



Australian Government

Department of Infrastructure and Regional Development

Trends ➤ Transport and Australia's Development to 2040 and Beyond



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Director — Publishing and Communications Section
Department of Infrastructure and Regional Development
GPO Box 594, Canberra ACT 2601 Australia

Email: publishing@infrastructure.gov.au

Website: www.infrastructure.gov.au

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EXECUTIVE SUMMARY

What will Australia look like in 2040? While this cannot be answered with certainty until that time, our future depends on informed decisions made today. In recent years, our nation has regularly featured in the highest rankings of the Organisation for Economic Co-operation and Development's (OECD) Better Life Index. Maintaining and building upon our current standard of living will support future generations to remain happy, healthy, productive and competitive in what is an increasingly connected and technologically advanced world.

This report updates and extends the 2013 publication *Trends: Infrastructure and Transport to 2030* with projections out to 2040 and, where possible, thereafter. Trends draws on a variety of data sources such as research by the Bureau of Infrastructure, Transport and Regional Economics (BITRE), and other government and industry sources.

Trends provides a sound evidence base on the key strategic issues that are projected to affect the portfolio into the future. It does not recommend policies to address these issues or include references to the existing or proposed policies and activities of the current Australian Government.

Economic context

Understanding Australia's economic landscape provides context for the changes in the transport sector. Over recent decades, the rapid industrialisation of the Chinese and Indian economies has driven a sharp increase in the demand for commodities and a consequential rise in commodity prices. Australia's mineral wealth and geographic proximity to the Asia-Pacific region enabled our economy to prosper.

Yet commodity prices have subsided and Australia's mining industry is transitioning from a construction phase to a production phase.

Structural change is noted as a hallmark of the modern Australian economy. The transition in the mining industry is consistent with structural changes across many of Australia's regions, with the long-term trend away from employment in primary industries and manufacturing in favour of services.

Meanwhile, low interest rates and the decline in the exchange rate since early 2013 have contributed to rebalancing the economy towards the non-resource sectors. The lower Australian dollar means that our exports are relatively cheaper and therefore more competitive internationally.

Looking forward, Australia may benefit from the rising per capita incomes of Asian countries, with Asia predicted to account for 66 per cent of the global middle-class population by 2030.¹ This, coupled with ageing demographics in Asia, may lead to an increased demand for education, tourism and financial services.

After successive budget deficits, Australia faces a tight fiscal environment. This means we must be smarter and more open to new ways of providing transport capacity for Australia's increasing freight task and growing population, while ensuring transport infrastructure is positioned to adapt to the changing demands of the future.

1 Pezzini, M, 2012, *An emerging middle class*, Organisation for Economic Co-operation and Development



Innovation and disruption

The 'Internet of Things' is changing the way we connect and interact with the world around us. It is driving new business models like sharing economies (such as Uber), spurring innovation and transforming community expectations. This connectedness is accompanied by growth in robotics and automation, advanced analytics using Big Data, drones and 3D printing. These 'disruptive' technologies are transforming how we use transport and improving productivity.

Notably, vehicle technology is shifting toward increasingly sophisticated automation – from autonomous emergency braking and advanced speed control to fully automated operation. The potential benefits of such features include improved safety, efficiency, environmental and social outcomes, and traveller convenience.

In Australia, fully driverless vehicles could be on the market in the next few years, although it may be decades before a significant proportion of the passenger vehicle fleet are fully automated. This new technology could improve mobility for people with disability, the young and elderly, free up parking space for urban redevelopment, reduce infrastructure construction costs and make better use of existing infrastructure.

Changes in climate and extreme weather events remain an ongoing challenge for Australia. Infrastructure assets are susceptible to the impacts of changing weather patterns² and the disruptive impacts of extreme weather often result in large-scale expenditure by the Australian Government, state and territory governments on disaster relief, recovery assistance and infrastructure restoration.

Currently, Australia has the eighth highest national transport emissions in the OECD³ and these are projected to increase by 25 per cent between 2013–14 and 2029–30.⁴

With Australia committing to reduce greenhouse gas emissions by 26 to 28 per cent on 2005 levels by 2030—and other countries adopting new targets to reduce greenhouse gas emission levels further—the adoption of more energy efficient transport and cleaner forms of fuel is expected to increase substantially over coming decades.

2 Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, 2013, *Climate adaptation outlook*, Australian Government, Canberra

3 Organisation for Economic Co-operation and Development (OECD)/International Transport Forum, 2014, 'Greenhouse gas emissions database', OECD

4 Department of the Environment, 2015, *Australia's emissions projections 2014–15*, Australian Government, Canberra

Transport as a service

Transport services connect people to jobs, their communities and essential services.

Although one in eight people in Australian cities use public transport for daily commuting, driving remains the preferred means of transport within Australian cities accounting for 80 per cent of travel.⁵

The avoidable social costs of congestion in Australia's capitals may continue to rise from approximately \$16.5 billion in the 2015 financial year to around \$30 billion by 2030.⁶

International air travel will grow strongly to 2030, with both domestic and international passenger movements through Australia's capital cities expected to double.⁷

In addition to transporting people, Australia relies on its freight transport services to connect us to world trade – from the farm gate through to our major ports and airports.

Australia's national land freight task is expected to grow by around 75 per cent between 2011 and 2031.⁸

Maritime transport underpins Australia's international trade. Over the past decade, total international trade through Australian ports has more than doubled from 680.6 million tonnes in 2004–05 to 1,447.0 million tonnes in 2014–15.⁹

Meanwhile, air freight will continue to grow as demand for just-in-time delivery increases for items such as high value manufacturing and mining products, perishables such as food, urgent medical products and market flowers.

Beyond moving people and things, transport infrastructure influences the organisation of cities so that labour and capital can be used more efficiently and flexibly.¹⁰ Globally, policy trends towards transit-oriented development are expected to continue with the aim of alleviating the impacts of urban sprawl and congestion, such as lost productivity, social exclusion, emissions and health impacts.¹¹

In Australia, governments still primarily own and finance road infrastructure and assets, with all three levels of government raising revenue for transport-related activities.¹² While there is only very limited hypothecation of road-related revenue to road expenditure, the cost of building and maintaining our roads is increasing at a rate faster than road-related revenue collected from motorists in taxes and charges.

5 Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2015, *Australia's commuting distance: cities and regions*, Information Sheet 73, Australian Government, Canberra

6 BITRE, 2015, *Traffic and congestion cost trends for Australian capital cities*, Information Sheet 74, Australian Government, Canberra

7 Based on BITRE data, analysis and projections

8 Based on BITRE data, analysis and projections

9 BITRE, 2016, *Australian Sea Freight (unpublished data)*, Australian Government, Canberra

10 Department of Infrastructure and Regional Development, 2015, *State of Australian Cities 2014–2015*, Australian Government, Canberra

11 Tourism and Transport Forum, 2010, *The benefits of transit oriented development*, Tourism and Transport Forum, Sydney

12 Constitutional responsibility for road infrastructure provision lies primarily with state, territory and local government



Regional development

Australia has diverse regions with differing opportunities and challenges.

The Australian population as a whole is ageing and this will have a greater impact in regional Australia. Not only is the portion of people aged 65 and over increasing faster in regions than our capital cities, but this increase in ageing populations will be more difficult to support in regional Australia. The smaller populations and longer distances make services and transport options more difficult to fund and provide.

It is also more difficult for people in regional Australia to achieve the same labour market outcomes when compared to their major city counterparts. The differences in regional labour market disadvantage can be attributed to a number of factors including a region's access to higher education, industry diversity, transport networks and the skill level of its labour force.

Although the services sector is now Australia's major employer in both regional and urban areas, it is estimated that 44 per cent of Australian jobs are potentially at high risk of automation. However, job losses are expected to be somewhat offset by new jobs generated by emerging technologies.¹³

In the coming decades, regional Australia will continue to experience a number of challenges relating to its demographic and industry structure. However, many opportunities lie in improving the connectivity of regions through transport and communications infrastructure to facilitate access to jobs of the future.

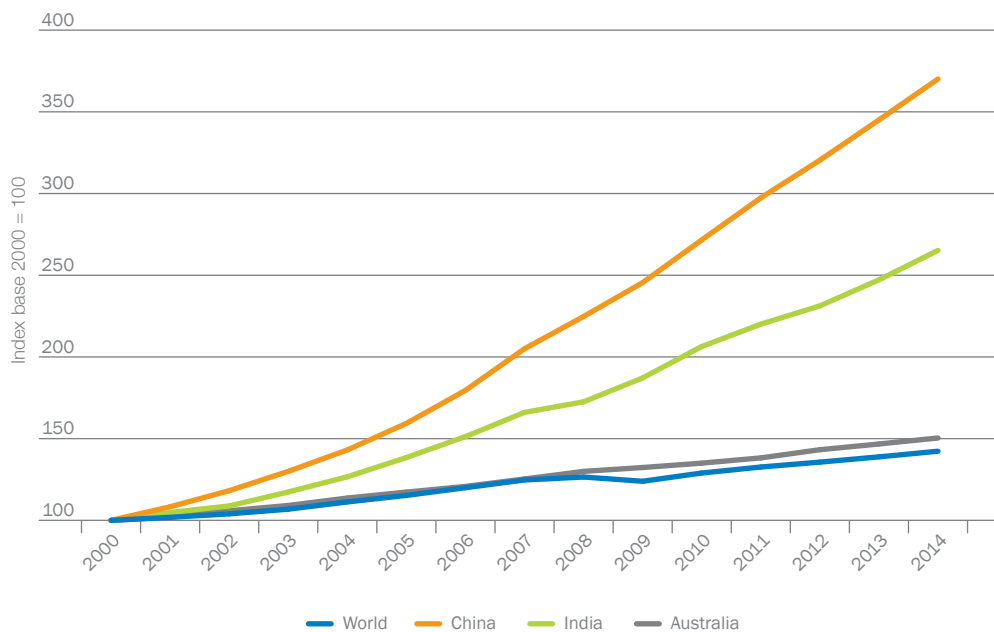
Fostering innovation and embracing opportunities based on trends in the transport sector will provide economic growth and productivity gains, allowing Australia to continue to prosper in the years up to 2040 and beyond.

¹³ Hajkowicz, Reeson, Rudd, Bratanova, Hodggers, Mason and Boughen, 2016, *Tomorrow's digitally enabled workforce: megatrends and scenarios for jobs and employment in Australia over the coming 20 years (Megatrends)*, CSIRO

ECONOMIC CONTEXT

Since the turn of the century, the world economy has seen many changes including an increased focus on security, a global financial crisis and rapid economic growth in Asia (Figure 1.1). This growth reflects the rapid industrialisation of the Chinese and Indian economies in particular, which led to a sharp increase in the demand for commodities to feed their expanding manufacturing sector and a consequential sharp rise in commodity prices. Australia's mineral wealth and geographic proximity to the Asia-Pacific region enabled our economy to participate in this growth.

Figure 1.1: Annual GDP Index, selected countries

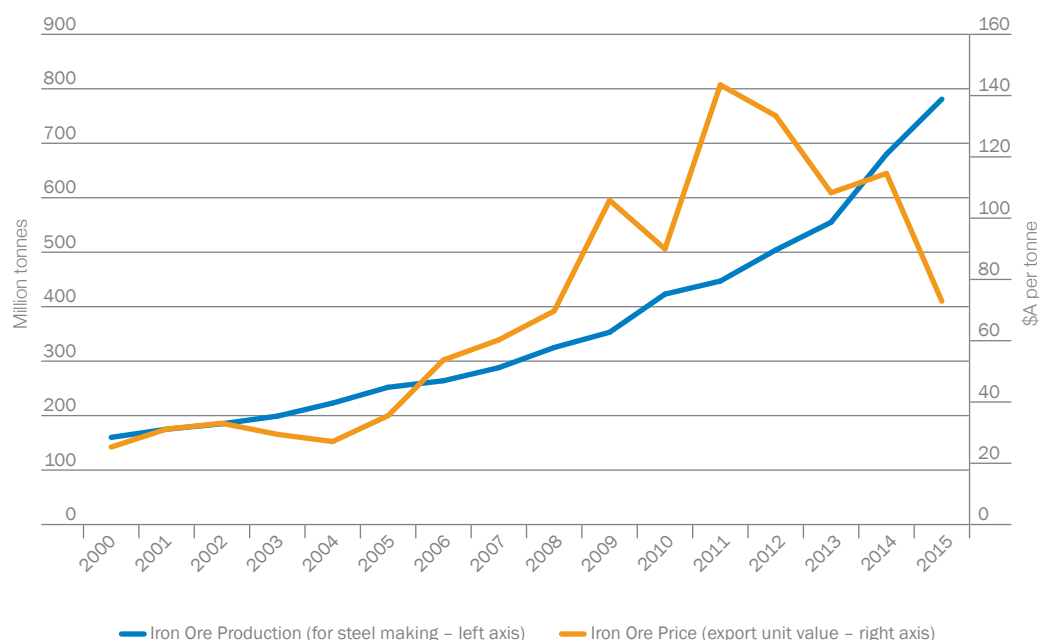


Source: World Bank 2015, World Development Indicators.

This demand for commodities was particularly evident to Australia's iron ore producers. Over the three years to 2014–15, iron ores and concentrates were Australia's largest export by value, accounting for around a third of all goods and services exports.¹⁴ Although there was a sharp increase in capital expenditure at mine sites and freight linkages to ports over the five years to 2012, the long timelines involved in constructing new infrastructure contributed to a substantial lag between commodity price rises and increases in production (see Figure 1.2). For example, work on the Roy Hill iron ore project in the Pilbara region of Western Australia began in 2011 and made its first shipment in December 2015.

