Passenger transport

5.1 Introduction

The state of the passenger transport sector

Australia's passenger transport networks serve an enormous variety of needs in a range of different environments, from congested and fast-growing cities to regional centres and remote communities. Given the demands placed on our networks, it is not surprising that the sector faces challenges.

Conditions of access to and the quality of our networks are not the same across different locations and for different people. This variation in service levels is the result of a necessary balance between providing appropriate transport access, and the financial and environmental trade-off of doing so in areas of varying density and demand.

The challenge of achieving a balance is compounded by a lack of transparency about why and how money is spent, particularly on the maintenance of our existing networks. This sits alongside the growth of emissions within the transport sector, which is the second largest emitter of greenhouse gas emissions in Australia.[1]

Transport is also a major source of air pollution, one of the next major environmental challenges for our cities.[2]

Transport can be particularly difficult to access for lower income households, people with disability, older people, rural and remote communities, and people living on the outskirts of fast-growing cities. Our fast-growing cities suffer from congestion while our remote communities often have under-utilised and poorly-maintained assets.

However, there are also positive developments that will help in achieving this balance. The transport sector is in a state of rapid innovation, with advances in communications technology, user interfaces, transport operations technology, electric vehicles and, eventually, driverless cars offering customers unprecedented mobility and access to information, as well as potentially improving the environmental and safety performance of the sector.

Our passenger networks serve diverse needs

People's travel patterns vary depending on the time of day, purpose of trip, availability of transport options and distances to be travelled. While this section looks at high-level statistics regarding people's transport choices, such as whether they drive, walk or take public transport, it is important to remember that each mode of transport is one component of larger transport networks. In practice, people switch between modes, either during a single trip or from day to day, depending on what is most time and cost-effective for them.

Australia-wide, there were 433 billion passenger kilometres travelled in 2015-16, up 5.39% since 2010-11.[3] Cars are overwhelmingly the dominant passenger transport mode, accounting for 279 billion (64.4%) of all passenger kilometres. Buses account for 4.99% and passenger rail services for 3.73% of passenger kilometres.[4] There have been minor, year-on-year variations between modes, but no significant trend in mode shift over the period.

However, aggregated statistics only tell part of the story. People's travel habits are complicated, and patterns of demand vary depending on context. Public transport use is highest in our four largest cities, accounting for about 20% of journeys to work in the cities combined.[5] Nationally, on average 9.87% of journeys to work were by public transport in 2016, up from 8.99% in 2011.[6] Public transport is especially important for accessing key employment centres. For example, over 71% of trips to and from Sydney CBD in peak periods are by public transport.

Journeys to work are also showing growth in the number of people driving or cycling. There has been a decline in the number of people travelling as a passenger in a car, in a taxi, in a truck and walking. The growth in single-occupant car journeys to work and decline in journeys as a passenger highlights reduced levels of vehicle occupancy, a catalyst for growing congestion.

Where high urban densities place people close to other services, and support attractive all-day public transport frequencies, there is less reliance on car use for non-work journey purposes also. Thus, in Sydney's inner city, 69% of all trips are undertaken using public or active transport.[7] In Penrith, an outer-urban area of Sydney, by contrast, only 14% of trips of all purposes are undertaken by a mode other than car.[8]

While rates of use vary, walking and cycling are essential ways to travel. Whether people drive or catch public transport, most trips have a walking component. Over shorter distances, particularly in higher density-centres, walking is often the most common mode of transport. For example, in the centre of Melbourne's CBD (within the Hoddle Grid and Docklands), about 86% of all trips are made on foot,[9] while 49% of all trips in Sydney's inner city are walk-only trips.[10]

While cycling is less widespread than walking, it comes with significant health and environmental benefits. However, there are also significant variations between areas, with cycling being most popular in the inner suburbs of our major cities. Australian cities have also been subject to the global phenomenon of the emergence of new active modes like e-scooters and bikeshare. The long-run popularity of these services remains to be seen, with several operators having had a short-lived presence in Australia's fast-growing and some smaller cities.

For long-distance intercity and regional trips, catching a flight is often the most practical solution. Australia has some of the busiest air routes in the world, with Sydney-Melbourne being the second busiest and Brisbane-Sydney the eighth.[11] Air travel is also important for rural and remote communities, ensuring they have access to major centres and key services.

The performance of our transport services is uneven

This Audit assesses the performance of our transport networks, including the services operated on these networks, through the multiple lenses of access, quality and cost. Australia's population is highly urbanised, with the majority of Australians residing in our fast-growing cities. These cities feature significant public transport networks providing relatively high quality services to people residing in the middle and inner suburbs.[12] However, access to transport networks and services is uneven across the country, with people who live in remote Australia or on the urban fringe, older people, those with disability, and those experiencing financial stresses being particularly disadvantaged.

Most of the challenges facing the level of access, quality and cost that our transport networks offer are consistent with the findings of the 2015 Audit.

Access conditions remain uneven, regional infrastructure is poorly maintained, and costs, while remaining stable, have impacted some groups more than others. The cost of road congestion and public transport crowding in our fast-growing cities is forecast to grow.

In contrast, in smaller cities and regional centres, as well as regional towns, rural communities and remote areas, Australians face a very different challenge to that of congestion. Australia's expansive geography and dispersed population mean transport networks are extensive but often poorly utilised, with maintenance resources spread thinly.

The cost of transport to end-users has generally remained stable or decreased slightly in real terms, albeit with variations by user group, and notwithstanding the substantial increased expenditure by some governments on operating, maintaining and expanding transport networks.

While some of the recurrent costs of driving have increased, motor vehicles have become cheaper. In the case of public transport, governments can be reluctant to increase public transport fares due to the wider benefits of these modes as well as the community unpopularity of ticket price rises.

However, there remain certain groups of Australians who are transport-disadvantaged in financial terms. Flights to rural and remote Australia can be prohibitively expensive, and people without access to public transport usually spend more of their personal and household budgets on operating vehicles.[13]

All Australian households continue to have to allocate a large share of their household infrastructure budget to transport costs.[14]

The cost of congestion is growing in our large cities

This Audit projects the total costs of road congestion and public transport crowding in Australia's large cities will be $39.6 billion in 2031.

The majority of this cost is attributable to road congestion, $38.8 billion per annum, while public transport crowding makes up $837 million.

This Audit is the first time Infrastructure Australia has identified a cost of public transport crowding in our large cities.

This growth in congestion is in spite of significant investments in new transport infrastructure across our largest cities, particularly Sydney and Melbourne. Between the 2015 and 2019 Audits, the addition of 97 new projects to the Sydney transport network include substantial projects such as WestConnex, Sydney Metro Northwest, Sydney CBD and Parramatta Light Rail. Melbourne includes over 275 projects such as Melbourne Metro. Despite their scale, recent investments in transport infrastructure in our fast-growing cities is largely playing 'catch-up' rather providing additional capacity that will support substantial future growth.

While the costs of congestion are growing over time, Infrastructure Australia's forecasts of the rate of growth has reduced. The forecast cost of road congestion in 2031 is around $14.5 billion lower than our forecast in the 2015 Audit.

The reduction is the result of a combination of changes to inputs, particularly lower population projections by the Australian Bureau of Statistics, some changes to assumptions regarding travel behaviour, improvements to the model, as well as capacity increases to transport infrastructure networks since 2015.

The most significant differences between Audits are in Greater Perth, where projections have been reduced by 19% reflecting the slower rates of growth following the mining boom. In addition, the other three less populated urban regions (the Brisbane, Adelaide and Canberra conurbations) have reduced congestion cost forecasts that reflect lower population projections and increased transport infrastructure investment.

However, Australia's two largest cities, Sydney and Melbourne, are predicted to have higher congestion costs in 2031 than previously forecast, at 6% and 15% respectively. This reflects significant growth in these two cities since the last Audit. Sydney and Melbourne are both on track to have over six million residents by 2031.

To a lesser degree, the downward estimates of costs are also a sign of the impact of major infrastructure investments that have been committed in our largest cities.

Our modelling of future congestion, as well as opportunities to improve strategic transport modelling, are considered in more detail in a technical paper to this Audit, *Urban Transport Crowding and Congestion*.[15]

Our transport networks must work harder to promote social inclusion

Transport is an enabler of daily life. It provides people with access to jobs, services and leisure. People's level of access to transport networks, and the opportunities these networks provide, often vary. Governments need to address this if they want to promote social inclusion.

This is particularly the case for Australians who are experiencing disadvantage, such as lower income households, people with disability, older people, rural and remote communities, and people living on the outskirts of fast-growing cities – or who experience multiple types of disadvantage.

For example, people living in our outer suburbs often have both lower average incomes than inner-city residents and lack access to public transport. Based on the 2016 Australian Census, the average household income in outer Sydney is approximately 75% of the average inner Sydney household income.[16]

For such people it is harder, and more expensive in proportion to family income, to reach employment opportunities.[17] In Australia's five largest cities, 44% of outer-urban sector residents travel over 20 km to work, even though for 58% of these residents their employment is located in the same sector. In contrast, 76% of inner-urban sector residents live within 10 km of their workplace. Between the same two sectors, the proportion of people who live within walking distance of medium- or high-frequency AM peak public transport ranges from 96% of inner-urban residents down to 44% of outer-urban residents.[18]

The challenge of transport disadvantage is likely to expand in coming years due to the ageing of our population. Transport can be particularly difficult to access for people who are mobility impaired. Despite ongoing upgrades to our public transport networks, governments are almost certain to miss legislated deadlines to ensure public transport is accessible for people with disabilities.

Beyond our cities, access to transport networks is most limited for people who live in remote Australia. The survival of remote communities is dependent on road and air access. However, local governments often struggle to meet the cost of maintaining roads and airports, meaning remote Australians often lack access to key services, employment and consumer goods.[19]

The transport sector risks becoming financially and environmentally unsustainable

From a funding, maintenance and environmental perspective, our transport networks risk becoming unsustainable.

Australia is currently experiencing a transport infrastructure investment boom. Investment by the public sector is close to record levels, with governments focusing on building new roads and public transport projects.

However, Australia faces significant challenges not just in funding further new assets but in maintaining our existing and expanding asset base. At the heart of many of our transport funding problems is a weak link between usage and expenditure on the network.

These conditions are associated with a lack of transparency about why and how money is spent, particularly for maintaining our existing networks.

For roads, the problem of cost recovery has been exacerbated by a growing disparity between increasing traffic and the decreasing return of funds to governments from fuel excise due to improved vehicle efficiency. Fuel excise is the principal source of revenue associated with our road use. However, it is not tied to road or transport expenditure. In the 20 years to 2018, Australian vehicle kilometres travelled have risen, while excise revenue has decreased by 20%.[20] The prospect of the introduction of electric or alternative fuel vehicles could further accelerate that decline.

The gap between expenditure and income is as true of public transport as it is of roads, if not more so, with fare revenues not recovering the costs of operating or maintaining these modes. Many well-utilised transport networks cannot generate sufficient revenue in order to cover the costs of providing the service. The average public transport cost recovery from fares is low by international standards, averaging less than 30%.[21] The cost recovery from public transport is low in comparison to cities like Toronto, Auckland and Wellington. For each dollar spent by a public transport user on a ticket, between three to ten times that amount needs to be spent by the taxpayer to subsidise the true cost of providing the service.[22]

In 2016, investment in domestic transport networks represented approximately 1.3% of the nation's GDP.[23] As our population grows, and demand for transport increases and becomes more complicated, establishing effective, transparent and sustainable funding mechanisms for capital investment in and maintenance of our transport networks will be a key challenge. Despite strong support for user pays mechanisms for infrastructure, increases to direct user contributions can meet strong community resistance.[24]

Transport also faces significant environmental challenges. The transport sector is the second largest emitter in Australia and its emissions are growing. Transport accounts for about 19% of Australia's emissions, with cars being the single largest contributor.[25] Transport has shown the most rapid growth in greenhouse gas emissions since 1990, growing by 62.9%, and is projected to grow by a further 12% by 2030.[26] Nevertheless, the transport sector is on the verge of significant technology change. Shared and electric vehicles have the capacity to substantially reduce transport emissions.

The passenger transport sector is in a state of rapid transition

A broad range of economic, social and demographic factors are contributing to rapid changes in Australian travel patterns and demand that are further compounding the challenges to the financial and environmental sustainability of our transport networks.

Technological innovation in particular is transforming the way transport is delivered, and is allowing governments to evolve from direct service providers to mobility facilitators. New service models such as on-demand, rideshare and carshare are already disrupting the transport market. The deregulation of point-to-point transport, such as Uber, in all Australian jurisdictions has likely been a precursor of further changes to come.

Public transport providers are starting to test the costs and potential benefits of on-demand transport products in helping to expand the reach of networks. This shift has been enabled by improvements in digital communications, which provide access to real time information and online booking. Ultimately, our transport networks could move towards a Mobility as a Service (MaaS) model, where people will be able to integrate their journey seamlessly across all forms of transport.

Australia's transport network will also soon be transformed by the most far-reaching changes in vehicle propulsion technology since the internal combustion engine entered mass production. Electric vehicles have the capacity to reduce transport costs, improve our air quality, reduce emissions, lower traffic noise and promote better public health outcomes. However, maximising these benefits will depend on policy intervention by governments. Under a business-as-usual scenario electric vehicles might still only make up 6% of Australian passenger fleet sales in 2025. With policy support, this could be as high as 40%.[27]

Connected vehicles are available on market and the number is growing rapidly.[28] While specific uses can vary considerably, many connected applications will require the provision of complementary roadside and emergency services infrastructure to accommodate their use.

Automated vehicles are currently being trialled in Australia and have the capacity to revolutionise all aspects of our travel, from the need to own a private car at all, to the safety and reliability of mass transit. It is currently uncertain how automated vehicles will integrate into the existing transport network, but it is clear that governments have an important role to play in shaping their use.

In this chapter

5.2 Changing urban travel patterns explores the role of economic and social developments in changing urban transport demand and travel patterns. We also investigate the changing role of government from delivering to facilitating transport services, and opportunities to better cater for customers' needs through technology and data analytics.

5.3 Technology and the future of passenger cars explores how the private vehicle market has evolved and will continue to change at a rapid rate. We discuss how sharing and connectivity between cars already exists, how the mass roll-out of electric vehicles will likely occur within the next 20 years and how automated and autonomous vehicles will grow in sophistication over that timeframe and beyond.

5.4 International, interstate and inter-regional connectivity investigates long-distance travel. Specifically, we look at the important economic contribution of international airports and the challenges they face. We also review transport challenges faced in regional and remote Australia.

5.5 Funding and maintaining our transport assets discusses the lack of consistency and transparency across Australia in the funding and maintenance of our transport assets. We also look at the potential for emerging third-party revenue streams.

5.6 Passenger transport sustainability and resilience discusses the large and growing emissions footprint of the passenger transport sector. We explore emerging technologies' capacity to reduce emissions. We also discuss transport network resilience and its role in safeguarding the liveability and economic strength of our communities.

5.7 Safety in the transport sector looks at recent trends in road safety and note we are unlikely to meet targeted reductions in fatalities. We also discuss vulnerable road users, such as cyclists and pedestrians, and investigate growing transport cybersecurity concerns.

5.8 Transport accessibility and equity explores the unevenness of access to transport and the opportunities it reaches, with a specific focus on those experiencing disadvantage. This includes lower income households, people with disability, older people, rural and remote communities, and people living on the outskirts of fast-growing cities.

Performance of the sector

Access

More than
1 in 2
people cannot walk to public transport in the outer suburbs [29]

Quality

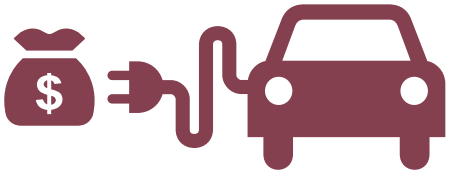
More than
3 people
are killed each day on our roads [30]

Cost

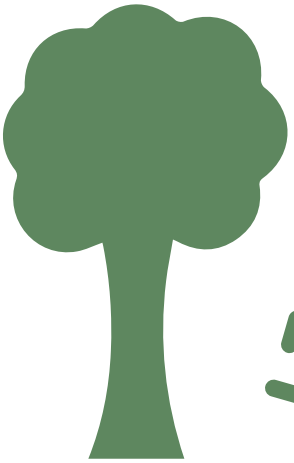
Transport accounts for
65%
of the direct costs households pay for infrastructure [31]

Cost

Electric vehicles
are forecast to reach price parity in 5-10 years [32]



Access

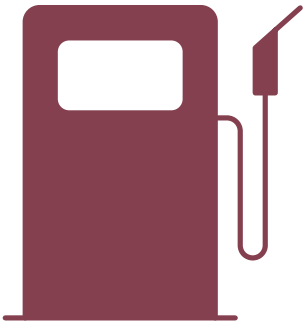


55%
of Australians would like to see more investment in active transport infrastructure [33]

Access

44%
of people find it easy to access rideshare or on-demand transport services [34]

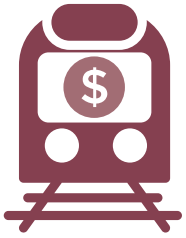
Cost



Average household
spends around $200 per week
on owning and operating vehicles [35]

Cost

26%
of people think our rail services are **expensive** [36]



Quality

In 2031, public transport crowding will grow five times to cost Australia
$837 million per year [37]

Scale of the sector

Asset

Australia's rail network is the
length of a return trip to London from Sydney [38]

Asset

Australia's road network could wrap around the world
22 times [39]

Customer

161 million
people pass through our airports each year [40]

Industry

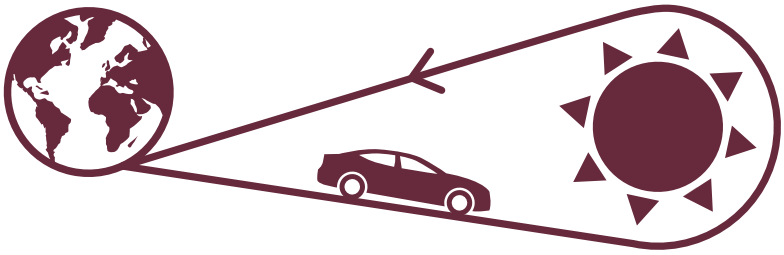
716
regulations stopping autonomous cars [42]

Industry

Highly automated vehicles first trialled in Australia in 2018 [43]

Customer

Australians drive the equivalent of
1,000 times from Earth to the Sun
every year [41]



Asset

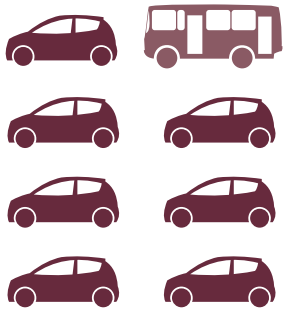
Cars typically sit idle
95% of the time [44]

Industry

8 Sydney Opera Houses
could be built with the **annual subsidy** to public transport [45]

8 x

Customer



1 in 10
trips to work are by public transport and
7 in 10
are by car [46]

5.2 Changing urban travel patterns

At a glance

This section explores how governments must cater to diverse travel patterns and higher demand in an increasingly urbanised Australia, and to avoid the high, and growing costs of congestion. Approaches include greenfield planning, non-radial transport grids and active travel modes such as walking and cycling.

We also look at the role of industry in supporting governments to better facilitate services instead of providing them directly. Approaches include new technologies, transport modes and use of data.

Our travel patterns are changing and becoming more diverse

People's travel behaviour is becoming increasingly complicated. Traditionally, public transport planning has been geared towards catering for peak period trips into and out of major employment centres. Today's reality sees people travelling in large volumes outside the peaks, for multiple reasons, on a mixture of transport modes.

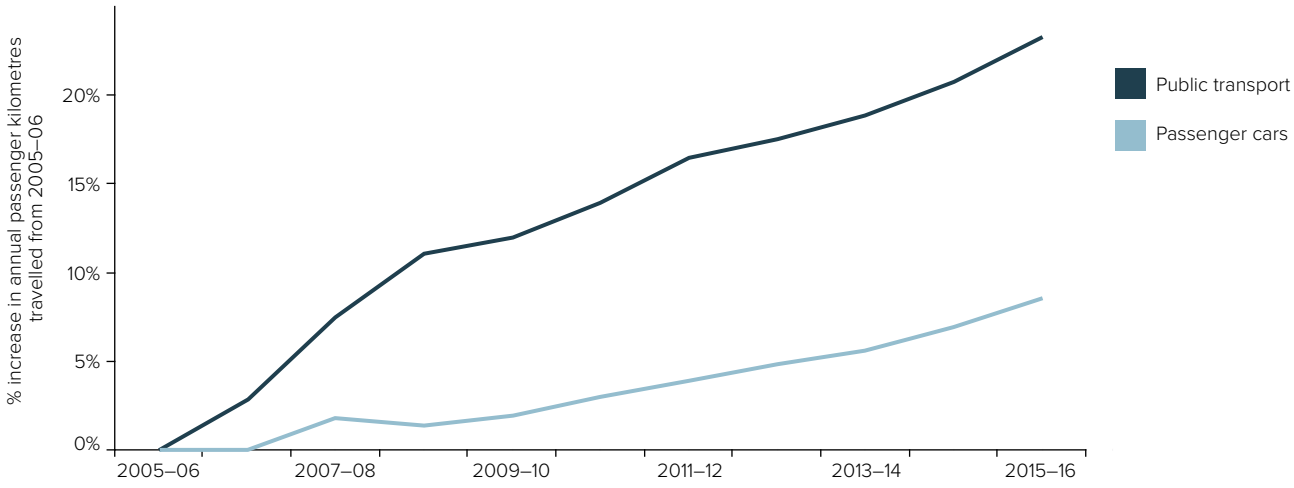
Simple population growth, as well as changing travel habits, is increasing the demand for urban public transport. While private vehicles are still the single most-used mode, public transport travel has grown by 24% over the past 10 years compared to only 8% for private vehicle travel (Figure 1).[47]

Travel demands have always been much more complicated than the 'daily commute', and it is probable that non-work sources of demand have been insufficiently catered for over many years. Major trends are changing how people travel in our cities, making the passenger transport task larger, and more challenging, than it has been in the past.

