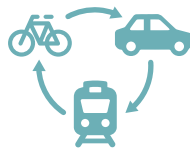
New types of technology and service delivery model such as Mobility as a Service (MaaS), transport-on-demand, autonomous vehicles, contactless payments, big data and analytics will significantly change how customers experience transport and make their travel choices. Some of these shifts will happen quickly, while some are more likely to occur over a longer period of time. What is clear is that while transformation within the transport sector will be rapid, it will also be unpredictable as new services and paradigms emerge and take-up of these services increases.

MOBILITY TRENDS

Transport on Demand



Mobility as a Service



Contactless Payments



Autonomous Vehicles



Shared Mobility



Electric Vehicles



Big Data and Artificial Intelligence



Not only has technology and innovation reshaped how we access mobility, it has fundamentally changed the way we think about urban design and how we will keep our cities and our regions moving into the future. Historically, the development of cities and regions has been driven by large scale infrastructure projects and major investment in roads and public transport networks, many of them fixed, linking Australia’s sprawling suburbs with CBD locations and employment hubs.

To address significant policy challenges such as population growth, urbanisation and increased levels of congestion, governments across Australia have focused on investing in additional road and public transport infrastructure projects. This investment in Australia’s mass transit will be critical to the long-term efficiency of transport networks across Australia and will reduce congestion on our roads and increase capacity on our rail, bus and ferry networks.

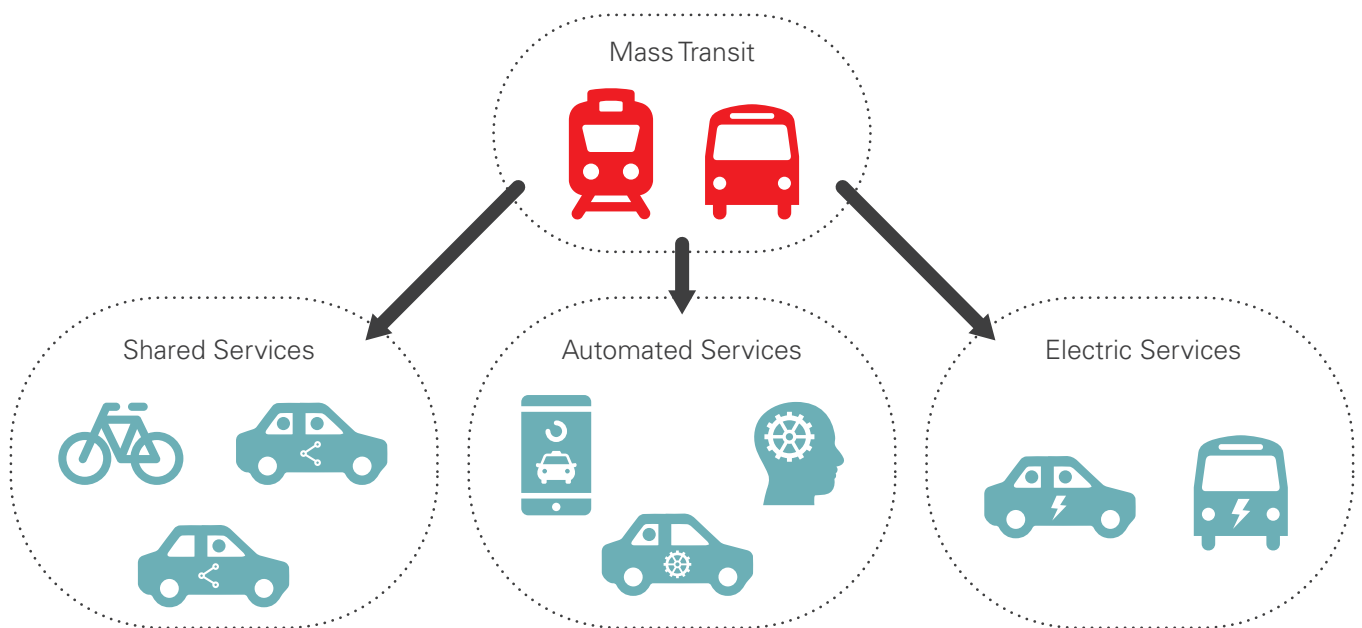
While future investment in mass transit is critical, new infrastructure cannot of itself solve all of our mobility problems. A strategy that focuses solely on building new transport infrastructure and providing traditional transport services is doomed to fail due to scarcity of land, particularly in urban areas, as well as constrained government resources and infrastructure inflexibility in outer regions, which cannot be connected quickly enough to keep pace with population growth. We cannot simply build our way out of congestion.

To maximise the growth and the productivity of our cities and regions and to improve liveability, we must make better use of existing infrastructure through technologies and integrated systems that drive greater efficiencies and support an increased uptake of public transport services.

It is likely that a realistic transport future will require targeted investment from government in a high-frequency, reliable and interconnected public transport system that is supported by new technologies that are shared, autonomous and electric.

IS THIS THE FUTURE OF MOBILITY?

High Frequency Mass Transit supported by Shared Mobility, Autonomy and Electrification



CHALLENGES FOR THE FUTURE OF MOBILITY

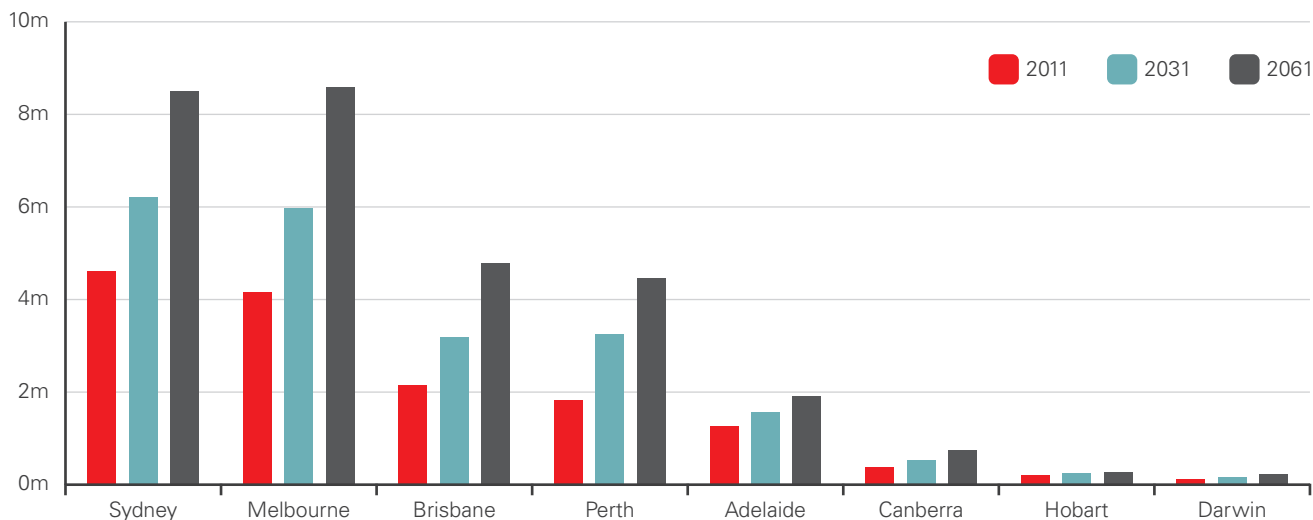
Governments and decision makers face challenges that will have a critical impact on mobility into the future. These challenges will require innovative thinking as well as collaboration between government and the private sector. Dealing with these challenges and transitioning to a more connected and automated mobility ecosystem will be complicated, but if managed correctly, will present economic and social opportunities, and stimulate and accelerate innovation that could transform how we move and how our cities and regions evolve into the future.