14 Department of Foreign Affairs and Trade, 2015, *Australia's trade in goods and services 2014–15*, Australian Government, Canberra

Figure 1.2: Australian iron ore production and price

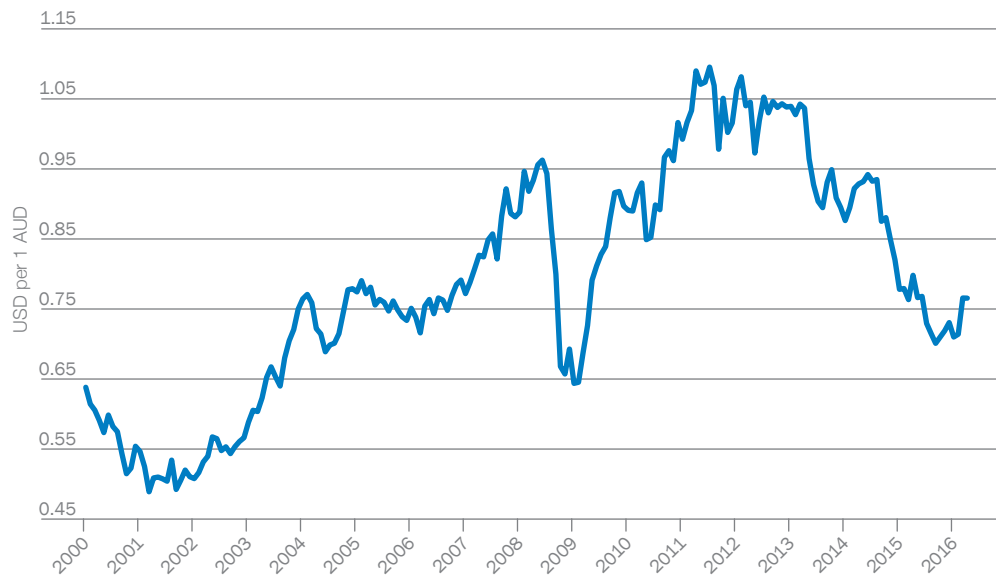


Source: Department of Industry, Innovation and Science, Resources and Energy Quarterly, and Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), Australian Commodity Statistics.

It is to be expected that commodity prices would rise dramatically in a short-term response to increased demand, but then subside as production levels increase to meet this demand. Iron ore prices have eased since the peak in 2010–11, reflecting both substantial increases in global supply as capacity expansions come on line in Australia and Brazil, and an easing in demand growth, especially from Asia. While commodity prices are significantly lower than the peaks of a few years ago, production has continued to grow as new mining projects come on line. As mining industry construction projects conclude and the industry moves from a construction phase to a production phase, the mining workforce will change from a large construction-based workforce to a smaller production-based workforce, resulting in significant structural changes for affected regions.

The significant increase in the value of commodity exports led to a strengthening of the Australian currency through to 2011–12. While this resulted in more affordable imported consumer products, it also led to lower returns to other Australian exporters or import-competing industries. As mines expanded their output and commodity prices eased, the exchange rate also eased to somewhere closer to its long-term average (see Figure 1.3).

Figure 1.3: Change in value of AUD relative to USD (USD per 1 AUD)



Source: Reserve Bank of Australia 2016, monthly historical exchange rates, FXRUSD.

Low interest rates and the decline in the exchange rate since early 2013 have contributed to rebalancing the economy towards the non-resource sectors. The lower Australian dollar means that our exports are relatively cheaper and therefore more competitive internationally. This has led to greater opportunities in service sector exports particularly tourism and education, which grew at 4.1 per cent and 9.2 per cent respectively from 2012–13 to 2013–14.¹⁵

East Asia now accounts for about one quarter of Australia's business service exports and almost half of travel service exports. Around half of international students in Australia come from East Asia, and another ten per cent or so come from India.¹⁶

Looking forward, Australia will benefit from the rising per capita incomes of Asian countries, with Asia predicted to account for 66 per cent of the global middle-class population by 2030.¹⁷ This, coupled with ageing demographics in Asia, will lead to an increased demand for education, tourism and financial services.

¹⁵ Department of Foreign Affairs and Trade, 2015, *Australia's trade in goods and services 2014–15*, Australian Government, Canberra

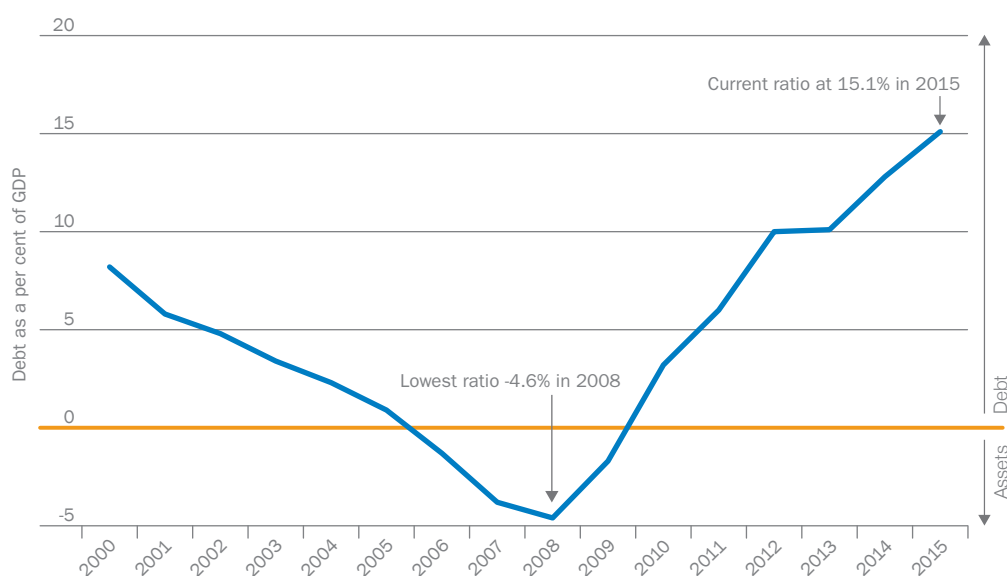
¹⁶ Reserve Bank of Australia, 2016, *May statement on monetary policy*, Sydney

¹⁷ Pezzini, M, 2012, *An emerging middle class*, Organisation for Economic Co-operation and Development



Australia's increased freight task and growing population will need additional infrastructure. However while the Australian economy weathered the Global Financial Crisis better than most developed nations, successive Australian Government deficits have led to net debt of \$242 billion as at June 2015¹⁸ (see Figure 1.4). This is not considered sustainable in the long-term. Australia needs to develop innovative ways to generate more transport infrastructure capacity with less Australian Government funding, either by using different funding methods, through land transport market reforms or by embracing technologies that maximise the benefits we receive from our current infrastructure.

Figure 1.4: Australian Government net debt to GDP ratio



Source: Australian Bureau of Statistics (ABS), 2016, *Government finance statistics, Australia, 2014–15*, Catalogue number 5512.0, ABS, Canberra, and ABS, 2016, *Australian national accounts: national income, expenditure and product, Dec 2015*, Catalogue number 5206.0, ABS, Canberra.

¹⁸ Australian Bureau of Statistics, 2016, *Government finance statistics, Australia, 2014–15*, Catalogue number 5512.0, ABS, Canberra

INNOVATION AND DISRUPTION

Technology: exponential opportunities

The future of transport and infrastructure in Australia is perhaps best viewed through the lens of a smart phone, rather than a crystal ball. The 'Internet of Things' is changing the way we connect and interact with the world around us. It is driving new business models like sharing economies (such as Uber) and bringing consumers who demand higher or customised services into previously stable markets. This connectedness is accompanied by growth in robotics and automation, advanced analytics, drones, and 3D printing. Such so-called 'disruptive' technologies are transforming how we use transport and the way we interact with infrastructure, bringing exponential opportunities as well as some significant challenges.

Technological advances are fundamentally changing the design and operation of Australia's transport systems. They are reducing the cost of new infrastructure, improving the efficiency in the use of existing infrastructure, and improving road safety and freight efficiency. For example, low-cost, internet connected sensors being deployed in smart phones and fixed infrastructure like street lights provide access to better real-time traffic data, and can be used to optimise planning and road management activities.

On the Sydney Harbour Bridge, sensors and sophisticated data analytics are being used to predict maintenance problems before they occur, reducing costs and disruptions to users.¹⁹

Vehicle technology is shifting toward more sophisticated automation – from autonomous emergency braking and advanced speed control to fully automated operation. Vehicles are also increasingly connected through wireless communication to real-time safety messages between vehicles or infrastructure. The potential benefits of such features include improved safety, efficiency, environmental outcomes, and traveller convenience. Fully automated vehicles could also improve mobility for people with disability, the young and elderly, free up parking space for urban redevelopment and reduce infrastructure costs.

Upper bound projections indicate that shared automated vehicles (combined with a high capacity public transport network) could reduce the size of the national vehicle road fleet by as much as 90 per cent. In contrast, lower bound projections indicate that mixing shared automated vehicles with conventional cars (combined with a low capacity public transport network) could result in up to seven per cent more cars being required to provide the same level of service. These results suggest that shared automated fleets may face some transition issues in the presence of legacy fleets.²⁰

To realise the potential benefits and manage any transition complications, policy makers will need to facilitate the uptake of this technology by revisiting regulatory models, removing barriers, facilitating improved enabling services such as positioning or mapping, and addressing potential risks, such as cyber security.

¹⁹ National ICT Australia, 2014, *NICTA response to the public infrastructure*, Productivity Commission issues paper and draft report, NICTA, Sydney
²⁰ International Transport Forum, 2014, *Urban mobility: systems upgrade*, International Transport Forum and Corporate Partnership Board, Paris



Outside of the public realm, mining and defence facilities already employ fully automated technology. Interest among road operators is rising – South Australia hosted the first demonstration of a highly automated vehicle on a public road in the Southern Hemisphere in November 2015. Further demonstrations and trials are planned by industry and state governments, and fully driverless vehicles may enter the market in the period 2020–2030 (although it could be 2035–2040 before a significant proportion of vehicles are fully automated). Integration with other technologies such as vehicle-to-vehicle communications, electrification and ride-sharing could dramatically improve the performance of Australia's transport networks. Automated vehicles may disrupt or complement other transport options like light rail, taxis and traditional bus services – especially in delivering first-and-last mile services.²¹ Automation is forging ahead in other modes too. Sydney Metro's Northwest rail project will provide Australia's first fully automated rail lines from 2019. Advancements in robotics have improved operations efficiency and safety at the Port of Brisbane and Port Botany.²²

Business models are likely to change significantly as a result of automation and other technological changes. The logistics industry will be impacted by disruptive technologies. As additive manufacturing (3D printing) takes off, logistics and manufacturing are converging.²³ Car parts can now be produced in the workshop, rather than ordering them in from elsewhere.²⁴ Logistics innovators see disruptive technologies as a part of business. In 2015 Amazon filed patents for a 3D printing delivery truck, gained approval for drone delivery trials, and launched its *Flex* service – a sharing economy model allowing participants to deliver for Amazon, monetising their vehicle and smartphone ownership. Sharing economy platforms are creating opportunities and productivity benefits while agitating previously sedentary markets. Services such as Uber are challenging existing regulatory structures, spurring innovation, and transforming community expectations. As technology continues to lower transaction costs, such services are now established consumer alternatives to traditional services.²⁵ In this transition, new consumers and competitors may hold concerns on how sharing platforms operate, however, the productivity benefits may override these in the long-term.²⁶

21 Department of Transport, 2015, *Pathways: connecting Canada's transportation system to the world*, Canadian Government, Canada

22 Saulwick, J, 2015, 'Sydney's Patrick terminal goes automated, with fewer staff but dancing robots', *Sydney Morning Herald*, June 18

23 Halterman, T, 2015, 'German shipping giant, TNT is working to integrate 3D printing into supply chain', *3D Printing*, May 22

24 Karena, C, 2013, '3D printing on the road to motoring spare parts', *Sydney Morning Herald*, November 26

25 Chan, ND and Shaheen, SA, 2011, 'Ridesharing in North America: past, present, and future', *Transport reviews*, vol. 32, no. 1, pp. 93–112.

26 Frey, T, 2014, 'The disruptive nature of the sharing economy: finding the next great opportunities', *Futurist Speaker*

Technology will be a key enabler for Australia to meet its rising demands for infrastructure and transport. The challenge for government is to facilitate technological transformation, while ensuring safety outcomes are achieved.

Big Data

Ninety per cent of digital data was created over the two years 2014 and 2015. It is growing by 2.5 quintillion bytes daily²⁷ (that's roughly equivalent to over half a billion HD movie downloads²⁸), expanding from the explosion in social media and mobile connectivity, and ubiquitous embedded sensors and devices. The digital world is growing at an exponential pace from two billion objects in 2006 to a projected 200 billion by 2020.²⁹ Today's cars run on around 100 million lines of code and produce up to 25 gigabytes of data an hour.³⁰

Big Data can provide accurate, rapid and comprehensive information to inform transport and infrastructure use, promoting productivity. Such analytics can address urban issues of waste management, transport and traffic congestion. The infrastructure and transport sectors are already harnessing this information. In Stockholm, for example, traffic data from GPS systems in taxis is analysed to provide online journey planners by creating forecasts based on historical data, while at the same time building long-term visualisation tools for use by policy makers and traffic planners. The project has reduced congestion, resulting in commuter times falling by 20 per cent and vehicle emissions by 10 per cent.³¹ In aviation, data is being used to improve flight performance, cut turbulence, improve safety and identify engine defects 2,000 times faster than before.³²

Data streams from public transport usage, route mapping, GPS/satellite tracking and road-side sensor technologies continue to support³³ real time route suggestions, active traffic network management and regulatory or revenue collection applications.

Data can also optimise transport networks and infrastructure maintenance. Freight and passenger flows can be mapped in real-time, using data from phones, video, toll-roads and navigation systems. This can identify where infrastructure is under stress and enable investment to prevent problems arising as well as focusing investment on areas of greater benefit, for example to address congestion on high-use bridges or aiding the flow of traffic in and around ports.³⁴

While some concerns on data use relate to legal, privacy, safety and intellectual property issues, perhaps the most acute obstacle relates to skills and capacity. CSIRO sees Big Data analysis developing into a profession of specialists across sectors, conversant with machine learning, automation, cyber security, encryption and cloud computing.³⁵ With 44 per cent of Australian jobs at high risk of automation,³⁶ the transport sector will need to adapt³⁷ and build new skills.