These trends include:

- **Urbanisation:** Australia's population is becoming more urbanised. Over the period from 2017 to 2047, Australia's population is projected to increase by over 11 million people. About 80% of this growth is expected to occur in our five largest cities (Sydney, Melbourne, Brisbane, Perth and Adelaide),[48] meaning the scale of the transport task in our cities will increase during weekdays and weekends.
- **Ageing population:** The proportion of people aged over 65 is currently 15% and is projected to grow, by 2066, to 21% of a significantly larger overall population.[49] People's travel patterns change at different stages of their life. For example, retirees who no longer travel to work instead travel to more dispersed locations for leisure and access to services such as healthcare. Older people rely more on public transport when road safety requirements place limits on their driving, and are more likely to travel in off-peak periods than younger commuters.
- **Flexible working arrangements:** The growing role of contract work and casual, part-time employment means journeys to work are increasingly being undertaken at different times of the day and on different days of the week. Technology is also enabling people to work anywhere, at any time, with almost one-third of all employees regularly working from home.[50]
- **Increasing off-peak travel:** One consequence of the breakdown in the traditional '9 to 5' is the spreading of travel away from peak periods. People in flexible working situations may undertake their commute in the middle of the day or the late evening, or travel during the week for non-work purposes like shopping or seeing friends. The latter types of journey are not associated with major employment centres well serviced by trunk public transport services, and typically end at a location where it is easier and cheaper to park. Hence, while some cities have seen an increase in the frequency of rail services during off-peak hours, these hold limited attraction for someone driving to a suburban shopping centre. Equally, more frequent off-peak bus services may still not be competitive with driving if they are not able to use peak-oriented bus priority facilities.
- **Growing workforce participation:** Roles for women and men in paid and unpaid work are becoming more diverse. In particular, the travel patterns of dual-income families are becoming more complicated, with journeys to work often having to be timed to coincide with other commitments such as childcare and school drop-offs and pick-ups, further education, second jobs and shift work.
- **Better access to real-time transport information:** Technology is central to our changing travel patterns. Smartphone apps in particular are changing the way customers interact with public transport, providing real time information to help people to reduce their wait time, avoid service delays, and make better travel choices.

Figure 1: Travel is growing, particularly for public transport



Source: Bureau of Infrastructure, Transport and Regional Economics (2018)[53]

Urban transport is becoming more crowded and congested

With growing populations that are becoming more urbanised and more diverse in their travel patterns, the pressure on our transport networks is significant.

Infrastructure Australia has calculated the cost of the growing demand for urban transport in terms of crowding and congestion. The total cost of road congestion and public transport crowding was estimated to be $19.0 billion in 2016 and is expected to more than double to $39.6 billion by 2031, with road congestion making up $38.8 billion (Table 1).

Road congestion accounts for most of these costs. This is because private vehicles are still the dominant mode choice and road congestion is increasingly an all-day, everyday problem.

While crowding on public transport is mostly a peak period problem, this is rapidly growing as patronage increases and peak periods become longer. Crowding is especially evident on urban rail services as commuters look to avail themselves of the relatively good speed and reliability of the train for longer-distance travel, compared with road travel by car or by a bus operating in mixed traffic. The Sydney Trains network is a good example of how rapid growth in demand is causing overcrowding at stations and on trains, with impacts on service reliability and travel times.[51]

Infrastructure Australia also undertook costs of congestion modelling in the 2015 Audit. Overall, the projected cost of congestion for roads (public transport was not included in the 2015 calculations) is now about $14.5 billion lower. This is largely because of a significant reduction in projected population growth in Perth. In the 2015 Audit, ABS population projections for Perth had been developed at the height of the mining boom. With that city's economy now growing at a much slower rate, population projections have been adjusted accordingly.

The forecast cost of congestion also decreases for Brisbane, the Gold Coast and Sunshine Coast, the ACT and Queanbeyan, and Greater Adelaide. For the first two conurbations, population forecasts have decreased by 2% and 8% respectively, when compared to the 2015 Audit. For Adelaide, although population forecasts have remained stable, modelling outcomes now point towards a different spread of congestion impacts.[52]

In contrast, for our two largest cities, Sydney and Melbourne, the projected costs of congestion are now greater. This reflects the substantial growth in these two cities since the last Audit, their growing role in the national economy, and the forecast growing gap between travel demand and the supply of new roads and public transport infrastructure.

More detail on Infrastructure Australia's transport modelling can be found in the Australian Infrastructure Audit Supplementary Report, *Urban Transport Crowding and Congestion*, as well as Supplementary Reports examining the congestion impact on each of the six examined regions.

Table 1: Costs of road congestion and public transport crowding are forecasted to double from 2016 to 2031

Model area	Cost	2016 ($ millions)	2031 ($ millions)	2031 ($ millions) from 2015 Audit
Sydney, the Hunter and Illawarra	Public transport crowding	68	223	N/A
	Road congestion	8,038	15,693	14,790
Melbourne and Geelong	Public transport crowding	75	352	N/A
	Road congestion	5,485	10,379	9,006
Brisbane, the Gold Coast and Sunshine Coast	Public transport crowding	14	90	N/A
	Road congestion	2,084	5,969	9,206
Greater Perth	Public transport crowding	17	159	N/A
	Road congestion	1,525	3,620	15,865
Greater Adelaide	Public transport crowding	1	4	N/A
	Road congestion	1,444	2,619	3,747
ACT and Queanbeyan	Public transport crowding	1	8	N/A
	Road congestion	289	504	703
Total	Public transport crowding	175	837	N/A
	Road congestion	18,865	38,784	53,317
	Congestion and crowding	19,040	39,621	N/A

Source: Infrastructure Australia (2019)[54]

38. Challenge

Urban travel patterns are becoming increasingly complex, driven by economic, social, demographic and technological changes. There is a risk of growing divergence between the way our networks are planned and designed, and the needs of customers. Failure to cater for changing patterns of travel could contribute to growing congestion in our fast-growing cities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Land-use planning decisions impact on travel patterns in our cities

Travel patterns vary across each city, meaning transport planners cannot adopt a 'one size fits all' approach. Land use is a particularly important factor in how people travel. For example, the transport needs of people travelling to a CBD in the AM peak will be very different to parents taking their kids to Saturday morning sport in the outer suburbs.

Activity centres and higher-density areas require a mix of infrastructure and policy solutions, such as high-capacity public transport, robust parking policies and prioritisation for pedestrians and cyclists. In contrast, lower-density outer suburbs tend to be more reliant on private vehicles, but still require carefully planned public and on-demand transport services that balance attractive service levels with costs to government.

The rapid growth where existing suburbs have redeveloped at higher densities at the same time as greenfield land has been released for housing on the urban fringe, the rapid growth of our cities has added to the complex demands and pressures on our transport networks. There has been significant urban consolidation in established parts of our largest cities, particularly Sydney and Melbourne, which has increased population densities substantially in inner city areas. Our cities also continue to expand outwards, with State governments reporting that greenfield development rates account for about 20% of growth in Sydney, 30% in Melbourne and as much as 70% in Perth.[55]

The growth and complexity of our cities make them vibrant places to live and work, but also present challenges to planners. In some parts of our cities, infrastructure has not kept pace with population growth and development. Coordination across portfolios has been particularly problematic, meaning some growing communities have been left without sufficient access to key services.[56]

Governments and transport operators face major challenges in ensuring legacy networks and services remain fit for purpose and that new infrastructure is provided for greenfield and brownfield development. Aligning the delivery of transport infrastructure with housing, employment growth and other key infrastructure that influences the demand for transport, such as schools, universities and hospitals, is a particularly complicated task that requires whole-of-government coordination. In some jurisdictions this challenge is starting to be addressed through the establishment of governance models that look beyond traditional siloes, including the Greater Sydney Commission, although further work is needed in this area.

39. Challenge

Rapidly changing land use and development can place pressure on urban transport networks. Densification in our largest cities places pressure on legacy networks, while greenfield development requires new infrastructure and services. Failure to coordinate land use and transport planning can contribute to congestion and crowding in some areas, or a lack of adequate services in others.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Changing travel demand creates challenges for public transport network design

Our legacy public transport networks are largely radial. Major public transport routes are typically designed to carry people into a city's central business district from the suburbs. This is because our public transport networks have expanded progressively with our cities, extending from a central, dense and pre-motor vehicle core to connect to lower-density suburbs from which commuters have traditionally headed to the city.

The practical consequence of this is that public transport routes converge as they get closer to a CBD, meaning inner suburbs are serviced by a denser network of routes and stops than outer suburbs. Even if services in these inner areas operate less frequently in off-peak than peak hours, this has a lower impact on residents of high-density areas where non-work destinations such as shops, cafés and leisure facilities are within walking or cycling distance.

In contrast, public transport in our outer suburbs is typically characterised by longer travel times to major employment centres, lower levels of walking accessibility to public transport stops (and to other, non-work-related destinations), lower service frequencies and a shorter span of operating hours.[57] In this situation, even if public transport is the most viable choice for commuting, its use may not be realistic for other journey purposes, especially during the late evening or at the weekend.

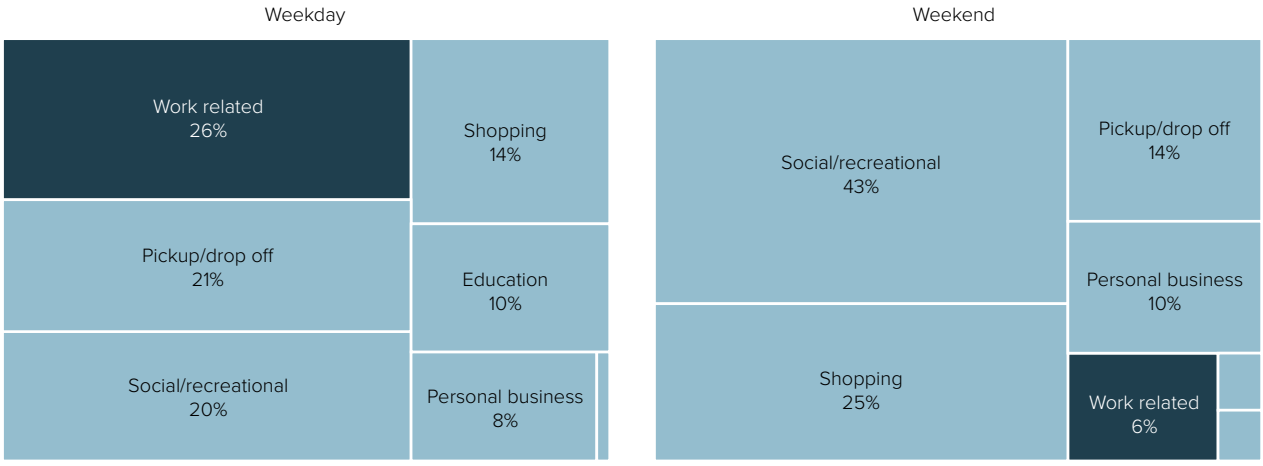
Work-related travel makes up only about a small proportion of trips, and even fewer on weekends –in Melbourne for instance, they comprise 26% of weekday trips and 6% of trips on weekends (Figure 2).[58] In addition, although our CBDs are important and dense employment centres, they account for a minority of all the jobs on offer across the larger conurbation in which they are located. For example, only about 33% of Melbourne's jobs are located in its inner city and CBD.[59]

Against this background the comparative inflexibility of public transport is a key reason why it struggles to compete with private vehicles. In our five largest cities, for example, about 19% of people catch public transport to work. Cars can take people between any origin and destination in a city. In contrast, our radial public transport networks serve a small number of destinations very well, such as CBDs and major employment centres, while large parts of each city, particularly in middle and outer suburbs, have relatively low service levels.[61]

The challenge for governments is to cater for a broader range of trips, including non-radial journeys and trips that are outside peak hours. This is particularly important in the context of changing patterns of demand, such as greater workplace flexibility, an ageing population and growing participation rates, which are all contributing to more varied and complicated travel patterns.

Some jurisdictions have identified the development of new, non-radial links. However, some of these projects may carry significant costs due to their delivery within existing urban areas. As a shorter-term solution, governments have started to encourage people to interchange between services as part of a single public transport journey. Each interchange represents an opportunity for a passenger to change their direction of travel and opens a greater diversity of potential destinations.

Figure 2: 26% of weekday trips and 6% of weekend trips in Melbourne are work related



Note: Values show proportion of trips for an average day in Melbourne. This is drawn from the 2014-16 Victorian Integrated Survey of Travel and Activity, which collects data across the two years.

Source: Victoria Government Department of Transport (2016)[60]

This is the principle by which connected public transport networks operate in cities and regional centres internationally. In Australian cities its application is being made possible by the availability of electronic ticketing data, which give planners rich information on travel patterns across a city's public transport network, at different times of the day, and can inform adjustments to peak and off-peak service patterns.

Well-designed, integrated networks that encourage interchanging are generally characterised by:

- Service hierarchies and suitable transport modes for each route.
- A 'grid' or 'connected' structure that ensures orbital routes interchange with radial routes, meaning passengers have the opportunity to change between services.
- High service frequencies and/or coordinated services that minimise the waiting time for transferring passengers.
- Well-designed interchanges that allow passengers to easily and quickly change between services.
- Interchanges, stations and stops that are easily accessible by active transport (walking and cycling) and include storage for bicycles and e-bikes.
- Integrated ticketing and fare regimes, which reduce the need for customers to buy separate tickets, and minimise any 'interchange penalty' (the requirement to pay for separate trips as part of a single journey) in the cost of the ticket.

40. Challenge

Our radial public transport networks are inflexible and have varied levels of service and relatively low mode shares. Unless our public transport networks are designed to cater for a broader range of trips, they will not meet the changing needs of a growing number of customers.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Metropolitan strategic transport models have limitations

Transport models are crucial in helping planners better understand the impact of policy and project decisions. The type and scale of transport models vary widely, from relatively targeted models used to examine changes resulting from individual projects, to city-wide, strategic models like those used in our Audit to predict likely future conditions across metropolitan regions.

Modelling a metropolitan region requires a wide range of assumptions to be made about how people will travel in the future, what infrastructure will exist and where and how people will choose to live and work. The models then give us a good picture of likely future challenges, but offer just one possible view of the future.

Some commonly understood limitations of metropolitan strategic models are that they find it difficult to account for:

- Different travel patterns on weekends and over holiday periods.
- The possibility that people will choose to live differently in the future and that population or jobs growth will occur in unforeseen places. The modelling in this Audit is based on the latest available State and Territory projections, to be as consistent as possible with other planning models.
- The possibility that people's travel behaviours will change in the future and they will choose different lifestyles to today's population. For example, people may choose to travel at different times of the day to avoid congestion, travel more on weekends or choose to use different modes. The modelling in this Audit considers a generic 'typical' day, and then looks at the typical peak periods within that day.
- The implications of technological changes, like automated vehicles. The wider impacts of these changes are being explored by the Australian Government and by the broader global community, and we anticipate having a much clearer understanding of this over the next five years. Due to significant uncertainty about the pace and impact of technological change, the Audit modelling assumes no change in technology.
- The benefits of small and/or non-road projects. Under a previous 'predict and provide' paradigm, models were geared towards highlighting the advantages of large projects, and especially large road construction projects whose value is principally derived from the mass aggregation of many small future travel time savings. As a consequence, more modest investments returning proportionately high benefits targeted at existing transport problems have been relatively excluded from consideration.
- Outcomes for outer-urban and peri-urban areas, because the travel zones in these areas are larger, meaning estimated travel times are less accurate.

Identifying the best solutions to the challenges raised in this Audit will require further more detailed analysis and the exploration of a wide range of possible solutions, using new modelling techniques. This process is explained in detail in the Infrastructure Australia *Assessment Framework*.[62]

41. Opportunity

New technology and data sets are increasingly available in the transport sector, that can be used for planning and service delivery. Better information allows governments and operators to better understand and cater for customers' transport needs and expectations.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Active transport is at the heart of an integrated transport network

An integrated transport network has active transport at its core. Walking and cycling play a critical role in our transport networks, particularly for shorter trips and for the first or last kilometre in the journey between people's origins and destinations. For public transport journeys this can mean the connection between the trunk mass transit corridor and home or work.

This means that in order to cater for people's entire journey, from their front door to their final destination, planners have to consider and promote active transport as a critical component of the transport network.

Walking is naturally the most common way for people to move.[63] Most journeys at least start or end with a walking component, whether people are walking to their local railway station or from a car park to their office. For shorter trips, particularly in high-density centres, walking is often the most popular form of transport. For example, in Melbourne's CBD about 86% of all trips are on foot.[64]

Cycling plays a different and smaller role than walking, but is also important. Cycling can be a relatively quick form of transport, particularly for shorter trips. In dense parts of our cities, cycling often takes less time than driving for a journey below 5 km.[65] This means cycling is normally more competitive in our inner-urban areas than the outer suburbs. For example, in Greater Melbourne an average of 1.8% of trips are by bike, but in more central local government areas, such as Yarra and Port Phillip, cycling is closer to 7% of trips.[66]

Active transport also has obvious environmental and health benefits. It produces no direct emissions and helps to improve people's fitness and wellbeing. The benefits of active transport have been recognised by the World Health Organisation, which notes it is key to reducing the 3 million deaths globally each year that are caused by physical inactivity.[67] New technology, such as electrification for bikes and scooters, is providing opportunities for broader groups of people to access the benefits of active transport.

However, despite its benefits, active transport remains a challenge for Australian policymakers. Australia sees relatively low rates of active transport use compared to European countries. About 5% of Australia's journey-to-work trips are undertaken solely by active transport. Over 30% of trips in Sweden, Germany and Denmark, and over 50% in the Netherlands, are by walking or cycling.[68]

Active transport has markedly declined among certain parts of the community over the 50-year post-war period during which the level of vehicle ownership increased from one car for every six to seven Australians, to one for less than every two Australians.[69] The number of Australian children regularly walking or cycling to school has halved in the last 40 years, with less than one-third now regularly using active transport to get to school.[70]

There are numerous potential causes for Australia's active transport shortfall. In particular, pedestrians and cyclists are especially vulnerable to road crashes. Additionally, beyond the inner areas of our larger cities, there are generally long distances to be covered between people's homes and their potential destinations, such as local shops or public transport stops.

However, long distances are not the only reason, as many short trips are undertaken by car in Australia. For example, there are over two million car trips every day in Sydney that are less than 2km in length.[71]

Other commonly cited barriers to walking and cycling refer to insufficient infrastructure. About 70% of people in New South Wales say they would cycle more if they had access to separated bicycle lanes.[72] Similarly, surveys carried out in Western Australia show that more people would walk if better footpaths were provided.[73] Problematically, however, it is the densely settled areas where walking and cycling would be most feasible in land use terms that are the most challenging places in which to find the space to widen a footpath or excise a traffic lane for a cycleway.

From a transport planning perspective, a key challenge is ensuring that our active transport networks are integrated with public transport. Many of our public transport facilities are not easily accessible, meaning the mobility-impaired and older people are less likely to walk to their local station or bus stop. In addition, people may feel unsafe, particularly at night, when they walk or cycle to public transport.[74] Finally, cyclists need storage facilities at public transport stations and stops.

While there are likely multiple reasons for Australia's comparatively low levels of walking and cycling, it is clear there is an opportunity to improve and better integrate active transport with the rest of our networks.

42. Challenge

Australia has relatively low rates of active transport, driven by a range of issues including low densities and long distances, insufficient infrastructure and safety concerns. Without action, our transport networks and travel patterns will remain poorly integrated and sustainability improvements will be limited.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

5.3 Technology and the future of passenger cars

At a glance

Technology is disrupting the private vehicle market, as users embrace the most efficient and affordable methods of transport. Key changes include:

- The growing sharing economy is making car ownership less attractive.
- New technology connects cars to the internet and their physical surroundings.
- Electric and autonomous cars will soon be available.

This section looks at the potential benefits of these changes, and the regulatory barriers they face.

Technology is disrupting the private vehicle market

Technological change has always gone hand-in-hand with the automotive sector and car travel. Most users have experienced change through incremental in-car improvements in safety, fuel efficiency, audio visual, wayfinding technology and satellite navigation systems. However, over the next 15 years, the pace of change will dramatically increase. Technology and digital connectivity will fundamentally change how customers interact with transport infrastructure and how operators deliver transport services.

The cars of the future will be:

- **Shared:** Cars are already becoming part of the shared economy.
- **Connected:** Cars are increasingly connected to the physical environment they occupy, including adjacent vehicles and infrastructure.
- **Electric:** The shift away from the internal combustion engine is under way, and within 10-15 years it is possible that as many as one in three passenger vehicles sold in Australia could be electric.
- **Autonomous:** Within the next couple of generations many users may be able to get where they need to go without a driver.

Each technology presents a large amount of uncertainty, risk and reward. Depending on their implementation, each could have positive or negative effects on consumer quality, cost and access outcomes. What is clear is that there will be profound impacts on the way we travel and how much we pay to do so.

Governments and industry need to be on the front foot to ensure that they keep pace with the speed of technological development and the influence of its advocates. Without planning, the benefits on offer to consumers and taxpayers could be lost.

Our vehicles are becoming part of the shared economy

Mobility as a Service accounts for door-to-door journeys

Mobility as a Service (MaaS) represents a shift away from personally-owned transport towards mobility solutions that are consumed as a service, through either 'pay-as-you-go' or periodic subscription business models. MaaS aims to allow the user to purchase from a variety of mobility options to best suit their needs, using a digital application, such as a smartphone app. A well-designed and implemented MaaS scheme can save consumers costs and provide an alternative to personal car ownership.

Under the ideal MaaS model, travellers access real time information on how to get to their destination, by whichever mode or combination of modes is most efficient and affordable, and then use the same interface to book and access preferred services. MaaS aims to bring together private and public operators to allow seamless travel and to better match supply to demand.

As such, MaaS could be a useful tool for public transport providers that are increasingly looking towards on-demand and multimodal transport solutions to help expand the reach of their public transport networks, and fulfil the first and last mile transport needs of passengers. The impacts of MaaS could be accelerated and multiplied when coupled with other emerging technologies, particularly automated vehicles.