POPULATION GROWTH

Australia's population is expected to grow by eight million people in the short-term, with our total population likely to exceed more than 30 million people by 2031.¹ Most of this growth will occur in Australia's four largest cities – Sydney, Melbourne, Brisbane and Perth – placing significant pressures and constraints on existing urban road and transport networks. With many of our roads and transport networks already at or near capacity, it will be critical for governments not only to address the current and immediately-foreseeable deficiencies but also to appropriately plan for long-term growth. This will ensure supply of transport services can support increased demand and provide efficient, frequent and reliable services between residential, employment hubs and key social hubs such as hospitals, schools and shopping precincts.

FIGURE 1.1: POPULATION OF AUSTRALIA'S CAPITAL CITIES 2011 – 2062



Source: Infrastructure Australia 2016, *Australian Infrastructure Plan*.



AGEING POPULATION

The percentage of older Australians as part of the total population will also increase considerably. It is estimated that the number of people aged over 65 will increase from 3.2 million (from a 2012 baseline) to more than 5.7 million by 2031. This equates to a 77 per cent increase in the number of older Australians over the period. It will be critical for decision makers to ensure that older Australians are able to access to public transport into the future. The role of on-demand transport services, providing safe and reliable connections to and from major transport hubs is a promising solution to this growing issue. However, TTF research indicates that people aged over 55 are still to be convinced about the benefits of on-demand services, with less than 2 per cent indicating that they would prefer on-demand services over timetable services.

1. Infrastructure Australia 2016, *Australian Infrastructure Plan*.



URBANISATION

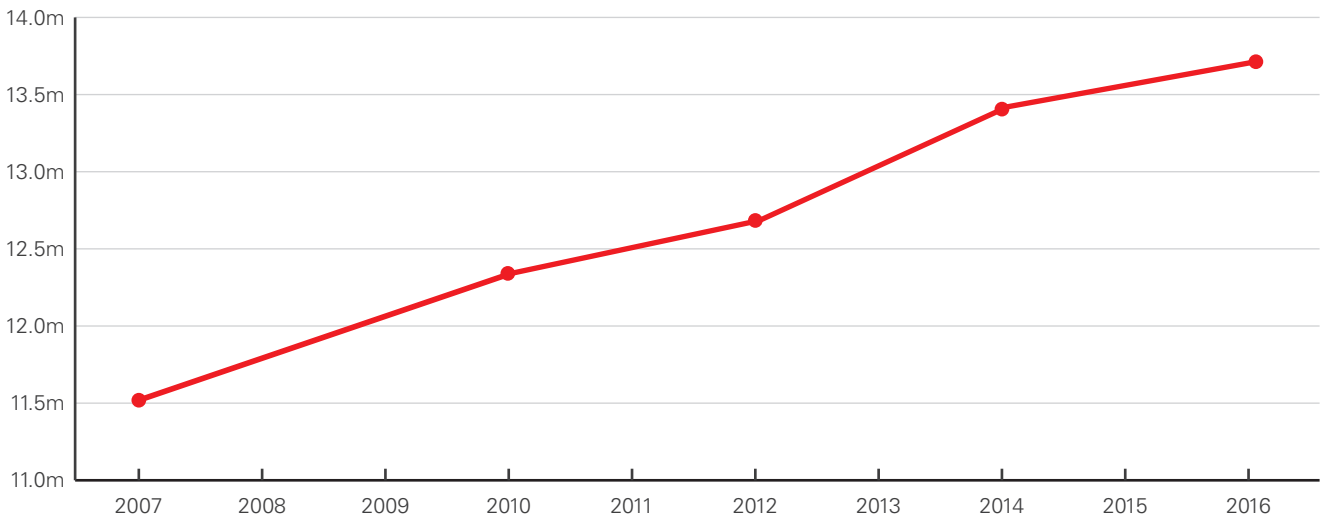
The growth of urban areas and cities is occurring at a rapid pace. Cities are the engine rooms of economies and provide a significant proportion of employment opportunities. Three in four Australians currently live in the nation’s 20 largest cities, and over 60 per cent of these live in the capitals of Sydney, Melbourne, Brisbane, Perth and Adelaide.² This figure will continue to grow, with an additional 5.8 million people expected to reside in Sydney, Melbourne, Brisbane and Perth by 2031.³ Providing well-connected transport infrastructure to manage projected growth in our cities and urban areas will require a long-term vision and will be made more difficult due to physical constraints that may prohibit construction of above-ground infrastructure. Urbanisation will however, provide opportunities for technology, innovation and new service delivery models to thrive, particularly shared mobility options such as ride-share, car-share and bike-share.



CONGESTION AND CAR OWNERSHIP

Congestion will continue to be a challenge for our future transport networks. The preventable cost of congestion in Australia is estimated to increase from \$16.5 billion (from a 2015 baseline) to \$37 billion by 2030.⁴ Increased levels of car ownership will likely have a significant impact on congestion and will place further demand on existing road networks.

FIGURE 1.2: NUMBER OF PASSENGER VEHICLES OWNED



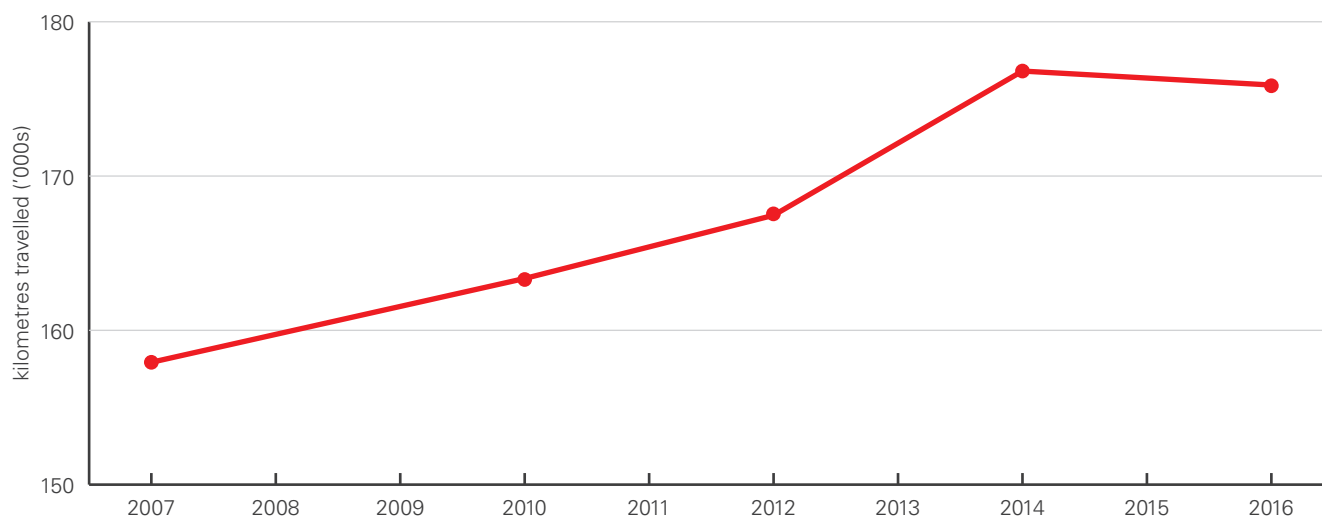
Source: Australian Bureau of Statistics 2017, *Survey of Motor Vehicle Use, Australia, 12 months ended 30 June 2016*.