27 IBM, 2015, *Bringing big data to the enterprise*, IBM

28 PC Advisor, 2013 'What is Big Data? Understanding Big Data, and how it affects us all' PC Advisor

29 Intel, 2016, *A guide to the internet of things*, Intel

30 McKinsey & Company, 2014, *What's driving the connected car*, McKinsey & Company

31 IBM, 2010, *IBM helps city of Stockholm predict better commuting options*, IBM

32 CSO, 2015, BSA's 'What's the big deal with data?' report illustrates worldwide impact of data revolution

33 Schimbinschi, F, Nguyen, X.V, Bailey, J, Leckie, C, Vu, H. and Kotagiri, R, 2015, 'Traffic forecasting in complex urban networks: leveraging Big Data and machine learning' in *Proceedings of the 2015 IEEE International Conference on Big Data*, Santa Clara, United States of America, 29 October –1 November

34 Fitzpatrick, R, 2015, 'On the road: research can improve transport across Australia', *The Conversation*, 9 July 2015; Casserly, M, 2013, 'What is big data' PC Adviser, 24 April 2013; CSC, 2012, 'Big Data universe beginning to explode', CSC

35 Hajkowicz, Reeson, Rudd, Bratanova, Hodgson, Mason and Boughen, 2016, *Tomorrow's digitally enabled workforce: megatrends and scenarios for jobs and employment in Australia over the coming 20 years (Megatrends)*, CSIRO

36 Hajkowicz, Reeson, Rudd, Bratanova, Hodgson, Mason and Boughen, 2016, *Tomorrow's digitally enabled workforce: megatrends and scenarios for jobs and employment in Australia over the coming 20 years (Megatrends)*, CSIRO

37 Cully, M, 2015, *Industry and workforce futures*, State of the Nation Conference, Department of Industry and Science, Canberra



Extreme weather

The disruptive impacts of natural disasters often result in large-scale expenditure by the Australian Government, state and territory governments on disaster relief, recovery assistance and infrastructure restoration.

In 2011, all jurisdictions, except the Northern Territory and Tasmania, had well-developed commercial insurance arrangements to protect their non-road assets. However, there remains a significant gap in the insurance of road assets, which are generally uninsured. The ACT and Victorian governments maintain commercial insurance policies for their roads, demonstrating that cover is available in some circumstances (refer to Table 2.1 below).³⁸

Table 2.1: Insurance arrangements of states, 2011

	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Non-roads	✓	✓	✗	✓	✓	✗	✓	✓
Roads	✓	✗	✗	✗	✗	✗	✓	✗
Terrorism	✗	✓	✗	✓	✗	✗	✗	✓

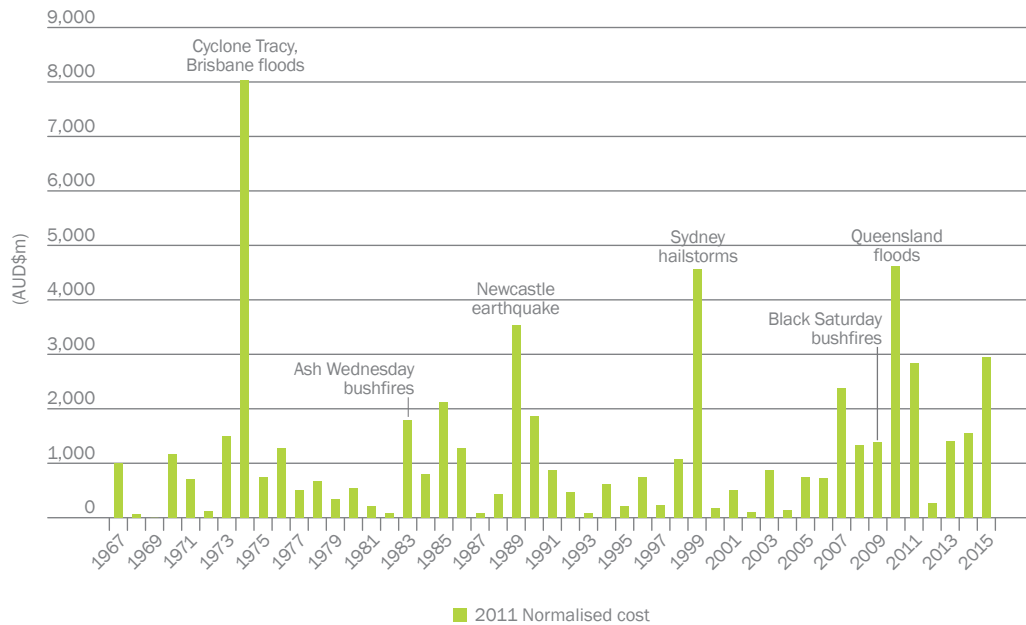
Source: Department of Finance and Deregulation, Review of insurance arrangements of state and territory governments under the Natural Disaster Relief and Recovery arrangements determination 2011 Phase 1 Report.

Infrastructure assets are susceptible to the impacts of changing weather patterns.³⁹ There has been a general upward trend in insurance losses, with these increasing significantly between 2007 and 2010 as shown in Figure 2.1.

³⁸ Department of Finance and Deregulation, 2012, *Review of insurance arrangements of state and territory governments under the Natural Disaster Relief and Recovery Arrangements Determination 2011 Phase 1 Report*, Australian Government, Canberra

³⁹ Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, 2013, *Climate adaptation outlook*, Australian Government, Canberra

Figure 2.1: Insurance losses from natural disasters



Source: ICA (2014e), ICA Data Globe 2016 and Productivity Commission, 2014, Natural Disaster Funding Arrangements, Australian Government.

Changes in climate and extreme weather events are not only capable of causing direct damage to infrastructure assets, but can also cause operational disruptions with flow-on financial, economic and logistical consequences.⁴⁰

Given the likelihood of climate variability having increasing impacts on insurance losses, the mitigation of and adaptation to climate impacts should be considered in future infrastructure investments.

Higher average temperatures will accelerate damage to roads and track buckling in the rail network, further adding to already rising costs. Elevated levels of carbon dioxide in the atmosphere also have the potential to accelerate deterioration of concrete. Overall, infrastructure developers and managers will increasingly need to consider Australia's climate change adaptation to ensure adequate provision is made for system resilience—approaches that minimise the consequences of asset and service failure across the range of likely climate scenarios while considering the cost of providing resilient infrastructure.⁴¹

40 Productivity Commission, 2014, *Natural Disaster Funding Arrangements*, Inquiry Report no. 74, Canberra

41 Organisation for Economic Co-operation and Development/International Transport Forum, 2015, *Adapting transport infrastructure to climate change*, OECD/ITF, Paris



Energy and emissions

Transport energy use and carbon dioxide (CO₂) emissions are closely linked, as carbon-intensive fossil fuels are the main fuel used across the transport sector.

Australia is the world's 13th largest emitter of overall greenhouse gas emissions, producing 1.3 per cent of global emissions.⁴² In 2013–14, domestic transport accounted for around 17 per cent of Australia's greenhouse gas emissions, with approximately 60 per cent of this attributable to light vehicles.

From 2013–14 to 2029–30, transport emissions are projected to increase by 25 per cent.⁴³ Passenger vehicles will remain the largest contributor, but emissions from civil aviation, light and heavy commercial road vehicles and rail are expected to grow at a faster rate.⁴⁴

Similarly, strong global growth is also projected for transport emissions. For instance, CO₂ emissions from maritime transport in 2050 are projected to be between 50 and 250 per cent higher than current levels.⁴⁵ This indicates that by 2050 international shipping emissions could represent between six and 14 per cent of total global emissions.⁴⁶

Australia currently has the eighth highest national transport emissions in the OECD and trends indicate this is likely to continue.⁴⁷ The average emissions intensity for new passenger vehicles in Australia in 2014 was 43 per cent higher than the European Union average due to differences in the transport task, consumer preferences and policy settings.⁴⁸

Noxious emissions (such as oxides of nitrogen and particulates) from road vehicles will continue to have an impact on air quality and public health in Australian cities. While air quality in our cities is good by international standards, noxious emissions from road vehicles will continue to remain a concern for regulators. International developments, such as a shift to gasoline direct injection technology, the alleged use of 'defeat devices' by the Volkswagen Group and recent findings by the United Kingdom and Germany of a significant difference in 'tested' and 'on-road' emission levels for diesel vehicles more generally, suggests that further changes to noxious emission standards (to reduce emission limits and improve the integrity of the testing regime) will be necessary to minimise any adverse health impacts from changes in the vehicle fleet.

42 Climate Change Authority, 2015, *Australia's climate policy options – special review – second draft report*, Australian Government, Canberra

43 Department of the Environment, 2015, *Australia's emissions projections 2014–15*, Australian Government, Canberra

44 Bureau of Infrastructure, Transport and Regional Economics, 2009, *Greenhouse gas emissions from Australian transport: projections to 2020*, Working Paper 73, Australian Government, Canberra

45 International Transport Forum, 2015, *Shipping and climate change: where are we and which way forward?*, ITF

46 International Maritime Organization, 2014, *Third greenhouse gas study 2014*, IMO, London

47 Organisation for Economic Co-operation and Development/International Transport Forum, 2014, 'Greenhouse gas emissions database', OECD, Paris

48 National Transport Commission, 2016, *Carbon dioxide emissions intensity for new Australian light vehicles 2015 – Information Paper*, Australian Government, Canberra

Fuel efficiency and emissions reduction

Advancements in technology are being used to increase fuel efficiency and reduce emissions.

With Australia committing to reduce greenhouse gas emissions by 26 to 28 per cent on 2005 levels by 2030, and other countries adopting new targets to reduce greenhouse gas emission levels further, the adoption of improved fuel efficiency and cleaner forms of fuel is expected to increase over coming decades. Global initiatives favouring low-carbon transport are gaining momentum in developed economies, including the increased use of electric vehicles and alternative aviation fuels.

In the road transport sector, emissions can be reduced through changes to vehicle design such as greater use of light-weight materials and improvements to transmissions and engine management systems. There are also technologies that can provide real-time feedback to encourage more efficient driving practices.

Manufacturers are developing hydrogen fuel cell vehicles and are continuing to improve the battery life of other electric and plug-in hybrid vehicles to increase the distance travelled before refuelling/recharging is required. These measures, and the reducing costs of technology, will improve the viability of these vehicles as alternative options for consumers.

In the aviation sector, environmental performance has improved dramatically since the early 1990s through technological innovation and operational changes, including improved fuel efficiency, the use of voluntary carbon offset schemes and the uptake of alternative fuels. In Australia, most new and some older aircraft are now fitted with navigation systems that use satellite-assisted guidance to fly with a high degree of accuracy, and with only a small variation in the actual routes flown from one aircraft to another. The International Civil Aviation Organization (ICAO) is also aiming to reduce emissions from international civil aviation by two per cent a year until 2050, and obtain carbon-neutral growth from 2020.⁴⁹

In the maritime sector, a number of domestic shipping companies are converting vessels to use new liquefied natural gas fuels, resulting in a significant reduction in CO₂ emissions.

Domestically in the maritime sector, the Energy Efficiency Design Index (EEDI) has been established to improve energy efficiency for ships built from 2013. Under this regulation—and provided that the required energy efficiency level is attained—ship designers are free to use the most cost-effective solutions. The EEDI standards will be phased in from 2013 to 2025.

It will be important to harmonise Australian and international vehicle emission standards to ensure Australia can take advantage of the latest technologies to reduce emissions.

There is yet to be international agreement on a standardised approach to measuring CO₂ emissions from heavy vehicles at a whole vehicle level due to the wider range of heavy vehicle configurations. This may limit the potential to reduce heavy vehicle greenhouse gas emissions by direct regulation. However, further regulatory reforms to encourage the uptake of more efficient and higher productivity vehicles (through performance based standards) will help reduce greenhouse gas emissions from the heavy vehicle fleet.

49 International Civil Aviation Organization (ICAO), 2013, *ICAO Assembly Resolution A38-18 on climate change*, ICAO, Montreal



Further changes to international standards may lead to technological improvements that will be incorporated into Australia's domestic fleet. Electric and hydrogen-cell vehicles present both a challenge and opportunity as they require new refuelling and recharging infrastructure.

Electric vehicles could allow users to recharge vehicles at home, and reforms to electricity pricing may be required to ensure the electricity grid can use the latent battery storage capacity in managing any consequential changes to demand. To effectively reduce greenhouse gas emissions, Australian electric vehicles will need an electricity generation source that produces less than 600 tonnes of CO₂ per gigawatt-hour. Current coal-fired plants produce approximately 1,000 tonnes of CO₂ per gigawatt-hour. If a less emissions intensive source of electricity generation is not used, Australia will not receive any greenhouse gas reduction benefits from electric vehicles.⁵⁰

As with electric vehicles, any greenhouse gas reduction benefits from hydrogen fuel cell vehicles would depend on how hydrogen fuel is produced. The US Department of Energy's findings suggest that hydrogen fuel produced by the most common method (natural gas reforming) would result in lower greenhouse gas emissions relative to petrol vehicles.⁵¹

⁵⁰ Pond, S, 2015, *Low carbon transport on the move*, The United States Studies Centre, Sydney

⁵¹ United States Department of Energy, 2016, Office of Energy Efficiency & Renewable Energy, *Hydrogen production: natural gas reforming*, Washington

TRANSPORT AS A SERVICE

Services for people

Transport services connect people to jobs, their communities and essential services. In 2009–10, average weekly household expenditure on transport related goods and services was \$226.13, which accounted for approximately 18.3 per cent of total household expenditure nationally. Average household expenditure on transport has decreased from 16.3 per cent of total goods and services expenditure in 1984 to 15.6 per cent in 2009–10.⁵²

In Australia, driving remains by far the preferred means of transport within capital cities accounting for 80 per cent of travel.⁵³ Light passenger vehicles account for approximately 75 per cent of the vehicles on our roads.⁵⁴ The morning travel peak has increased in duration and sharpened in impact in the last 30 years, greatly increasing the pressure on urban transport networks. This appears to be driven in part by an increase in discretionary travel in the morning peak period.⁵⁵ The avoidable social costs of congestion in the eight Australian capitals was estimated to be approximately \$16.5 billion in the 2015 financial year (in 2010 dollars), rising from about \$12.8 billion in 2010. These costs are projected to rise further to about \$30 billion by 2030 in the absence of measures to cut congestion.⁵⁶

One in eight people in Australian capital cities use public transport for daily commuting.⁵⁷ After two decades of decline, public transport patronage has increased since 1996. The largest increases in mode share over this period were in Perth and Melbourne (both 2.2 percentage points) and Sydney (2.1 percentage points).⁵⁸

The increase in public transport patronage has occurred mainly on rail systems. In Australian capital cities, 65 per cent of kilometres travelled on public transport occur on heavy rail and 30 per cent on buses. Light rail and ferries make up the remaining five per cent.⁵⁹

Increases in public transport use are thought to be primarily the result of population growth rather than modal shifts from the use of private vehicles. Light vehicle ownership and use will go through a series of disruptions over the coming decades: the combination of autonomous vehicles and shared economy models will likely change light vehicle usage patterns as well as ownership and service access models. The impacts will also likely disrupt (positively or negatively) public transport service provision.