Elements of MaaS already exist in Australia, but no jurisdiction offers a single common framework within which a range of private sector actors can work together to coordinate all multimodal travel choices. Awareness of the potential benefits of MaaS is increasing. The Queensland Government has established a MaaS project office and government bodies have called for consideration of MaaS in future transport planning.[75]

The shared economy is here and growing. Its growth has been enabled by advances in digital connectivity, the ubiquity of smartphones and changing customer expectations. The shared economy is expanding the range, availability and penetration of car-based passenger services through new platforms for ridesharing (e.g. Uber, Lyft, Ola), carsharing (for example, GoGet, Green Share Car, Flexicar) and peer-to-peer carsharing (e.g. Car Next Door, DriveMyCar). More recently sharing has also extended to other parts of the car industry, such as car parking and accessories, like trailers and caravans.

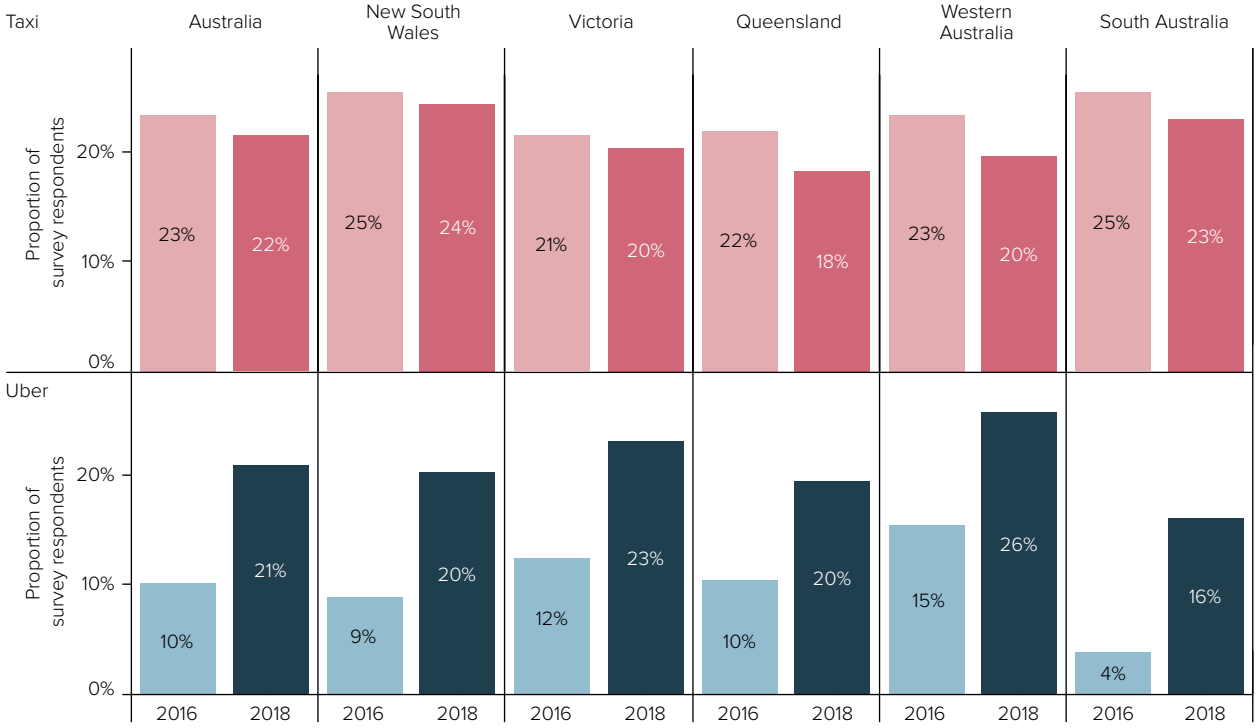
The shared economy has resulted in major changes for transport users, particularly in our cities. Where available, it can reduce transport costs, increase ride quality through the offer of personalised services, improve convenience, and reduce the need to own a private vehicle.

Cars, which were once an asset purchased for private and often single-occupant use, have the opportunity to be shared or hired, earning the owner a return. Peer-to-peer carsharing combines aspects of the rideshare economy and traditional carsharing to provide more choice around vehicle types, rental periods and charges.

Peer-to-peer carsharing has allowed car owners to put their vehicle to greater use. This is relevant, as cars typically sit idle for 95% of the day and cost the average Australian family $22,000 per year, or 17% of average household income.[76] According to Car Next Door, car owners can make between $3,500 and $10,000 per annum by renting out their unused vehicle.[77] This gives car owners a chance to monetise their assets while increasing car availability to other users. In Australia, there are 16 carshare providers, which collectively generated $69.7 million in annual revenue in 2015-16.[78]

The ridesharing economy is even more prevalent. Ridesharing service Uber was used by one in five Australians within the three months to December 2018, double the number in the same period two years prior (Figure 3).[79] This increase coincided with a reduction in taxi journeys of 1.9%.

Figure 3: Uber use is rising rapidly, while taxi use is declining



Note: Respondents were asked whether they had travelled by Uber or taxi in an average three months to December 2016 and December 2018.

Source: Roy Morgan (2018)[80]

However these services have been to date largely absent from regional centres, Uber is expanding to smaller regions including Bathurst, Tamworth, Rockhampton, Gladstone, Bundaberg, Warrnambool and Horsham.[81]

The growth of affordable and convenient sharing options continues to make the prospect of owning a car at all less attractive for more Australians. Whether it is due to the increasing availability of these transport choices or for other reasons, recent trends suggest younger Australians see car ownership as a choice rather than a necessity. Licence rates for young Victorian adults decreased by 18% from 2001 to 2016, with 18-year-olds having the lowest licensing rate on record (36%).[82] Small declines are also being seen in New South Wales.[83]

Nevertheless, car ownership remains high in Australia.[84] The opportunity for reduced car ownership may be limited to inner city areas, where access to public transport is better and the take up of ride and carsharing is most prevalent.[85] For now there are many diverging views of the impacts of carsharing and ridesharing on the transport network.

Table 2 highlights the uncertainty facing governments, in terms of their preparedness to deal with a wide range of potential impacts from new technology on the transport sector.

Where a rideshare is used for, say, the return leg from a traditional public transport trip, in place of driving oneself both ways, the total number of single-occupant private car trips could be reduced, with benefits for congestion. Multi-occupancy rideshare services, that allow multiple customers to share the vehicle with other customers in return for a cheaper fare, could also reduce congestion. Carsharing in place of personal car ownership could reduce the demand for parking in dense urban areas.

However, carsharing and ridesharing can also add to road congestion. Studies of large cities including New York and San Francisco have found evidence of the growth in ridesharing contributing to congestion by tempting customers away from more space-efficient public transport services, and through drivers cruising the road network between fares, or competing with buses and other vehicles for scarce kerb space when picking up and dropping off customers.[86] In these circumstances, the viability, cost recovery and, ultimately, frequency of traditional public transport services can be compromised, leaving government as the service provider of last resort for users without the financial resources to access a personalised Mobility as a Service product.

Table 2: Transport sharing options have uncertain impacts on private vehicle use

Product	How could this product lead to an increase in vehicle kilometres travelled?	How could this product lead to a decrease in vehicle kilometres travelled?	Potential vehicle kilometres travelled change
Carsharing	Personal car use becomes more affordable for non-car owners. '8% of users would drive more'.[87]	Existing car owners give up ownership. '35% of users would drive less', based on survey (n = 6,167) of car2go members in five US cities.[88]	Reduction in vehicle kilometres travelled. 'Potential for 11% reduction per average user'.[89]
Ridesharing	Ridesharing promotes car travel as an alternative to traditional public transport use.	Ridesharing in larger vehicles could displace multiple vehicle trips.	Ridesharing to common CBD destinations would likely displace public transport use, based on survey results (n = 2,501) from investigation of Melbourne CBD car pooling scheme.[90]
Multimodal apps (for example, Whim and SMILE)	Provides easy and attractively priced access to rideshare and carshare.	Provides easier access to public transport, bikesharing and walking.	Likely to have marginally negative impacts on travel demand and vehicle kilometres travelled. In Vienna, the SMILE pilot saw a 21% reduction in private car usage, but only a small proportion of the total fleet was affected.[91]
Ride sourcing (promoting access to ridesharing through multimodal apps)	Reduced cost, differentiated service and brand repositioning attract public transport users to travel by rideshare.	Existing car owners with poor access to trunk public transport become able to use public transport due to availability of attractive first and last kilometre solutions.	Analysis indicates total trips can increase by 0.05%.

Source: Deloitte (2017)[92]

43. Challenge

The accessibility and affordability of ride and carsharing could decrease demand for public transport. In these circumstances, demand shifts from space efficient public transport back to cars, potentially increasing congestion.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Cars are increasingly connected to the world around them

The number of devices connected to the internet is 20 to 30 billion worldwide, and cars are becoming a big part of this story.[93] Some cars already send up to 25 gigabytes of data to the cloud every hour.[94] The amount of data exchanged will increase massively as cars become more autonomous.[95]

Cooperative vehicles already running on Australian roads use digital technology and the internet to communicate wirelessly with other vehicles, roadside infrastructure, mobile phones and transport management systems, including traffic signals. Drawing on these data sources, vehicles provide audible and visual prompts to assist drivers and warn them about upcoming traffic accidents, congestion and quicker routes.[96] These technological advancements are improving the quality, safety, efficiency and cost of users' journeys. A recent United States study on the impact of smart technology on the national car fleet calculated national annual savings of US$6.2 billion from fuel efficiency gains alone.[97]

The full benefits of cooperative vehicles that are capable of even greater autonomy, up to and including driverless operations, will only be realised when enabling physical infrastructure and operating systems are in place, supported by appropriate regulations. Policy-makers need to be proactive to keep pace with technological development. If they are not, users will not access the full benefits of increased connectivity.

Governments have made progress towards enabling more connectivity between vehicles and the surrounding environment. Queensland has been at the forefront of innovative trials to enable the use of cooperative vehicles. States and territories across Australia have also been rolling out intelligent transport systems along motorways under the Managed Motorway Initiative. Most jurisdictions are installing elements of electronic message boards, tidal flow systems, vehicle detection sensors, smarter traffic lights, variable speed limit signs and CCTV cameras on motorways and selected arterial roads, and integrating these into operating systems that monitor traffic conditions,[98] manage congestion and respond to incidents in real time.[99] However integration of these systems remains piecemeal.

The growth and improvement of cooperative intelligent transport systems will see the benefits already achieved on such routes expand across wider road networks.

Queensland is preparing for cooperative and automated vehicles

The Queensland Department of Transport and Main Roads' Cooperative and Automated Vehicle Initiative aims to validate the effectiveness of cooperative and automated vehicles as part of Australia's largest on-road trial of vehicles and infrastructure. The project will begin with a nine-month on-road trial in Ipswich in 2019.

500 private and fleet vehicles retrofitted with cooperative intelligent transport systems technology will be involved in the pilot. These devices will enable vehicles to 'talk' to one another and to roadside infrastructure. The devices will also provide safety warnings about a range of conditions, such as pedestrians crossing at signalised intersections, hazards on the road and congestion ahead.

Outside Queensland, automated vehicles trials using small shuttles are underway on a mix of private land and the public road estate. These trials have the opportunity to inform regulation and to increase community awareness of change.

44. Opportunity

Connected vehicles can reduce accidents, improve traffic flow and reduce costs for drivers.
Leveraging this new technology could improve access, quality and cost outcomes for users.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Within 10-15 years up to a third of cars sold could be electric

Electric vehicles will challenge internal combustion vehicles' dominance over the Australian automotive industry. Currently consumers wanting to buy an electric vehicle face several barriers, namely range anxiety, a lack of vehicle choice and a large upfront price. Consequently, electric vehicles only comprise 0.2% of our current fleet, which is somewhat lower than in other comparable countries, such as the United States, New Zealand and Germany.[100] However, this low level of uptake is not indicative of where the electric vehicle market is heading. As the barriers to electric vehicle adoption fall, uptake rates will rise.

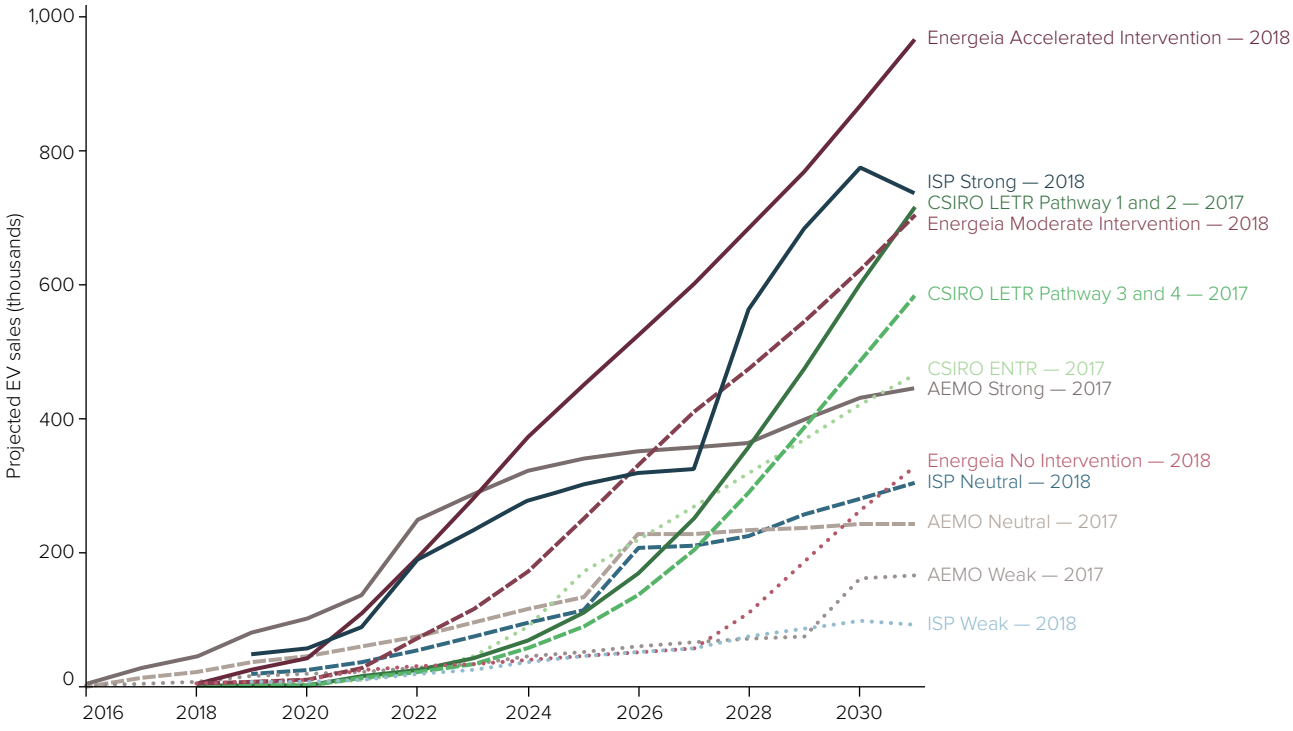
The creation of a mass market for electric vehicles will be driven in large part by the rapid reduction in electric vehicle costs relative to internal combustion engine vehicles. The price of a lithium-ion battery, which makes up over half of the cost of an electric vehicle, is falling. Many analysts, such as Bloomberg New Energy Finance, predict price parity could occur as early as 2025.[101] Alongside this, battery capacity and life are increasing, allowing longer trips on a single charge, more charging stations are being installed, and consumers are being offered a more diverse range of vehicles to meet their needs.

Electric vehicle owners also stand to save significant recurrent costs. Operating costs, including fuel and maintenance, are significantly lower than for internal combustion engine vehicles.[102] Presently, electric vehicle owners spend $380 per annum on maintenance, while internal combustion engine vehicle owners pay $750 per annum.[103]

As with MaaS products which increase the availability and affordability of carsharing as an alternative to traditional public transport use, governments will need to be alert to the risk of cheaper motoring leading to congestion impacts. More positively, cheaper driving will be particularly beneficial for the rural and remote communities which suffer the most from high per-kilometre travel costs.

Several leading research organisations, government agencies and industry groups have produced electric vehicle uptake projections (Figure 4). The range of projections highlights significant uncertainty, but also the consensus view that adoption of electric vehicles into the Australian market will accelerate between 2020 and 2030.

Figure 4: Australian electric vehicle sales projections are increasingly optimistic



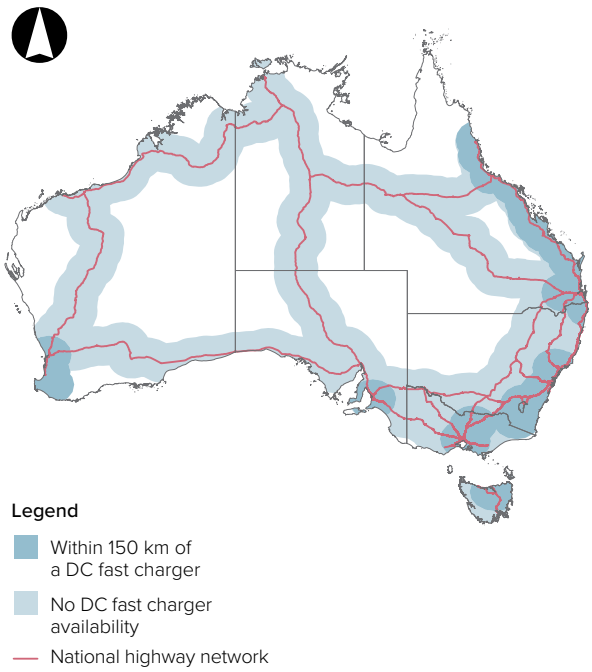
Source: Clean Energy Finance Corporation (2018)[104]

Given this uncertain timeframe and the lack of current electric vehicles on our roads, it is not surprising that there are fewer than 100 publicly available Direct Current (DC) fast chargers in Australia,[105] which results in limited coverage on the National Highway Network (Figure 5). DC fast charging stations can provide 70 km of driving range for every ten minutes of charging.

The current lack of charging infrastructure increases consumers' range anxiety. This anxiety is more pronounced in regional, remote and rural areas where charging infrastructure is required to connect communities and allow inter-regional travel. These communities do not offer the economies of scale to justify private investment in charging infrastructure at this time. Infrastructure Australia's 2019 *Infrastructure Priority List* has recognised this and identified a national electric vehicle fast-charging network as a high priority for the next five years.[106]

Some investment in a national charging network has already begun. The Queensland Government has committed to installing a 1,800 km fast charging network from the state's southern border to Cairns. The Australian Government, through ARENA, is separately providing $6 million to develop 21 public fast charging stations.[107] This network, which will space stations no more than 200 km apart, will link up driving routes from Brisbane to Adelaide (via Sydney and Melbourne) and in separate sections of Western Australia. Private companies, including Tesla and the NRMA, have also installed chargers, and several local councils have been proactive in installing slower kerbside chargers in residential areas.[108]

Figure 5: As at November 2018, non-proprietary fast charger coverage of the National Highway Network is limited to major population centres



Note: Coverage as of 15 November, 2018.

Source: Infrastructure Australia analysis of PlugShare (2018)[109]

45. Challenge

Many regional, remote and rural communities do not have the economies of scale to justify private investment in charging infrastructure. Without charging infrastructure, users in these areas will have fewer opportunities for electric vehicle uptake.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

There is universal agreement on the need to plan for autonomy

The need to plan for fully automated vehicles is already starting to reshape the way we think about the role of transport, whether in our cities or in connecting Australia's most remote communities.

The five standardised levels of vehicle autonomy are outlined in Figure 6. Based on the Level 2 automation already offered by many newer vehicles on Australian roads, the irreversible move towards, ultimately, full vehicle automation is already changing how road users interact with their vehicle and experience their journey.

Increased vehicle autonomy can benefit all types of places, from fast-growing cities to rural and remote communities alike.

Many analysts are anticipating that Level 4 automation will be commercially available before 2025.[110] Beyond that point, as shown in Figure 7, forecasts for the achievement of Level 5 automation span a wide range of possible timeframes.

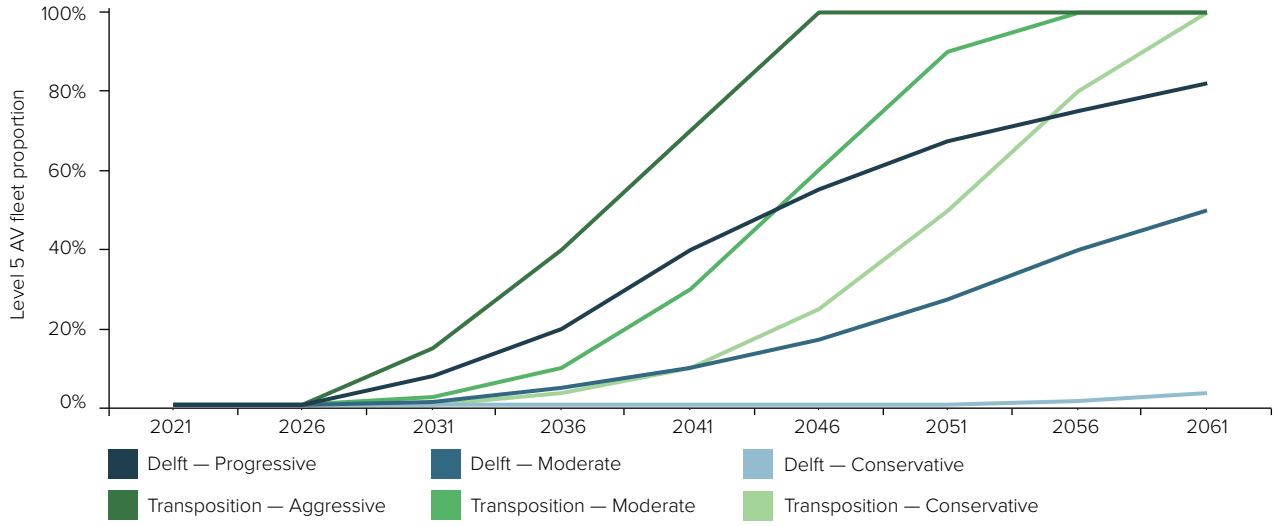
Uncertainty around the timing of the final step to full vehicle automation is to be expected. The total benefits of this technology, especially the road safety gains, will only be maximised level of uptake is beyond the point at which the risk of a fully automated car sharing the road – and colliding – with a less sophisticated vehicle falls away. Regardless of when this point will be reached in Australia, current transport network planning decisions must be informed by the assumption that roads built today with 40 year predicted lives will in time be used by fully automated vehicles.