2. Department of Infrastructure and Regional Development 2015, *State of Australian Cities 2014-2015 – Progress in Australian Regions*.

3. Infrastructure Australia 2016, *Australian Infrastructure Plan*.

4. Department of Infrastructure and Regional Development 2015, *Traffic and congestion cost trends for Australian capital cities*.

FIGURE 1.3: TOTAL KILOMETRES TRAVELLED (PASSENGER VEHICLES)



Source: Australian Bureau of Statistics 2017, *Survey of Motor Vehicle Use, Australia, 12 months ended 30 June 2016*.

As evidenced by Figure 1.4 the number of passenger vehicles in use across Australia has increased from approximately 11 million in 2007 to nearly 14 million in 2016. 2016 Census Data shows that between 2011 and 2016 the number of vehicles per household increased, particularly in suburban and regional local government areas.

FIGURE 1.4: CAR OWNERSHIP PER HOUSEHOLD

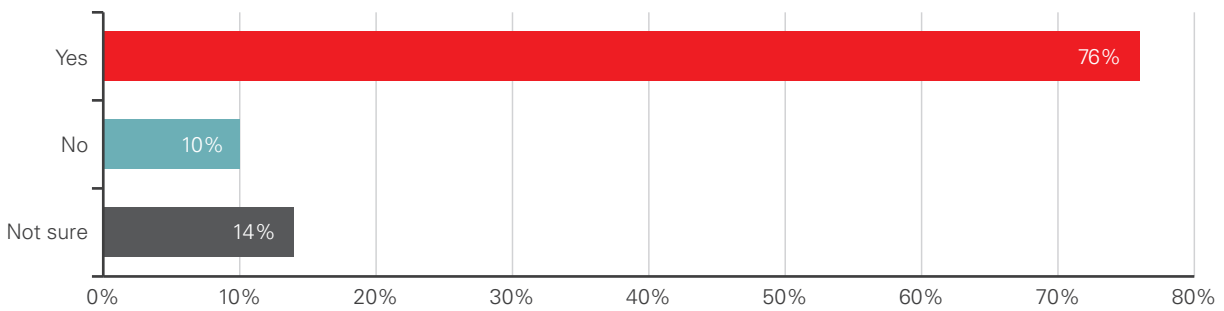
LGA	2016	2011
New South Wales		
Sydney	0.8	0.8
Blacktown	1.8	1.7
Sutherland	1.9	1.8
Wollongong	1.7	1.6
Orange	1.7	1.7
Victoria		
Melbourne	0.7	0.8
Brimbank	1.9	1.8
Greater Geelong	1.8	1.7
Ballarat	1.8	1.7
Mildura	1.9	1.7
Queensland		
Brisbane	1.7	1.6
Ipswich	1.9	1.8
Sunshine Coast	1.8	1.7
Gold Coast	1.8	1.8
Gladstone	2	2

Source: Australian Bureau of Statistics 2017, *2016 Australian Census Quick Stats*.

CHALLENGES FOR THE FUTURE OF MOBILITY (CONTINUED)

Industry-based research indicates that private car ownership will most likely decline in coming decades and be replaced by subscription based mobility services. But consumers are yet to be convinced about this shift, with 76 per cent of consumers believing that they will still own their own car in 10 years' time.

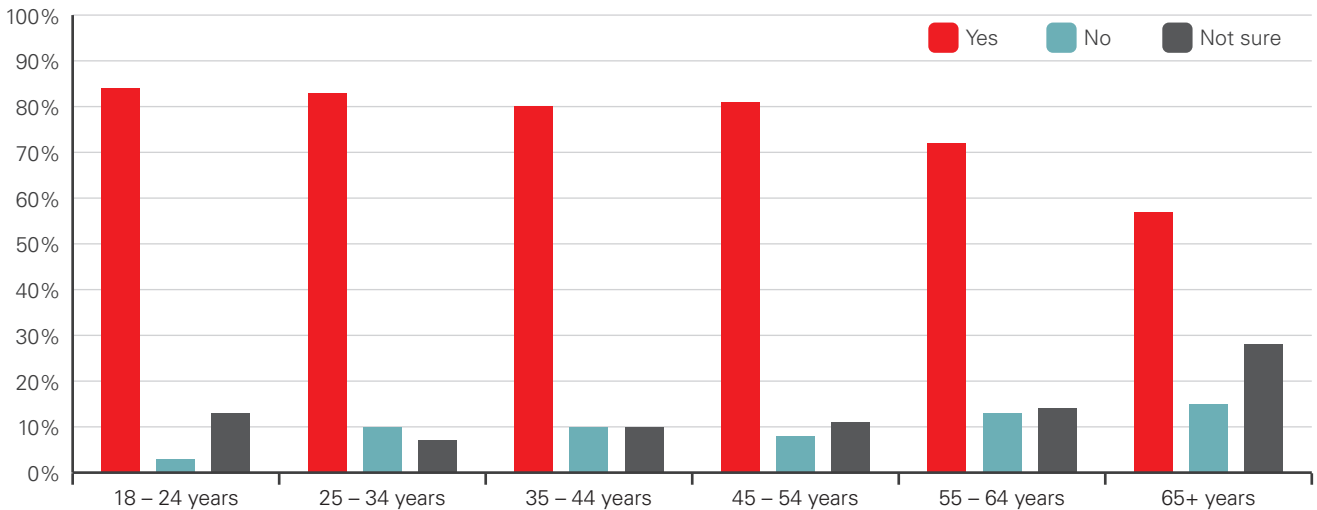
QUESTION: DO YOU THINK THAT YOU WILL OWN A CAR IN 10 YEARS' TIME?



Source: TTF/Nielsen

TTF research also indicates that 84 per cent of 18-34 year olds believe that they will own their own vehicle in 10 years time. These statistics suggest that younger generations, more familiar and receptive to new technology and innovations, may still need to be convinced that their short-term mobility future does not include car ownership.