52 Australian Bureau of Statistics (ABS), 2010, *Household Expenditure Survey*, Catalogue number 6530.0, ABS, Canberra and ABS, 1984, *Household Expenditure Survey*, Catalogue number 6530.0, ABS, Canberra. Note 2009–10 expenditure levels are based on transport related goods and services within the transport and recreation groups, whereas the change in expenditure is based on the transport group.

53 Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2015, *Australian Infrastructure Statistics Yearbook 2015*, Australian Government, Canberra

54 ABS, 2015, *Motor Vehicle Census, Australia*, 31 Jan 2015, Catalogue number 9309.0, ABS, Canberra

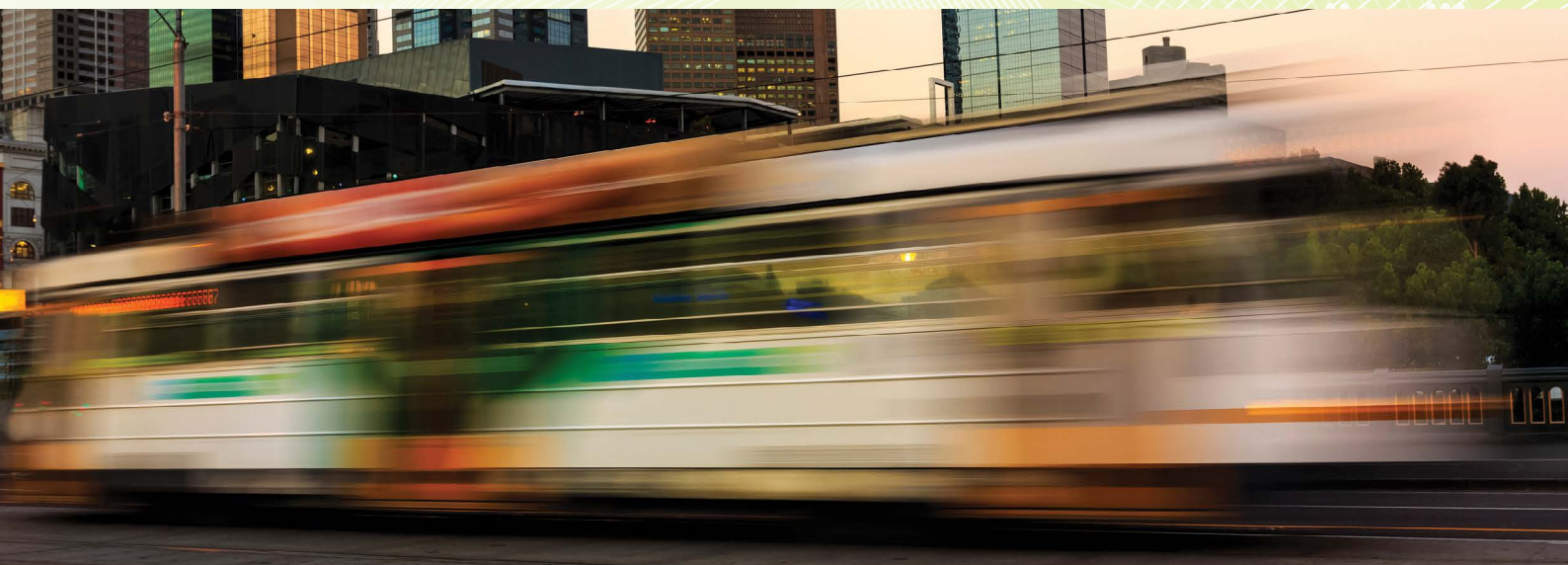
55 Department of Infrastructure and Regional Development, 2012, *State of Australian Cities 2012*, Australian Government, Canberra

56 BITRE, 2015, *Traffic and congestion cost trends for Australian capital cities*, Information Sheet 74, BITRE, Australian Government, Canberra

57 BITRE, 2015, *Australia's commuting distance: cities and regions*, Information Sheet 73, BITRE, Australian Government, Canberra

58 Mees, P and Groenhart 2012, *Transport policy at the crossroads: travel to work in Australian capital cities 1976–2011*, School of Global, Urban and Social Studies, RMIT, Melbourne

59 BITRE, 2014, *Urban public transport: updated trends*, Information Sheet 59, Australian Government, Canberra



Globally, passenger air transport has recorded unprecedented growth rates each year since 2010.⁶⁰ In Australia, high levels of domestic and international passenger growth at major airports are already testing the capacity of airport infrastructure during peak periods. International air travel will grow strongly to 2030, with both domestic and international passenger movements through capital cities almost doubling. The largest growth at major airports is expected to occur on the Gold Coast (139 per cent), followed by Perth (135 per cent) and Darwin (127 per cent).⁶¹

In regional areas, the aviation sector is adjusting to the mining industry's transition from a construction phase to the operational phase of production, which has seen a decline in the demand for fly-in fly-out services. In contrast, the lower Australian dollar has seen an increase in demand for services to tourism destinations.

Most of the infrastructure that Australians will use in 2031 has already been built.⁶² Looking ahead, addressing service gaps and capacity constraints in transport services for people will remain a challenge in the face of growing and ageing populations and the corresponding pressures on government budgets. Australia must be smarter and open to new ways of providing transport services if we are to gain the greatest return on our existing investments, and ensure transport infrastructure is positioned to adapt to changing demands.

Balancing public expectations with an increasing need for efficiency is also a growing challenge. This is particularly the case with the safety and security of transport services – both being fundamental concerns of governments and industry. While transport fatality rates have continued to decline due to improvements in infrastructure regulation, technology and industry practices, regulation is also becoming increasingly complex as business models and technology change rapidly. Security threats will remain for the foreseeable future, and like safety, the range of compliance activity and the tools required to ensure the system is secure has grown. Maintaining the balance between protecting the travellers from the impacts of security threats and responding to growth in demand for services will remain a major challenge for regulators and industry.

60 Organisation for Economic Co-operation and Development/International Transport Forum, 2015, ITF Transport Outlook 2015, OECD/ITF, Paris

61 Based on Bureau of Infrastructure, Transport and Regional Economics data, analysis and projections.

62 Infrastructure Australia, 2015, *Australian infrastructure audit: our infrastructure challenges executive summary*, Australian Government, Canberra

Services for freight

Effective and competitive transport services are critical to Australia's access to markets and to our prosperity. World road freight volumes are growing strongly, driven by major manufacturing economies and growing consumer markets such as China and India.⁶³ Australia relies on its freight transport services to connect us to world trade – from the farm gate through to our major ports and airports.

Australia's national land freight task is expected to grow by around 75 per cent between 2011 and 2031.⁶⁴ Over three quarters of Australia's non-bulk freight is carried on roads,⁶⁵ dominating freight movements between Sydney, Melbourne, Brisbane and Adelaide.

Australia's rail networks also play a key role in meeting the national freight task and supporting the economy. In 2013–14 freight rail carried 1.3 billion tonnes of freight and contributed approximately \$5.1 billion to the Australian economy.⁶⁶ Of this volume, around 98 per cent was bulk freight (predominately resource and agricultural export products to ports) and two per cent was intermodal freight (containerised traffic). Rail dominates non-bulk freight movements between Perth and the eastern states.⁶⁷

By 2040, rail freight is expected to increase above its 2010 level by 130 per cent, mainly due to continuing expected (although somewhat subdued) growth in mineral exports.⁶⁸ Automation such as driverless trains will continue to extend into the rail sector, particularly rail freight.

Maritime transport plays an important role in Australia's freight task through the movement of low cost, bulk goods between ports. In 2011–12 domestic coastal shipping accounted for 17 per cent of Australia's total freight task (measured as billion tonnes per kilometre).⁶⁹

Maritime transport also underpins Australia's international trade. Over the past two decades port throughput, as measured by containerised cargo, increased by between 159 to 453 per cent across the five major Australian port terminals: Brisbane, Sydney, Melbourne, Adelaide and Fremantle.

The efficiency of ports and the transport infrastructure that links them to various markets is vital in reducing import and export costs. Port productivity and efficiency has been driven by capital improvements, including the expansion of existing terminals, new cranes and automation of stevedoring operations. Wharf-side and land-side indicators suggest little improvement in the productivity and efficiency across Australia's five major container ports since 2014. However, the historical trend has been regular improvements in these indicators.⁷⁰

Capacity expansions and asset maintenance are key challenges due to the dominance of maritime in transporting Australia's commodity exports. The sector will remain crucial to Australia seizing economic opportunities in the decades ahead.

By value, air freight is a critical component of Australian international trade. Air freight will continue to grow as demand for just-in-time delivery increases for items such as high value manufacturing and mining products, perishables such as food, time urgent medical products and market flowers. Air freight processing centres covering security, quarantine, customs and quality control will need to remain flexible to keep pace with demand. Remotely piloted aircraft systems (or drones) are also likely to play an increasing role in remote freight delivery, particularly for small items.

63 Organisation for Economic Co-operation and Development/International Transport Forum, 2015, 'ITF transport outlook 2015', OECD/ITF, Paris

64 Based on Bureau of Infrastructure, Transport and Regional Economics (BITRE) data, analysis and projections.

65 BITRE, 2015, *Yearbook 2015: Australian infrastructure statistical report*, Australian Government, Canberra

66 BITRE and Australasian Railway Association, 2015, *Trainline 3: statistical report*, Australian Government, Canberra

67 BITRE and Australasian Railway Association, 2014, *Trainline 2: statistical report*, Australian Government, Canberra

68 Based on modelling in BITRE, 2014, *Freightline 1 – Australian freight transport overview*, Australian Government, Canberra

69 BITRE, 2015, *Yearbook 2015: Australian infrastructure statistical report*, Australian Government, Canberra

70 BITRE, 2015, *Waterline 57, Statistical Report*, Australian Government, Canberra



Services for network corridors

Transport infrastructure can change the spatial organisation of cities so that labour and capital can be used more efficiently and flexibly.⁷¹ These deeper markets and closer connections promote competition and greater specialisation by workers and firms. This in turn enhances innovation for a more dynamic economy.⁷²

Growing demand for transport infrastructure investment in Australian cities has increased the focus on infrastructure planning, land-use and corridor protection. Based on current trends, the avoidable social costs of congestion is estimated to increase in all eight Australian capital cities by 2030. That will in turn constrain productivity. In Sydney, congestion is estimated to increase from \$6.1 billion in 2015 to up to \$12.6 billion by 2030.⁷³

By shaping the pattern of development and influencing land-use planning decisions, governments at different levels can work together to help create an efficient transport network that will facilitate sustainable urban and regional development. The ability to invest in any future infrastructure relies on identifying potential transport corridors and land sites early. All levels of government need to work together to preserve these corridors.

Ineffective corridor protection can make infrastructure projects vastly more expensive and reduce productivity due to congestion. Potential negative outcomes include corridors being 'built out', increasing the need for tunnelling and remedying amenity impacts. Infrastructure Australia, for example, has indicated that the need to build a tunnel could multiply the cost per kilometre by approximately eight to 10 times.⁷⁴

Globally, policy trends towards transit-oriented development are expected to continue, with the aim of alleviating the impacts of urban sprawl and congestion, such as lost productivity, social exclusion, emissions and health impacts.⁷⁵ Countries currently implementing transit-oriented development include Denmark, the United Kingdom and regions of the United States (such as California's Bay Area), where residential and commercial developments are designed to maximise access to public transport services.

71 Department of Infrastructure and Regional Development, 2015, *State of Australian Cities 2014–2015*, Australian Government, Canberra

72 Lowe, P, 2013, 'Productivity and Infrastructure', speech presented to the IARIW–UNSW Conference, Sydney, NSW, 26 November 2013

73 Bureau of Infrastructure, Transport and Regional Economics, 2015, Information sheet 74, *Traffic and congestion cost trends for Australian capital cities*, Australian Government, Canberra

74 Office of the Infrastructure Coordinator, 2013, *Development of a national corridor protection strategy*, Infrastructure Australia, Canberra

75 Tourism and Transport Forum, 2010, *The benefits of transit oriented development*, Tourism and Transport Forum, Sydney

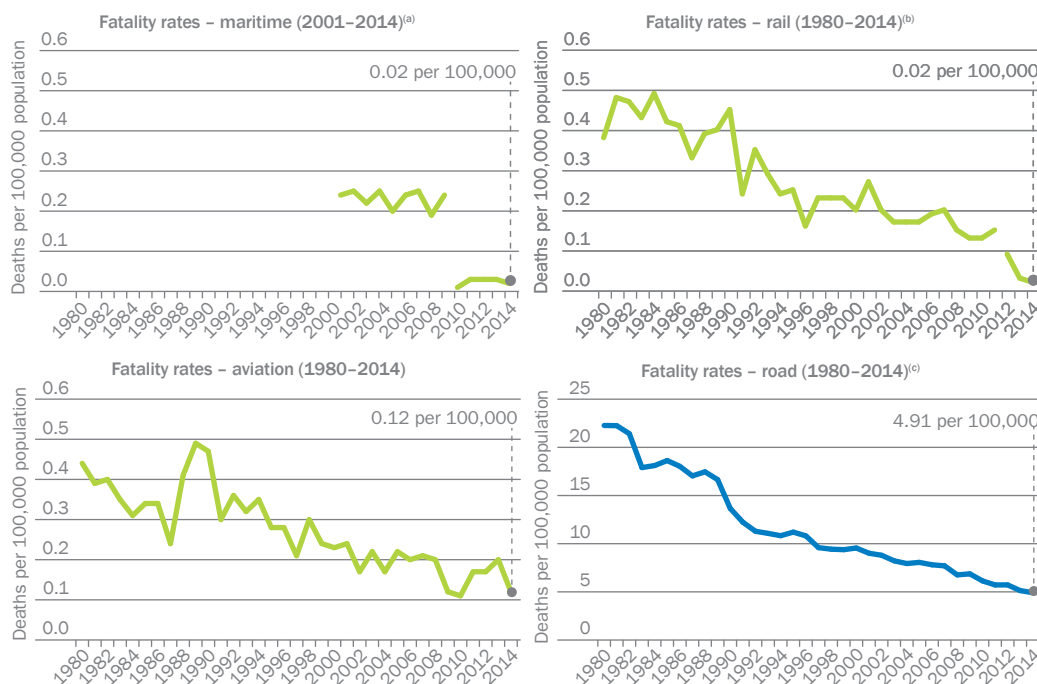
Inefficiency in one part of a network or in one mode of transport has impacts in other parts of the network or modes. For example, land side productivity of ports impacts the productivity of maritime trade,⁷⁶ road capacity constraints surrounding airports can affect the timely and efficient movement of goods and people, and a lack of public transport can force more people into private vehicles (or active travel). A lack of price signals in one mode can impact competitiveness and investment decisions as well as distort choices between transport modes.⁷⁷

Safety and security

Improvements across transport safety and security are likely to continue, driven by developments in regulation, technology and industry practices.