Figure 6: There are six levels of autonomous driving

	L0	L1	L2	L3	L4	L5
	No automation	Driver assistance	Partial automation	Conditional automation	High automation	Full automation
Driver	In charge of all the driving	Must do all the driving, but with some basic help in some situations	Must stay fully alert even when vehicle assumes some basic driving tasks	Must be always ready to take over within a specified period of time when the self-driving systems are unable to continue	Can be a passenger who, who with notice, can take over driving when the self-driving systems are unable to continue	No human driver required – steering wheel optional – everyone can be a passenger
Vehicle	Responds only to inputs from the driver, but can provide warnings about the environment	Can provide basic help, such as automatic emergency braking or lane keep support	Can automatically steer, accelerate, and brake in limited situations	Can take full control over steering, acceleration, and braking under certain conditions	Can assume all driving tasks under nearly all conditions without any driver attention	In charge of all the driving and can operate in all environments without need for human intervention

Source: Intel (2018)[111]

Figure 7: Analysts are uncertain about when level 5 automated vehicles will become a sizeable portion of our fleet



Source: Jacobs (2019)[112]

With an eye to this future, current driverless vehicle trials in Adelaide,[113] and Sydney,[114] and associated legislative changes, represent necessary steps towards high automation.[115] Industry is developing the underlying technology for autonomous vehicles by investing substantial amounts into research and development. Some notable examples:

- Waymo, a subsidiary of Google Alphabet, is running large-scale trials and its vehicles have travelled 10 million kilometres on public roads since 2009.[116] Waymo has launched the world's first fully automated ride-hailing service in Phoenix, Arizona.
- General Motors is planning to launch an autonomous ride-hailing service in 2019.[117]
- Volkswagen is planning a 2020 vehicle release and has committed $50 billion by 2023 to investment in new technology, digitisation, autonomous driving and electrification.[118]
- Ford, Tesla and Daimler are planning to release self-driving cars within the next three years, and have trials under way.[119]

Level 3 automation is already available for some commercially available passenger vehicles, such as the luxury Audi A8. While this vehicle offers a glimpse of the technology that will eventually be common to all of Australia's fleet, the A8's autonomous functionality cannot be used on Australian roads until permitting legislation is in place. This is an example of Australian regulation not keeping pace with the speed of technological development.

Regulations are vital to optimising community and consumer outcomes

Autonomous vehicles have the potential to improve safety, reduce costs, create more liveable communities and offer more convenient transport services. However, the practical impacts of the roll-out of this technology are as uncertain as its timing.

The ability for vehicles to travel safely close to one another could result in significant improvements to traffic congestion, travel times and parking space requirements. The cost of ridesharing would drop significantly without the need for a driver. Under scenarios where vehicles are shared between multiple users, the gains could be even larger. The biggest improvements are arguably to be expected in safety, with around 94% of car accidents said to be caused by human error.[120] Alongside this, time spent in traffic in a Level 5 autonomous vehicle could be more productive and enjoyable than hands-on driving through congestion.

However, autonomous vehicles could also have negative impacts on our transport networks and communities. The increased quality, access and reduced cost offered by autonomy could result in more users favouring car use over public transport, potentially increasing road congestion.[121] Our kerbsides could also become an even more contested space, as people will need room to get into or out of vehicles. There is also a concern that autonomous vehicles would circulate empty when not in use, increasing the total number of vehicle kilometres travelled. Autonomous vehicles might encourage people to live further away from dense urban centres, increasing urban sprawl and road use. Finally, unless or until completely separate networks are available for the use of active transport and motor vehicles, the need for autonomous vehicles to share space with pedestrians and cyclists could be problematic.

Our roads and cities will also need time and investment to adapt to autonomous vehicles. Since autonomous vehicles would not require a parking space at the end of each trip, they could free up space in our cities. High levels of automation could reduce the need for on and off-street parking and potentially traffic signals, assuming the retention of road-crossing solutions for active transport users. Analysts estimate that as much as 97% of the space used for parking could be repurposed,[122] albeit this would require autonomous vehicles to continue moving around the road network even when not in use, and at night. This is unlikely to be efficient. Ideally vehicles would be able to access parking for maintenance and during periods of low demand.

Autonomous vehicles clearly face policy, community and regulatory barriers before they can safely operate on Australian roads. In 2016, the National Transport Commission identified more than 716 provisions in transport-related laws and regulations that could act as barriers to autonomous vehicles. Some governments are being proactive and setting the foundations for a positive autonomous vehicle future. In June 2016, South Australia was the first jurisdiction to pass laws to allow road trials of connected and automated vehicles.[123] In May 2017, states and territories agreed to national guidelines for trialling automated vehicles.[124]

In 2019, the Autonomous Vehicles Readiness Index ranked Australia as 15th out of 24 countries. This shows that Australia is making progress towards the deployment and use of autonomous vehicles on our roads, while falling short of best practice.[125] Continued work is required to turn high-level agreements achieved thus far into reforms constituting a nationally consistent regulatory framework that supports the safe commercial uptake and use of new technology and systems.

46. Challenge

There is a lack of appropriate regulation, trials and physical infrastructure to enable the use of many cooperative and autonomous vehicle features. Without action, the benefits offered by cooperative and autonomous vehicles will be missed.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

5.4 International, interstate and inter-regional connectivity

At a glance

Given Australia's size and isolation, long-distance travel is a crucial function for our transport network. Infrastructure must cater to varied trip patterns, usage densities and climates. This section covers:

- International travel – the air travel sector faces airport congestion, curfews and security delays, while our growing cruise industry lacks berths in the major cities that need them most.
- Interstate and regional travel – regional roads are poorly funded and maintained, while flights suffer from high costs and low demand. Rail struggles to compete, but could expand.

Long-distance travel is important to Australia

Long-distance travel is an inevitable part of living in Australia. We are one of the largest countries on earth, with enormous distances between our major cities, regional centres, tourist hubs and remote communities. Perth, for example, is considered one of the most remote cities in the world. It is closer to East Timor and Jakarta than to Sydney.

Australia is also isolated from the rest of the world. We are home to three of the top 10 longest direct commercial flights in the world, Perth–London (ranked 3rd), Sydney–Houston (ranked 6th) and Sydney–Dallas (ranked 7th).[126] Despite our isolation, Australians travel extensively and we receive millions of international visitors each year. In 2018, there were over 40 million people movements across our border, with 99% of these arrivals and departures being by air.[127]

Our international, interstate and inter-regional transport infrastructure needs to cater for a very broad range of trip patterns, density of use and climates. From our busy international airports to our critical but sparsely-used remote roads, our long-distance transport networks face various funding, regulatory and accessibility challenges.

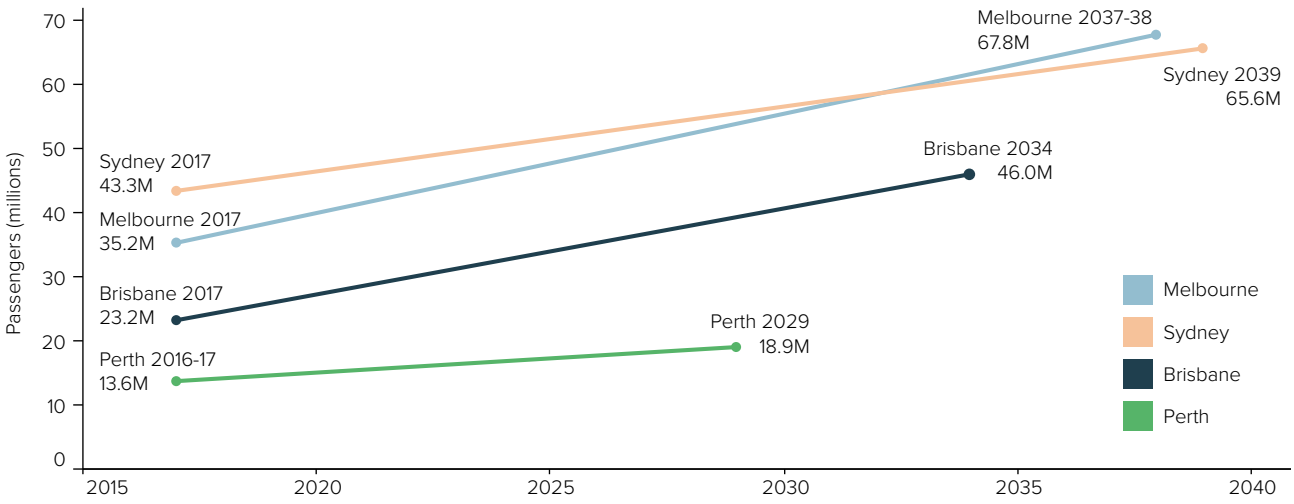
Airports are our gateways to the world

Our international airports are critical to our connectivity with the rest of the world. Nearly all our international travellers (tourists and returning Australians) come through our airports, with over 20 million international arrivals each year.[128]

International airports are also central to our economy. In 2016-17, they facilitated about $32.3 billion in tourism activity and either directly created or supported over 200,000 jobs.[129]

Traffic is growing, with all of our major international airports forecasting significant growth in passenger and aircraft movements in the next 20 years (Figure 8).[130]

Figure 8: Our capital city airports are forecasting strong growth



Source: Australian Airports Association (2018)[131]

Domestically, Australians moving around the country are also highly reliant on flying. With nearly 10 million annual passenger seats on offer, the route between Sydney and Melbourne was the second busiest globally in 2018, Sydney–Brisbane is eighth. In an unpredictable environment where external influences ranging from climatic events to fuel price fluctuations can disrupt aviation operations, this level of dependence presents continuity risks.[132]

With aviation activity increasing in step with the expansion of the cities connected by our busiest flights, congestion is a major challenge on both the air and land sides of our airports. In response to the growth in demand, four of Australia's major cities are undergoing significant air capacity upgrades. The Australian Government is building a second and curfew-free airport in Western Sydney, and the major 24-hour airports in Melbourne, Brisbane and Perth are constructing or planning additional runways. Brisbane's new runway is due to open within a year, while the upgrades to Perth and Melbourne are still in planning.

In addition to our major airports, international flights also use smaller city and regional airports such as Adelaide, Cairns, Darwin, Broome, Port Hedland, Gold Coast and Sunshine Coast. These airports are important for local tourism and economic development, often acting as multimodal transport hubs and centres for commercial activity.[133]

Australia's major airports are mature assets with established private sector operators. Airports are economic entities whose income stream is made up of aircraft landing fees, and varying levels of non-aeronautical revenue such as retail leases and parking fees.

Although our major international airports are privately operated, governments continue to play an important role across numerous aspects of airports' daily operation, regulation and long-term planning, including:

- Monitoring and reporting through the ACCC
- Regulatory oversight by the Productivity Commission
- Setting aviation safety standards, security, immigration and customs processes
- Air traffic control and fire and rescue (through Airservices Australia)
- Providing supporting ground transport links such as local roads and public transport.

Our major airports have faced many challenges in recent years, particularly with growing ground transport congestion around Sydney,[134] and Melbourne airports.[135] This has resulted in significant infrastructure investment around these two airports, with the New South Wales Government currently undertaking preliminary design works on the Sydney Gateway package of road upgrades around Kingsford Smith Airport, and the Victorian Government having recently announced a rail link to Melbourne's Tullamarine Airport. Significant investments to improve transport connections to smaller airports in Brisbane and Canberra have been undertaken over the past 5 to 10 years. The Forrestfield Airport Link will provide a heavy rail connection to Perth Airport when complete.

Our airports' operations are also circumscribed by regulation. Sydney and Adelaide airports are subject to curfews in order to reduce noise impacts on the residents of surrounding densely-populated and long-established suburbs. The regulation of Sydney's Kingsford Smith Airport focuses on the type of aircraft allowed to fly between 11pm and 6am, and the number of hourly movements during operating hours, as opposed to the resulting level of noise or other impact. The Productivity Commission is currently investigating the economic regulation of airports. In its draft report from February 2019, the commission notes that restrictions on operating hours protect communities from noise but can, by forcing land-side movements to happen when cities' transport networks are already at their busiest, come at the cost of airport efficiency.[136]

Finally, delays can be caused by security, customs and immigration processes. Australia's security and customs procedures play an important role, but improvements can always be made. Australia ranks 24th in the world for the 'burden of customs procedures' at our gateways, behind many of our OECD competitors.[137]

47. Challenge

There is congestion on roads around our major airports, particularly in Sydney and Melbourne. Unless addressed, travelling to airports will become increasingly unreliable, leading to longer travel times.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

48. Challenge

Some of our major airports are subject to operational restrictions reducing airport efficiency however adding to local amenity. Without regular reviews to ensure regulation is fit for purpose, the efficiency of our airports could be unnecessarily compromised.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Roads are the lifeblood of our regions

Roads are the 'heavy lifter' of regional transport, accounting for the vast majority of passenger kilometres travelled in regional areas.[138] This is because the dispersed nature of jobs and people make cars the most practical mode of transport for most trips.

Roads are typically the most important – and often only – link between regional and remote communities and other centres, cities and regions. They are therefore critical in ensuring access to key services such as health and education, and for tourists and travellers to sustain the visitor economy away from cities. Roads are also critical for transporting agricultural and mineral products.

However, there are substantial challenges in ensuring regional roads are sufficiently funded and maintained, appropriately serve remote communities, and are safe.

First, road funding and maintenance is not directly linked to use or road-related revenue. This means that funding and maintenance is susceptible to the budget limitations of different levels of government. While the array of available programs may be significant in the type and quantity of funding on offer, in the absence of national framework to guide investment and maintenance there is inconsistency between jurisdictions in the application of these resources. Long-distance routes crossing state and territory borders are particularly at risk in this respect.

Second, regional roads in particular lack funding consistency. While key freight routes and high road safety risk locations in regional areas generally attract federal and state funding, most roads are the responsibility of local governments. These governments are often fiscally constrained, have very extensive networks to maintain and deal with significant road degradation due to heavy vehicles and extreme weather.

Third, the use of regional and remote roads is less safe than in urban areas. A combination of higher speeds, driver fatigue from long hours spent on the road, the spreading of enforcement resources over a wide area, and infrastructure of a variable quality mean crashes tend to be more serious outside our cities. In terms of exposure, there is therefore a greater rate of fatalities and serious injuries occurring on regional roads.[139]

Finally, the major and accelerating transformation in vehicle technology will present several challenges and opportunities for our regions over at least the next 15 years. Specifically:

- Slow deployment of charging infrastructure may delay electric vehicle access and uptake in regional areas. Charging stations are largely concentrated in our cities and a lack of stations has been identified by around two-thirds of motorists as a key barrier to the adoption of electric vehicles.[140]
- Automation and connectivity may help reduce crashes, making longer trips undertaken in a range of adverse conditions more viable.

49. Challenge

Governance and funding of our regional road networks is inconsistent and lack transparency. This means funding and maintenance is subject to budget volatility of different levels of government. Without change to road network governance, our regional roads will continue to be poorly funded, maintained and safety may decline.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Regional aviation services often struggle to be viable

Aviation services provide important inter-regional connections. However, ensuring the viability and availability of regional air services will continue to be a challenge for the foreseeable future.

Significantly outnumbering our 16 major airports, there are over 160 regional and remote airports in Australia. These are generally owned, operated and maintained by local governments. These governments often face significant fiscal constraints and the majority of regional airports (60%) operate at a loss. This is because airports require substantial and ongoing expenditure on maintenance and safety and security compliance.

Remote airstrips can also face difficulties due to extreme weather and the limited ability of local government and communities to ensure they are safe. These airstrips and are a critical link for remote communities to key services, particularly in northern Australia. The Federal Government operates a remote airstrip upgrade program. Airstrip owners and operators can apply for funding to ensure their airstrips can remain functional.

There are also challenges to ensuring sufficient and affordable services to regional and remote towns. Regular air services on domestic routes have been deregulated since 1990. However, where demand is insufficient to justify commercially-operated services, government intervention has been necessary to ensure a minimum level of service.

Numerous Federal Government schemes are in place, including the Remote Air Service Subsidy Scheme (RASS) and the Enroute Charges Payment Scheme. The programs aim to subsidise and reimburse costs and charges. Some state governments also regulate regional air routes which have insufficient demand for commercial operations, to ensure competition between airlines. Regulated routes generally grant a monopoly to a single carrier and stipulate a maximum fare.

Despite federal and state government subsidies and regulation, regional airfares have become a focus for governments in recent years. A Western Australian Parliamentary inquiry submitted its report into regional airfares in late 2017, and a Commonwealth parliamentary inquiry is due to report in June 2019.

The Western Australian inquiry found there are community perceptions that regional and remote airfares are too high.[141] This is particularly the case for airfares on unregulated routes, where the government has left prices to be determined by operators.[142]

The Australian Airports Association and numerous regional and remote communities have called for the Australian Government subsidy schemes to be expanded. There have also been calls for greater state government intervention of unregulated air routes to improve transparency in the methodology used to set fares, thereby helping to highlight whether further regulation may be required.[143]

50. Challenge

Regional aviation often struggles to be financially viable and customers view it as costly. Without action, regional and remote communities will lack access to air services and affordable airfares.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Regional rail could play a bigger role

Regional railways serve a broad range of functions. They can act as regular commuter services, helping to link satellite communities to major cities. They can also facilitate regional connectivity, linking our regional centres and smaller towns. Australia also has an interstate rail network, which carries passenger services between major capital cities.

Regional railways can broadly be split into three markets that each serve different geographical areas:

- **Short-distance intercity** services are the most heavily patronised and generally link major cities to satellite cities and major regional centres. Examples include Newcastle-Sydney-Wollongong, Melbourne-Ballarat, Sunshine Coast-Brisbane-Gold Coast and Perth-Bunbury.
- **Long-distance intercity** services connect interstate capitals with each other and with regional centres. Examples include NSW Trainlink's Sydney-Brisbane, Sydney-Canberra and Sydney-Melbourne services.
- **Leisure and heritage** services operate largely for tourists and railway enthusiasts. Examples include the Kuranda Scenic Railway and the Indian Pacific. These services can play an important role in regional and remote tourism as they bring customers to relatively remote towns.

Our regional rail services carry a relatively low share of passengers. Australia's vast distances mean that long-distance rail does not compete with the travel times offered by airlines. In regional and remote Australia, where population centres are small and widely dispersed, most communities are not served by rail, or by such a low service frequency that this mode struggles to compete with the flexibility of car use.

However, there is the potential for some regional railways to play a bigger role in our transport networks. Our short-distance intercity services are important for commuters as well as for city-to-city connectivity, and have the greatest potential to grow their market share. These services often have uncompetitive travel times compared to driving but can still be well-patronised, particularly for commuting trips to major employment centres and CBDs.

The Victorian experience has shown that targeted track upgrades can reduce travel times, increase frequencies and result in significant patronage growth for short-distance intercity services. Following the Victorian Government's Regional Fast Rail Program and Regional Rail link construction, patronage has doubled on Victoria's regional trains, which are now experiencing crowding.[144]

Improvements to longer-distance intercity services, particularly along Australia's east coast, have long been debated and there have been numerous feasibility studies. The most recent government-led study, published in 2013, examined a possible high-speed railway linking Brisbane-Sydney-Canberra-Melbourne and stopping at numerous smaller cities and regional centres along that route. The study found the project would come at a cost of $114 billion ($2012), would have a net present value of $101 billion and would ideally be completed by 2058. Infrastructure Australia has recommended that a corridor for high-speed rail connecting these cities be reserved as soon as possible.[145] The New South Wales Government is investigating four potential routes in a fast intercity rail network, with the assistance of Australian Government funding.[146]

51. Challenge

Our regional railways generally have uncompetitive travel times with cars and planes. This means they carry a relatively small share of passengers. Unless travel times are improved, regional rail will continue to play a small role, meaning regional customers have less choice when they choose to travel.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Cruise ships are a small but growing industry

A small but growing area of Australia's visitor economy, and source of international arrivals, is the cruise shipping sector. There were 1.34 million cruise passengers in 2017, the number having quadrupled since 2010.[147] The cruise industry contributed about $5.28 billion to the economy in 2016-17.[148]

Cruise ships can be important to our major cities but also at regional ports, where the number of passengers who disembark can be very significant relative to local populations and tourism numbers. At some smaller ports, such as Darwin, cruise ships also represent a particularly welcome economic opportunity because they can boost tourist numbers in traditionally quieter times of the year.

Governments play a similar role for cruise ships as they do for airports, by ensuring suitable land transport links, pilotage, security, and customs and immigration processes.

An additional role is to ensure sufficient berthing space for cruise ships. This has increasingly become a problem, particularly in Sydney. This is the marquee port for Australia and the South Pacific Region because of its harbour and iconic structures like the Opera House and Sydney Harbour Bridge.[149] Sydney Harbour is the only port in Australia to have two cruise ship passenger terminals – at Circular Quay and White Bay.

However, the growing popularity of cruise ships, and the trend towards larger ships, mean there is insufficient berthing capacity in Sydney. The White Bay terminal cannot accommodate larger ships because they cannot fit under the Harbour Bridge. This lack of capacity could harm cruise shipping in Australia, with some cruise operators citing Sydney's lack of capacity as the reason for Australia not being on their itinerary in 2018-19.[150]

The NSW Government is investigating opportunities to increase berthing capacity and this initiative was added to the *Infrastructure Priority List* in 2019.

Cruise ships in Darwin can contribute to regional tourism

Darwin Port already acts as a final destination (or turnaround port) for smaller cruise ships during its peak tourist season (the May to October dry season). This means that smaller vessels use the port as a beginning and/or end point for itineraries that typically explore the northern Australian coastline, with passengers often staying in Darwin before and after their cruise.

However, for larger international cruise ships, the season in Australia generally runs from October to April (the tropical north's wet season), when operators relocate their fleets to the South Pacific region for the southern hemisphere summer.