QUESTION: DO YOU THINK THAT YOU WILL OWN A CAR IN 10 YEARS' TIME? (BY AGE)



Source: TTF/Nielsen

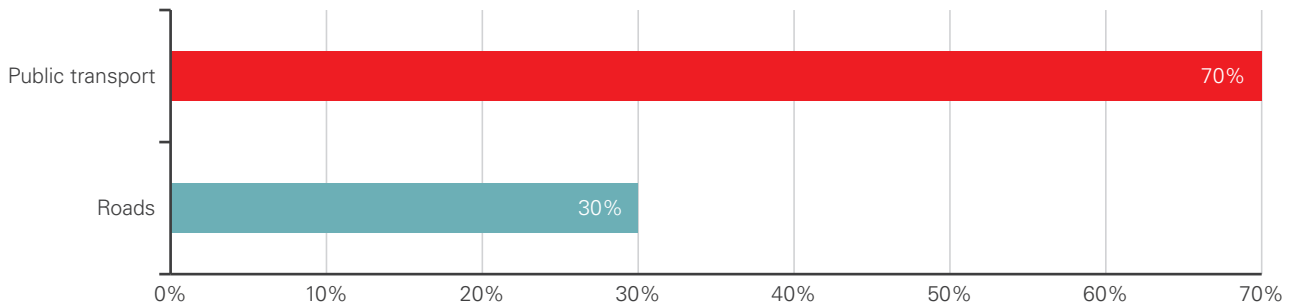


ENCOURAGING MODE SHIFT

Changing the travel behaviours of commuters and encouraging mode shift also remains a challenge for decision makers. While 70 per cent of commuters believe that governments should prioritise future investment in public transport infrastructure over road infrastructure, 57 per cent of commuters opt for a private vehicle as their preferred mode of transport.

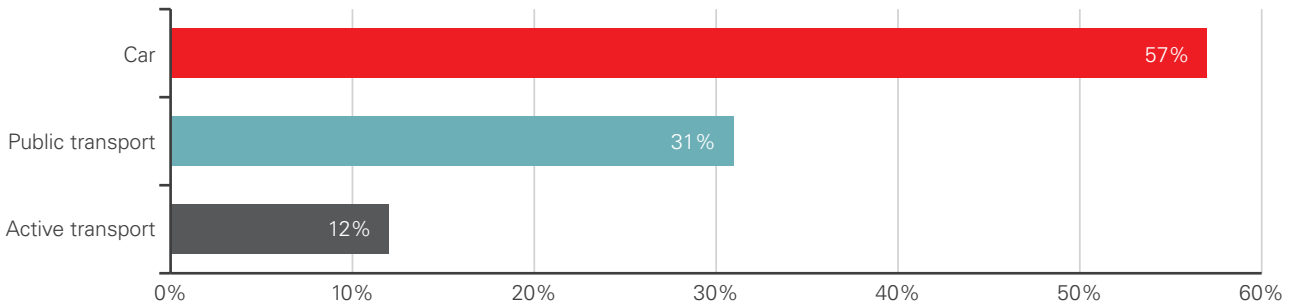
This indicates that for many commuters, public transport services may not be a viable or convenient alternative to driving. Longer term, shared and on-demand services could resolve these issues by providing safe, efficient and reliable first-last-mile connections between residential areas and major transport hubs.

QUESTION: WHAT INFRASTRUCTURE SHOULD AUSTRALIAN GOVERNMENTS PRIORITISE?



Source: TTF/Nielsen

QUESTION: WHAT IS YOUR PREFERRED MODE OF TRANSPORT?



Source: TTF/Nielsen



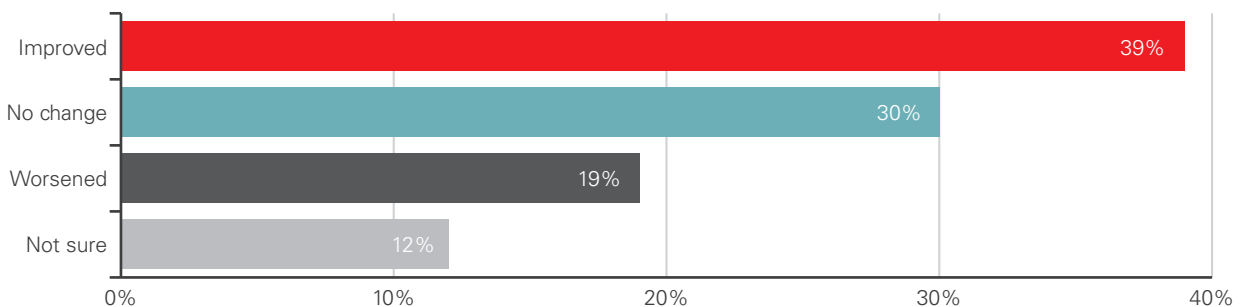
CONSTRAINED GOVERNMENT RESOURCES

Understanding how much investment to make in the transport system, and how to fund that investment, is a critical challenge for governments across Australia. It will become more complex over the next decade and beyond, as the model used to collect and distribute revenue from land transport users through mechanisms such as fuel excise, come under increasing pressure as vehicles become more fuel efficient and consumers opt for electric or hybrid vehicles. Reduced government income from these revenue sources will not only make it difficult to build new transport infrastructure but will also place pressures on maintaining existing infrastructure and services. It is critical that governments consider future funding sources and delivery models for building transport infrastructure and maintaining services in the longer term.

CURRENT STATE OF PLAY IN AUSTRALIA

Australia is currently in the middle of an unprecedented transport infrastructure boom with record levels of expenditure currently committed by governments across the nation. State governments, in particular New South Wales, Victoria and Western Australia are delivering public transit infrastructure projects that will transform and future proof mobility and transport networks. Investment in major public transport infrastructure projects and new transport services will be essential to address the challenges outlined above.

QUESTION: HAVE PUBLIC TRANSPORT SERVICES IMPROVED OVER THE PAST 5 YEARS?

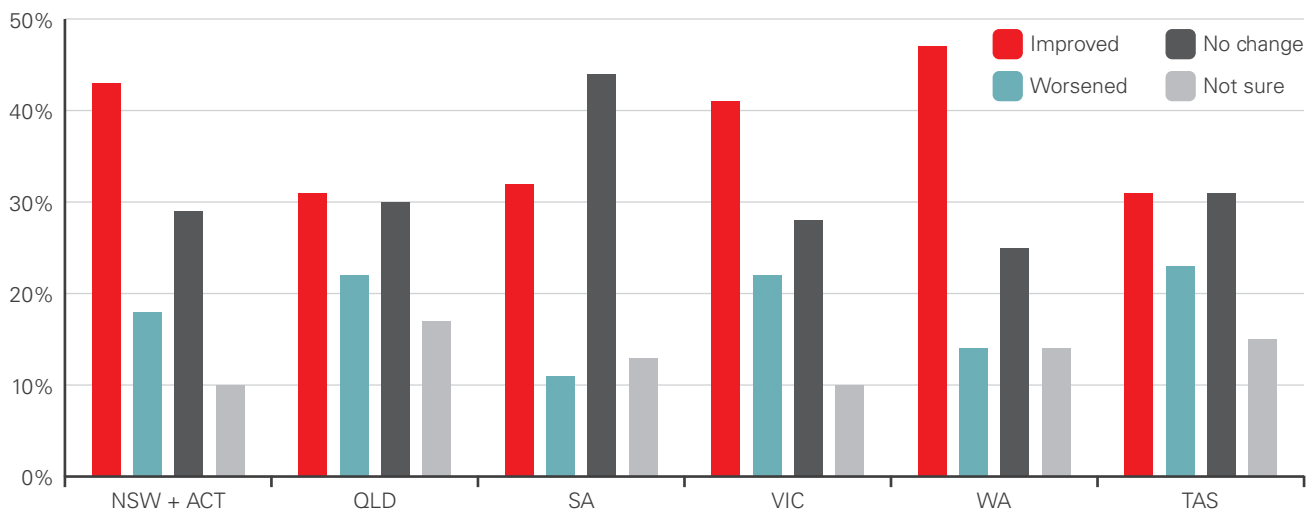


Source: TTF/Nielsen

Investment in transport infrastructure and the delivery of new services over the past five years has been well received by commuters, with 39 per cent of commuters across Australia indicating that their public transport services had improved, compared with 19 per cent who believe that it had worsened.

