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**Cover**: Melbourne city aerial view

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Contents

Executive Summary ................................................................................................................ 2

1. Background and methodology .......................................................................................... 12

2. Melbourne today and in 2046 .......................................................................................... 24

3. Melbourne scenario analysis ............................................................................................ 36

4. Sydney today and in 2046 ............................................................................................... 60

5. Sydney scenario analysis .................................................................................................. 72

6. An urban reform agenda for Australia’s fastest growing cities ...................................... 94

List of Recommendations .................................................................................................... 112

Appendix A – Scenario development assumptions ................................................................ 114

Appendix B – Assumed transport networks ...................................................................... 116

Appendix C – Transport network modelling .................................................................... 120

Appendix D – Green space and social infrastructure modelling .................................... 122

References ........................................................................................................................... 126
Executive Summary

Australia’s largest cities are facing a watershed moment in their growth and development. In the coming 30 years the size of the Australian population will grow substantially. Between 2017 and 2046, Australia’s population is projected to increase by 11.8 million people.¹ That’s equivalent to adding a new city, roughly the size of Canberra, each year for the next 30 years.

About 75% of this growth will occur in Sydney, Melbourne, Brisbane and Perth.² Growth on this scale will transform these cities. A growing population is an exciting opportunity to increase our national economic prosperity and liveability. The potential benefits are immense.

But Australians face a complex set of choices regarding what this change will look like. Are our cities going to grow out or up? How do we align the location of jobs with the needs of our changing economy? How do our infrastructure networks need to change to accommodate more demand? How can we ensure the world-class liveability of our cities is maintained and enhanced?

These are difficult decisions, with each requiring trade-offs and compromise. But inaction is not an option, nor is business as usual. If we fail to effectively anticipate and respond to growth, the likely results will be declining economic productivity, increasing environmental pressures and a marked reduction in each city’s quality of life.

We must act now to preserve and enhance the elements of each city that make them such attractive places to live and work.

This paper identifies the choices facing our largest cities and the best pathways to respond. It:

1. provides independent advice to Australian governments on how to respond to the challenges and opportunities of growth
2. provides the community with accessible information on the potential outcomes of growth and change in their cities
3. demonstrates the value of more innovative strategic planning tools and calls on Australian governments to increase the sophistication of their long-term planning practices.

The future development of Australian cities, big and small, was a major focus of the Australian Infrastructure Plan

Infrastructure Australia published the Australian Infrastructure Plan in February 2016. It outlines an evidence-based pathway towards more efficient and productive infrastructure for Australia’s future. The Plan explored some of the key challenges facing Australian cities in the context of population growth:

“Population growth will transform our cities. Our four largest cities are set to undergo a higher density urban transformation. Our aim for these cities should be to deliver high-quality, higher density living, connected by world-class infrastructure services. In our smaller cities, we should ensure their many and diverse advantages are maximised. The opportunity exists to ease the pressure on our larger cities by growing the populations of the smaller ones. Delivering these solutions will require us to reform how we plan and govern our cities.”³

¹ Source: Australian Bureau of Statistics
² Source: Australian Bureau of Statistics
³ Source: Australian Infrastructure Plan
This paper builds on the direction set in the Plan, by seeking to provide governments and the community with an accessible evidence base and reform agenda, with which to prepare Australia’s largest cities for population growth and change over the coming 30 years.

While Australia’s smaller cities will not grow at the same scale as our largest cities, they are home to a large number of Australians, and will experience the same challenges over a longer timeframe. Future Infrastructure Australia research will examine the unique opportunities facing our smaller cities and the options to capitalise on them to deliver national benefits.

**Australia’s prosperity is intrinsically linked to the successful development of its largest cities**

More than ever before, Australia’s long-term prosperity is linked to the performance of our cities. Cities are increasingly the generators of Australia’s wealth, where a growing number of Australians choose to live and businesses choose to locate. This trend is not unique to Australia, many countries around the world are also rapidly urbanising, and taking advantage of the economic and social opportunities that growing cities can bring.

In 2015-16 Australia’s four largest cities contributed just over 60% of our national Gross Domestic Product (GDP). Over time this contribution is expected to increase. Since the middle of the 20th Century, the focus of the national economy has gradually shifted from agriculture, manufacturing and more recently resources, towards largely knowledge-intensive service sectors, which now make up over 60% of the nation’s economy and around 20% of exports. Cities are the ideal location for these sectors, which typically locate in large employment centres, enabling collaboration and ready access to skilled labour.

At the same time, cities are where a large number of Australians choose to live and work, with the trend set to increase in coming decades. Over the next 30 years the percentage of the population living in Australia’s four largest cities will increase from 58% to 64%. This trend reflects the increasing number of businesses, and in turn jobs, located in Australia’s largest cities, and shifting preferences, among some sections of the community, towards a metropolitan lifestyle.

**Australia’s largest cities are facing a future of fundamental growth and change**

Australia’s largest cities are undergoing a period of profound change. In coming decades, they will each experience fundamental shifts in their structure and operation.

Population growth is a central driver of this change. In the next 30 years, Sydney’s population is projected to increase by 2.4 million people, growing to be a city of 7.4 million. Over the same period, Melbourne is projected to grow by 2.7 million people, to be a city of 7.3 million. The growth of Brisbane and Perth, while on a smaller scale, will still bring substantial change to both cities. Between now and 2046, Brisbane is projected to grow by 1.6 million people and Perth by 2.2 million people, delivering cities of just under 4 million and 4.3 million, respectively.

This means the Brisbane and Perth of tomorrow will become cities the size of Melbourne and Sydney today. While Melbourne and Sydney will become cities comparable to the current size of some of the world’s most significant urban economies, operating more like the Hong Kong, New York and London of today.

The growth and development of Sydney, Melbourne, Brisbane and Perth will create exciting opportunities for Australia. But to effectively capitalise on these opportunities, the structure and operation of these cities will need to change.
To meet the demands of population growth, these four cities must rapidly increase the delivery of well-located housing supply and ensure that housing remains affordable to a broad cross-section of the community. Each city will be required to plan for and appropriately locate an expanding jobs market. The capacity and efficiency of each city’s infrastructure networks will also need to be increased. Road and public transport networks will need to be upgraded in line with demand. Additional pressure on utility infrastructure, namely water, telecommunications and energy, will need to be understood and accounted for. The capacity of key social infrastructure facilities, such as hospitals, schools and green space, will need to be increased.

Growth alone though is not the only challenge faced by Australia’s cities. The convergence of fundamental shifts across several sectors has an as-yet-unknown but potentially significant impact on the structure and operation of our cities in coming decades, and particularly on the infrastructure required to support them.

These shifts include:

■ The ageing population: Over the next 40 years the proportion of the Australian population aged 65 and over will significantly increase, while the proportion of working-age people will decrease. This means Australia’s governments will face increasing fiscal gaps, which will impact on funding availability for the necessary infrastructure upgrades and additions required to support Australia’s growing population.

■ Rapid technological transformation: Technological change across a range of sectors within the Australian economy is fundamentally disrupting how goods and services are provided, regulated, consumed and paid for. This will have implications for the planning, design and operation of Australian cities both now and in the future, including our transport networks.

■ The increasing urban freight task: According to the 2015 Australian Infrastructure Audit, Australia’s containerised freight task is projected to experience substantial growth, increasing by 165% by 2031, with cities being a primary location for this growth. This will have implications for our urban freight networks, in particular first and last mile transport and handling, which will impact the future structure of our cities.

■ The impacts of climate change: The changing global climate is driving shifts in short-term weather patterns, including increased extreme weather events, and long-term climate trends. At the same time, Australia’s cities are a key source of emissions, and are located in areas which are at risk from climate change impacts. Policy and regulatory responses from governments to climate change will therefore have significant implications for the operation of Australian cities, particularly the larger ones.

■ The shifting structure of national and global economies: The national economy is in a state of transition. As the mining investment boom winds down, the focus of the economy is shifting towards service and knowledge-intensive activities. Cities are the ideal location for these agglomerating economies, enabling collaboration and easy access to skilled labour. This has implications for the spatial structure of our cities, and the infrastructure which supports them.

■ Changes to the nature and location of work: Technological innovation, including ongoing developments in communications, robotic technology and artificial intelligence, are enabling changes to the way we work. These changes will have implications for the nation’s key employment centres, primarily located in our cities, with flow-on impacts for infrastructure networks and social equity across our cities.

The implications of technology, demographic, and economic changes within Australian cities are currently unknown. Many of these changes are contingent on the trajectory of technological development, market uptake, and significant policy and regulatory reform.

The community and decision makers need better tools to understand their future city

In the context of rapid growth and uncertain change, there is a clear case for evolving our planning and governance practices to improve the evidence base available to decision makers and better inform and involve the community. Meeting the demands of a growing population within our largest cities over coming decades will require communities to make a series of choices regarding the type of city they want to live in.

Current long-term planning processes for Australia’s largest cities generally draw on population and employment projections to produce a metropolitan vision, which paints a high-level picture of what it will be like to live and work in the city in coming decades. These visions are supported by corresponding delivery milestones and policy objectives, such as location-specific targets for the zoning of land to support new housing or the creation of new jobs or the identification of new or upgraded infrastructure.

Under traditional long-term planning practices there has been limited public discussion about what population growth practically means for the current and future residents of our cities. The community does not have easy access to the necessary tools and analysis to understand the scale of prospective growth, the potential pathways to cater for this growth, and, most importantly, the relative trade-offs associated with different decisions about how each city should grow. For example, living in a low-density area with large homes and backyards, but further away from jobs and amenities, or living in a higher density area with smaller
homes and more shared space, but closer to jobs and amenities.

As a result, there are often understandable reservations in parts of the community regarding the potentially adverse impacts of population growth and corresponding land-use outcomes, such as increased housing density or longer travel times.

**Scenario planning tools can provide the community and decision makers with a more robust picture of what the future could look like**

Scenario planning is a strategic tool that presents the public and decision makers with a range of different options for what the long-term development of a city could look like. Each scenario is a potential portrait of the future, which details how the city could perform under a unique set of conditions. The use of scenarios is based on a recognition that the future is difficult to predict with certainty, and that several outcomes are possible and should be considered.

The process has two clear benefits for cities facing significant and uncertain change:

- It allows decision makers, as part of the process of articulating and implementing a long-term vision for a city, to consider a range of possibilities and build necessary flexibility into policy and investment decisions.

- It enables a more transparent public discussion of the choices and trade-offs inherent within different approaches to growth. This can help governments to have a more holistic public discussion about what growth means and provides a more transparent process for defining preferred future directions.11

While Australian governments are increasingly using scenario tools, it has yet to become an established practice when planning for our cities, and there has been only a limited sample of this work made publicly available.

**Infrastructure Australia has used scenario planning to evaluate the trade-offs inherent within potential long-term growth pathways for Melbourne and Sydney to 2046**

Infrastructure Australia has developed six hypothetical growth scenarios, three each for Melbourne and Sydney. The scenarios seek to test commonly posed questions about how Australian cities could grow and change, including:

- Should our cities expand outwards, at a low density, or consolidate inwards at a higher density?

- Should we seek to locate jobs in centres or distribute them more evenly across the metropolitan area?

- What mix of modes and network structure is best suited to meet the needs of a larger city?

They assume consistent metropolitan boundaries and common population and employment growth totals for each city. They then focus on three variables, which differ across the scenarios:

- Where each city’s additional population lives and the intensity and style of development they live in

- Where each city’s additional jobs are located

- The future structure of the transport network.

The scenarios, tailored to match the unique characteristics of Melbourne and Sydney, are:

1. **The Expanded Low Density scenario:** This scenario tests a future in which population growth is distributed with the aim of minimising the impact on existing urban areas. In essence, the scenario directly caters to the desire of some in the community for the character of their immediate environment to remain unchanged.

2. **The Centralised High Density scenario:** This scenario tests a higher density, inner-city growth future which aims to enable more people to live and work closer to existing transport infrastructure and major employment centres. The scenario envisages a lifestyle shift for many in these suburbs, with increased apartment living, active and public transport use and a greater reliance on shared (rather than private) services and spaces becoming the norm.

3. **The Rebalanced Medium Density scenario:** This scenario aims to rebalance each city’s spatial structure by distributing new housing and employment more evenly across the whole city. It seeks to test the feasibility and outcomes of first, locating jobs closer to where people live, and second, more evenly distributing the impact of new housing, by focusing development at a medium density across the city.

By focusing on Melbourne and Sydney, the paper does not disregard the significant level of growth set to occur in Australia’s other large cities, namely Brisbane and Perth. Instead Melbourne and Sydney are presented as case studies of the choices and trade-offs that will be faced across Australia’s four largest cities as they each grow and change in coming decades.

Precisely predicting the future is an impossible task and the three scenarios presented in this paper should not be viewed as an exact vision of the future. In reality, a complex interplay of policy decisions and unforeseen factors will shape the long-term development of Australia’s cities. This could include the decentralisation of population growth to neighbouring cities, such as Geelong (VIC), Wollongong (NSW), the Gold Coast (QLD) or Peel (WA), or deviations from the projected population growth levels because of external factors such as changes to migration policy, or shifting domestic or global economic conditions.
What the scenarios do not address

Like all future visioning exercises, scenario planning is necessarily a simplified version of the future. However, cities develop and change in response to a broad range of complex and interdependent factors, some of which are beyond the scope of this paper. The scenarios in this paper do not specifically address:

- **Changing demographics**: For example, the ageing population, policy interventions to incentivise decentralisation of population growth away from our larger cities, or other changes to regional, interstate or international migration patterns.

- **Rapid technological transformation**: For example, significant uptake of battery storage, electric and autonomous vehicles, further development and implementation of intelligent transport systems, or changes to key sectors such as health and education from technological disruption.

- **The increasing urban freight task**: For example, investment and reform to enhance and upgrade urban freight networks in line with a growing population.

- **The impacts of climate change**: For example, increased extreme weather events, long-term climate changes, and policy interventions impacting on the energy sector.

- **Changes to the structure of national and global economies**: For example, collapses or booms, and shifts within sectors.

- **Changes to the nature and location of work**: For example, changes as a result of automation and more people working from home due to communications technology innovation.

- **The impact of population growth on other infrastructure sectors**: For example, investment and reform to enhance and upgrade energy, telecommunications and water infrastructure.

The exclusion of these variables is not a reflection of their importance. Their exclusion reflects the inherent uncertainty that surrounds them and the bounds of what can be feasibly modelled and considered within one report.

The performance of each scenario has been modelled and analysed according to a suite of five indicators

Infrastructure Australia has compared the performance of the three hypothetical scenarios within each city by modelling their respective impact on the performance of each city’s infrastructure, using a suite of five indicators.

The Victorian Government’s Victorian Integrated Transport Model (VITM) and the New South Wales Government’s Sydney Strategic Travel Model (STM) were used to model each city’s transport network performance and environmental impact. Arup’s Transport Travel Time Analysis (T3a) tool was used to model demand for and access to social infrastructure and green space under each scenario. Table 1 provides a summary of the five indicators used.
Table 1: Summary of indicators used to compare the relative performance of scenarios

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance of the transport network</td>
<td>Uses a range of data points to identify how different configurations of the public transport and road networks perform, including mode share, congestion and travel times, under each scenario.</td>
</tr>
<tr>
<td>Access to jobs</td>
<td>Identifies how access to jobs changes in different parts of the city under each scenario.</td>
</tr>
<tr>
<td>Environmental performance of the road network</td>
<td>Calculates the relative CO₂ emissions of the road network under each scenario.</td>
</tr>
<tr>
<td>Access to and demand for social infrastructure</td>
<td>Identifies how the demand for and access to existing key social infrastructure assets such as hospitals, schools, and tertiary education facilities, change under each scenario.</td>
</tr>
<tr>
<td>Access to and demand for green space</td>
<td>Identifies how the demand for and access to existing green space, such as parks and gardens, change under each scenario.</td>
</tr>
</tbody>
</table>

Findings from the scenario analysis and Australian Infrastructure Plan have informed an urban reform agenda for Australia’s largest cities

Nine key findings have emerged from the scenario analysis of Melbourne and Sydney. These provide valuable insights for all Australian cities experiencing rapid population growth and change, regardless of the future growth scenario that is followed. Infrastructure Australia has combined this evidence base with analysis from the Australian Infrastructure Plan to develop 15 recommendations and an urban reform agenda for Australia’s largest cities.

This agenda provides all levels of government with advice on how to successfully meet the demands of population growth in Sydney, Melbourne, Brisbane and Perth in coming decades, through changes to urban planning, policy, investment and delivery processes.

The findings and corresponding recommendations are:

Finding 1

Unplanned growth delivers the worst outcomes for Australia’s fastest growing cities. The scenario analysis shows that well-planned cities, where the location of jobs, homes and their supporting infrastructure networks are coordinated to maximise accessibility and liveability, will deliver the best outcomes for Australian communities. For both Melbourne and Sydney, the scenario which delivers the greatest proportion of greenfield development, the lowest population densities, and the lowest integration between land use and infrastructure has poorer job and infrastructure access outcomes for future residents. This makes clear that if our largest cities are going to successfully respond to growth, changes to their structure and operation, and the processes used to deliver these, will be needed.

Recommendation

The Australian Government should establish a consistent framework of incentives to drive the delivery of national benefits within our cities at the project, place and reform level, such as National Partnership and Project Agreements, City Deals and Infrastructure Reform Incentives.

Recommendation

Australia’s largest cities should establish institutions and processes which enable the delivery of metropolitan-scale governance.

Recommendation

Australian governments should improve the flexibility, transparency and sophistication of current strategic planning tools and practices to improve decision making and deliver better planning outcomes for the long-term growth of our cities.

Recommendation

Australian governments should improve the quality and accessibility of community engagement at the strategic planning stage of a city’s development.
Recommendation

Australian governments should focus on outcomes rather than outputs when developing the policy and regulatory frameworks that respond to changing technologies and services.

Recommendation

In the context of climate change, Australian governments should prepare metropolitan resilience strategies which establish clear policy, regulation and guidelines for strengthening the resilience of the planning, coordination and construction of our cities as they grow.

Finding 2

Public transport is crucial to improving accessibility in Australia’s largest cities. Under all scenarios, the use and performance of public transport services across the cities improves. Even as our largest cities grow by over two million people, both the public transport mode share, and the proportion of jobs that can be accessed by public transport, increase. This shows that public transport is well-suited to moving large volumes of people, particularly in higher density environments.

Recommendation

Australian governments should increase investment in public transport infrastructure in cities experiencing significant population growth. Investment in mass transit is crucial to reducing congestion, increasing accessibility and reducing the rate of emissions growth.

Recommendation

The Australian Government should encourage state and territory governments to focus and prioritise efforts toward achieving full accessibility compliance across public transport networks in Australia’s largest cities within defined timeframes.

Finding 3

Cars continue to play an important role in our cities. However, across all scenarios, congestion significantly increases, and adding new roads is only part of the solution. The scenario analysis indicates that private vehicles continue to be used for the majority of trips within our largest cities, and the total number of trips on our roads increases significantly. Construction of new roads alone cannot accommodate this demand and alleviate congestion at the same time. Land-use planning and transport network investment will need to be complemented by other approaches, including demand management mechanisms such as road user charging, and public transport investment.

Finding 4

We need to use existing infrastructure in our largest cities more efficiently. The scenario analysis shows that population growth, particularly in established areas, will increase the demand on existing economic and social infrastructure. New infrastructure will be needed to support growth, but governments should also maximise the return on investment from existing assets. ‘Sweating’ existing assets can be more financially effective and less disruptive to the community than building new infrastructure. This could include ensuring appropriate maintenance, renewal, technology upgrades and demand management strategies are in place.

Recommendation

Australian governments should routinely review the capacity of economic and social infrastructure within our cities and develop strategies to ‘sweat’ existing assets to extract greater value for communities.

Finding 5

As demand increases, coordinating and prioritising additional or upgraded infrastructure between and within governments will be a challenge. The scenario analysis shows increases in demand for transport, health services, schools and tertiary education facilities, which will require new and upgraded infrastructure. Governments

Finding 5
and the community will face a series of choices about the sequencing, type and location of infrastructure to support growth. Problems arise when new developments and infrastructure are planned and delivered in isolation. A place-based approach which considers interrelated elements and the broader needs of an area can deliver better community outcomes.

**Finding 6**

Well-planned infrastructure to service employment centres enhances the job accessibility of our cities and can deliver national benefits. The three scenarios present a spectrum of economic geographies ranging from single central business districts to several distributed employment centres. Across the scenarios, the analysis shows that access to jobs is improved when cities are serviced by an established set of employment centres, particularly when connected by public transport, rather than a dispersed employment structure, requiring private vehicle access.

**Recommendation**

Australian governments should adopt a place-based approach when translating metropolitan visions into the sequencing and delivery of development with infrastructure.

**Finding 8**

As our largest cities grow and densify, green and public spaces play an increasingly important role in maintaining liveability. The scenario analysis shows that regardless of the way in which these cities grow, population growth on the scale projected will see access to private space decrease while demand for green and public space increases. This transition will place a much greater emphasis on each city’s public realm. It is critical that these assets are protected and enhanced to ensure that the liveability of Australia’s largest cities is maintained.

**Recommendation**

As our cities grow, Australian governments should focus on maintaining and enhancing green infrastructure and the public realm to ensure they remain liveable.

**Finding 9**

Land-use changes can play some role in addressing the amount of carbon emissions our cities generate. Australian cities are the principal generators of Australia’s carbon emissions and, without significant change, the growth of these cities will only increase this trend further. The scenario analysis shows that different land-use and transport infrastructure choices can improve the environmental performance of our cities’ transport networks. Higher density spatial patterns that encourage mode shift away from private vehicles towards active and public transport generate lower carbon emissions, reducing the city’s impact on the environment.

**Recommendation**

Australian governments should work collaboratively to establish a stable national framework to respond to climate change and reduce emissions in line with our international commitments.
The aim of this analysis is to support the work of governments

The purpose of this paper is to test and better understand strategic ideas about the impacts of types of growth. As a result, each scenario is deliberately hypothetical and strategic in focus, and does not specifically reflect the current long-term metropolitan visions for these cities.

Defining and implementing visions for our cities is the responsibility of state and territory governments, supported by the Australian and local governments. Infrastructure Australia acknowledges that the Victorian and New South Wales Governments are finalising and implementing metropolitan plans. This paper does not argue whether these plans are ‘right’ or ‘wrong’, rather the scenario analysis contributes to the ongoing government and community discussions about planning our cities.

Specifically, this paper aims to:

- Provide the community with accessible information on the relative trade-offs that are inherent in any decision regarding how cities accommodate population growth. This will help to increase the sophistication of the community’s engagement with the processes of change. The three scenarios provide the community with a set of examples against which they can compare their current experiences of their city, increase their understanding of how their city might change in coming decades and better interrogate the long-term strategies for their city.

- Provide advice to decision makers across governments regarding the future development of Australia’s fastest growing cities. The analysis of the three 30-year scenarios for Melbourne and Sydney and supporting recommendations provide governments with an insight into how cities of Melbourne and Sydney’s future size might grow, and the outcomes delivered by different land-use, employment, and infrastructure decisions.

- Demonstrate the inherent value of more innovative strategic planning tools. It advocates for more sophisticated planning practices to meet the challenges and opportunities of the coming decades.

A guide to reading this paper

This paper is split into six chapters:

1. **Background and Methodology**: Identifies the scale of change set to take place in our largest cities and provides an overview of the paper’s underpinning methodology.

2. **Melbourne today and in 2046**: Provides an overview of the history of Melbourne’s planning and development, outlines the current state of play in the city and explains how the three hypothetical growth scenarios have been developed and applied to the city.

3. **Melbourne scenario analysis**: Evaluates the performance of Melbourne under the three future scenarios, using the five indicators. Identifies a set of key findings regarding the relative outcomes delivered by the different spatial structures.

4. **Sydney today and 2046**: Provides an overview of the history of Sydney’s planning and development, outlines the current state of play in the city and explains how the three hypothetical growth scenarios have been developed and applied to the city.

5. **Sydney scenario analysis**: Evaluates the performance of Sydney under the three future scenarios, using the five indicators. Identifies a set of key findings regarding the relative outcomes delivered by the different spatial structures.

6. **A reform agenda for Australia’s fastest growing cities**: Draws on the scenario analysis to present a reform agenda for Australia’s fastest growing cities, including recommendations for all levels of government regarding action that is required now to prepare these cities for growth in the future.

Each chapter begins with an ‘At a glance’ box. These provide the reader with a snapshot of the content and structure of the forthcoming chapter.

Appendices provide further detail on the modelling inputs and outputs used in this paper:

- **Appendix A – Scenario development assumptions**
- **Appendix B – Assumed transport networks**
- **Appendix C – Transport network modelling**
- **Appendix D – Green space and social infrastructure modelling**

The maps presented in this paper can be viewed in more detail at [www.infrastructureaustralia.gov.au](http://www.infrastructureaustralia.gov.au).