During this season, larger international vessels often include Darwin as a first or last port of call as the ships enter or leave Australian waters. Larger cruise ships generally use Darwin as a transit port, meaning passengers are often disembarked for a few hours or a day to explore the city. This can provide an important economic injection during the low tourist season for Darwin.

However, Darwin's port has limited capacity. Future growth in cruise numbers will depend on the port's ability to handle passenger and related technical services, such as refuelling and provisioning, on a larger scale.[151]

52. Challenge

The popularity of cruise ships in Australia in growing, producing important tourism opportunities for fast-growing cities and regional centres. However, there are a lack of berths for international cruise ships, particularly in Sydney. Without additional berthing capacity, Australia will lose cruise ships and tourist visitation will decline.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

5.5 Funding and maintaining our transport assets

At a glance

While the public sector invests heavily in transport, private spending has started to decline. This section discusses funding and maintenance challenges the sector faces in the next 10–15 years:

- There is a growing disconnect between how far people drive and how much they pay.
- Public transport projects can be costly, and funding is often not transparent.
- Regional and remote areas must maintain large networks with limited funding.

It also looks at new technologies and the potential revenue that comes with them.

Asset maintenance and renewal are critical to our transport networks

There are major challenges to sustainably maintaining services and assets. The capability of Australian governments to plan, manage and undertake works to maintain and renew the assets in our transport network has not improved in recent years. In the 2015 *Australian Infrastructure Audit*, we highlighted that maintenance data are inconsistent across infrastructure managers. Unfortunately, there is still no consolidated national dataset for transport infrastructure maintenance, and guidelines remain ad hoc and do not cover each sector equally or in sufficient detail.

The Australian Local Government Association and Austroads have published reports which help to quantify maintenance expenditure and to determine appropriate methods to assess the cost and benefits of maintenance over time.[152] Although these are helpful contributions, there are still no agreed service levels which asset maintenance should aim to achieve.

In fact, there is no single metric to determine the appropriate level of maintenance, renewal or rehabilitation for a transport asset. Ideally, expenditure should be sufficient to maintain a pre-determined service level and should be part of a detailed asset management plan. However, in practice, determining service levels can be difficult (particularly for aged infrastructure), and it can be challenging to distinguish between maintenance expenditure and expenditure which might enhance the economic benefit of an asset.[153]

Regardless of service level requirements, the funding challenge will become more pressing over time. Sectors that are heavily reliant on government funding rather than user charging, including roads (particularly in regional areas) and public transport, are most likely to suffer from inadequate maintenance regimes because expenditure on assets is not directly linked to their use.

53. Challenge

Asset maintenance lacks transparency, consistency and accountability. This is particularly the case for sectors that rely on government funding rather than user charges, such as roads and public transport. Unless addressed, maintenance of our transport networks will become increasingly unsustainable.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

There is competition for capital investment, asset renewal and maintenance funds

There has been substantial investment in transport infrastructure in recent years. Despite this expenditure there are major challenges to sustainably fund and maintain services over the next 10-15 years.

A lack of information and resourcing to plan and undertake asset management, limited or nascent mechanisms to link funding to needs, few incentives to improve efficiency, and declining revenues will all have consequences for the quality and affordability of transport services. These challenges are more pointed as we enter a period of rapid disruption in how transport services are provided, and as people's needs and expectations of the transport system change.

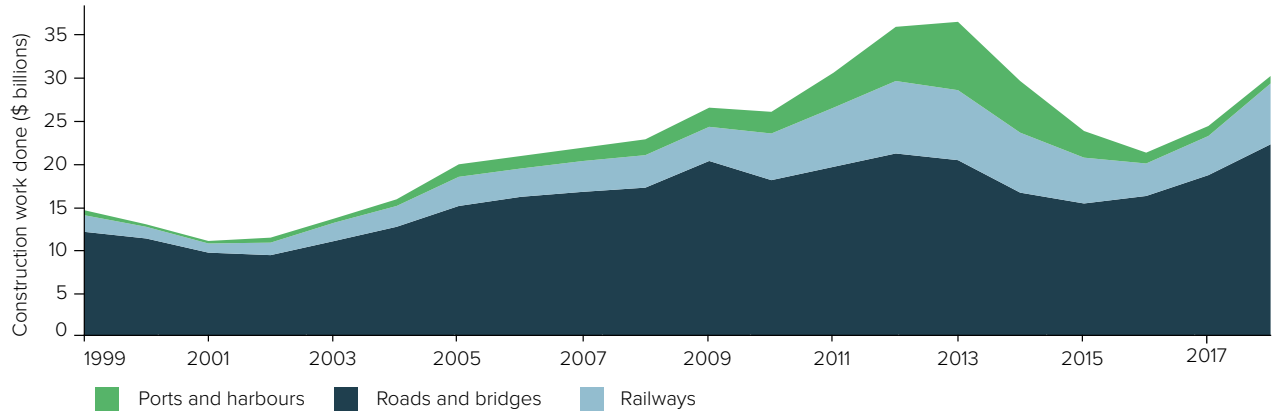
With some fluctuations, the average annual level of investment in all Australian transport infrastructure types has increased substantially over the last 20 years. The value of new construction work on our transport networks in 2017-18 was about $30 billion, excluding the maintenance of existing infrastructure, as shown in Figure 9. In addition to the modes shown here, airports are estimated to have invested $11.5 billion in improvements over the decade to 2018.[154]

Private sector expenditure increased during the investment phase of the resources boom from 2007 to 2013, but is now declining as many projects move into their production phase. Public sector investments have focused on roads and large public transport projects, at a time of growing concern about congestion in our cities and lack of connectivity in regional areas. Most jurisdictions have major transport projects underway or committed, and investment is close to or above record levels depending on location.

State governments overwhelmingly shoulder the burden of transport funding. Public transport is a state government responsibility and can account for up to 60% of state capital budgets.[155] In terms of roads, the states provided close to two-thirds of total government funding in 2016-17 (Figure 10).[156]

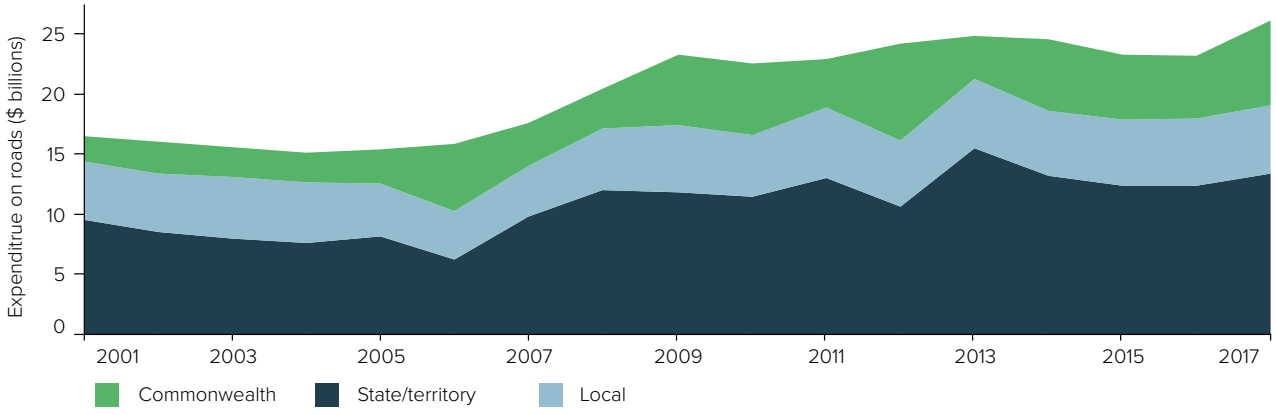
Every dollar spent on transport has an opportunity cost. In the case of government expenditure, the opportunity cost is the money that cannot then be spent on other services, such as health and education. The growth in transport capital expenditure in recent years means that transparency in decision-making around the allocation of funds is critical to levels of public confidence in our networks' long-term sustainability.

Figure 9: The value of transport sector construction has grown strongly in the last 20 years



Source: Bureau of Infrastructure, Transport and Regional Economics (2018)[157]

Figure 10: State governments spend the most on roads



Source: Bureau of Infrastructure, Transport and Regional Economics (2018)[158]

Road use, funding and expenditure are not adequately linked

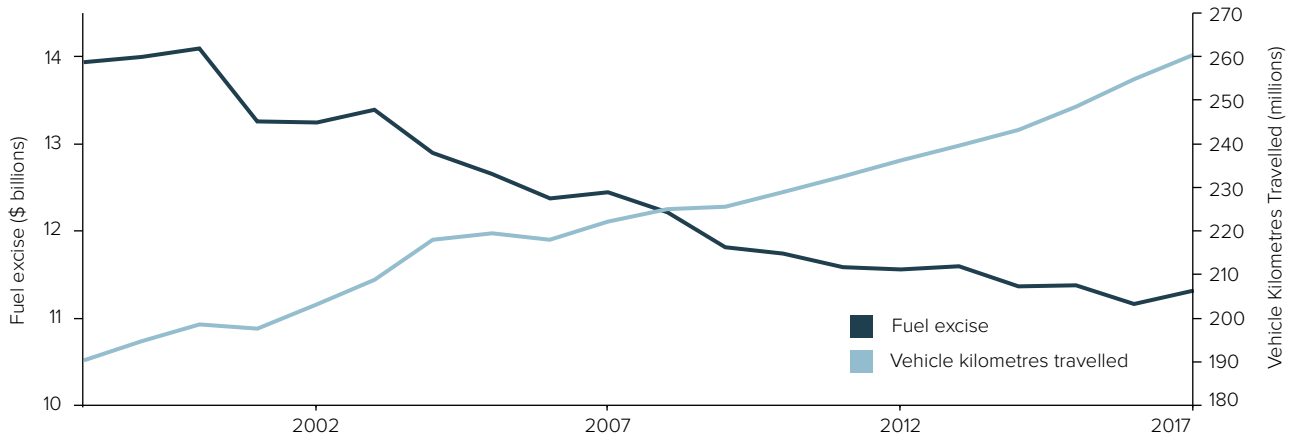
There is no formalised link between how funds are raised from road users and how that money is spent. The principal forms of road-related charges are federal fuel excise, state registration and licensing fees and tolls.

Fuel excise was originally designed as a proxy consumption-based charge, where revenue from a cost impost on litres of fuel purchased would increase with demand for roads and driving. However, the correlation between vehicle kilometres travelled and the demand for fuel no longer functions in the way it once did, with fuel excise decreasing in real terms and kilometres travelled increasing over the last two decades (Figure 11). This trend is likely to worsen as cars become increasingly fuel-efficient and electric vehicles make up a growing proportion of our fleet.

This means that, in the short to medium term, fuel excise will be replaced as the principal form of road-related revenue by state-based charges which are not linked to the distance people drive, such as registration and licence fees. The existing and growing disconnect between the kilometres people drive and how much they pay raises numerous challenges:

- **It is inequitable:** because people who rarely drive subsidise people who frequently drive. It also increasingly means that people who own newer and more fuel-efficient or electric vehicles pay less tax.
- **It is inefficient:** because road users are not charged for their use. This means that once registration and licence fees are paid, people are actually incentivised to drive. In addition, drivers pay the same amount regardless of the time of day and location of their trip. This means there are no financial incentives for people to change their travel habits to be more efficient, by driving after peak hour or switching to public transport.
- **It is unsustainable:** because fuel excise, the largest single contributor of road-related revenue, will continue to decline, meaning expenditure will outstrip income.
- **It is not transparent:** because there is no link between usage and expenditure, the reasons and justification for capital and maintenance expenditure decisions are rarely published and can be inconsistent.

Figure 11: Revenue from fuel excise declined while vehicle kilometres travelled grew



Source: Bureau of Infrastructure, Transport and Regional Economics (2018)[159]

54. Challenge

There is no clear link between expenditure on roads and usage, which means road expenditure is inequitable, inefficient, unsustainable and lacks transparency. Without reform, revenue from fuel excise will decline, drivers will not be charged fairly and people will be incentivised to drive, contributing to congestion.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Major public transport investment decisions lock in ongoing subsidies and lack transparency

The cost of public transport projects can be large, taking up a significant proportion of state government budgets.[160] It is therefore critical that the funding of public transport projects is as transparent as possible.

Some large public transport projects have published business cases, which is helpful for transparency. However, announcements on projects are sometimes made prior to proper assessment.[161] This is most often the case with 'big ticket' expensive infrastructure projects, which do not have the same economic benefits as more modest enhancements. In addition, post-completion reviews are rarely undertaken or published, meaning we often do not know whether investments were justified, and we cannot learn all the available lessons from past projects.[162]

In addition to the upfront cost of projects, it is important to remember that, under prevailing fare regimes, public transport requires indefinite operating subsidies. Our major public transport networks have operating costs in excess of $9 billion per annum.[163] Cost recovery from fares in Australia is relatively low by international standards, averaging between 20% and 30%.[164] Research commissioned by Infrastructure Australia estimates there is an annual public transport operating subsidy by governments of about $7.4 billion.[165]

The scale of the operating subsidy provided to public transport can make it vulnerable to shifts in government policy as well as changes in budgetary conditions. Given the importance of maintaining and expanding public transport, especially in our rapidly growing cities, improving cost recovery is becoming increasingly important as it will ensure the sustainability and stability of public transport services over the long term.

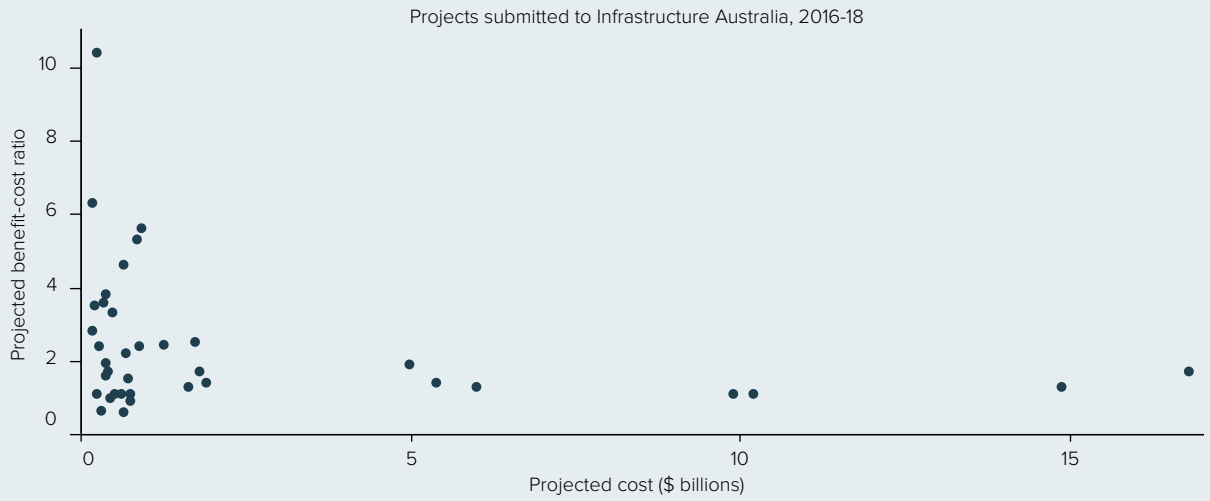
Smaller, efficiency-enhancing projects often have higher returns

Large infrastructure projects are frequently in the media and the subject of significant public debate. However, smaller projects, such as 'better use' interventions to improve the productivity of existing assets, cost less and generally create better economic returns.

Of the projects submitted to Infrastructure Australia for assessment between 2016 and 2018, those with the highest benefit-to-cost ratios were also the cheapest (Figure 12). This is because larger projects generally include significant upfront costs, with benefits being realised many years later. A discount rate is applied to benefits that accrue in later years, so they can be compared on the same footing as projects that deliver benefits earlier. While major projects can be critical to Australia's long-term liveability, smaller initiatives also demand attention.

For more information, see Infrastructure Australia's *Assessment Framework*.[166]

Figure 12: Lower cost projects often have higher benefit-cost ratios



Source: Infrastructure Australia analysis

55. Challenge

Public transport investments and operating subsidies are substantial, but decisions lack transparency. Unless addressed, public transport will continue to be subject to political cycles and budget conditions.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Local governments face challenges in maintaining regional and remote assets

The lack of transparency regarding road funding in Australia, combined with the inconsistency of asset management and financial planning standards and practices across local governments, is particularly problematic in regional and remote areas. Local governments in regional and remote Australia face the dual challenge of maintaining geographically extensive networks while having a relatively low revenue base from which to fund roadworks. The NRMA has identified that local governments in NSW face a roads maintenance funding backlog that grew from $1.96 billion in 2016 to $2.2 billion in 2018.[167]

Federal and state-significant roads in regional areas are usually key freight routes, and as such more likely to attract funding for both capital and maintenance purposes. However, local government roads do not usually attract the same degree of freight traffic, and therefore may not be subject to the same attention and funding arrangements.

In addition, local government can find it difficult to justify maintenance expenditure on roads, particularly in sparsely-populated areas, due to low traffic levels. This can be problematic for remote communities, who are reliant on their roads to access key services such as health care and education. While regional groupings of councils in states including Victoria and Queensland have had some success in sharing data and, in some cases, coordinating works on local roads, this approach may be harder for the most isolated areas.

Regional local governments are currently reliant on federal and state government grants, which as with any grants program can be subject to unpredictability. Grants from government are also generally for new projects, and do not include ongoing funding for maintenance. In other words, while a grant may be welcomed in the short term, it can actually increase the cost burden on local governments in the longer term.

Regional local governments face similar challenges in trying to maintain and operate airports. Over 60% of regional airports currently operate at a loss and about 40% expect to continue operating at a loss in the foreseeable future.[168]

Regional airports are capital-intensive and require ongoing maintenance and upgrades in line with strict safety and security regulations. However, unlike larger airports, they do not have the same revenue-diversification options such as retail parks, hotels, parking fees and rent from businesses.

It is projected that regional airport operating costs will increase by 38% over the next decade, with an infrastructure funding shortfall of $170 million.[169]

56. Challenge

Regional and remote local governments struggle to fund and maintain roads and airports. Local governments often have relatively small revenue bases but are responsible for the maintenance of expensive transport networks. Without addressing funding shortfalls and maintenances practices, regional and remote infrastructure will become increasingly unsustainable.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

New revenue streams are emerging

The challenge of sustainably funding our transport networks in the future may be exacerbated by emerging technologies and business models. Threats to revenue are presented by electric vehicles, whose users do not pay fuel excise, and by shared and automated vehicles, as multiple ownership and on-demand transport use could lead to a decline in registration revenues.

However, emerging technologies also provide an opportunity. Improved communications and tracking technologies, combined with readily available data, mean there are growing opportunities to expand existing revenue streams and take advantage of emerging sources of income.

Road network user charging has long been identified as the most economically efficient means of charging for our roads.[170] Technology has helped to overcome many of the technical barriers for implementing road user charging, with widely available GPS data and growing connectivity between vehicles and roadside infrastructure. A national road user charging regime is increasingly regarded as an option for addressing declining fuel excise revenue and a potential future decrease in registration revenue.[171] However, in the absence of jurisdictional champions even slow progress in moving towards such a regime has faltered if not stalled.

In addition to charging for access to the physical transport network, access to services provided by the digital transport network may be charged in the future. As customers increasingly interact directly with third-party service providers and intermediaries in a blended public private service model, new pricing models will emerge to manage access and costs. Customers are likely to gravitate towards seamless transactions and travel over the next 5-10 years, and transport payments will increasingly be funnelled via a single 'digital wallet' for mobility transactions.[172] Subscriptions to a range of mobility services via the wallet may replace direct payments to providers for services (such as, tolls and tickets).

This changing relationship between customers and how they pay for mobility services will have implications for transport sector revenue, due to impacts on pricing, demand management and service choice. In this more fragmented transport operating environment, governments will need to consider opportunities to monetise information flows as one of a number of revenue options to compensate for lost sources.

Finally, there remain opportunities to expand existing revenue sources by improving mechanisms such as value capture and better managing third-party revenues.

Value created by transport investments can be disproportionately captured in property prices, as a windfall gain to property owners. Value capture taps into this by socialising some of the uplift in prices. In doing so, it can reduce the funds needed from other taxes and user-pays sources.[173]

Operators are also increasingly capturing revenue from third parties through advertising and rental income. Most public transport operators, road managers and government transport departments are already actively seeking to enhance third-party revenue.

57. Opportunity

There are numerous emerging revenue sources for the transport sector, with many related to technological development and changing patterns of demand for transport. There is an opportunity for emerging revenue streams to improve the financial sustainability of our transport networks.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

5.6 Passenger transport sustainability and resilience

At a glance

In the next five to fifteen years, our systems will likely experience radical physical and technological changes. Good planning will help us meet user needs, maintain the environment and support our economy.

This section reviews our growing emissions footprint and its impacts on our health. It looks at how we can use better planning and new technology to become more sustainable and resilient

The importance of sustainability and reliability

Over the next five to fifteen years, transport networks' physical and technological systems are likely to experience radical changes. How we design, build and use our current and future transport networks will have a large bearing on the long-term sustainability and resilience of our cities, regions, and rural and remote communities.

Sustainability and resilience are not fringe concepts, but good economic practice. They offer the opportunity to create vibrant communities that meet user needs, maintain the environment and support our economy. Delays in preparing the transport system for the impacts from external conditions such as a changing climate expose the economy to higher costs and more disruption.[174] Australia can meet its present needs without compromising the ability of future generations to meet their own.

Adapting to climate change and pursuing sustainable environmental outcomes form a core responsibility for infrastructure planners, owners and operators. While governments often have ambitions to incorporate sustainability and resilience into transport projects, the final investment can fail to reflect this ambition due to the lack of a consistent approach that supports the translation of goals into actions.

Conversely, resilience and sustainability have become significant concerns for many communities. Users are changing their transport behaviour and many are willing to pay more for sustainable transport options that are compatible with their values, such as electric vehicles. Users' interest in sustainability is also changing the way companies do business. Businesses are making commitments to less carbon-intensive fleets, setting internal emissions reduction targets and investing in renewable energy to power their operations.