Satisfaction with public transport services varies between jurisdictions, however it is noted that greater levels of satisfaction were generally recorded in jurisdictions where governments have invested, or are investing, in new transport infrastructure and services including Western Australia, New South Wales and Victoria.

QUESTION: HAVE PUBLIC TRANSPORT SERVICES IMPROVED OVER THE PAST 5 YEARS? (BY REGION)



Source: TTF/Nielsen



INCREASING FOCUS ON TECHNOLOGY AND INNOVATION

Investment in public transport services will need to be complemented by technology, innovation and digital disruption. How governments manage innovation and disruption in the transport industry will be critical to addressing future mobility challenges. Governments must become more agile and nimble in responding to and anticipating digital disruption and must also ensure that they do not become a barrier to future innovation. It is encouraging that a number of jurisdictions have taken a proactive approach to preparing for a smarter mobility future.

CASE STUDY: TRANSPORT FOR NSW FUTURE TRANSPORT STRATEGY

The NSW Government and Transport for NSW are leading the way with the development of a *Future Transport Strategy*. The Strategy looks beyond the current pipeline of transport projects and attempts to anticipate what mobility will look like into the future by analysing megatrends and developing a *Future Transport Technology Roadmap*. These documents have been developed following significant consultation with key industry stakeholders and will ultimately ensure that NSW is in a position to respond to future technology and social changes.



TRENDS THAT WILL TRANSFORM THE TRANSPORT SECTOR

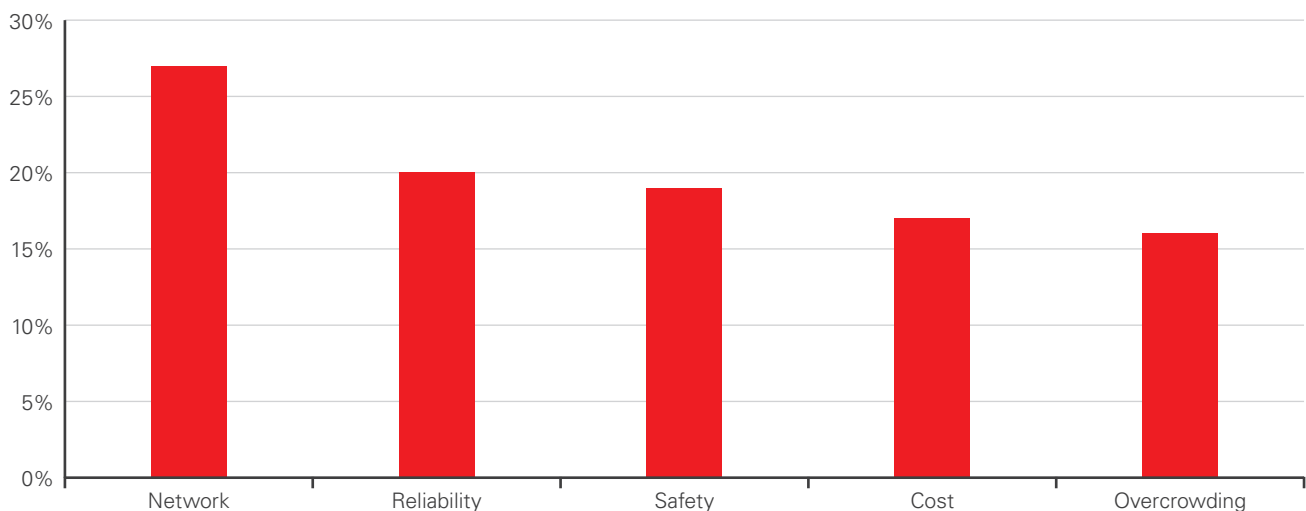
It is difficult to envisage clearly what the future of transport will look like given the rapid pace and evolving nature of technology and innovation. However, to provide efficient and effective transport networks, enhance connectivity and to address the mobility challenges of the future, it is likely that existing modes of transport will need to be complemented by new services and delivery models driven by technology. The development of these technologies and service delivery models will in most cases be led by the private sector, with success determined by customer take-up and acceptance. Governments will also play a significant role in encouraging and facilitating innovation within the transport sector by providing an environment that is responsive and open to change. It will also be critical for governments to understand how to drive innovation by working in collaboration with the private sector to implement transport technologies that will transform future mobility. The mobility trends listed below are not intended to be exhaustive, however they provide a high level overview of what could transform the future transport landscape.

ON-DEMAND TRANSPORT

Through the near universal acceptance of technology and the prevalence of real-time information provided through smart phones, modern commuters expect a seamless transport experience and demand instantaneous information about their services as well as their mobility options. Commuters expect hassle-free travel that gets them to their destination efficiently and affordably and they want to choose their preferred mode of travel based on their own personal needs and circumstances. Flexible on-demand transport services, booked through smart phone applications enable commuters to customise their journeys to suit their unique needs.

On-demand transport services that are requested and provided in real-time could also support a greater uptake of public transport services, particularly where existing transport networks provide inadequate connections or where existing transport services are unreliable. 27 per cent of commuters have indicated that the main barrier to catching public transport services more often is due to the public transport network failing to provide adequate connectivity. Additionally, 20 per cent of commuters highlight reliability issues as a factor in their decision to not use public transport more often.

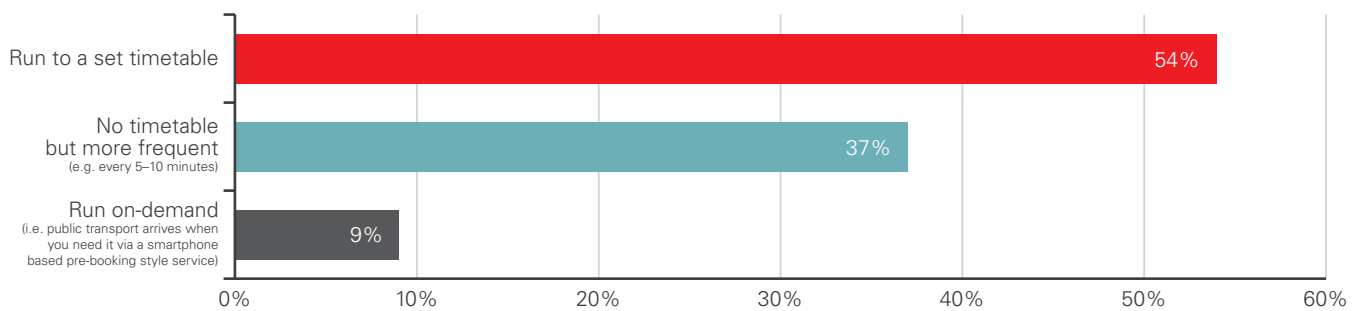
QUESTION: WHAT PREVENTS YOU FROM CATCHING PUBLIC TRANSPORT MORE OFTEN?