Transport fatality rates have continued to decline over recent decades as indicated below in Figures 3.1 to 3.4.

Figures 3.1, 3.2, 3.3 and 3.4: Fatality rates by transport mode



Source: Bureau of Infrastructure, Transport and Regional Economics Yearbook 2015: Australian Infrastructure Statistics

NB: Time-series are not consistent due to data limitations

(a) Marine fatalities data from 2010 onwards were compiled using a different methodology and should not be compared with earlier results.

(b) Rail fatality and serious injury data from 2012 onwards excludes suspected suicide and trespass occurrences. They were compiled using new methodology and should not be compared with earlier results.

(c) Y-axis range is not the same as other transport modes.

Today, road fatalities still account for the highest number of deaths, at 4.91 annual deaths per 100,000 people—41 times the rate for aviation. Around half of all road-related deaths are from either head-on or single vehicle run-off-road crashes.⁷⁸

76 Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2015, *Waterline 57 statistical report*, Australian Government, Canberra

77 Based on *The Australian Government Competition Policy Review*, 2015, Australian Government, Canberra

78 BITRE, 2015, *Road trauma Australia, 2014 statistical summary*, Australian Government, Canberra



Photo courtesy of VicRoads

Road crashes are estimated to cost the Australian economy \$27 billion each year.⁷⁹ Between 2004 and 2015 accidents involving articulated trucks accounted for 9–11 per cent of road fatalities.^{80, 81}

In 2014, the road transport industry fatality rate was more than 10 times the national average. It was the most dangerous industry ahead of agriculture, forestry and fishing. Although the industry makes up only two per cent of the Australian workforce it accounts for 21 per cent of workers killed.⁸²

In 2015, there were 1,205 fatalities on Australian roads, a decrease of 61.9 per cent from 1965 levels (3,164 fatalities). Compared to 2015, projections to 2030 indicate road fatalities are likely to fall by around 13.0 per cent to 1,048 road deaths.⁸³

While road deaths have declined steadily, hospital data suggests the rate of road traffic injuries has increased from 141.7 cases per 100,000 people in 2000 to 160.3 per 100,000 people in 2013. Of those hospitalised, the number of people with life threatening injuries has also increased.⁸⁴

Meanwhile, in the rail sector, collisions with infrastructure and derailments are the most common form of accidents. In 2013, 84 of the 93 notified fatalities were acts of suspected suicide.⁸⁵ Overall, the rate of fatalities has decreased dramatically in the rail sector since the late 1980s.⁸⁶

79 Department of Infrastructure and Regional Development, 2016, *Road Safety*, Australian Government, Canberra

80 Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2016, 'Australian Roads Death Database', Australian Government, Canberra

81 Note: Articulated trucks refer to trucks with pivots. A B double truck is an example of this. Heavy rigid trucks are vehicles with three or more axles and a gross vehicle mass of more than 8 tonnes.

82 Safe Work Australia, 2015, *Work-related Traumatic Injury Fatalities Australia 2014*, Safe Work Australia, Canberra

83 BITRE, (2016, forthcoming), Information Sheet 76, *Developing National Road Safety Indicators for Injury*, Australian Government, Canberra

84 BITRE, (2016, forthcoming), Information Sheet 76, *Developing National Road Safety Indicators for Injury*, Australian Government, Canberra

85 BITRE, 2015, *Trainline 3: Statistical Report*, Australian Government, Canberra

86 BITRE, 2015, *Yearbook 2015: Australian infrastructure statistics*, Australian Government, Canberra

Over the last ten years, maritime safety has also experienced modest improvements across areas related to fire safety, lifesaving appliances and pollution prevention.

Internationally, the rate of aircraft accidents is at an historic low, despite the series of high profile crashes and incidents in recent years.⁸⁷ In 2014, the Australian domestic aviation fatality rate was the second lowest on record since 1971.⁸⁸

Looking forward, advancements in technology that reduce the likelihood of human error could reduce road fatalities by 30 per cent by 2033.⁸⁹ Consequently, it is crucial that regulatory settings are appropriate and do not impede improved automation.

The regulatory framework for transport security adopts international standards and recommended practices. Transport security risks and measures can impact operations across aviation, the air cargo supply chain, maritime (including offshore oil and gas) and mass passenger transport systems such as road, rail, trams and ferries.

Air travel to and from Australia is forecast to see overseas visitors increase by around 140 per cent from 15.1 million in 2014–15 to 36.6 million by 2030–31.⁹⁰ Although the bulk of this increase will likely be concentrated through relatively few airports, stretching existing capacity.⁹¹

The domestic and global maritime sectors are also forecast to expand over coming decades. Between 2014 and 2030, vessel activity at Australian ports is forecast to grow by 34 per cent.⁹²

Transport systems world-wide continue to be attractive targets for terrorists. Elements of transport systems such as terminals and intermodal hubs are inherently vulnerable to attacks as large numbers of people gather at predictable times.

The emergence of new and evolving technologies across transport sectors also influences the threat environment. Technological developments such as the evolution of improvised explosive devices which are difficult to detect will prove an ongoing challenge to screening technologies.

In addition, overcoming cyber security threats will continue to be one of Australia's national security priorities. Improvements in the scale, sophistication and perpetration of cyber-crime will make these increasingly difficult to identify and defeat.

Australia's threat environment is complex and dynamic. Currently the majority of transport security threats have origins or linkages outside Australia.

Transport regulation is becoming increasingly complex as business models and technology change rapidly. Balancing public expectations of safety and security with increasing demand for efficiency will continue to be a challenge.

87 Evershed, N, 2015, 'Aircraft accident rates at historic low despite high-profile plane crashes', *The Guardian*, 25 March

88 Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2015, *Yearbook 2015: Australian infrastructure statistics*, Australian Government, Canberra

89 McAuley, J, Cregan, M, and Risbey, T, 2015, *The impact of airbags, electronic stability control and autonomous emergency braking on Australian light vehicle fatalities: methodology and findings*, BITRE, Canberra

90 BITRE, 2012, *Air passenger movements through capital and non-capital city airports to 2030–31*, Report 133, Australian Government, Canberra

91 Department of Infrastructure and Regional Development, 2014, *Transport Security Outlook to 2025*, Australian Government, Canberra

92 BITRE, 2010, *Australian Maritime Activity to 2029–30*, Australian Government, Canberra and BITRE, 2015, *Yearbook 2015: Australian infrastructure statistics*, Australian Government, Canberra

Revenue and investment

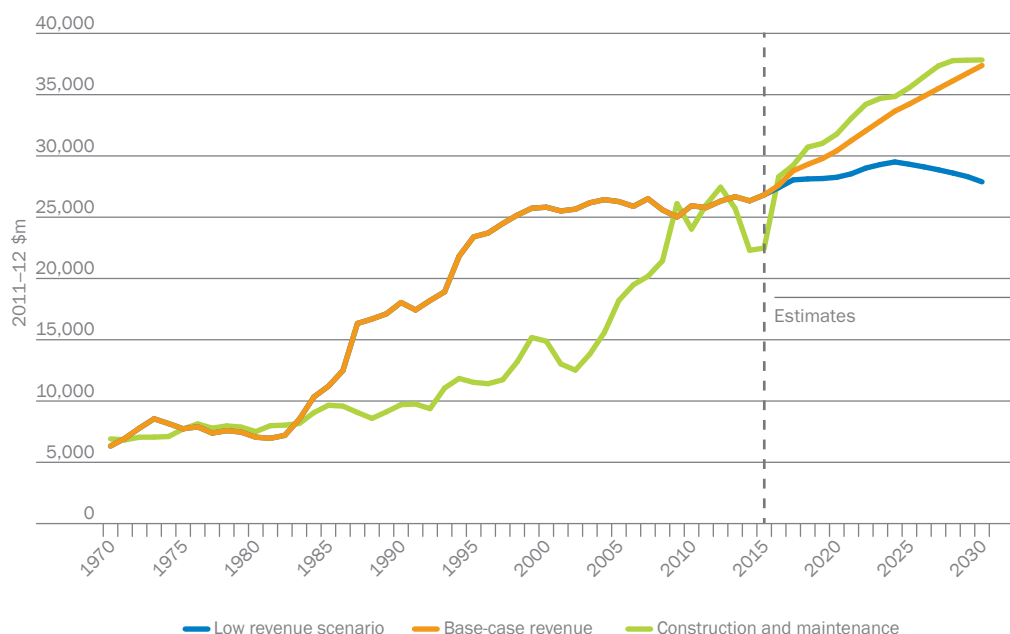
In Australia, governments still primarily own and finance road infrastructure and assets.⁹³ Infrastructure, transport and planning are among the highest areas of the Australian Government budget over the past 11 years, with spending growth well above GDP growth.⁹⁴ The levels of private versus public investment vary greatly across transport modes, with roads having the lowest proportion of private investment of all. Airports, airlines, ports and shipping have been through extensive periods of privatisation and liberalisation.

There have been increases in private sector financing through Public Private Partnership (PPP) models in recent years, and also for the construction and operation of roads. The commercialisation of roads is mainly limited to newly constructed toll roads that are usually major urban arterial roads or interurban highways.

The three tiers of government in Australia each raise funding to varying degrees from transport-related activities. In 2013–14 approximately 63 per cent of the total road-related revenue collected was attributable to Australian Government taxes and charges, 30 per cent to state and territory charges, and seven per cent to tolls charged by the private sector.⁹⁵ Local governments also fund transport infrastructure through rates charges.

While there is only very limited hypothecation of road-related revenue to road expenditure, the cost of building and maintaining our roads is increasing at a rate faster than road-related revenue collected from motorists in taxes and charges as indicated in Figure 3.5.

Figure 3.5: Road-related revenue and expenditure estimates to 2030 (2011–12 prices)



Source: Bureau of Infrastructure, Transport and Regional Economics, 2015, *Australian Infrastructure Statistics Yearbook 2015*, Table 1.4, p.42 and earlier issues and BITRE estimates.

⁹³ Responsibility for road infrastructure provision lies primarily with state, territory and local government.

⁹⁴ Terrill, M, 2015, *Submission to Select Committee into the Abbott Government's Budget Cuts*, Grattan Institute, Sydney

⁹⁵ Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2015, *Australian Infrastructure Statistics Yearbook 2015*, Table 1.4, p.42 (and earlier issues) and BITRE estimates.



Figure 3.5 shows indicative modelling of future revenue and construction and maintenance costs to 2030. These scenarios outline the growing challenge to fund and, importantly, maintain our roads. The base case projection is for revenue and construction and maintenance costs to grow roughly in line with each other over the next 15 years (with taxes and charges increasing to cover growing costs). However, as new technology changes the way we travel – with electric vehicles, highly fuel efficient cars, car sharing and autonomous cars becoming more common – there is a likely future decline in fuel excise, registration, licencing, policing and non-compliance fine revenues to governments. The low revenue scenario highlights the risk that these technologies will challenge future governments' ability to fund transport infrastructure.

Except in the case of some state and territory registration fees, road-related fees and charges are generally not allocated to road expenditure but go towards general revenue. Motorists in Australia therefore have little visibility of the use of existing taxes and charges because of their variety and complexity.

As an enabler of economic growth, the efficiency and effectiveness of Australia's transport services directly impacts Australia's future economic and individual prosperity. There are significant opportunity costs from a failure to plan and make investments that are informed by the trends that will impact the transport sector.



REGIONAL DEVELOPMENT

Demographic change

The demographic structure of regional Australia differs from that of metropolitan areas. Regional population growth is slower than in cities, primarily due to higher rates of overseas migration into the major cities. Two of the most significant influences on the demographic structure of regional communities are population ageing and population mobility.

Australians are getting older and this change will have a greater impact in regional Australia. In 2027, the number of people aged 65 and over in both inner regional and outer regional areas is expected to increase by approximately five and six per cent respectively.⁹⁶ In contrast, the increase for the same age group in major cities is expected to be around half as much. This increase in ageing populations will be more difficult to support in regional Australia where smaller populations and longer distances make services and transport options more difficult to fund and provide. An older age structure will also likely result in a decline in workforce participation. However, ageing regions can also create employment opportunities in growth industries such as the aged-care sector.

Australia has a very mobile pattern of population settlement. More than 40 per cent of Australians changed their place of residence over the five years between 2006 and 2011.⁹⁷ In this period, inner regional Australia was the only remoteness category to have a net gain of internal migrants.⁹⁸

In contrast, international migrants of prime working age are typically attracted to major cities, including several of our largest regional centres, rather than small regional communities.⁹⁹ This settlement pattern has contributed to the expansion of our cities while also increasing the pool of skills in local and national labour markets.

While the majority of humanitarian settlement occurs in metropolitan areas, many entrants have also successfully settled in regional communities or have subsequently moved to regional locations including Shepparton, Launceston, Albury, Coffs Harbour, Toowoomba, Townsville and Mount Gambier.

Australia is highly urbanised. This pattern has seen the proportion of the population living in towns and rural areas declining since the early 20th century.¹⁰⁰ Increasing numbers of people are moving to larger regional towns to access services, amenities and job opportunities.