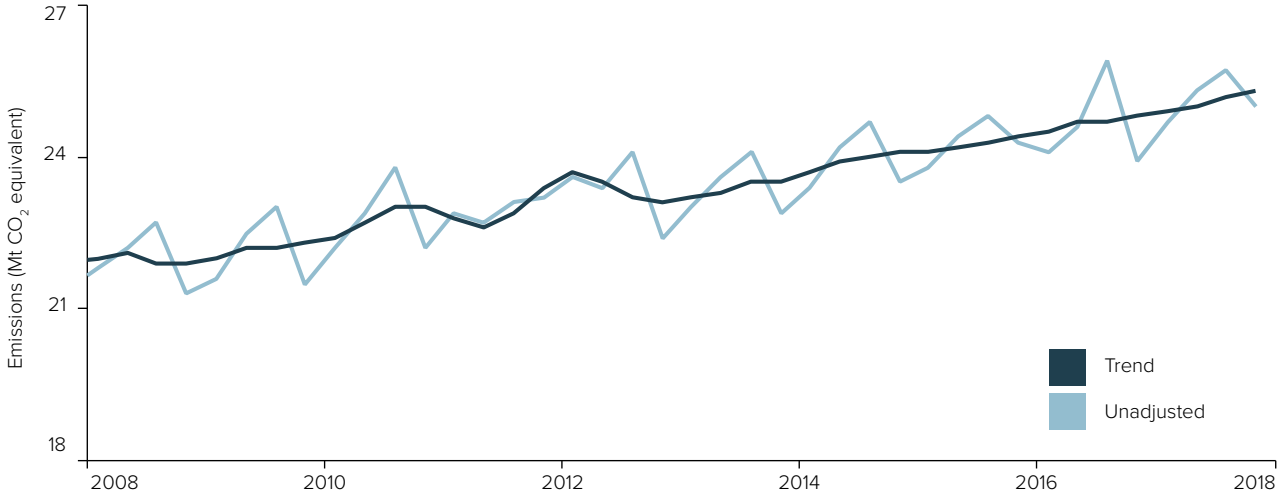
Passenger transport has a large and growing emissions footprint

The transport sector is the second largest source of Australian greenhouse gas emissions, at 19% of total emissions.[175] Transport emissions have grown faster than any other sector, increasing by around 60% since 1990.[176] Problematically, transport emissions are growing at a time when our nation is focused on reducing emissions from any and all sources (Figure 13).

Australia has one of the most emissions-intensive transport sectors in the world. There is considerable scope for our passenger transport sector to play its part in helping Australia meet its emissions reduction obligations.

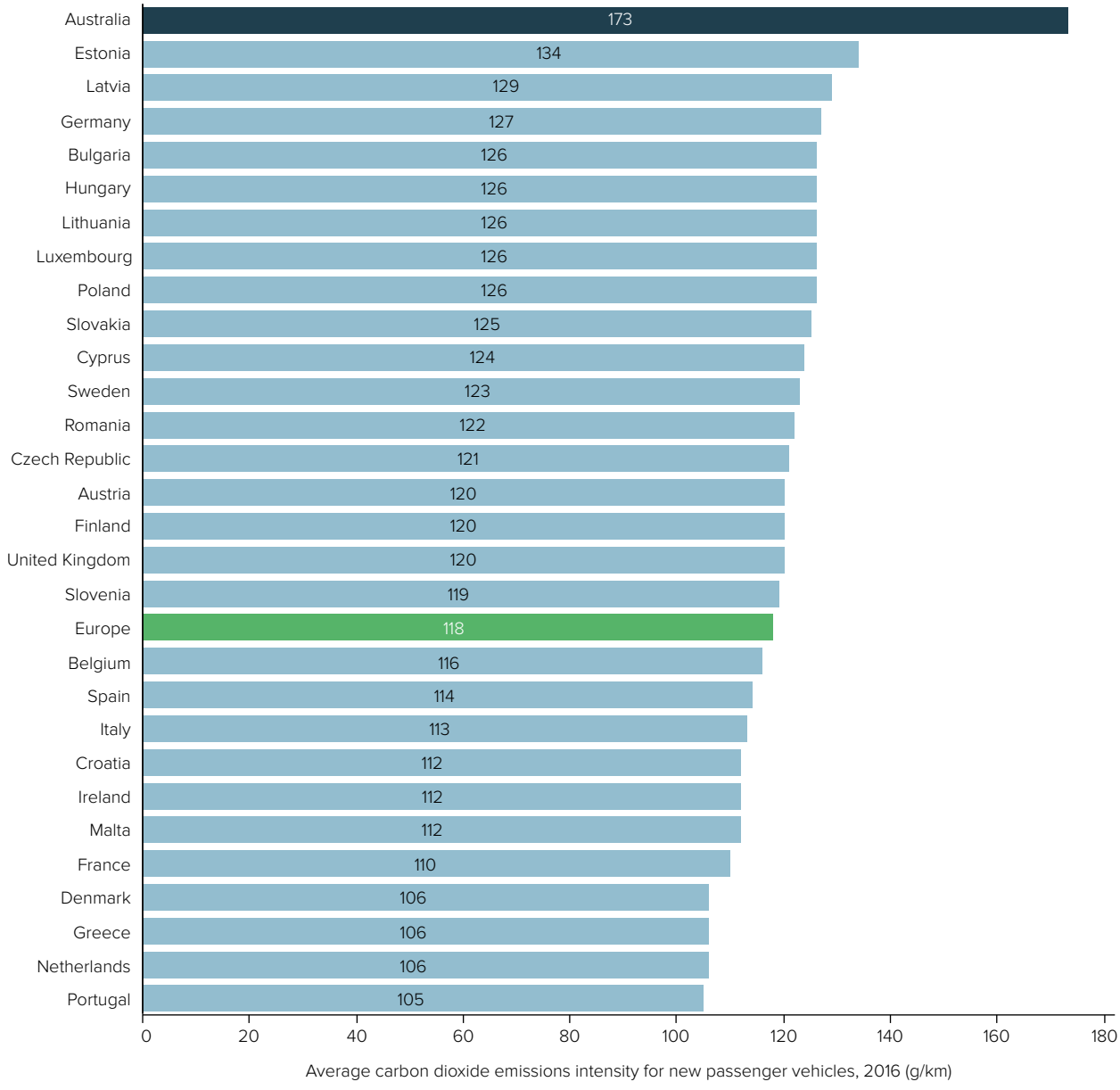
The emissions intensity of Australian transport networks is largely attributable to our reliance on private vehicles. Most Australians use their car as their primary mode of transport. In regional, rural and remote areas, users often have no other option. For this reason, 90% of non-capital city commuters use a private vehicle to get to work.[177] Our vehicles are some of the most emissions-intensive in the developed world (Figure 14). Due to Australia's car dependence and the emissions standards of our vehicles, passenger vehicles represent 46% of all transport emissions (Figure 15).[178]

Figure 13: Transport emissions have been growing



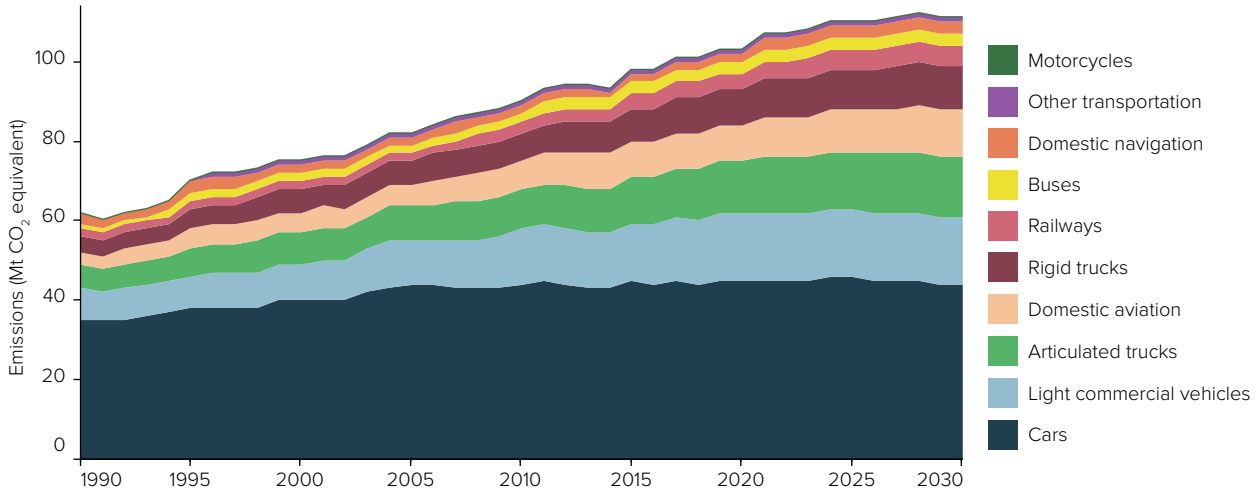
Source: Department of the Environment and Energy (2018)[179]

Figure 14: Australia's new passenger vehicles are more emissions intensive compared to Europe



Source: National Transport Commission (2018)[180]

Figure 15: Cars' total emissions are far higher than other modes of passenger transport

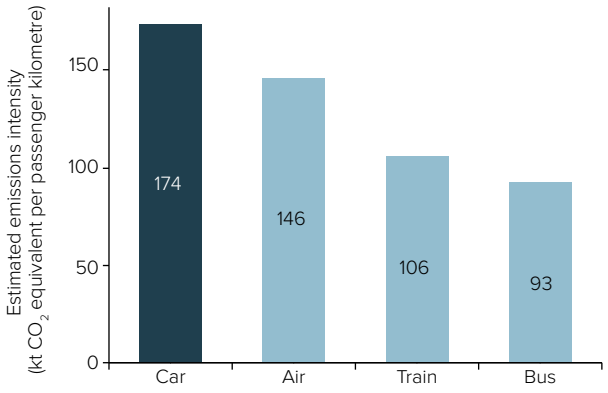


Source: Department of the Environment of Energy (2017)[181]

For the last ten years, the share of emissions from cars has been relatively stable despite increases in total vehicle kilometres travelled. This is due to improvements in fuel efficiency and the emissions ratings of new vehicles. However, projected emissions to 2030 indicate that these improvements are not enough to offset the growth in emissions from other transport modes. Specifically, emissions from articulated and rigid trucks, as well as light commercial vehicles, are expected to account for a growing share of the transport sector's total.

Existing technology offers the opportunity to reduce the emissions intensity of passenger transport. Mode shift away from private vehicles to public and active transport use, for example, could significantly reduce emissions. On average, public transport modes are less emissions-intensive than private cars, with well-patronised train services being the most efficient motorised passenger mode by this measure (Figure 16).

Figure 16: Private vehicles are more emissions intensive than public transport



Source: Bureau of Infrastructure, Transport and Regional Economics (2018)[185]

However, car use can also have a reduced impact in this respect, through the introduction of stronger vehicle emissions standards, the greater uptake of electric vehicles, and measures to incentivise higher levels of vehicle occupancy through ridesharing schemes.

Cars are not the only large source of Australian passenger emissions. Emissions from the aviation sector have grown strongly as domestic and international air travel has become cheaper and more accessible. In the past decade, the number of annual passengers on domestic flights has increased from 50 million to 63 million.[182] As a result, the civil aviation sector contributed more than 2% of Australia's emissions over that period.[183] While aircraft are becoming more fuel efficient, it has not been enough to offset the growth in air traffic. CO_2 emissions from domestic aviation are expected to be 40% higher in 2030.[184]

58. Challenge

Transport sector emissions are increasing. Passenger cars account for the vast majority of emissions, but heavy vehicles and aviation are projected to drive growth in emissions in the next ten years. Without action, the emissions intensity of passenger transport may cause negative environmental impacts and Australia will fail to meet its emissions reduction targets.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Transport activities can have detrimental effects on our personal health

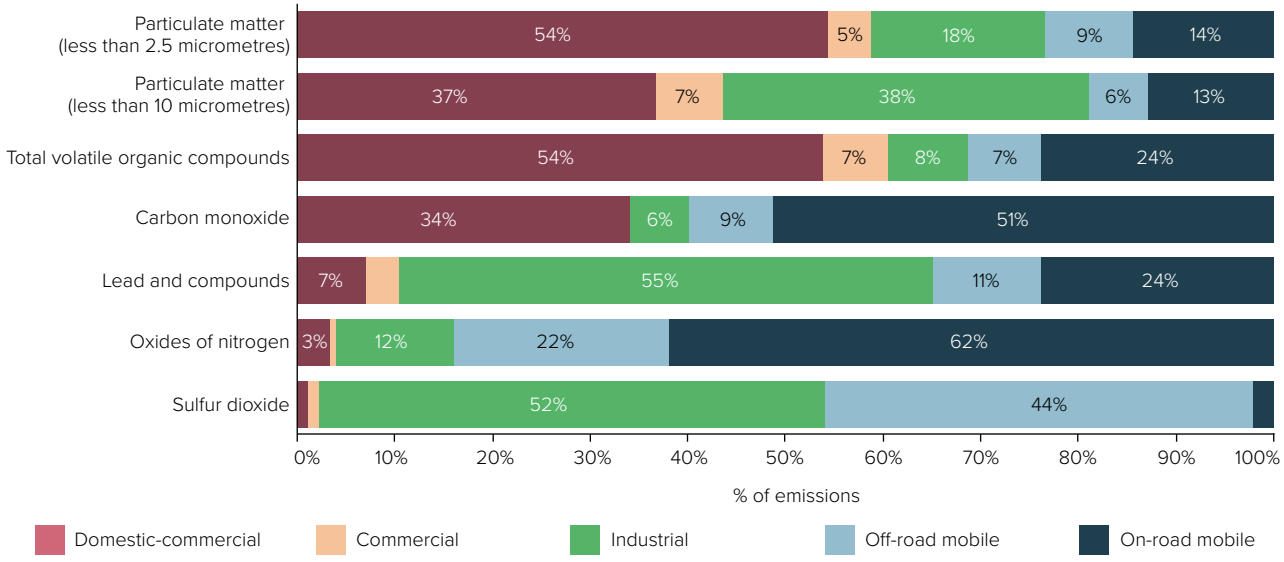
As well as greenhouse gas emissions that contribute to the global impact of climate change, the Australian passenger transport sector produces other airborne pollutants that have an adverse impact on localised air quality and human health outcomes. Additionally, the greater use of sedentary transport modes, especially driving, and associated reduced rates of active transport use have been shown to be damaging to personal health and wellbeing.

The negative impacts of transport on air quality are largely due to our reliance on petroleum. Petroleum powers internal combustion engine vehicles, aircraft and some public transport. It creates airborne pollutants, including particulates, that can be harmful to our health and damaging to our ecosystems.

While Australia's air quality is good by international standards and advancements in vehicle efficiency standards have helped to reduce pollutants and emissions, an estimated 3,000 deaths in 2007 were caused by urban air pollution.[186]

The transport sector is a major contributor to urban air pollution. For example, in Sydney 61% of nitrogen oxide emissions are attributed to motor vehicles.[187] Figure 17 shows air pollutant emissions by source for Sydney in 2008.[188] This pollution tends to be concentrated around major road corridors,[189] posing a health challenge for cities seeking to encourage denser development in central areas where traffic levels can be most intense.

Figure 17: The transport sector (classified as off-road and on-road mobile) is a major contributor to poor air quality



Source: Department of the Environment and Energy (2016)[190]

Maritime and non-road passenger transport, such as diesel locomotives and cruise ships, also contribute to air pollution. These emissions are largely unregulated in Australia, although concerns about cruise ships, which use heavy fuel while they are docked, have already resulted in restrictions on these vessels in Sydney Harbour. As a further precaution, sulphur fuel restrictions will apply to all vessels from 2020.[191]

In terms of human health, there is also a large and growing body of evidence regarding the costs of physical inactivity in Australia, and the personal and social benefits of using active transport over sedentary modes.[192] This especially applies to train or bus travel which generally includes a walking or cycling trip to access the public transport stop. A significant percentage of car trips in Australian cities are shorter trips that are within cycling or even walking distance.[193] Changes in travel patterns and expectations which have over time led to active transport being used for such trips impact personal health outcomes in areas including cardiovascular disease,[194] mental illness,[195] and childhood obesity.[196]

Achieving further reductions in the health costs of passenger transport to our community will require more concentrated effort from Australian governments.

Transport sustainability goals are often not achieved

Governments often have ambitions to achieve transport sustainability goals, such as reducing private vehicle use. However, outcomes may not deliver on these aspirations. Expediency and siloed decision making can compromise the sustainability objectives outlined at a project's inception.

Policy-makers need to get better at translating goals into actions and developing their strategic approach. Reports such as *Sydney's Walking Future* help to cement strategic goals.[197] These reports can act as a point of reference for infrastructure decision-makers to prioritise public and active transport.

The private sector also has a role to play in ensuring our infrastructure is built sustainably. Increasingly, industry is adopting stricter standards which helps to achieve a more sustainable built environment.

Long-term sustainability planning is particularly important in our cities, which still have a large car mode share, low-density urban settlement patterns and growing populations. The Climate Council has indicated that cuts to emissions in cities could deliver up to 70% of the nation's required reductions under the Paris Agreement.[198]

Reductions in car mode share can be accelerated by having more compact cities with high-quality, affordable transport systems. In Tokyo and Seoul, over 75% of journeys are on public or active transport.[199] These cities have used land-use planning to deliver high-density suburbs and encourage mode shift away from private vehicles, while meeting the day-to-day needs of users for accessibility and connectivity. Denser cities boost public transport patronage, allowing operators to run more efficient, frequent and higher-quality services for users. The sustainability of our road network is also linked to its efficiency. Less fuel is used and less pollution produced per vehicle on free-flowing routes. The avoidance of congestion is therefore desirable to reduce the health and environmental costs of transport. This could involve consideration of approaches that reduce vehicle use including demand management, use of higher productivity vehicles and emerging technology such as connectivity and automation.

Better standards can improve sustainability

The development of widely adopted standards has improved sustainability outcomes in the passenger transport sector. Standards can deliver sustainability and resilience benefits at low costs to users by guiding design and lifecycle decisions. Some of the organisations assessing assets and providing ratings include the Infrastructure Sustainability Council of Australia, the Global Real Estate Sustainability Benchmark and the Green Building Council of Australia.

These ratings provide a benchmark for project design and lifecycle decisions that reduce carbon use and waste, save water and promote high-quality environments. The adoption of these guidelines is contributing to better sustainability outcomes on passenger transport projects, such as the Flinders Street Station Upgrade and Sydney Metro Northwest tunnels. Many project developers are voluntarily adopting these standards, to build community goodwill and avoid expensive future retrofits.

How buildings are designed and constructed also has a bearing on the transport network's sustainability. This is why the Green Star rating system takes into account a building's access to public transport, active transport facilities, low-emissions vehicle infrastructure and supply of car parking.

59. Challenge

Australian governments often do not incorporate sustainability or resilience into their final infrastructure projects. Without regular action, active and public transport modes will be underutilised and our infrastructure will be less resilient and sustainable.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Emerging technology could reduce transport's impacts

Cars will continue to be an important part of Australia's passenger transport system. It is therefore critical to cost-effectively roll out new technology that can reduce the emissions and air pollution intensity of private vehicles.

New, more sustainable technology is driving changes in the transport sector.[200] Passenger rail and tram networks in our major cities are already electrified. However, a transition in our bus and light vehicle passenger fleets from internal combustion engines to hybrid electric, plug-in electric, hydrogen fuel cell and automated vehicles could deliver even greater emissions reductions.

Hydrogen and electric vehicles' emissions are based on where they source their electricity. Recharging an electric vehicle from the renewables-dominated grid in Tasmania would cause far fewer emissions than an electric vehicle powered by the coal-dominated Victorian system. It is likely that most users will source their electricity from the grid rather than from a local source such as domestic solar panels due to the high volume of electricity required to charge an electric vehicle. At present, an average new internal combustion engine vehicle emits 185g CO_2 per kilometre, while an average electric vehicle – when recharged from the grid – around 98g of CO_2 per kilometre.[201]

It is unclear whether automated vehicles will have an effect on emissions. Automated vehicles using efficient routes and carrying multiple customers could reduce emissions and save energy compared to current travel patterns. These vehicles will be designed to drive in close proximity to each other, reducing drag. However, in a scenario where the availability of driverless cars increases vehicle kilometres driven, this technology could increase Australia's emissions footprint.

A sustainable transport sector also requires that attention be paid to the whole-of-life impacts of new technology. For example, each electric vehicle purchased will contain a lithium-ion battery. As the mass market for electric vehicles develops, the number of lithium-ion batteries will dramatically increase in Australia, and we will need methods of sustainably disposing of, reusing or recycling these assets.

60. Opportunity

If partnered with low carbon intensity fuels hybrid electric, plug-in electric, hydrogen fuel cell and automated vehicles are less emissions intensive than internal combustion engine vehicles. These technologies can be leveraged to transition to a low-carbon transport sector. Reducing transport sector emissions would help Australia meet its international obligations while also improving local air quality.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Increasing the resilience of transport networks is challenging for governments

Alongside sustainability, planning for a more resilient transport sector will be vital to Australia's economic strength and liveability. Our transport infrastructure faces major threats from extreme weather events, inadequate maintenance, accidents, terrorism and cyberattacks.

As the populations of our fast-growing cities increase, so too do the consequences of disruption. Even minor incidents can cause large disruptions and be costly for users and taxpayers. For example, in 2018, the disruption caused by a single morning peak-hour incident on the Sydney Harbour Bridge was estimated to have had an economic cost of $5 to $10 million.[202]

Major disruptions will occur in a future where severe weather events are more frequent and more damaging. Changes in climate and extreme weather events cause damage to transport assets and prevent communities from being able to carry on their day-to-day lives or businesses. It is estimated that the January 2009 heatwave in Melbourne resulted in financial losses of approximately $800 million, primarily due to electricity outages and transport network disruption.[203]

Risks to our network are not evenly distributed. Each geographical area will face its own challenges and will require different investments. In cities, higher instances of extreme heat events can damage roads and shut down rail networks, while carbon dioxide can slowly accelerate the deterioration of concrete.[204] Regional areas, which are heavily reliant on major highways, can face major disruption due to floods and bushfires.