Source: TTF/Nielsen

Flexible on-demand transport services have the potential to enhance connectivity to and from public transport hubs for many commuters, however many commuters remain unconvinced about the future role of on-demand transport services, with 54 per cent of commuters preferring that their transport services run to a set timetable. 37 per cent of commuters would like their services to run without a timetable, provided services were more frequent. Less than 10 per cent would prefer on-demand transport services booked through smart phone applications.

QUESTION: WHEN THINKING ABOUT PUBLIC TRANSPORT, WOULD YOU PREFER THAT YOUR SERVICE?



Source: TTF/Nielsen

Notwithstanding the above, on-demand transport services, and technology supporting these services, will continue to evolve and will be explored by governments as a lower-cost alternative to running fixed route services while also providing more convenient door to door journeys for commuters.

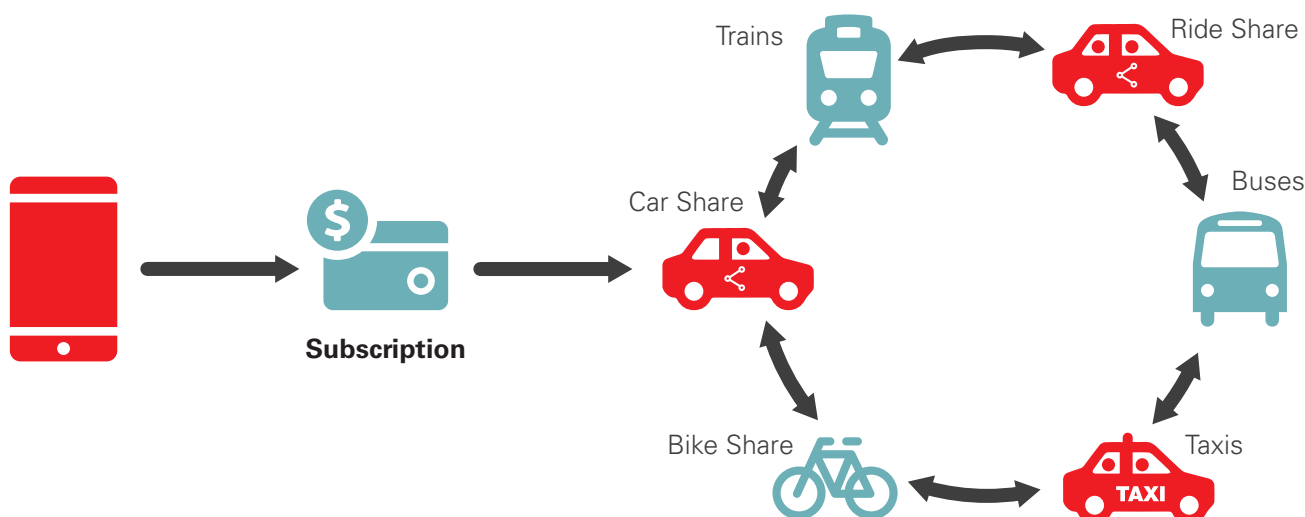


MOBILITY AS A SERVICE (MAAS)

The concept of Mobility as a Service (MaaS) – a platform that provides integrated mobility solutions based on customer needs – is not new. However, given advancements in smart-phone technology and data analytics, MaaS solutions provide users with a mechanism to plan, book and pay door-to-door journeys on all modes of transport including trains, buses, taxis, ride-share or bike-share services via a single mobile application.

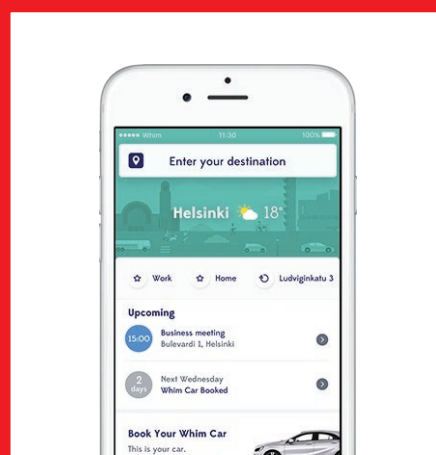
The aim of MaaS platforms is to personalise mobility for each unique user and to provide an attractive alternative to car ownership. Given current and projected levels of congestion on Australian roads, a move towards urbanisation and the increasing cost of car ownership, MaaS platforms could reshape mobility, particularly within urban areas. MaaS platforms are still developing and future success will depend on delivery models that provide commuters with value for money. Future success will also require increased cooperation and integration between private and public transport services.

MOBILITY AS A SERVICE



CASE STUDY: WHIM MOBILITY AS A SERVICE

Whim, the world’s first MaaS solution was launched in Helsinki by MaaS Global in 2016. Through its subscription based integrated mobility app, MaaS Global offers user access to different modes of transport options including 2,500 taxis, rental cars from 50 locations across Finland, as well as buses and ferries bike share from one mobile application. The app learns users’ preferences and syncs with their calendars to suggest ways to get to an event or to certain locations. Payment options include per trip or monthly subscription, allowing subscribers to pay for mobility services via a single platform.



SHARED MOBILITY SERVICES

Shared mobility services have already changed the way we travel. Ride-share services such as Uber have provided a new dynamic within the sector that did not exist a decade ago. Smart phones have made shared services more convenient, and adoption of shared services, including ride-share, car-share and bike-share continue to increase, providing flexible alternatives to traditional modes of transport such as the private motor vehicle travel.

Shared mobility is a natural solution to reducing the number of vehicles owned and the total number of kilometres driven into the future. In 2015 taxis and ride-share services accounted for 4 per cent of global miles travelled, however it is estimated that this could increase to 26 per cent by 2030.⁵ Further, Uber estimates that shared autonomous vehicles could reduce the number of cars on the road by around 90 per cent.⁶

Shared services also play a vital role in supporting existing public transport services, addressing first and last mile issues by providing connections to and from transport hubs as well as servicing areas with limited public transport options or fixed-route services. Governments are now seeing the potential of leveraging ride-share services to support the existing transport mix and are forming partnerships to integrate shared services with traditional public transport services.



CASE STUDY: ACT GOVERNMENT AND UBER PARTNERSHIP

The ACT Government and Uber entered an Australian-first partnership in December 2016 to provide commuters with seamless travel between Night Rider bus stops and their doorstep to help address Canberra's last mile challenge. The partnership saw Night Rider bus users get a \$10 trip discount with Uber for trips from selected bus stops and home between 11pm and 2.30am.⁷

In addition to ride-share services, bike-share could also support a multimodal and integrated transport network that extends the reach of existing public transport services and networks, particularly in urban environments. Traditional bike-share schemes have required the return of bikes to a fixed dock location, but smart phone technology has made accessing bike-share schemes more flexible and more convenient for end-users.

5. Morgan Stanley 2016, *Shared Mobility on the Road of the Future*.

6. Uber, *The Future of Mobility*.

7. The Canberra Times 2016, *Uber discount for Night Rider bus users in Canberra this festive season*.

CASE STUDY: DOCKLESS BIKE SHARING

Dockless bike-sharing schemes such as oBike, a Singapore based company, have launched in Australia in recent months. Unlike traditional fixed bike-share schemes, oBike customers are able to locate, reserve and unlock a bike using a mobile application. Once finished, the customer is able to park the bike in a legal area and lock it using the app. It is anticipated that a number of similar bike-share schemes will launch into the future.

Innovative services based on the sharing economy will continue to evolve into the future and will likely play a significant role in the future success of on-demand services and MaaS delivery platforms.

AUTONOMOUS VEHICLES

Autonomous vehicles are predicted to transform mobility and change travel patterns and behaviours. It is difficult to envision specifically how autonomous vehicles will change mobility but there is little doubt that the shift will be significant, with lasting implications for car ownership, registration, insurance and driver licensing. It is also difficult to predict when autonomous vehicles will reach a critical mass, with McKinsey estimating that fully autonomous vehicles will make up 1 or 2 per cent and 12 to 15 per cent of partially autonomous light vehicles on the global road network by 2025.⁸

Advances in autonomous vehicles have the potential to provide a number of benefits including improved road safety outcomes and increased access to mobility, combined with on-demand ride-share services, autonomous vehicles could integrate within an integrated mobility system, providing a safe and reliable first and last mile option for commuters and encouraging a greater uptake of public transport services. However the impact of autonomous vehicles on congestion is still in question. ***Will total car kilometres and traffic congestion increase or decrease in a driverless future and what impact will they have in progressing the development of public and on-demand transport solutions?***





CONTACTLESS AND OPEN-LOOP PAYMENTS

How commuters pay for transport will have a critical impact on how services are accessed into the future. The simpler and more seamless the payment, the better the customer experience. Simpler payment options will make public transport more attractive and will provide operational efficiencies for transport operators.

In recent years, smartcards such as Opal, Myki and GoCard have been introduced across Australia, transforming how commuters pay for services. However, these cards will be replaced in the near future as transport authorities move towards 'open-loop' and contactless ticketing solutions allowing customers to pay for transport services with their debit and credit cards, digital wallets and smartphones. As this technology is rolled-out, it will be important for governments to provide a level playing field for card providers to ensure greater consumer choice and access to seamless payment options.

CASE STUDY: TRANSPORT FOR LONDON

Transport for London (TfL) has led the way with contactless payments, introducing technology developed by Cubic Transportation Systems (CTS) that allows commuters to pay for fares quickly with just a tap of a contactless enabled card or mobile device. The technology was quickly embraced by commuters, with more than one billion journeys now made by contactless payment cards.⁹ 40 per cent of all pay as you go journeys are now made using contactless technology, up from 25 per cent in early 2016.¹⁰

CASE STUDY: TRANSPORT FOR NSW

The NSW Government announced in July 2017 a trial of contactless payments on Sydney's Manly Ferry Service. The trial, using technology developed by CTS allows commuters to use their Mastercard to access the popular service. The trial of contactless payments on the Manly Ferry also supports tourism, with visitors making up 40 per cent of passengers who use the Circular Quay to Manly Ferry.¹¹

8. McKinsey & Company 2015, *The Internet of things: Mapping the value beyond the hype*.

9. Transport for London 2017, *One billion journeys made by contactless payment of London's transport network*.

10. Transport for London 2017, *One billion journeys made by contactless payment of London's transport network*.

11. Transport for NSW 2017, *No Opal Card? No worries – just tap your Mastercard*.

ELECTRIFICATION

Electrification of private and public transport vehicles continues to increase with McKinsey estimating that global electric-vehicle sales rose from 50,000 in 2011 to nearly 450,000 in 2015.¹² Further, the Boston Consulting Group estimates that by 2030 around a quarter of all miles driven in the US could be in shared autonomous electric vehicles.¹³

Worldwide, the shift to electric vehicles has gained momentum with France¹⁴ and the United Kingdom¹⁵ indicating that they will ban petrol and diesel vehicles by 2040. While electric vehicle sales in Australia have stalled, with just 219 electric vehicles sold in Australia in 2016, governments are attempting to encourage their growth through reduced registration fees, free parking and publicly available charging stations.

CASE STUDY: ELECTRIC HIGHWAYS

The RAC WA, in partnership, with local councils is developing an 'Electric Highway' in Perth and throughout the South West, providing publicly accessible electric vehicle fast-charging stations. Similarly, the Queensland Government has announced an 'Electric Super Highway' providing a series of fast-charging electric vehicle stations from the Gold Coast to Cairns to encourage the uptake of electric vehicles in Queensland.¹⁶

Electrification could also be the "next big thing" for public transport with electric vehicles increasingly replacing diesel buses in response to energy policies and environmental requirements. As battery technology improves and governments demonstrate a greater commitment to electric bus technology, the take-up of electric buses is likely to accelerate, providing a more environmentally sustainable mode of public transport.

CASE STUDY: AUSTRALIAN-MADE ELECTRIC BUSES

The first Australian designed, engineering and manufactured electric bus to be used on a public transport system in Australia has been launched in South Australia. The bus will be used a part of a citywide trial on Adelaide's main public transport network. The trial will provide the South Australian Government with information about how electric buses might be used as part of Adelaide's main public transport network.¹⁷

12. McKinsey & Company 2017, *The future(s) of mobility: How cities can benefit*.

13. The Boston Consulting Group 2017, *By 2030, 25% of miles driven in US could be in Shared Self-Driving Electric Cars*.

14. The Australian Financial Review 2017, *France to end petrol car sales by 2040 as it embraces electric vehicles*.

15. The Guardian 2017, *Britain to ban sale of all diesel and petrol cars and vans from 2040*.

16. Queensland Government 2017, *The future is electric for Queensland motorists*.

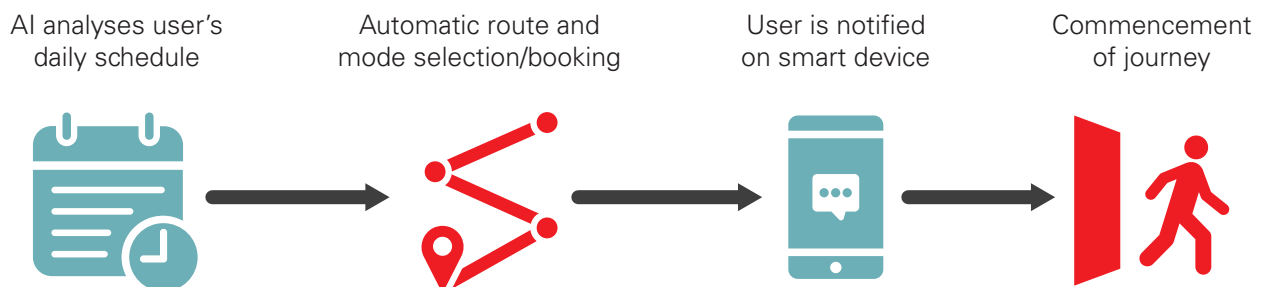
17. South Australian Government 2017, *First Australian-made electric bus rolls of production line in Northern Adelaide*.



BIG DATA AND ARTIFICIAL INTELLIGENCE (AI)

Big data, predictive analytics and artificial intelligence (AI) will continue to transform mobility into the future. Data, mainly collected through mobile apps, has made it easier for commuters to plan their journeys through the provision of real time information about public transport and traffic conditions. New ways of generating, collecting, sharing and analysing data will also help determine where future investment is most required, while connecting users with operators and ensuring the customer is at the centre of every decision on infrastructure. Through the collation of data from numerous sources, it is possible that information could be channelled into algorithms that predict an individual's behaviour, such as booking or suggesting transport services based on scheduled meetings or past movements. This will further personalise mobility and provide an improved customer experience that is unique and flexible to each user.