Two thirds of Australia's population lives in a capital city, however there are also many regional people who reside in an urban setting. For example, approximately 1.9 million Australians live in cities with populations of between 25,000 and 100,000 residents.¹⁰¹

96 National Aged Care Data Clearing House, *Population projections, 2012 (base) to 2027 for all states and territories at Statistical Area Level 2 (SA2) by sex and age*

97 Bell, Charles-Edwards, Ueffing, Stillwell, Kupiszewski and Kupiszewska, 2015, Internal migration and development: comparing migration intensities around the world, *Population and development review*, 41 (1): 33-58

98 Department of Infrastructure and Regional Development, 2014, *Progress in Australian Regions: Yearbook*, Australian Government, Canberra

99 Productivity Commission, 2015, *Migrant intake into Australia*, draft report, November 2015

100 Bureau of Infrastructure, Transport and Regional Economics, 2014, *The evolution of Australian towns*, Australian Government, Canberra

101 Australian Bureau of Statistics, 2011, *2011 Census of population and housing*, ABS, Canberra

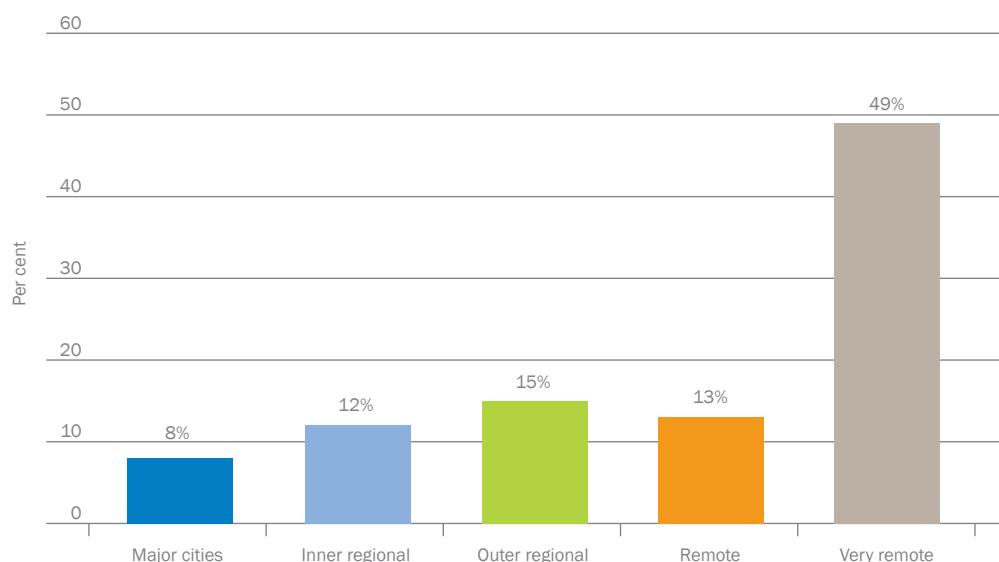


Locational disadvantage

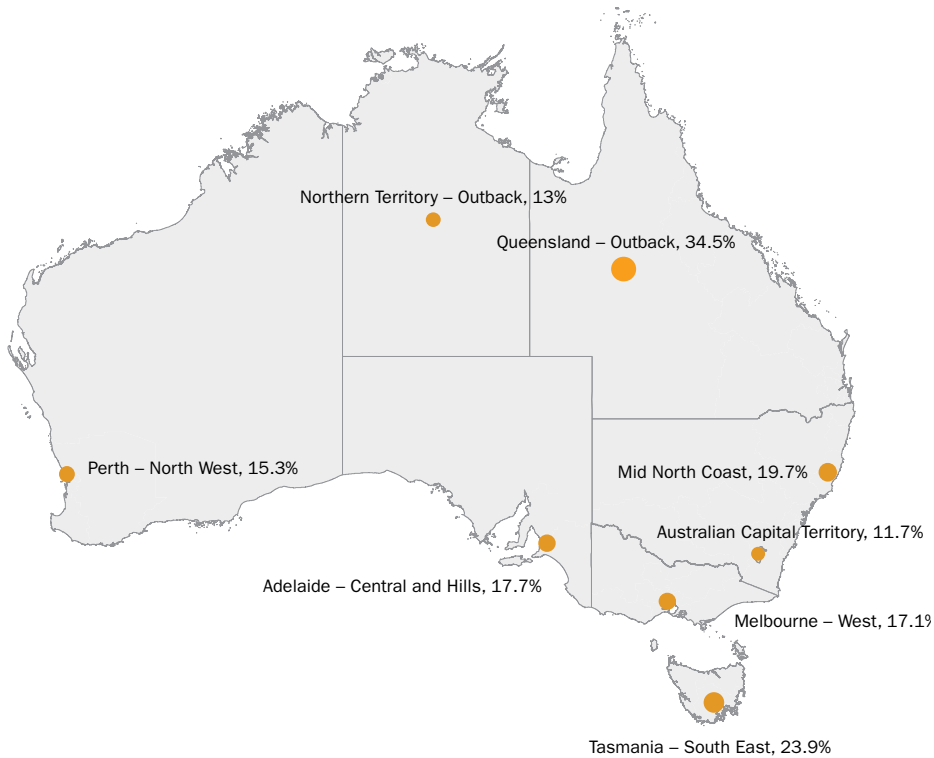
Regional Australia is characterised by variation in socio-economic advantage and disadvantage. It can be more challenging for regional populations to participate in the broader economy and mitigate the risk of long-term socio-economic disadvantage. Outside the major cities, there is also typically less access to health and education services.

This locational variation is illustrated in Figure 4.1 below which highlights the disparity between the proportion of the population in the lowest socio-economic class in regional and remote areas and that of major cities (the absolute number of people is lower in remote locations).

Figure 4.1: Population in lowest socio-economic indexes for areas (SEIFA) decile, 2011



Source: ABS 2011, Socio-economic Indexes for Areas (SEIFA) (cat. no. 2033.0.55.001) Regional Labour Market Outcomes.

Figure 4.2: Regions with the highest youth unemployment in each Australia state and territory

Source: ABS 2016, Labour Force, Australia, March 2016, 15–24 year olds, 12 month moving average.

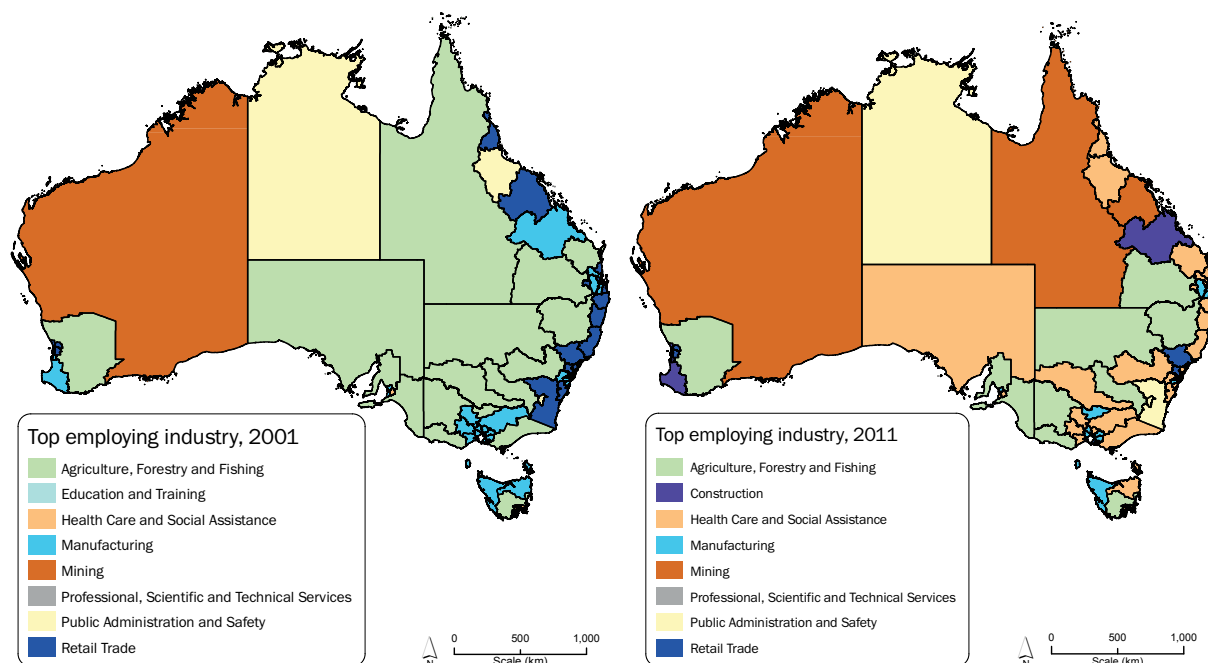
It is more difficult for people in regional Australia to achieve the same labour market outcomes when compared to their major city counterparts. The differences in regional labour market disadvantage can be attributed to a number of factors including a region's access to higher education, industry diversity, transport networks and the skill level of its labour force.

This disadvantage is particularly pronounced in young adults (15 to 24) who are disproportionately affected by the lack of employment opportunities and economic downturns. Youth unemployment is consistently twice the rate of the overall working population. This trend is exacerbated in regional areas where young adults engagement in full-time work or study declines with increasing remoteness.

Industry across regions

Trade liberalisation and other microeconomic reforms have contributed to significant structural change in regional Australia. Between 2001 and 2011, major trends at the national level included employment growth in mining and construction, and health care and social assistance industries. Conversely, the agriculture, forestry and fishing; retail trade and manufacturing industries all declined over the same period. The services sector is now Australia's major employer in both regional and urban areas.

Figure 4.3: Largest employing industries, 2001 and 2011



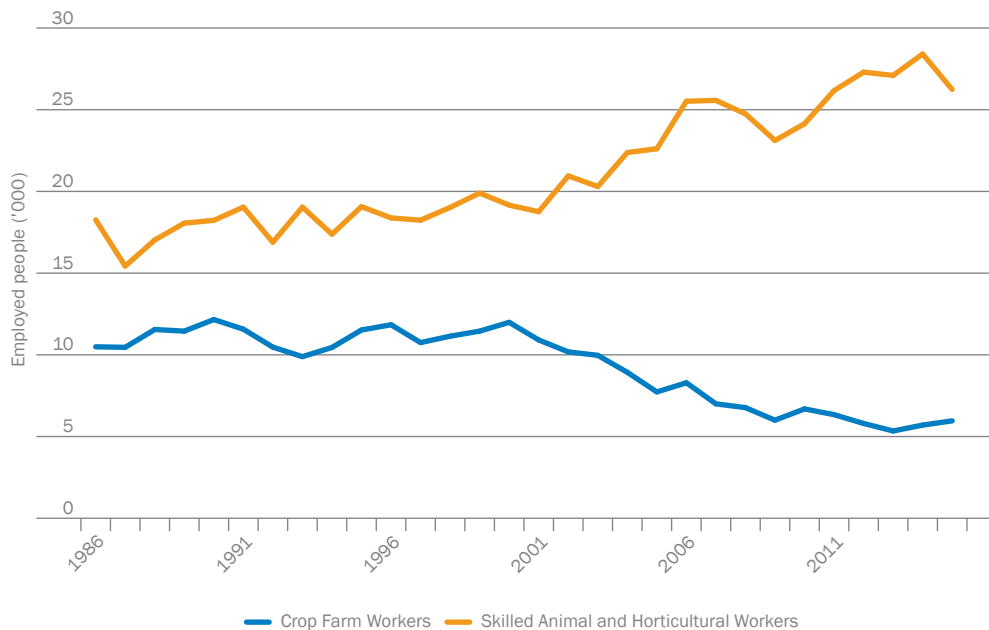
Source: Department of Infrastructure and Regional Development 2015, State of regional Australia: progress in Australian regions 2015.

Into the future, some of the most significant factors influencing employment will include change in industry structure, technological advances and globalisation. The trend towards employment requiring skills and training is also set to continue. The CSIRO estimates that while 44 per cent of Australian jobs are potentially at high risk of automation, this technology will also be responsible for the creation of new jobs.¹⁰²

Agriculture, one of Australia's largest regional industries, provides an example of the effect of mechanisation and automation on employment opportunities. Employment in agriculture has long been in decline as improved technology and farming practices lift productivity. This mechanisation has led to a reduction in low-skilled roles, while simultaneously creating job growth in higher skilled roles. For example, reduced employment in low skilled crop farming occupations has been more than offset by growth in employment in skilled animal and horticultural roles. Figure 4.4 below illustrates this trend.

¹⁰² Hajkowicz, Reeson, Rudd, Bratanova, Hodggers, Mason and Boughen, 2016, *Tomorrow's digitally enabled workforce: megatrends and scenarios for jobs and employment in Australia over the coming twenty years (Megatrends)*, CSIRO

Figure 4.4: Shift to higher skilled occupations in the agriculture industry



Source: ABS, Labour Force, Australia, detailed, quarterly, November 2015.

Another recent example of structural change is the mining sector. Since the middle of the last decade, the mining industry has grown and delivered strong employment growth in some regional and remote areas.

However, as the industry transitions to the production phase, greater automation will reduce jobs. Over the five years to November 2020, employment in the mining industry is projected to decrease by 14.1 per cent nationally.¹⁰³ This is likely to constrain economic growth in regional communities, which have supplied mining jobs, or where mining exploration and construction has been supported by local industry.

A projected growth area for regional economies is in the human services-related industries, particularly health care and social assistance for an ageing population. This will have significant implications for regional populations as service industries are more likely to cluster in regional centres than in smaller towns and rural areas.

Tourism and related industries such as accommodation, food services and retail trade are also expected to continue to deliver economic growth in regional areas with help from the low Australian dollar.¹⁰⁴

Tourism related industries currently contribute approximately 20 per cent of total employment in regional Australia.^{105, 106}

To capitalise on the positive influence of structural change, innovation and science will be critical for Australia to deliver new sources of growth and maintain high-wage jobs. Innovative firms are more competitive, more able to capture increased market share and more likely to create jobs in knowledge intensive industries.¹⁰⁷

¹⁰³ Department of Employment, 2016, *Industry employment projections – 2016 report*, Australian Government, Canberra

¹⁰⁴ Tourism Research Australia, 2015, *State of the industry 2015*, Australian Government, Canberra

¹⁰⁵ Department of Employment, 2014, *Industry employment projections – 2015 report*, Australian Government, Canberra

¹⁰⁶ Total employment (not full time equivalent) for the three industry categories of accommodation and food services, retail trade, and arts and recreation services were used as a proxy

¹⁰⁷ Department of Industry and Innovation, 2015, *National Innovation and Science Agenda Report*, Australian Government, Canberra

Knowledge intensive industries are important for regional economies because of their links to innovative products and new production processes, productivity and the creation of well-paying jobs.¹⁰⁸ The highest absolute percentage of employment in knowledge intensive industries is in the major cities (34.5 per cent). However, between 2006 and 2011, the highest growth occurred in very remote Australia (2.8 per cent), albeit from a low base (15.4 per cent).¹⁰⁹

Interconnected regions

Well connected cities and regions can improve economic and social outcomes. The long-term impact of transport infrastructure on development patterns has been well documented. For example, a new road could cause significant economic and social change.¹¹⁰ Transport and communications infrastructure play a key role in both access to services and markets, and will also facilitate access to the jobs of the future.