Rural and remote communities need transport access for necessities such as food and fuel, but have to deal with the accelerated deterioration of road pavement through heat wear or flood damage, which can require additional urgent repairs. In October 2016 the Newell Highway was closed for six weeks between West Wyalong and Forbes in central western New South Wales due to flooding. This resulted in increased road freight transport costs, losses in tourism expenditure and agriculture production, and increased road maintenance expenditure along the highway itself and key detour routes.

Our passenger transport network will have to adapt to new circumstances while limiting disruption to its function. Weather-related risks to transport assets and services, and their interdependency with other types of at-risk infrastructure such as the electricity grid, need to be understood and managed. Preparing transport infrastructure and services to be more resilient will minimise the consequences of asset and service failures, reducing costs and improving access for users. The longer these resilience upgrades are delayed, the more they are ultimately likely to cost.[205]

However, an excessively risk-averse approach could overestimate the probability or severity of risks, resulting in over-investment in assets. This could result in the costs of mitigation exceeding an efficient and balanced approach. Transport users and taxpayers would wear the costs of unnecessary investments. A balanced approach will require a focus on measures that minimise the effects of extreme weather, while considering the costs of providing additional infrastructure.

61. Challenge

Climate change is likely to cause increasingly frequent and severe weather events that damage transport assets. Without resilient infrastructure, network functionality could be limited and the costs of upgrades could be more substantial.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

5.7 Safety in the transport sector

At a glance

Recent trends show we are unlikely to meet our targets for reducing road crashes and fatalities. These are costing us $30 billion a year, causing social trauma and affecting user behaviour.

This section discusses how infrastructure solutions can improve our safety outcomes, particularly for the users most at risk. It also looks at the cybersecurity risks that come with new technology.

Road fatalities are declining, but still not meeting reduction targets

In 2018, 1,226 Australians were killed and around 36,000 hospitalised following a road crash.[206] This road trauma is estimated to cost the Australian economy $30 billion annually.[207] More than just financial costs are felt. Crashes cause trauma for families and local communities, and can change how users interact with their transport networks, often at the cost of more efficient, affordable and sustainable transport options.

In 2011, the National Road Safety Strategy was developed in response to Australia's unacceptably high fatality rate. The strategy is based around a multidimensional Safe Systems Approach that aims for safer vehicles, safer behaviour, safer speeds and safer roads. The strategy recognises that road users will make mistakes – but the road system should be forgiving, so that a mistake does not result in death or serious injury.

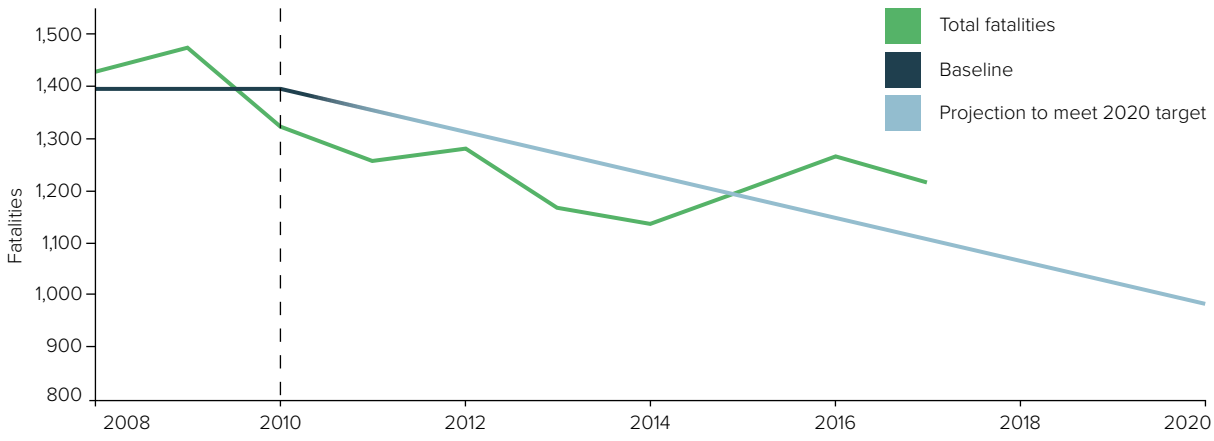
The National Road Safety Strategy aimed for a 30% reduction in road crash fatalities between 2010 and 2020. As of 2017, there has only been a 14.1% reduction.[208] While passenger car deaths have decreased at the fastest rate since 2010, they still account for 60% of all road deaths in Australia.[209]

Motorcyclist and pedal cyclist fatalities have seen no improvement.[210] In 2015-2016, there was even an increase in road fatalities. This suggests that the nation's road safety performance may even be stalling, as shown in Figure 18, and foreshadows a challenging review process when jurisdictions renegotiate the National Road Safety Strategy.

A lack of reliable, consistent data across all levels of government makes it difficult to identify all of the reasons for the increase in fatalities in the 2015-2016 period. Without data on injury incidence and crash causes, there are gaps in our knowledge about the road system's safety performance. Appropriate infrastructure and policy responses require robust and reliable data. An accurate and consistent evidence base is also important as the road network adapts to changes in its use.

One known reason for the increase in fatalities in 2015-2016 is the effect of driver fatigue and distraction. From 2013 to 2017, more people died in New South Wales fatigue-related crashes than drink-driving crashes.[211] The use of mobile phones accounts for at least 2% of all fatal crashes involving distraction,[212] although this factor is under-reported due to strong disincentives against self-admission and the absence of witnesses to single vehicle crashes.[213]

Figure 18: Fatalities are decreasing, but not fast enough to meet our 2020 target



Source: Bureau of Infrastructure, Transport and Regional Economics (2018)[214]

Infrastructure plays a critical role in road safety outcomes

The Safe Systems Approach aims to ensure that, when a driver makes a mistake, it will be unlikely to result in a crash. Road infrastructure can support this outcome. To do this requires cost-effective allocation of Australian Government, state and territory, and local government funding. Road safety funding is significant. For instance, the Australian Government provided $744.5 million to the Black Spot Program from 2013-14 to 2021-22.[215] To spend funds efficiently, there needs to be identification, assessment and prioritisation of high-risk sections of the transport network. Tools such as AusRap's national network rating are useful.[216] However, more data would reduce inefficient capital-intensive safety investments.

States and territories have implemented a variety of low-cost infrastructure safety solutions. South Australia, New South Wales, Victoria and Tasmania have installed wire rope barrier systems. Western Australia has installed audio-tactile markings.[217] Simply reducing the speed limit on a high-speed road can also result in a reduction of over 30% in serious and fatal injuries.[218] Speed limits are more effective when supported by infrastructure such as point-to-point speed cameras and mobile speed cameras. Point-to-point speed cameras could reduce deaths by 49%.[219] Progress in the use of point-to-point speed cameras has stalled, in terms of their limited enforcement hours, slow roll-out and use at few locations.[220]

Our road infrastructure investments need to strike an appropriate balance between safety, productivity and liveability. For example, while reducing speed limits to 30 km/h in dense urban areas can increase safety for pedestrians,[221] this approach is not likely to be suitable for freight routes of importance to national productivity. A selection of appropriate road safety policies should be balanced across the needs of all road users, the economy and the liveability of our communities.

There is also an opportunity to prepare our road infrastructure for the safety technology of the future. In itself, technological innovation which is making vehicles safer, such as automation, will not deliver safer roads. That outcome will be dependent on investment in the machine-readable road infrastructure and communications components which advanced technology vehicles are likely to depend on, such as line markings, road signage and smart poles.

62. Challenge

Road safety performance is not on track to meet the objectives of the National Road Safety Strategy. Without action road users will continue to be vulnerable and at risk of serious injury or fatality.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

63. Challenge

Project selection and funding is based on incomplete safety data. Without action, this will inhibit effective cost allocation and understanding of trade-offs with other transport outcomes, such as productivity.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

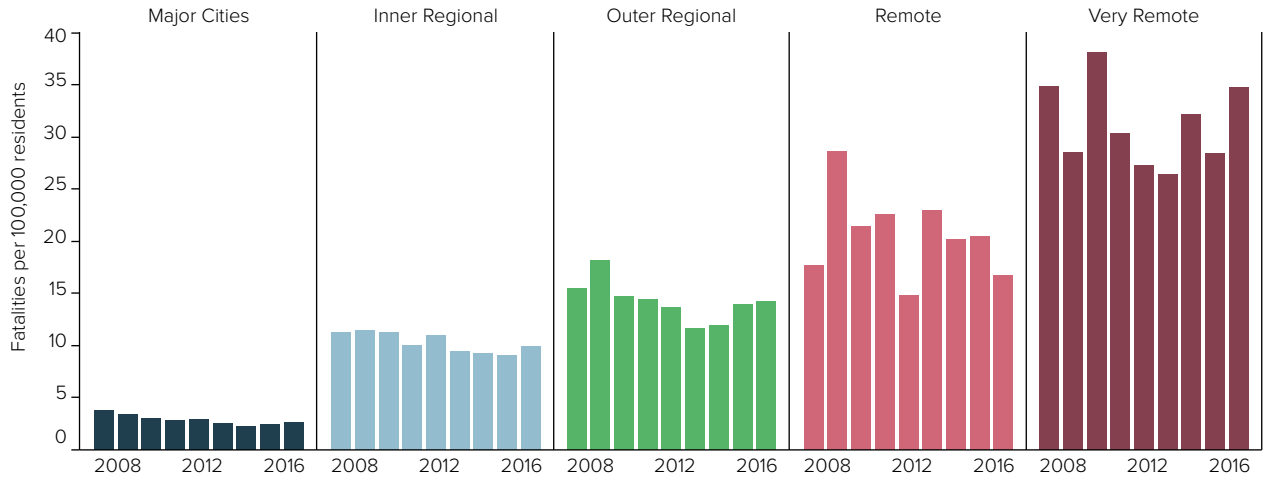
Regional, rural and remote road users are at greater risk

Regional, remote and rural road users face a higher risk when they travel on their local roads. Figure 19 shows that a disproportionately higher rate of fatalities occurs in regional or remote areas. Up to 65% of total road deaths occur in sparsely populated regional and remote areas.[222] Most fatal crashes occur on a stretch of road with a speed limit over 100 kilometres per hour.[223]

Regional communities have low population density and extensive, low-quality road networks with high speed limits. Lower safety standards are not the result of the poor performance of local governments, but the inevitable consequence of service provision to a relatively small number of people spread over a large area. As a result, there are challenges to maintaining, upgrading and renewing ageing assets, and achieving the rising standards associated with other parts of the road network. While local governments manage roads, all three levels of government, the community and the private sector hold levers to reduce regional road crashes.

The 2019 *Infrastructure Priority List* has identified regional safety improvements as a high-priority initiative. The initiative recognises the need to continue to identify, assess and prioritise high-risk sections of regional roads across Australia.[224]

Figure 19: Fatalities occur at a disproportionately higher rate in regional or remote areas



Source: Bureau of Infrastructure, Transport and Regional Economics (2018)[225]

64. Opportunity

Regional, rural and remote road networks are less safe. There is an opportunity to focus investments and policies on these areas. Identifying, assessing and prioritising sites for upgrades and road treatments on high risk corridors could optimise investment and reduce fatalities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

An older vehicle fleet makes it difficult to embrace new safety technology

Australians are driving their cars for longer. The average age of the Australian fleet has risen from 12.5 years in 2014 to 13.1 years in 2016.[226] As a result, many Australians are driving cars that do not meet best-practice safety standards. This has implications for safety outcomes. Vehicles aged over 15 years are four times more likely to be involved in a crash than vehicles aged five years or less.[227]

Increasing vehicle safety standards reduces road crashes. Users are five times more likely to be killed or injured in an Australasian New Car Assessment Program (ANCAP) one-star car than in an ANCAP five-star car.[228] Road safety standards ensure that Australians are given access to safe vehicles. The proportion of ANCAP five-star vehicles in the Australian fleet increased from 76% in 2013 to 91% in 2017.[229] Since every vehicle imported and sold can have a life of 30 years or more, safety standards have long-term implications.

While vehicle safety features are important for keeping users safe, human error still causes 94% of road crashes.[230] Vehicle connectivity and automation technologies can reduce the risk of human error in the short term and eliminate it over the long term. Automated vehicle technology is already included in many Australian vehicles, including auto emergency braking, lane-keeping assist, adaptive cruise control and intelligent speed assist. These safety innovations are helping to reduce rear-end crashes, prevent collisions during lane changing and maintain safe speeds.

Safety-oriented vehicle standards can have productivity and environmental impacts. Safety features often add weight to a vehicle, leading to the production of more emissions. Different users will have a different willingness to pay for such safety features, especially when they compete with other user values. It will be challenging to balance safety features against affordability, productivity and environmental concerns.

65. Challenge

Australians are holding on to their vehicles for longer. Older vehicles often do not meet modern safety standards and are more likely to injure or kill if involved in a crash.

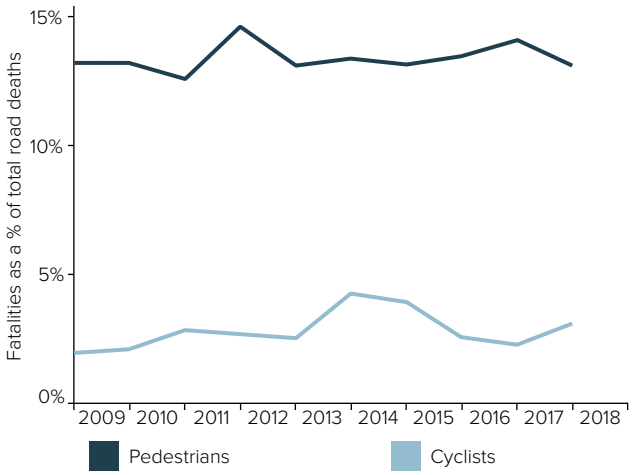
When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Pedestrians and cyclists are particularly vulnerable

Walking is Australia's most common transport mode. Most Australians start and/or end each longer journey on foot or a bicycle. Pedestrians and cyclists are vulnerable to crashes. In 2016, 182 pedestrians and 29 cyclists were killed in regional and urban areas of Australia,[231] and their proportions of all road deaths have not decreased over the past ten years (Figure 20).[232] Non-fatality crashes are even more common. In 2015, 9,352 pedestrians and cyclists were hospitalised.[233] Transport networks should enable safe, affordable and efficient active travel, with pedestrians and cyclists using the network at their own pace.

Figure 20: The proportions of all road deaths by pedestrians or cyclists have not fallen in the past 10 years



Source: Bureau of Infrastructure, Transport and Regional Economics (2018)[234]

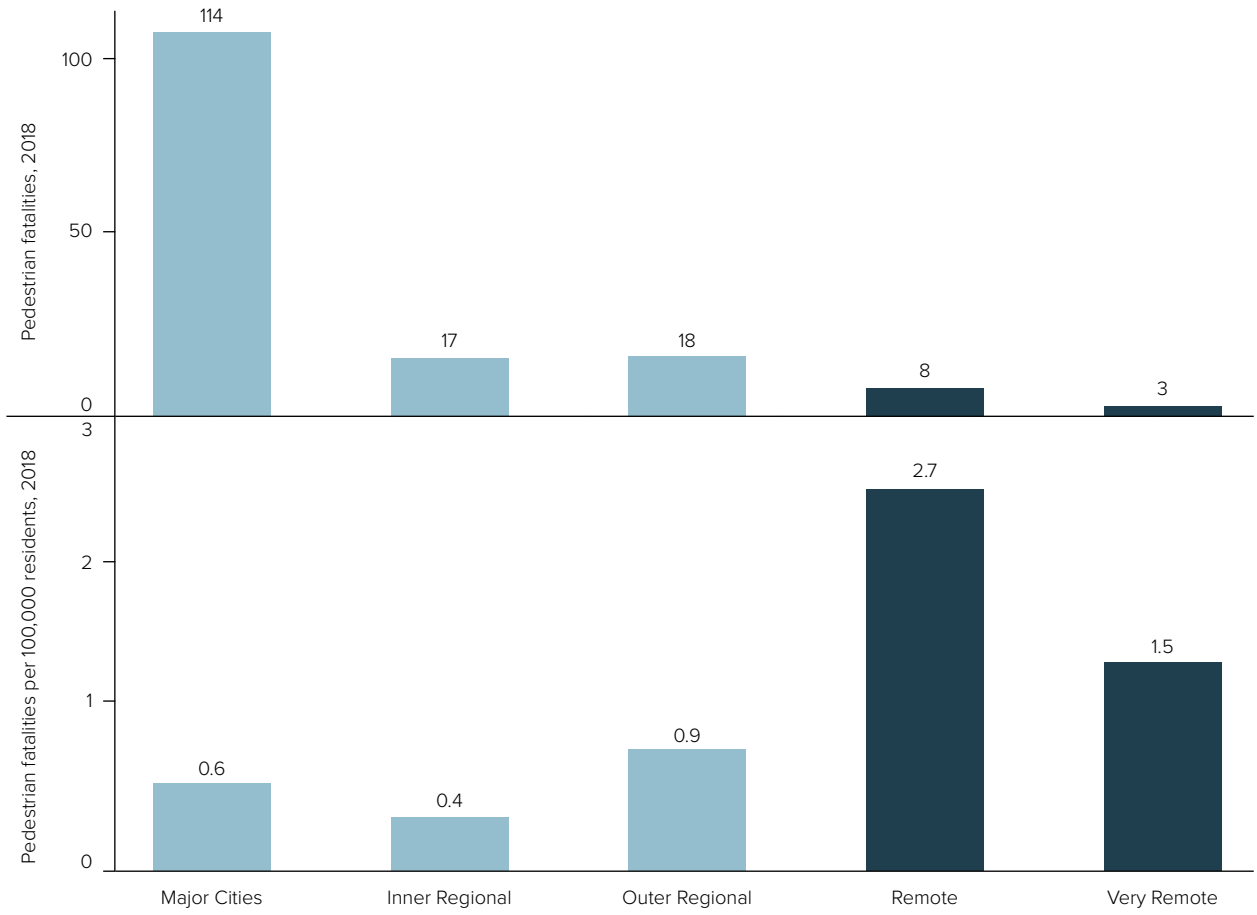
Pedestrian and cyclist safety is a countrywide issue. Thousands of people walk in the Sydney and Melbourne CBDs and other dense urban environments every day. These areas often do not prioritise non-motorised traffic. In regional, rural and remote areas, inadequate pedestrian and cyclist infrastructure results in even higher fatality and injury rates compared to metropolitan areas (Figure 21).

Female active and public transport users are particularly conscious of their vulnerability to assault, injury and confrontation with other transport system users.[235] This feeling is most pronounced at night, when there is limited passive surveillance. One in four women do not walk alone in their local area after dark because they feel unsafe.[236] Perceptions of safety on public transport are worse, with up to 23% of women not feeling safe if using public transport alone after dark.[237] Perceived threats to personal security on the active and public transport network at night lead many to favour private transport. This shift in modes reduces the beneficial effect of more people being active in public spaces, further driving down active transport participation.[238]

Infrastructure and policy decisions can make active transport users safer. For instance, many older and vulnerable people find that crossing a road at traffic lights can be a stressful and dangerous experience. Traffic light timings that operate at 1.2 metres per second are often inadequate for older pedestrians who on average walk at 0.9 metres a second.[239] In recognition of almost one quarter of pedestrian crashes in New South Wales occurring at signalised intersections, that state's councils have been considering more frequent and longer pedestrian crossing opportunities and crosswalk widening at major intersections.[240] This could have large benefits in other areas, considering that people aged over 70 make up 33% of pedestrian deaths in Victoria.[241]

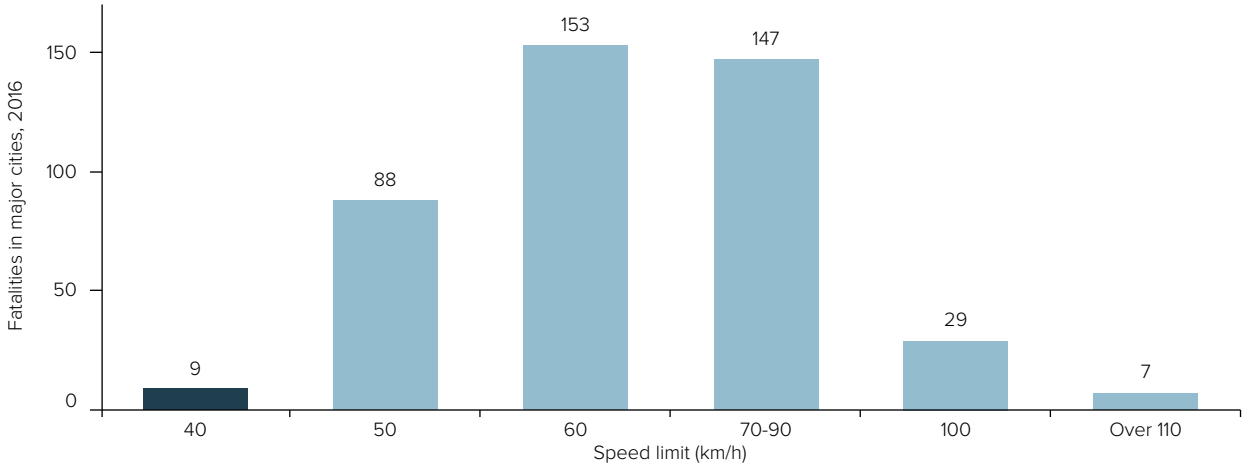
Another proven method of limiting pedestrian and cyclist injuries and fatalities is to lower the speed limit (Figure 22). As such safety improvements can affect productivity and accessibility for other modes of transport, road design and management decisions need to strike an appropriate balance between safety, productivity and liveability.

Figure 21: Pedestrian fatality rates are higher in regional and remote Australia



Source: Infrastructure Australia analysis of Bureau of Infrastructure, Transport and Regional Economics (2019) and Australian Bureau of Statistics (2019)[242]

Figure 22: The number of fatal crashes in 40km/h zones is much lower than in higher speed zones



Source: Bureau of Infrastructure, Transport and Regional Economics (2018)[243]

66. Challenge

Pedestrian and cyclist fatalities are over represented in fatalities and injuries. Without action, active transport users will continue to be injured and killed, and the attractiveness of active transport will remain low.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Cybersecurity is critical to transport's resilience

Australia's transport providers are transforming their businesses through the ever-increasing use of technology to provide better services to customers. Australians can access real-time information to find the most efficient mode of transport, calculate the cost and duration of travel, and book and pay for a service. Transport providers use this data to further understand customer needs and improve their offerings.