HOW ARTIFICIAL INTELLIGENCE COULD TRANSFORM THE DAILY COMMUTE



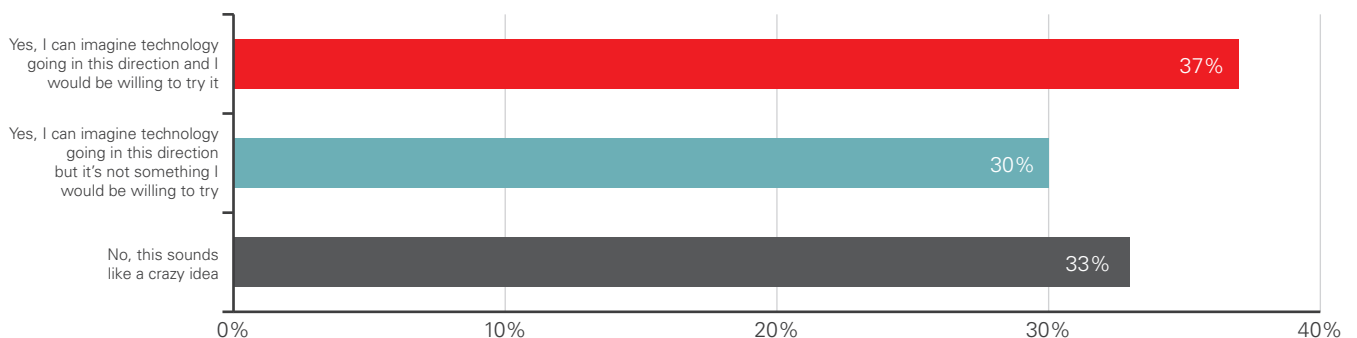


Personal Airborne Transportation System (Source: Australian Business Traveller)

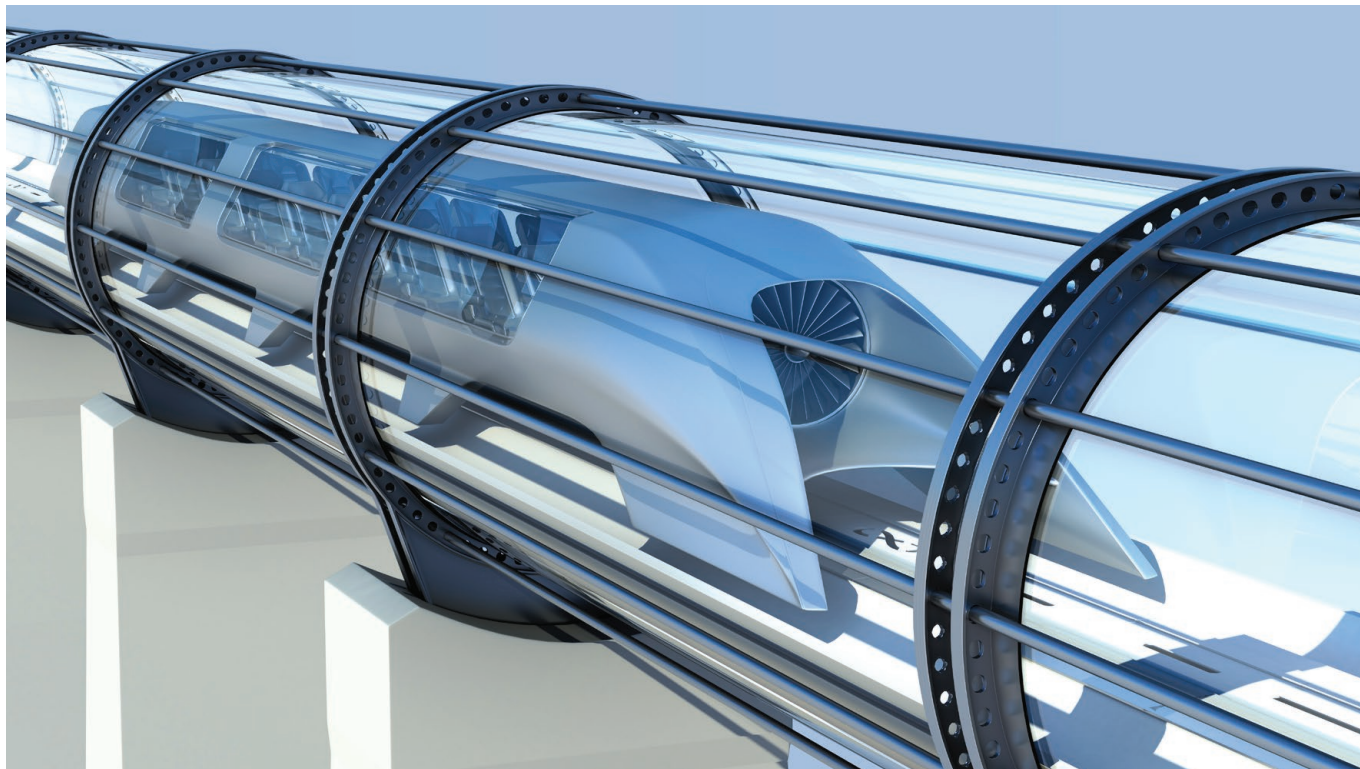
PERSONAL AIRBORNE TRANSPORTATION SYSTEMS

Personal Airborne Transportation Systems (PATS) or ‘drones’ are currently in development phase around the world. As future populations consolidate in urban areas, emerging technologies such as PATS could play a critical role in the movement of people and goods. Dubai’s Roads and Transport Authority is preparing to commence commercial services of PATS in the near future. The concept may sound a little far-fetched to many, but TTF research shows 67 per cent of Australians can imagine a future where they are transported by on-demand air services. ***Should governments be actively considering or preparing for a mobility future that includes on-demand and autonomous airborne services?***

QUESTION: CAN YOU IMAGINE A FUTURE WHERE PEOPLE AND GOODS ARE TRANSPORTED BY FLYING AUTONOMOUS DRONES?



Source: TTF/Nielsen



HYPERLOOP

Hyperloop is billed as the first new mode of transport in more than 100 years. The technology seeks to use electric propulsion and levitation to move passengers and cargo at faster-than-airline speeds through a low-pressure tube with unprecedented energy efficiency. It has been estimated that Hyperloop systems could provide direct to destination services and departures at a rate of more than once a minute, completely transforming how people travel and how goods are distributed into the future.

Hyperloop One plans to build the first functioning Hyperloop system by 2021 and has recently completed and tested its first 500 metre prototype track in Nevada. Hyperloop One has also won the backing from governments to explore the potential of the system in the Netherlands, Finland and Dubai. It has been estimated that a Hyperloop One link between Dubai and Abu Dhabi would reduce a journey of more than 90 minutes to just 12 minutes. This technology, should it be successful, could have significant implications for mobility in Australia. ***Is it too early for decision makers to be thinking about a future Hyperloop system that links Brisbane, Sydney and Melbourne?***

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