Faster internet connectivity is bringing the emerging workforces of Asia into direct competition with domestic markets.¹¹¹ Poor mobile phone and broadband coverage was raised by 45 of the 55 Regional Development Australia (RDA) committees in 2013. Some of these also reported that this poor coverage prevented business growth and investment.¹¹²

Many regional areas also reported issues with their public transport system including a lack of reliable, efficient and affordable public transport options and limited services in many areas.¹¹³ This is because the lower population density in regional and remote Australia moderates the viability of some public transport options in the Australian context.

Bureau of Infrastructure Transport and Regional Economics analysis found that the average commuting distance in Australia is 15.6 kilometres. However, these distances are generally higher in areas outside of the major metropolitan centres.¹¹⁴ Low demand increases the cost per trip per user in regional Australia. Innovations such as the emergence of self-driving vehicles and the sharing economy model of low volume vehicle services may assist with this challenge.

For regional businesses to thrive, they need access to local, national and international markets. Australia has a clear comparative advantage in agribusiness, resources and energy, all largely based in regional areas. Furthermore, two-thirds of Australia's total export earnings come from regional industries.¹¹⁵

Physical infrastructure is crucial for ensuring that cities and large regional centres—which are home to many of the gateways to international trade for regions—function effectively to connect people, goods and services to markets. Shipping and ports are an important interface with the land freight task, transporting Australian-made goods and raw materials between major domestic centres, and as access points for international trade.¹¹⁶

108 Department of Infrastructure and Regional Development, 2014, *Progress in Australian regions: yearbook*, Australian Government, Canberra

109 Department of Infrastructure and Regional Development, 2014, *Progress in Australian regions: yearbook*, Australian Government, Canberra

110 Department of Infrastructure and Regional Development, 2014, *The evolution of Australian towns*, Australian Government, Canberra

111 Hajkowicz, Reeson, Rudd, Bratanova, Rodgers, Mason and Boughen, 2016, *Tomorrow's digitally enabled workforce: megatrends and scenarios for jobs and employment in Australia over the coming twenty years* (Megatrends), CSIRO

112 Australian Bureau of Statistics (ABS) 2013, *Research paper: a review of Regional Development Australia committee regional plans*, Cat. No. 1381.0

113 ABS 2013, *Research paper: a review of Regional Development Australia committee regional plans*, Cat. No. 1381.0

114 Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2015, Information Sheet 73, *Australia's commuting distance: cities and region*, Australian Government, Canberra

115 Department of Infrastructure and Regional Development 2016, *Investing in regional growth 2016–17*, Australian Government, Canberra

116 BITRE, 2014, *Freightline 1 – Australian Freight Overview*, Australian Government, Canberra



The future of regional Australia

In future decades, regional Australia will continue to experience a number of challenges relating to its demographic and industry structure. These include population ageing, the changing nature of industry and work, and the provision of cost effective services to a spatially dispersed population.

Emerging modes of innovative service delivery using communications technologies and other mechanisms have potential to provide services to those previously unable to access them through traditional means. Some recent changes in services delivery that are likely to benefit regional Australia include flexible regional models of health services and improved distance education capabilities.

Rapid technological development including digitisation and automation is also likely to pose significant challenges and opportunities for regional Australia. People in unskilled or low-skilled occupations are likely to experience the greatest pressure and new capabilities will be required for the jobs of the future. This may present an additional challenge for regional Australia where there is less access to and fewer educational and training opportunities.

Targeted infrastructure investment, strategic planning and increased connectivity and mobility will help secure the future of regional economies and communities.



WHERE TO FROM HERE?

Knowing where we've been, who our key international, business and community partners are, and riding the technological wave which both challenges and facilitates the enrichment of the Australian way of life, will prove critical in growing our economy through to 2040 and beyond.

Trends has considered the possible impacts on Australia of a range of key global directions over coming decades in addition to economic imperatives requiring government consideration and possible intervention.

Growing markets and recognising opportunities for trade and investment will remain crucial to maintaining and improving our living standards. This will also be vital to accommodating shifts in internal migration and demographic changes as they impact transport and infrastructure needs around the country.

Meanwhile, as disruptive technologies merge into shared economies—such as smartphone-facilitated ride-sharing—they will continue to challenge existing revenue models and test the responsiveness of policy makers and regulators.

Growth in technological capabilities will transform employment, bringing both challenges and opportunities in the future. Knowledge intensive industries—as well as their links to innovative products and new production processes—are important to productivity and the creation of well-paying jobs. Transport and communications infrastructure will facilitate access to many of the jobs of the future.

Ongoing acknowledgement and understanding of the impacts of natural disasters and extreme weather conditions will remain key in designing, planning and locating transport-related infrastructure such as roads and ports.

The challenge, as always, will be to strike a balance between a suitable regulatory framework with flexibility to allow for innovation and space for the necessary research and development to enable economic prosperity.

Working within global regulatory frameworks across the aviation and maritime transport sectors will continue to reinforce our respective roles in the safe and secure transnational movement of passengers and global supply chain connectivity.

Realising alternative local governance frameworks to more effectively manage our regions and deliver better planning outcomes will be required to better meet the predicted expansion of urban areas.

Continued monitoring and analysis of geopolitical and economic global and national trends that impact Australia's development are essential if we are to continue to be a prosperous, innovative and globally competitive nation into the future.

KEY ISSUES AT A GLANCE

Economic Context



Since the turn of the century, the world economy has seen many changes including an increased focus on security, a global financial crisis and rapid economic growth in Asia

Australia's mineral wealth and geographic proximity to the Asia-Pacific region enabled our economy to prosper

Australia could benefit from the rising per capita incomes of Asian countries, with Asia predicted to account for 66 per cent of the global middle-class population by 2030

Infrastructure



Most of the infrastructure that Australians will use in 2031 has already been built

Advances in technology, particularly automation, will improve the efficiency, safety and convenience of transport services

The cost of building and maintaining our roads is increasing at a rate faster than road-related revenue collected from motorists in taxes and charges

Road



Passenger kilometres travelled is expected to grow at two per cent annually to 2030

Light passenger vehicles account for approximately 75 per cent of the vehicles on our roads

The social costs of congestion in Australia's capital cities is projected to rise to \$30 billion by 2030

Australia is entering a 'disruptive period' with the increasing automation of vehicles and infrastructure, and the emergence of a sharing economy

Rail



The continued automation of rail networks will improve rail efficiency and lower service costs

By 2040, rail freight is expected to increase above its 2010 level by 130 per cent

Rail accounts for almost half of the freight activity within Australia, up from 36 per cent in 2000

Public Transport



Patronage has increased to around one in eight commutes in major cities, with demand forecast to continue to rise in line with expected population increases

Based on passenger kilometres travelled, public transport usage is projected to grow by 32 per cent across all capital cities between 2011 and 2030

Cost recovery from public transport fares is low by international standards – low population densities increase the cost and difficulty of providing services



Active Travel

Rising congestion levels and crowded public transport in urban areas can act as an incentive for some people to switch to active transport activities, such as walking and cycling

Melbourne and Sydney have experienced strong growth in commuter cycling



Aviation

For distances greater than 400 kilometres, flying is the preferred means of travel

Crucial to the movement of high-value freight and supports our service industries

International air travel will grow strongly to 2030, with both domestic and international passenger movements through capital cities almost doubling

Growth in demand is already testing capacity at major airports during peak periods



Maritime

The backbone of international trade, carrying 99 per cent of trade by volume

Over the past two decades port container throughput increased by between 159 to 453 per cent across the five major Australian port terminals



Transport Issues

Australia has the eighth highest national transport emissions rate in the OECD

Changes in climate and extreme weather events are capable of causing direct damage to infrastructure assets and operational disruptions with flow-on financial, economic and logistical consequences

Transport fatality rates have continued to decline due to improvements in infrastructure regulation, technology and industry practices



Regional Development

In 2027, the number of people aged 65 and over in regional areas is expected to increase by approximately five to six per cent

Job growth in regions is more likely to come from human services-related industries

Rapid technological development including digitisation and automation is also likely to pose significant challenges and opportunities for regional Australia



AUSTRALIA'S TRANSPORT MODES AT A GLANCE

Road

Driving remains by far the preferred means of transport within cities and for trips of up to 400 kilometres. In 2013, Australia accounted for 1.8 per cent of world passenger road travel and 3.6 per cent of global road freight.¹¹⁷

Commuters make up a large proportion of passenger kilometres travelled, with 60.2 per cent of these travelling to work using a private vehicle.¹¹⁸ Light passenger vehicles account for approximately 75 per cent of the vehicles on our roads.¹¹⁹ Morning travel peak-time has increased in duration and sharpened in impact over the last 30 years, greatly increasing the pressure on transport networks. This appears to be driven in part by an increase in discretionary travel in the morning peak period.¹²⁰

World road freight volumes are growing strongly, driven by major manufacturing economies and growing consumer markets such as China and India.¹²¹ Over three quarters of Australia's non-bulk freight is carried on roads,¹²² dominating freight movements between Sydney, Melbourne, Brisbane and Adelaide.

Efficient transport infrastructure is crucial to unlocking the productivity gains that will underpin Australia's future prosperity.

While there is only very limited hypothecation of road-related revenue to road expenditure, the cost of building and maintaining our roads is increasing at a rate faster than road-related revenue collected from motorists in taxes and charges.

Aspects of the current system of road-related fees and charges, such as fixed registration charges and stamp duty, do not provide a direct signal to road users about the cost of service provision and can encourage inefficient use of road services.

Population growth, urban development and changes in the broader economy will increase future demand on road infrastructure and, based on current trends, congestion is forecast to increase in major urban areas, which will constrain productivity. Without improved congestion management, the net social costs of congestion are expected to almost double over the next 15 years. The avoidable social costs of congestion in the eight Australian capitals was estimated to be approximately \$16.5 billion in the 2015 financial year (in 2010 dollars), rising from about \$12.8 billion in 2010. These costs are projected to rise further to around \$30 billion by 2030 without measures to cut congestion.¹²³

117 Per cent of OECD selected countries: Organisation for Economic Co-operation and Development/International Transport Forum, 2015, *Passenger transport*, OECD

118 Australian Bureau of Statistics (ABS), 2012, *New 2011 Census data reveals more about Australia*, ABS, Canberra

119 ABS, 2015, *Motor vehicle Census, Australia, 31 January 2015*, Catalogue number 9309.0, ABS, Canberra

120 Department of Infrastructure and Regional Development, 2012, *State of Australian Cities 2012*, Australian Government, Canberra

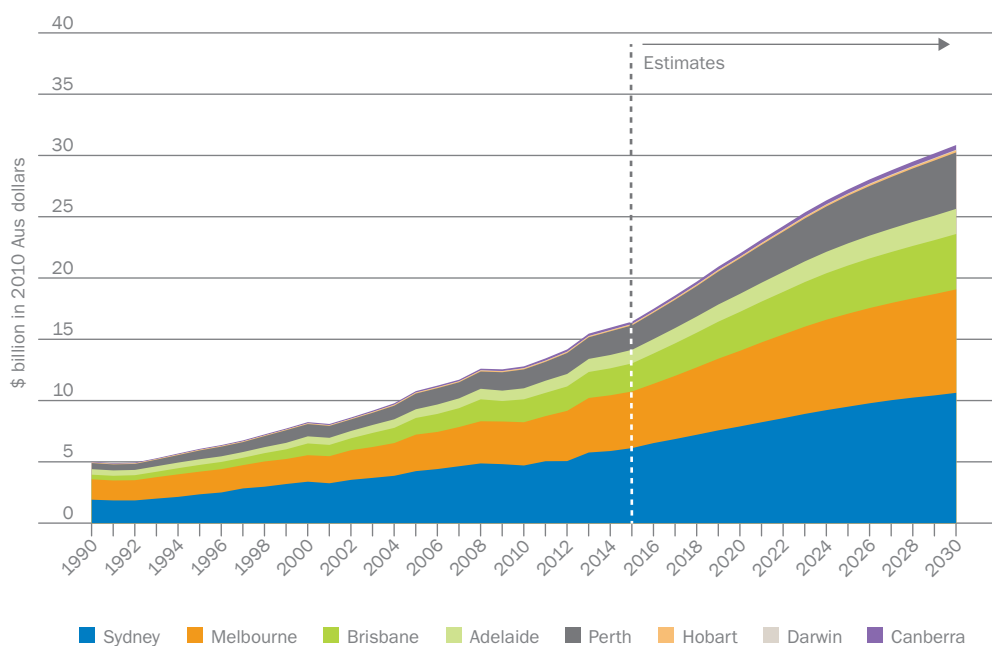
121 Organisation for Economic Co-operation and Development/International Transport Forum, 2015, *ITF transport outlook 2015*, OECD/ITF, Paris

122 Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2015, *Australian Infrastructure Statistics Yearbook 2015*, Australian Government, Canberra

123 BITRE, 2015, *Traffic and congestion cost trends for Australian capital cities*, Information Sheet 74, Australian Government, Canberra



Figure A.1: Upper baseline projections of avoidable social costs of congestion by city



Source: Bureau of Infrastructure, Transport and Regional Economics Information Sheet 74 – Traffic and congestion cost trends for Australian capital cities.

Supply chain efficiency could be improved by reducing the competing demands of freight and passenger vehicles in and around key economic nodes such as ports and airports.

Changes in consumer behaviour and competitive markets are together accelerating the power and speed of innovation within the automotive industry. It is possible that vehicle automation will converge with other complementary developments and business models to fundamentally change the way transport networks operate.

It will likely be decades before a fully self-driving fleet could be realised. Appropriate infrastructure and regulation will be required to keep pace and will be essential to reaping the benefits that automation in transport can provide.

Rail

Australia's rail networks play a key role in meeting the national freight task and supporting the economy. Rail accounts for almost half of freight activity in Australia, up from 36 per cent in 2000.

Domestically, passenger rail growth has outpaced other surface transport modes over recent years, but still makes up only a small portion of passenger kilometres.¹²⁴ Rail patronage has seen resurgence in Sydney, Melbourne and Perth since 2009.

The efficient landside movement of containers is being tested by rising congestion that is occurring within and around Australia's major container ports. Rail is recognised as potentially playing a greater role in meeting the landside logistic challenges presented by rising urban congestion and growing shipping container volumes.

Conversely, there are significant factors threatening the ongoing viability of Australian grain freight rail networks throughout regional Australia.

Pressure will increase for intermodal (largely containerised) freight with increased use of both short and long haul rail services between metropolitan terminals and major ports as well as on interstate freight routes.

By 2050 almost 12 million tonnes of freight is expected to move between Melbourne and Brisbane each year—more than twice the current levels.¹²⁵

The main rail route between Melbourne and Brisbane passes through Sydney, where passenger rail is generally given priority over freight services and the existing coastal rail line does not provide a level of service that allows rail to compete with road in terms of costs or transit time.

Public transport

Public transport is an important part of managing the nation's passenger transport task, with one in eight people in Australian capital cities using it for daily commuting.¹²⁶

We are also seeing a rise in public transport use – after two decades of decline, public transport patronage has steadily increased since 1996. The five years to 2011 saw the biggest increase since 1976. This has occurred mainly on rail systems. Sixty per cent of public transport occurs on heavy rail and 36 per cent on buses. Light rail and ferries make up the remaining four per cent.¹²⁷

Based on passenger kilometres travelled, public transport usage is projected to grow by 32 per cent across all capital cities between 2011 and 2030.¹²⁸

Technology will continue to improve the efficiency and effectiveness of public transport. Real-time traveller information and integrated ticketing will continue to improve services. Advanced technology operations management can improve the efficiency of existing public transport networks. The planned Sydney Metro Northwest will be the first fully-automated metro/passenger rail system in Australia.¹²⁹ It is on track to open to customers in the first half of 2019.

¹²⁴ Hale, C, 2011, *Evolving futures for Australian and international passenger rail*, in Australasian Transport Research Forum, Adelaide, Australia, 28 to 30 September

¹²⁵ Inland Rail Implementation Group, 2015, *2015 Melbourne–Brisbane inland rail report*, Inland Rail Implementation Group, Sydney

¹²⁶ Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2015, 'Australia's commuting distance: cities and regions', Information Sheet 73, Australian Government, Canberra

¹²⁷ BITRE, 2014, 'Urban public transport: updated trends', Information Sheet 59, Australian Government, Canberra

¹²⁸ BITRE, 2013, *Research Report 129 – Public transport use in Australia's capital cities: Modelling and forecasting*, Australian Government, Canberra

¹²⁹ Sydney Metro Northwest, 2016, *Project Overview*, NSW Transport, Sydney

As public transport networks expand in urban areas, the cost recovery will become increasingly important. At present, direct user charging does not reflect the cost of providing public transport services. Cost recovery in Australian urban mass transit systems is on average around 25 to 30 per cent, well below many transport systems internationally.¹³⁰ As such the public transport system in Australia requires high levels of government subsidies and is a significant budget item for state treasuries.

A lack of reliable, efficient and affordable public transport options often exacerbates social isolation and limits access to services in rural and remote communities.

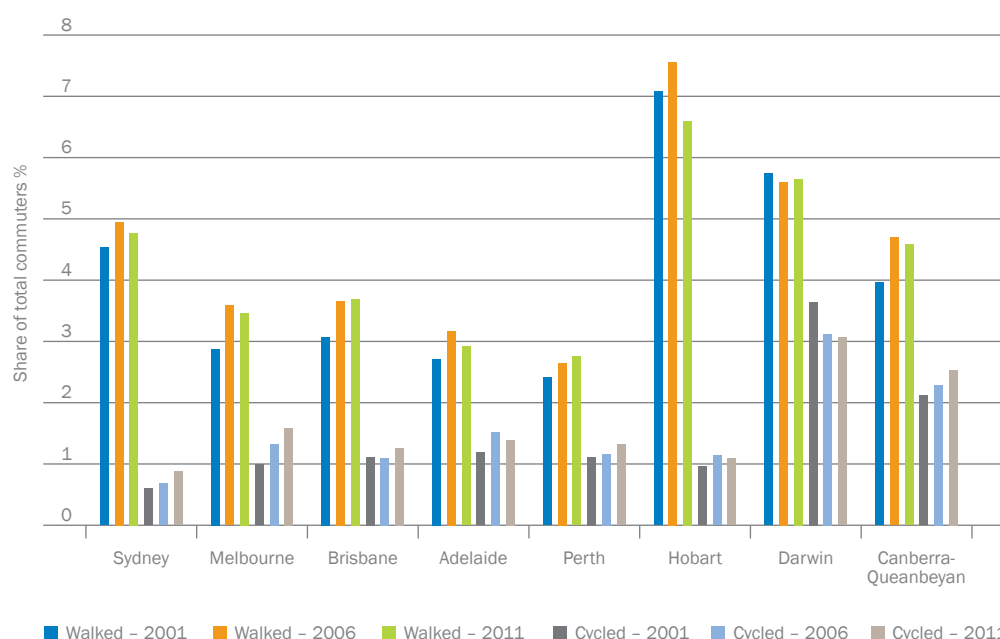
In the absence of additional capacity, demand for urban public transport networks will exceed capacity more often. As a result, governments will need to focus on expanding the capacity of existing services, as well as providing new services that incorporate new technologies such as autonomous vehicles.

Active travel

Rising congestion levels and crowded public transport in urban areas can act as an incentive for some people to switch to active transport activities, such as walking and cycling.¹³¹ Accessing public transport plays a key role in active transport, with the majority of public transport journeys beginning and ending with a walk from the bus stop or train station.

In inner-urban areas, active transport participation rates have risen in recent years, as demonstrated below in Figure A.2. Between 2006 and 2011, the proportion of commuters cycling to work grew by 38 per cent in Melbourne and 47 per cent in Sydney.¹³²

Figure A.2: Share of active transport by commuting mode, 2001–2011



Source: Bureau of Infrastructure, Transport and Regional Economics analysis of ABS Census of Population and Housing data for 2001, 2006 and 2011 (unpublished).

¹³⁰ Hale, C, 2011, *Evolving futures for Australian and international passenger rail*, in Australasian Transport Research Forum, 2011, Adelaide, Australia, 28–30 September

¹³¹ Department of Infrastructure and Regional Development, 2015, *State of Australian cities 2014–2015*, Australian Government, Canberra

¹³² Based on Bureau of Infrastructure, Transport and Regional Economics analysis of Australian Bureau of Statistics data from the 2006 and 2011 Census.

Active travel offers a range of benefits, such as reductions in congestion, greenhouse gas emissions and increased health benefits. Additionally, in contrast to road and public transport infrastructure, improvements to active transport networks can be relatively cheap and can be made comparatively quickly.

Inner-urban areas of Australia's cities provide the best opportunities to increase the uptake of active transport. Most value would be gained from focusing on networks around key activity centres, up to 1.5 kilometres for walking and up to five kilometres for cycling.

Aviation

In 2015–16, Australia's top 40 airports in terms of passenger numbers consisted of 11 international and 29 domestic airports.

In 2014, Australia accounted for 0.3 per cent of world passenger air travel¹³³ and 0.2 per cent of global airfreight.¹³⁴

The aviation industry contributed \$7 billion to Australia's GDP in 2014–15¹³⁵ and in August 2015 directly employed 58,900 people.¹³⁶

In 2014–15, 53 international airlines operated services to and from Australia. Although the sector carries only 0.1 per cent of Australia's international freight by weight, it is over 21 per cent of freight by value.¹³⁷

Globally, airline profitability remains an issue, although lower fuel prices have improved the financial positions of airlines. This pressure on profits has resulted in a greater focus on operational efficiencies and innovative business models.

Low-cost carriers have continued to increase their market share of Australian international traffic, from almost zero in 2004–05 to 16.3 per cent of total international traffic in 2014–15.¹³⁸

Regional areas have seen a decline in the demand for fly-in fly-out services, however the lower Australian dollar has seen an increase in demand for services to tourism destinations.

Passenger traffic is predicted to rise over the medium-term. The average annual growth rate for international passengers is forecast at 4.9 per cent between 2015 and 2034. Drivers of growth are expected to be from the Middle East (6.2 per cent) and the Asia–Pacific (6.1 per cent).

In Australia, high levels of domestic and international passenger growth at major airports are already testing the capacity of airport infrastructure during peak periods.

International air travel will grow strongly to 2030, with both domestic and international passenger movements through capital cities almost doubling.

The largest growth is expected to occur on the Gold Coast (139 per cent), followed by Perth (135 per cent) and Darwin (127 per cent).¹³⁹

133 The World Bank, 2015, *Air transport, passengers carried*, The World Bank

134 The World Bank, 2015, *Air transport, freight (million ton-km)*, The World Bank

135 Australian Bureau of Statistics (ABS), 2014, *Australian National Accounts: national income, expenditure and product, June 2015*, Catalogue number 5206.0, ABS, Canberra

136 ABS, 2014, *Labour Force, Australia, Detailed, Quarterly*, Catalogue number 6291.0.55.003, ABS, Canberra.

137 Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2014, *Freightline 1 – Australian freight transport overview*, Australian Government, Canberra

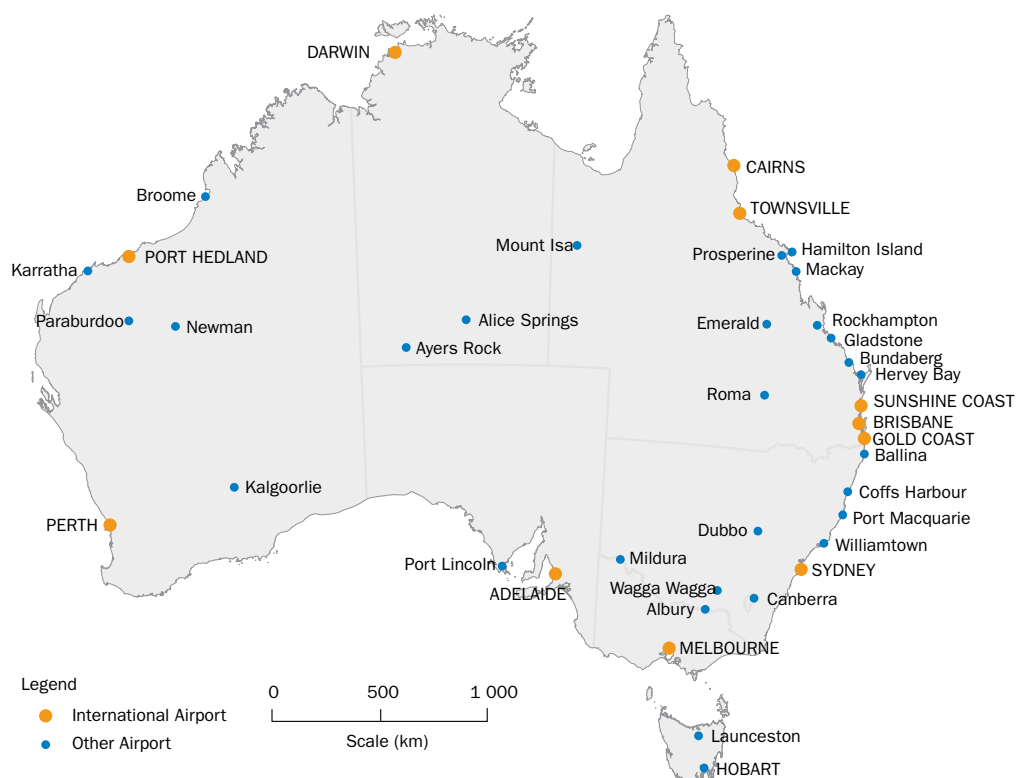
138 BITRE, 2015, *International airline activity 2014–15*, Australian Government, Canberra

139 Based on BITRE data, analysis and projections.



Efficiently meeting the future infrastructure needs of passenger and freight users will be a challenge across the aviation sector. As aircraft increasingly becomes the chosen transport method, government and industries will face the challenge of maintaining the appropriate regulatory oversights for safety and security, while facilitating the increased passenger flows and improving the passenger experience.

Figure A.3: Australia's top 40 airports by passenger volume in 2015-16



Maritime

As a relatively small open economy, international trade is particularly important for Australia. It allows us to compete internationally and brings in earnings to grow our economy, and improve living standards and social welfare.

International trade is underpinned by maritime transport with over 80 per cent of the world cargo by volume being transported by sea.¹⁴⁰ Crucially, Australia relies on sea transport for 99 per cent of its international trade (by volume).

Australia's broader economic transition to a service based economy is also being reflected in the maritime sector. The Australian cruise industry is emerging as an important service industry, with a six-fold increase in passenger numbers over the 10 years to 2014, from 158,000 in 2004 to 1,003,256 in 2014.¹⁴¹

International trade is critical to Australia's economic prosperity. The efficiency of ports and the transport infrastructure that links them to various markets is vital in reducing import and export costs.

More and larger maritime vessels carrying a larger volume of freight will continue to put pressure on ports and connecting infrastructure.

Productivity has declined across Australia's five major ports since 2014.¹⁴²

Efficiency measures—such as better management of terminal containers, maximisation of crane use, and the introduction of more automated handling equipment—provide opportunities to improve port efficiency and delay or avoid capital investment for expansion.

A range of regulatory measures such as curfews and restrictions that limit the movement of goods within ports and on connecting infrastructure impact on the ability of ports to operate efficiently.¹⁴³

The growth in the export freight task will put further pressure on land side freight infrastructure needed to support the efficient movement of freight to and from ports.

140 Organisation for Economic Co-operation and Development/International Transport Forum, 2015, 'ITF Transport Outlook 2015', OECD/ITF, Paris

141 Cruise Lines International Association Australasia (CLIA), 2014, *Cruise industry source market report Australia 2014*, CLIA, Sydney

142 Bureau of Infrastructure, Transport and Regional Economics, 2015, *Waterline 57, Statistical Report*, Australian Government, Canberra

143 Infrastructure Australia, 2016, *Australian infrastructure plan: priorities and reforms for our nation's future*, Australian Government, Canberra





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