As the technological landscape changes, transport providers will have access to even more detailed consumer information. Technologies such as autonomous vehicles will need to transmit and receive huge volumes of data in order to function. Digital systems storing and moving data will be integral to the delivery of transport services.

Consumer and systems information is valuable to malicious external actors. For this reason, cyberattacks are becoming more advanced, frequent and targeted. The value of the data held within the Australian transport network is unknown. However, Transport for London has estimated that use of such data contributes up to £130 million annually to that city's economy.[244] This value is based on travel that is more efficient, the creation of high-value jobs and the reduction of transport operating costs.

A cyberattack can inflict financial or reputational damage on individuals and businesses. Additionally, cyberattacks are capable of causing operational failures such as train derailments or crashes, which can threaten the safety of entire transport networks. While safety concerns are paramount, all security incidents degrade customer trust. Privacy is increasingly hard to protect for citizens in a digital world.

The Australian Government released a national cybersecurity strategy in 2016, highlighting the need for national investment in this domain.[245] The strategy aims to empower Australians with cybersecurity skills, while ensuring that Australia's networks and systems are resilient to attack. Tackling cyberthreats is key not only to protecting consumers' data and safety, but also to ensuring that Australia can benefit from step changes in technology. Estimates of the current level of investment in cybersecurity across our transport networks are not publicly available.

67. Challenge

Technological change is driving the collection of valuable data by transport operators and network owners. This information is valuable and can be vulnerable to cyberattacks.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

5.8 Transport accessibility and equity

At a glance

Many Australians lack equal access to transport, and the opportunities it opens up, due to financial, geographic, physical or cognitive restrictions. This section explores how these impact communities and the role played by infrastructure in addressing or compounding those challenges.

Our transport networks can do more to address social disadvantage

Not all Australians find daily travel simple, straightforward or affordable. People's experiences of using our transport networks vary across travel time, comfort and security outcomes, and in the level of disadvantage felt in relation to the affordability of tolls and fares, availability of services and physical accessibility.[246]

This section explores three common types of disadvantage:

- **Financial disadvantage** refers to people who experience financial stress. Transport is a key service, but its costs can sometimes be regressive, with those who are already financially stressed paying a greater proportion of their income to access the network and reach opportunities.
- **Physical and cognitive disadvantage** refers to people who have a mobility, sensory or cognitive impairment. Specifically, we focus on people with disability and older people.
- **Geographic disadvantage** refers to anybody who lacks access to transport because of where they live or work. This is a very broad section of the community, but it focuses on regional and remote Australians and people who live on the outskirts of our cities.

The section is split into the three common types of disadvantage for ease of analysis. However, it is important to acknowledge that some people experience greater levels of multiple disadvantage than others, and often issues of disadvantage are intertwined and can be compounded.

Outer-urban and regional communities are particularly at risk of transport disadvantage

Public transport plays a vital role in promoting social equity. Disadvantaged groups with limited access to public transport are especially at risk of social exclusion.

People living in outer-urban areas and regional centres often have poor access to public transport and rely heavily on private vehicles for access to jobs, education, services and entertainment.

Outer-urban and regional centres encompass a broad range of communities, from the outlying suburbs of our major cities, which are integrated within the broader urban economy, to regional centres that may be supported by a surrounding agricultural or mining hinterland.

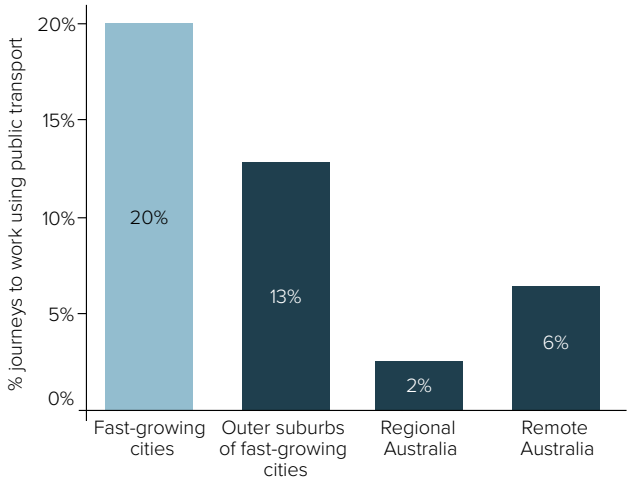
The transport needs and patterns within each area vary with context. However, governments and public transport operators often encounter common problems when delivering services to these areas. Lower residential and employment densities, combined with long distances and dispersed trip patterns, mean that public transport has traditionally struggled to provide sufficient service levels to compete with the private vehicle.[247]

There are three common challenges that outer-urban and regional communities face when seeking to use public transport:

1. **Access to public transport is lower.** Lower settlement densities mean people are less likely to live within walking distance of a public transport stop or station.
2. **Service frequencies are lower.** Operators can provide higher frequencies when there is sufficient demand. Demand is normally lower in outer-urban areas and regional centres, meaning frequencies are lower. This means people wait longer for services, and cannot interchange between services easily.[248]
3. **Travel distances are longer.** People living in outer-urban and regional areas tend to live further away from places of work, education, services and entertainment. For example, about 44% of people in outer-urban areas travel more than 20 km to work, compared to 7% of people in inner-urban areas.[249]

These challenges usually lead to lower patronage levels. Public transport use in the outer suburbs of our major cities and regional Australia is significantly below the average across our largest cities (Figure 23).

Figure 23: Fewer people use public transport in our outer suburbs, regional and remote Australia

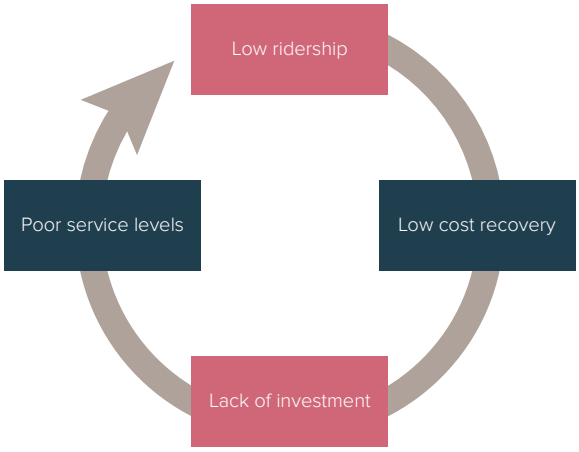


Note: The outer suburbs is included in the average for the fast-growing cities. Boundary definitions for outer suburbs can be found in *Outer Urban Public Transport*.[250] The majority of public transport use in remote Australia relates to people employed in the mining sector in Western Australia.

Source: Infrastructure Australia analysis of Australian Bureau of Statistics (2016)[251]

It is common for public transport services in lower-density environments to get caught in a self-defeating cycle. Existing services are poorly patronised, so governments do not invest in new infrastructure and improved service levels. This leads to poor performance, which further discourages partnership and cost recovery (Figure 24). Compounding this cycle in outer-urban areas where new communities are in an early stage of development, residents' natural response to poor public transport service levels is to buy more cars and drive instead. This embeds car dependence so that, even when communities grow to a size and density that might support reasonably frequent public transport services, it can be too late and costly to introduce these and induce people to switch from driving.

Figure 24: Outer-urban public transport is caught in a cycle of poor performance and service levels



Source: Infrastructure Australia (2018)[252]

The challenge for governments is to find ways to escape this cycle. There is an opportunity for public transport operators to utilise emerging technology to fill the gaps where traditional public transport has struggled. Infrastructure Australia's recent paper, *Outer Urban Public Transport: improving accessibility in lower density areas* discusses how emerging modes such as rideshare, carshare and on-demand buses could help to better serve people living in outer-urban and low-density areas.

68. Challenge

Public transport service levels and access is lower in the outer suburbs and regional centres. This results in lower public transport mode share, and a reliance on cars in these areas. Without action, people who live in these areas will continue to be reliant on their cars.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Transport makes up a large portion of household costs

Every household must pay to access key infrastructure and its cost can contribute to financial stress. In recent years energy costs have increased substantially and have become a key cause for concern. However, although energy has arguably experienced more attention in recent years, the cost of transport remains the largest single component of people's infrastructure bill.

In 2015-16, the average Australian household paid about $205 per week for transport, or 14.3% of total household expenditure, compared to $41, or 2.8% of total household expenditure, for energy (Figure 25).[253] While the costs of transport peaked as a percentage of household expenditure in 2009-10, they have still grown in real terms between 2003-04 and 2015-16.

The cost of using public transport has grown on average by 11% between 2003-04 and 2015-16.[254] However, the effect of this has been more than offset by reductions in the purchase costs of new vehicles, which decreased by 19.8% from 2003-04 to 2015-16.[255]

Transport costs are often higher in isolated suburbs within cities, as well as remote areas, which may overlap areas with lower average incomes. In the outer suburbs of our major cities, people generally rely more on their car than their counterparts in the inner city. This is likely because public transport is less accessible and lower quality in the outer suburbs than the inner suburbs, with services further away, less frequent, longer in reaching key destinations, slower and less reliable.[256]

As a result, overall the real costs of transport are higher in the outer suburbs (Figure 26). The cost of operating a vehicle is the key point of difference, with expenditure on fuel, lubricants and additives significantly higher in outer-urban areas faced with longer journeys to access work and services. The difference between inner and outer suburbs is even greater when calculated as a proportion of household expenditure.

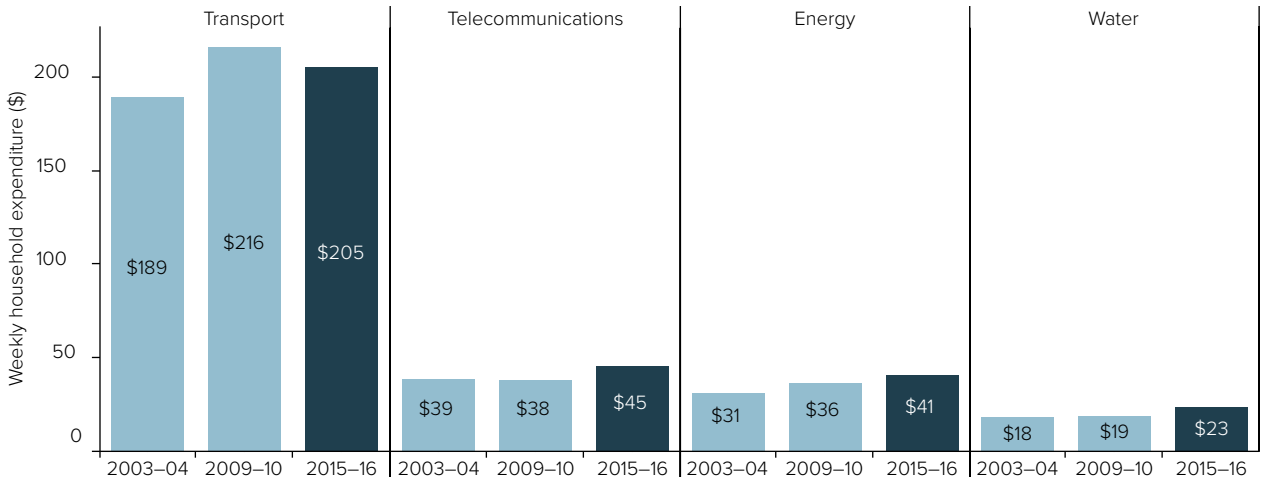
Transport in regional and remote Australia is very different to our major cities. Costs outside major cities (classified as 'rest of state') can be lower overall. However, in dollar terms this is largely because of low public transport use and an absence of parking fees and road tolls. The cost of operating a vehicle, such as fuel and vehicle parts and servicing, is higher on average than in the inner and middle suburbs of major cities.

However, when presented as a percentage of total household expenditure, the transport costs experienced outside capital cities constitute a heavier financial burden than in any other geographic area. Australians living outside our capital cities spend a greater share of their income on transport than anyone else.

Another important aspect of travel in regional and remote Australia is air travel. Distances in regional and remote Australia are immense, which often means flying is the only viable choice. Aviation is especially important for remote communities, as it can be the key link to important services such as healthcare, to economic opportunities and to family. It can be critical to perceptions about the connectivity and liveability of a region.

The cost of regional airfares relative to fares paid for higher-volume intercity routes has been a focus for governments in recent years. A Western Australian parliamentary inquiry submitted its report into regional airfares in late 2017, and a Commonwealth parliamentary inquiry is due to report in June 2019.

Figure 25: Transport contributes the greatest to household infrastructure costs



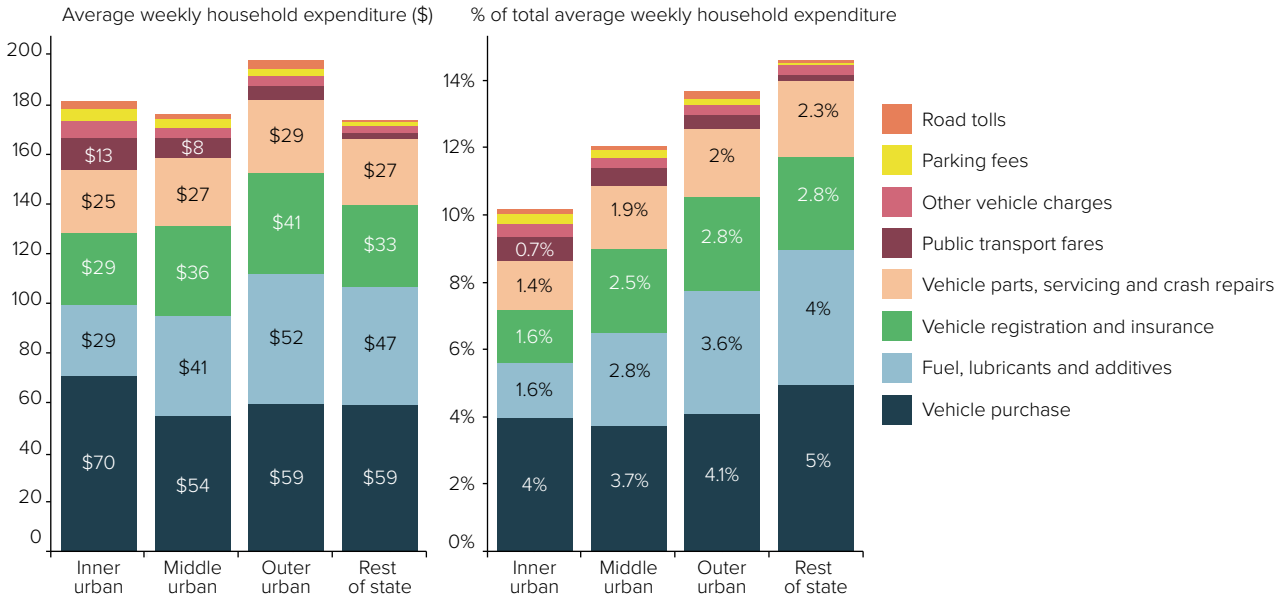
Note: Values are inflation adjusted to June 2016.

Source: University of NSW City Futures Research Centre and Astrolabe Group analysis of Australian Bureau of Statistics (2019), Bureau of Meteorology (2019)[257]

Data on regional and remote airfares need to be analysed with care because each route represents a market for private aviation operators. In other words, pricing will usually be determined on a case-by-case basis, subject to the commercial considerations of airlines. This means that data regarding pricing mechanisms and structures are commercially sensitive and difficult to access. Comparing average prices can also be problematic because of the variability in pricing over short periods of time and the fact that some regional air routes are regulated, which usually means their operator is granted a monopoly over a route and prices cannot exceed an agreed fare.

Despite the paucity of data, there are community perceptions that regional and remote airfares are too high.[258] This is particularly the case for airfares on unregulated routes, where a government has left prices to be determined by operators.[259] Airlines have acknowledged that flying to smaller population centres comes with high operating costs. A larger number of passengers offers potential economies of scale, e.g. improving aircraft utilisation and allowing for larger and more efficient aircraft with lower per-passenger operating costs.[260] For unregulated routes, customers ultimately pay the higher costs of serving smaller communities.

Figure 26: Household expenditure on transport is higher in the outer suburbs of our major cities



Note: These averages are for New South Wales, Victoria, Queensland, Western Australia and South Australia only. Inner-, middle- and outer-urban boundary definitions can be found in *Outer Urban Public Transport*.[261]

Source: Infrastructure Australia analysis of Australian Bureau of Statistics (2017)[262]

69. Challenge

People on the outskirts of our cities and in regional and remote Australia pay proportionally more for transport. Unless addressed, our transport networks will continue to be inequitable, with people in the outer suburbs and regional and remote Australia paying proportionally more.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Transport services are critical for people with disabilities and older people

Many Australians find daily travel a challenging task. For older people and those with disability, using active transport, public transport, on-demand services or a motor vehicle can be difficult or painful, or take a lot of time.

Over four million Australians have a disability, meaning that they have a limitation, restriction or impairment which has lasted or is likely to last six months and restricts everyday activities. Unsurprisingly, disability rates vary with age, with about 12% of people between 35 and 44, and over 85% of people over 90, reporting a disability.

There are, of course, a broad range of disabilities. Close to 6% of Australians have a profound or severe disability, which means they sometimes or usually require assistance to undertake core tasks (mobility, self-care and communication).[263]

Transport is a key enabler for people. It allows them to access work, leisure, education and healthcare services. Older people and those with disability are particularly vulnerable, and are at greater risk of experiencing social isolation and loneliness. They are also more likely to require frequent access to healthcare services.[264] Transport is therefore critical, because it helps some of our most vulnerable community members access the services they need to live healthy and fulfilling lives.

Public transport accessibility has improved, but will likely fall short of goals

In 2002, the Australian Government introduced Disability Standards for Accessible Public Transport (the Standards), requiring public transport to be fully accessible by 2022 and passenger trains and trams to be fully accessible by 2032.[265]

The Australian Government Department of Infrastructure, Transport, Cities and Regional Development reviews the Standards every five years. It is currently reviewing progress against the legislation's 2017 checkpoint, which requires 80-90% of services to meet the Standards.

Although individual agencies and local governments report advances in accessibility annually, often against goals set out in an accessibility plan, this reporting is inconsistent, meaning that comparisons are not readily made across time periods or between the performance of different jurisdictions. In the absence of more frequent national reporting, it is difficult to consolidate and compare state and local governments' progress. The potential for national oversight of accessibility in the five years between formal reviews is therefore challenging.

Despite inconsistent data, available information shows it is unlikely that services and infrastructure in most jurisdictions will be fully compliant with legislated requirements within the mandated timeframe. Table 3 shows key transport infrastructure for which there are data that are unlikely to meet targets. Progress against the Standards is possibly even worse than the data suggest. Information is not available for numerous types of infrastructure in different jurisdictions. For example, the accessibility of bus stops is not reported consistently in New South Wales.

Table 3: Numerous jurisdictions are unlikely to meet legislated accessibility requirements

Jurisdiction	Mode	Percentage accessible	Year
New South Wales	Railway stations	53.7%	2018
Victoria	Bus stops	52%	2012
	Tram stops	22%	2018
	Trams	24%	2018
Western Australia	Railway stations	53%	2018
South Australia	Buses	80%	2018
Australian Capital Territory	Bus stops	55%	2012
Tasmania	Buses	52%	2017
	Bus stops	37.5%	2017

Note: This is not presented as a comprehensive view, as not all jurisdictions publicly publish their progress.

Source: Transport for NSW (2018), Department of Transport (2012), Victorian Auditor-General's Office (2018), Transperth (2019), Government of South Australia (2018), Transport Canberra (2019), Metro Tasmania (2018)[266]

A lack of funding is perhaps the greatest challenge in meeting legislated standards. The latest review of the Standards identified that the infrastructure upgrades required between 2017 and 2022 are likely to cost the most, and achieve the lowest relative benefit to accessibility, making them unattractive investments to governments.

The financial pressure has been highlighted by local governments, which are often responsible for bus stops. Local Government NSW notes that the introduction of the Standards was not accompanied by additional funding for implementation, making it difficult to meet requirements.

State government operators have also struggled financially. Metro Tasmania, the state's largest government-owned transport operator, has advised it is unlikely to meet 2022 accessibility targets as significant financial investment is required and this has not been provided for in future budgets.[267]

There are also practical limitations in meeting targets. In some circumstances, networks would require significant overhauls or redesigns in order to be fully accessible. The City of Newcastle, for example, has advised that about 30% of all bus stops will never be compliant because many of them are on a slope, which means their access gradient exceeds requirements.[268]

Significant progress has been made in making public transport accessible since the Standards were introduced in 2002. However, there is still plenty of work to be done. It is unlikely that operators, and state and local governments will meet all requirements by the legislated deadline. There are numerous causes, including a lack of funding for upgrades and the practicalities of undertaking very large infrastructure programs and projects within the required timeframe.

Point-to-point transport will have a bigger role to play

While the focus of Disability Standards is on public transport, not everyone is physically able to use even compliant services. Of the 4 million-plus Australians living with disability, 250,000 can only use some form of public transport and 590,000 are unable to use any public transport at all.[269]

State governments historically have provided assistance by subsidising taxi fares for people who are unable to use scheduled public transport, and imposed obligations and offered registration incentives for taxis to be wheelchair-accessible.

Emerging transport operators, such as UberASSIST, are beginning to introduce fully wheelchair-accessible services. However, disability advocates have expressed concern that such operators are not consistently subject to the same subsidy schemes or regulatory obligations as taxis, meaning there are still very few accessible ridesharing options.[270]

Emerging transport operators are expected to play a bigger role in service provision in the next five years. The challenge for governments will be to ensure that benefits of new mobility business models extend to people with disability.

70. Challenge

There is insufficient funding to make our public transport networks accessible to people with disability. Unless funding shortfalls are addressed, legislated accessibility targets for public transport will not be reached and our networks will not be inclusive.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

71. Challenge

Emerging point-to-point operators are not subject to the same subsidy schemes and accessibility legislation as taxis, meaning they are not accessible to many people with disability. Without action, people with disability will not share in the benefits of emerging transport modes.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: