Background and methodology

At a glance

- Australia is set to experience sustained population growth. Sydney, Melbourne, Brisbane and Perth are expected to be primary locations of this growth. At the same time, the convergence of fundamental shifts across several aspects of city life has the potential to rapidly change the operation of our cities. The scope and outcome of these changes is currently unknown.

- In the context of rapid growth and some uncertainty about the pace and direction of change within Australia’s largest cities, current long-term planning practices need to evolve. Scenario planning presents governments with an opportunity to increase the evidence base available to decision makers and enable a more transparent public discussion about the choices inherent within different growth pathways.

- Infrastructure Australia has used scenario planning techniques to evaluate the impact of three growth scenarios for Melbourne and Sydney over the next 30 years. The purpose of the analysis is to provide the community with accessible information about the choices and trade-offs associated with different development paths, to create an evidence base for decision makers, and to demonstrate the inherent value of more innovative strategic planning tools.

1.1 The population growth trajectory of Australia’s four largest cities

According to the Australian Bureau of Statistics (ABS), as of 30 June 2016, the Australian population totalled 24.2 million people.\(^\text{12}\) Table 2 shows that Australia is an urban country, with just over two thirds (67.06\%) of Australians living in a capital city.

The distribution of the population is further dominated by the four largest cities (Sydney, Melbourne, Brisbane and Perth) which are home to just under 60\% of the national population. Of these four cities, Melbourne has grown the most in recent years, adding almost an additional million people between 2006 and 2016, while Perth has grown the fastest, increasing its population by 28\% over the same period.\(^\text{13}\)

Looking to the future, Australia is set to experience sustained growth in the size of its population. According to the ABS medium level population projections, the national population will grow by an additional 11.8 million people in the 30 years between 2016 and 2046. The role of our cities will increase over this time, as our four largest cities will be primary locations for this growth.\(^\text{14}\)

In the next 30 years, the ABS projects that Sydney’s population will 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, is on a smaller scale, with Brisbane 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.\(^\text{15}\)

However, long-term population projections are an inherently complicated undertaking. Table 3 compares the difference between the ABS 2013 medium level population projections for 2016, and the provisional observed ABS 2016 estimated resident population for Australia’s four largest cities.
### Table 2: Provisional Estimated Resident Population at 30 June 2016

<table>
<thead>
<tr>
<th>Indicator</th>
<th>NSW</th>
<th>VIC</th>
<th>QLD</th>
<th>WA</th>
<th>SA</th>
<th>TAS</th>
<th>ACT</th>
<th>NT</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital city population</td>
<td>5,029,768*</td>
<td>4,725,316</td>
<td>2,360,241</td>
<td>2,022,044</td>
<td>1,324,279</td>
<td>224,462</td>
<td>403,468</td>
<td>145,916</td>
<td>16,235,494</td>
</tr>
<tr>
<td>State/territory balance</td>
<td>2,709,506</td>
<td>1,453,933</td>
<td>2,488,636</td>
<td>536,907</td>
<td>388,775</td>
<td>293,126</td>
<td>NA</td>
<td>99,824</td>
<td>7,970,707</td>
</tr>
<tr>
<td>State/territory total population</td>
<td>7,739,274</td>
<td>6,179,249</td>
<td>4,848,877</td>
<td>2,558,951</td>
<td>1,713,054</td>
<td>517,588</td>
<td>403,468</td>
<td>245,740</td>
<td>24,210,809**</td>
</tr>
<tr>
<td>Capital city percentage of state/territory population</td>
<td>64.99%</td>
<td>76.47%</td>
<td>48.68%</td>
<td>79.02%</td>
<td>77.31%</td>
<td>43.37%</td>
<td>100.00%</td>
<td>59.38%</td>
<td>67.06%</td>
</tr>
<tr>
<td>Capital city percentage of national population</td>
<td>20.77%</td>
<td>19.52%</td>
<td>9.75%</td>
<td>8.35%</td>
<td>5.47%</td>
<td>0.93%</td>
<td>1.67%</td>
<td>0.60%</td>
<td>67.06%</td>
</tr>
</tbody>
</table>

* The ABS definition of the Greater Capital City Statistical Area for Sydney includes the Central Coast

** National population estimate includes Other Territories (including Jervis Bay Territory, Christmas Island and Cocos (Keeling) Island), which are counted separately to the states and territories.

### Table 3: Difference between ABS 2013 medium level population projections for 2016, and ABS 2016 provisional estimated resident population

<table>
<thead>
<tr>
<th></th>
<th>Melbourne</th>
<th>Sydney*</th>
<th>Brisbane</th>
<th>Perth</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS 2013 medium level population projections (for December 2016)</td>
<td>4,605,993</td>
<td>4,986,714</td>
<td>2,397,068</td>
<td>2,181,194</td>
</tr>
<tr>
<td>ABS 2016 provisional estimated resident population (for June 2016)</td>
<td>4,725,316</td>
<td>5,029,768</td>
<td>2,360,241</td>
<td>2,022,044</td>
</tr>
<tr>
<td>Difference</td>
<td>+119,323</td>
<td>+43,054</td>
<td>-36,827</td>
<td>-159,150</td>
</tr>
<tr>
<td>Percentage difference</td>
<td>Underestimated by 2.59%</td>
<td>Underestimated by 0.86%</td>
<td>Overestimated by 1.54%</td>
<td>Overestimated by 7.30%</td>
</tr>
</tbody>
</table>

* The ABS definition of the Greater Capital City Statistical Area for Sydney includes the Central Coast
This comparison demonstrates the difficulty of accurately determining the future through projections. In the case of Melbourne and Sydney, the 2013 population projections for 2016 under-estimated the level of experienced population growth, with Melbourne and Sydney growing by an additional 119,323 and 43,054 residents, respectively, above the 2013 projections. In contrast Brisbane and Perth, most likely reflecting the tapering off of the investment phase of the mining boom, grew below the 2013 projections by 36,827 and 159,150, respectively. This demonstrates that while, on balance, projections provide a reasonable indication of the future, they need to be developed and used carefully, particularly during times of shifting national and global economic conditions.

Regardless of these potential sensitivities, it is clear that Australia’s four largest cities are very likely to grow substantially. Population growth on the scale projected will transform our largest cities. Brisbane will add the equivalent of a third of its population. Even if Perth does not double in size, as projected by the ABS, it will still grow rapidly over coming decades. Melbourne and Sydney will become global cities, comparable to the current size of some of the world’s most significant urban economies.

The growth of Sydney, Melbourne, Brisbane and Perth will create exciting opportunities for Australia. A growing population is a powerful source of economic dynamism. Growth increases the size and skill base of our labour force, which is particularly important in the context of an ageing population. It will create a larger domestic market for businesses, creating real opportunities to enhance our national prosperity. A growing population is also an opportunity to enhance the vibrancy of our communities. It will facilitate the injection of new people and new ideas, increasing the diversity of these already multi-cultural centres.

But to effectively capitalise on these opportunities, the structure and operation of our largest cities will need to change. Each city will need to rapidly increase the supply of housing to meet the demands of a larger population. Additional jobs will need to be created to ensure each city’s increased population is as productive and prosperous as possible. The capacity and efficiency of infrastructure will also need to be enhanced to ensure that each city’s expanded population is provided with the necessary infrastructure service levels required to live happy and productive lives. Finding innovative, efficient and timely solutions to these challenges will be key to ensuring the population growth story within our largest cities is a positive one.

1.2 Australian cities are experiencing a period of fundamental change and uncertainty

The ongoing development of cities is the result of a range of interdependent and complex factors. Alongside population growth, Australia’s largest cities are also in the midst of a period of rapid change resulting from the convergence of fundamental shifts across several sectors. These shifts have the potential to rapidly change the operation of our cities in coming decades and have a material impact on the infrastructure required to support them.

Many of these shifts are contingent on ongoing technological development, market uptake, and significant policy and regulatory reform. As a result, there is a high degree of uncertainty about the outcomes of these trends, which in turn makes it difficult to predict and plan for their impact on Australian cities.

Key areas of change 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. In the infrastructure sector, the advent of new technologies such as electric and autonomous vehicles, battery storage, intelligent transport systems and disruptive smart phone apps and services are shifting demand for infrastructure and changing patterns of supply. This will have implications for the planning, design and operation of Australian cities both now and in the future.

- **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 2031.¹⁸ Cities will be a primary location for this growth. As the populations of our cities also grow, so too will the demand for goods. This will have implications for our urban freight networks, in particular first and last mile transport and handling, which will impact on 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 home to the bulk of the Australian population, and are generally located in coastal areas. They are therefore a key source of emissions, and 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 to service and knowledge-intensive activities. At the same time, the growth of the Asia Pacific region is driving increased demand for our goods and services. Cities are the ideal location for these sectors, enabling collaboration and easy access to skilled labour.¹⁹ 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. While these developments could deliver substantial productivity and efficiency improvements to a number of sectors, they will have fundamental implications for the nation’s key employment centres, primarily located in our cities, with flow-on impacts on infrastructure networks and social equity across our cities.

### 1.3 Current long-term planning practices need to evolve to deal with the scale of prospective growth and change

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 for Australia’s largest cities have followed a broadly similar pattern of development. Long-term population and employment projections are used to generate a high-level picture of what it will be like to live and work and move around in the city in coming decades. These visions are supported by corresponding delivery milestones and policy interventions, such as location-specific targets for the delivery of new housing or the creation of new jobs, the identification of new or upgraded infrastructure, or the development of policy reforms required to support implementation of the future vision. Visions are also communicated to supporting departments, and other levels of government, who play a contributing role in implementing the vision at the local level.

These processes and practices have delivered many positive results for Australian cities. Many of our cities are world-renowned as attractive places to live and work, and are routinely listed on global indices for liveability and quality of life. However, in the context of the expected pace of growth and change over the coming decades, there is a clear case for evolving these practices.

The complexity of city systems means that the articulation and implementation of a single long-term vision for a city is a difficult process. It runs the risk of setting in place a process of path dependency which may materially constrain decision makers’ ability to be flexible and adapt policy as circumstances change over time. This often means plans have short life-spans, with new plans replacing old ones, beginning the visioning process again. The academic Raymond Bunker has identified this risk in his analysis of Australian metropolitan planning:

> “The metropolitan strategy is constructed as a finely articulated and detailed picture of what the city will be a generation hence. There are intricate connections between its component parts as population and workforce distributions are calculated in different kinds of realms and places... The problem with this approach
1.4 Scenario planning provides the community and decision makers with a fuller picture of what change could mean, the choices available and the trade-offs involved

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:

1. 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.

2. 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.

Cities such as London, Hong Kong, Chicago, Madrid and Singapore, which are facing challenges similar to those in Australian cities, have begun to use scenario planning to increase the robustness of their long-term city plans. 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.

1.5 Scenario planning can help Australia’s fastest growing cities better understand the challenges and opportunities they face

Infrastructure Australia has advocated the case for scenario planning in the past. In this paper, scenario planning techniques have been used to evaluate the impact of three spatial scenarios each on Melbourne and Sydney over the next 30 years. The timeframe and scenarios have been developed separately to the NSW and Victorian governments and do not represent their respective policies or urban plans.

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.

The analysis paints a picture of what it would be like to live and work under the three different futures, and the relative trade-offs inherent between the scenarios. The paper also delivers a series of key findings and corresponding recommendations regarding how Australia’s fastest growing cities will need to be planned and structured to effectively meet the demands and opportunities associated with population growth.

Importantly, the paper does not identify one scenario over the others as the optimal future for Melbourne and Sydney. Defining and implementing a vision for our cities is the responsibility of state and territory governments, supported by the Australian and local governments. Infrastructure Australia seeks to enhance and support, rather than duplicate, that important work of governments. The 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 and advocates for an evolution in the sophistication of planning practices to meet the challenges and opportunities of the coming decades.

1.6 Methodology overview

The paper’s analysis of the three long-term scenarios for Melbourne and Sydney, and the identification of supporting recommendations for Australia’s fastest growing cities, is underpinned by a four-part methodology:

1. Scenario development
2. Scenario application
3. Scenario performance
4. Identifying an urban reform agenda for Australia’s fastest growing cities.

Scenario development

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 density and style of development they live in
- Where each city’s additional jobs are located
- The future structure of the transport network.
For practical purposes, and to ensure the scenarios for each city compare ‘like with like’, the total population and employment numbers used are based on the respective state government projections, and remain constant across the three scenarios for each city.

The scenarios are tailored to match the unique characteristics of Melbourne and Sydney. Table 4 outlines the key characteristics of the three scenarios.

**Table 4: Overview of Infrastructure Australia growth scenarios for Melbourne and Sydney**

<table>
<thead>
<tr>
<th>2046 Scenarios</th>
<th>Key themes</th>
<th>Distribution of population and housing</th>
<th>Distribution of employment</th>
<th>Structure of the transport network</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expanded Low Density scenario (2046)</strong></td>
<td>Tests a future in which the largest proportion of development (compared to other scenarios) is placed in outer greenfield areas, with the aim of minimising the impacts of growth on existing areas.</td>
<td>Melborne: 60% infill 40% greenfield</td>
<td>The distribution of employment follows the existing patterns of the city’s economic geography.</td>
<td>Additions to the network are structured with a focus on connecting the city’s expanded geographic footprint. As a result, the network is relatively rail focused, but there is also investment in public transport.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sydney: 70% infill 30% greenfield</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Greenfield areas are grown to their fullest extent, at a density comparable to current new suburban development.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Centralised High Density scenario (2046)</strong></td>
<td>Tests a higher density, inner-city growth future which locates people closer to existing transport infrastructure and major employment centres.</td>
<td>Melborne: 80% infill 20% greenfield</td>
<td>Employment is intensified around existing major employment centres, particularly the inner-city CBD and surrounding areas.</td>
<td>By concentrating development at key transport nodes the scenario aims to capitalise on areas already well-serviced by infrastructure. Additional investments are required, however, to expand the capacity of the existing network.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sydney: 90% infill 10% greenfield</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>New housing is focused in inner and middle ring areas at high-medium densities, close to high capacity transport nodes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rebalanced Medium Density scenario (2046)</strong></td>
<td>Tests the outcomes of rebalancing a city’s spatial structure by spreading the impact of new jobs and houses more evenly across the metropolitan area, around key centres.</td>
<td>Melborne: 70% infill 30% greenfield</td>
<td>The economic geography of the city is altered, with a proportion of job growth being moved to new employment centres. The aim of this scenario is dispersing new jobs closer to where the population lives.</td>
<td>The city’s transport network is enhanced to connect the city’s expanded economic and demographic geography.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sydney: 80% infill 20% greenfield</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>New housing is distributed more evenly across the metropolitan area, at a medium density, along public transport corridors.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix A outlines Infrastructure Australia’s assumptions underpinning the scenario development in further detail. It is important to note none of the scenarios represent Victorian or NSW government policy.

**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 to the future development of Australia’s largest cities. Similarly, the fact that they have not been included does not mean they are inconsistent with the scenarios tested. A combination of these factors and others will very likely have a material long-term impact on the development of Australian cities. Instead, their exclusion is a reflection of the inherent uncertainty that surrounds them and the bounds of what can be feasibly modelled and considered within one report.
Energy, telecommunications and water infrastructure

All four economic infrastructure sectors – energy, telecommunications, water and transport – are critical to the productivity of cities, and to the way of life for urban residents. Of these sectors, transport has the strongest influence on the planning decisions made by governments, and on the decisions made by individuals about where they live, work and socialise. While not a focus of the modelling and analysis presented in this paper, energy, telecommunications and water infrastructure will also play an important role in shaping the future of our cities.

These sectors are undergoing a range of transformational changes that will influence how services are delivered to growing urban communities. Similarly, changes in urban housing patterns, such as increasing densification, are likely to change patterns of demand for these services, and may place legacy assets under increasing strain. Meeting the changing needs of our growing cities across all forms of infrastructure requires governments to anticipate these changes, and plan to ensure supply can efficiently and sustainably meet demand into the future.

In the energy sector, the current national challenge is to provide affordable and reliable electricity to a growing population while transitioning to a more sustainable generation mix. Beyond the technical challenges of providing energy in growing cities, governments also face a range of social considerations. For example, people living in apartments or renting their homes may not have the physical or financial capacity to invest in household solar and storage systems. Changes to policies, laws and standards are likely to be required to provide residents with greater access to commonly owned rooftops, cooperative arrangements for investing in localised generation, and peer-to-peer electricity trading within communities.

Our telecommunications infrastructure will be influenced by further advances in technologies which are already changing the way we travel, work and communicate. As our cities grow, it will become increasingly important for our telecommunications infrastructure to provide reliable, accessible and affordable services to connect us to each other and to increasingly complex and digital city systems. As with energy assets, existing telecommunications infrastructure may be placed under pressure from increased demand, particularly in denser inner-cities, and will require planning and coordination to enhance and upgrade networks to meet demand.

For urban water systems, growing populations and changing urban environments bring new challenges. While the proportional growth in apartments has reduced water consumption per dwelling, this shift has also concentrated demand in smaller areas. Continued growth in urban populations will put increasing strain on sources of supply near our major cities and on legacy distribution networks within them. The majority of cost-effective sites for dams and wastewater treatment near cities have been used, and changes in rainfall patterns may reduce the available supply. In growth areas on the fringes of our cities, the challenge will be to use planning, green spaces and natural local features efficiently and sustainably. For infill areas, smart urban design is required to ensure developments make the most of smaller spaces and integrate water management within building layouts.

Scenario application

The scenarios have been tailored to match the unique geographic, historical and social characteristics of Melbourne and Sydney. Chapter 2 and Chapter 4 of the paper outline in more detail how the scenarios have been applied, including the distribution of population and employment, and changes to transport infrastructure for each city.

Infrastructure Australia commissioned SGS Economics and Planning to develop unique population and employment projections to underpin each city-specific scenario. To do this, they used the New South Wales and Victorian Governments’ baseline population and employment projections and, for each scenario, moved projected growth (between now and 2046) to different parts of the city according to the strategic themes of the scenario.

It is important to emphasise the existing location of population and employment remains largely the same (with the exception of some small redistributions) under all scenarios. The difference is largely in the location of projected growth. This is designed to reflect the role that the existing structure of our cities’ housing and employment patterns will have on the future structure of both cities.

Table 5 and Table 6 present the state government baseline projections that were applied in the scenario application process for the two cities.
Future Cities – 1. Background and methodology

Table 5: Sydney – New South Wales Government population projections

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2046</th>
<th>Change 2016–46</th>
<th>Percentage change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>4,680,000</td>
<td>7,340,000</td>
<td>2,650,000</td>
<td>57%</td>
</tr>
<tr>
<td>Employment</td>
<td>2,440,000</td>
<td>3,730,000</td>
<td>1,290,000</td>
<td>53%</td>
</tr>
</tbody>
</table>

Note: Population and employment rounded to the nearest 10,000. Change and percentage change is calculated using more detailed underlying data and then rounded.

Table 6: Melbourne – Victorian Government population projections

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2046</th>
<th>Change 2015–46</th>
<th>Percentage change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>4,460,000</td>
<td>7,260,000</td>
<td>2,800,000</td>
<td>63%</td>
</tr>
<tr>
<td>Employment</td>
<td>2,290,000</td>
<td>3,880,000</td>
<td>1,590,000</td>
<td>69%</td>
</tr>
</tbody>
</table>

Note: Population and employment rounded to the nearest 10,000. Change and percentage change is calculated using more detailed underlying data and then rounded.

The process of redistribution applied by SGS Economics and Planning reflected the strategic direction set by Infrastructure Australia, through the identification of a series of ‘change areas’ for each scenario. A ‘change area’ is a select geography within either Sydney or Melbourne, which translates the high-level strategic vision for that scenario to the geographic level. For example, for the Centralised High Density scenario, a series of ‘change areas’ were identified around high frequency public transport interchanges in Melbourne and Sydney’s inner and middle suburbs, and under that scenario an increased proportion of the growth in the population was distributed to these areas.

The population and employment projections informed transport network assumptions. For both cities, the existing networks, committed projects (defined as projects under construction or with money for construction in the latest budget) and projects on Infrastructure Australia’s Infrastructure Priority List are included in each 2046 scenario. The assumed transport networks are intended to support the land-use patterns under each scenario. For example, in Sydney’s Rebalanced Medium Density scenario there is more investment in public transport projects than the other two scenarios, in order to connect economic clusters (change areas) across the city. Lists of the major additions to the road and public transport networks for each scenario for Melbourne and Sydney are available at Appendix B.

This paper does not address the cost of delivering the assumed transport networks for each scenario in Melbourne and Sydney, or the differences between scenarios. Infrastructure Australia recognises the potentially significant costs associated with delivering upgrades and new transport networks in cities, particularly as urban populations grow, and that different combinations of networks will have different funding implications for governments. These implications will need to be considered and appropriately assessed by state governments as part of their own planning and investment strategies.

Scenario performance

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. Table 7 provides a summary of the five indicators used.

Table 7: 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 and fuel use 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>
Infrastructure Australia engaged Arup to use different models to evaluate the relative performance of the scenarios across the five indicators. The purpose of the modelling is focused on the implications of different land-use and transport network decisions. The two modelling exercises included:

1. **Transport network modelling:** Arup used the population and employment distribution models for each city to model the impact of each on the demand and performance of the hypothetical Melbourne and Sydney transport networks, and the environmental impact of the road networks. To complete this work, Arup used the Victorian Government’s Victorian Integrated Transport Model (VITM) and the New South Wales Government’s Sydney Strategic Travel Model (STM). Further details on this modelling can be found at Appendix C.

2. **Green space and social infrastructure modelling:** Arup used their Transport Travel Time Analysis (T3a) tool and the results of the transport modelling above to identify the impact on relative demand for and access to existing green space and social infrastructure under different scenarios. This analysis is underpinned by Australian, New South Wales and Victorian Governments’ data identifying the distribution of existing public green space and key social infrastructure assets. Further details on this modelling can be found at Appendix D.

The analysis of the results produced from these modelling exercises for Melbourne and Sydney can be found in Chapter 3 and Chapter 5 (respectively).

It is important to note that the modelling results for Melbourne and Sydney scenarios reflect different data sets and models. Given they apply to different cities, the VITM and STM have different inputs and assumptions, and use different mechanisms to calculate the performance of their unique transport networks. Similarly, the baseline population and employment projections for each city, and the green space and social infrastructure data sets used reflect different assumptions and methodologies. As a result, it is important that the outcomes of the scenario performance analysis between the two cities are not compared. Instead, the analysis aims to draw out comparisons and trade-offs between the three scenarios within each city.

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

The scenario analysis provides an evidence base for the impact that population growth will have on the function and liveability of our 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.

The recommendations which follow draw upon this evidence base, and the Australian Infrastructure Plan, to propose a wider urban reform agenda which provides all levels of government with advice on how they can update their planning, policy, investment and delivery processes to successfully meet the demands of population growth in Sydney, Melbourne, Brisbane and Perth in coming decades.

The urban reform agenda is divided into four key reform programs:

1. **Deliverability:** Australia’s governments will play a central role in delivering the planning, policy, regulation and funding to respond to the growth and change in Australia’s fastest growing cities. This section identifies several recommendations for governments on how to ensure the best outcomes are delivered.

2. **Economic performance:** The relationship between where people live, where jobs are located, and the performance of the transport network in connecting the two, have a material impact on the economic prosperity of our largest cities. This section outlines several reforms focused on ensuring these relationships operate as efficiently as possible in the context of a much larger population and associated pressure on infrastructure networks.

3. **Equity of access:** While the economic success of our cities is crucial, it can also increase the cost of living and contribute to equity divides between those who can afford to access the opportunities, services and amenity of the city and those who cannot. This presents a challenge, to balance success with providing housing and, access to jobs and opportunities, for the diversity of people required to make our cities function. Without intervention from government, the structural inequities present in our cities today will be reinforced as they grow. This section identifies a set of reforms focused on ensuring our largest cities remain accessible to all as they grow.

4. **Liveability and resilience:** As our largest cities grow in size, many of the features which define the high quality of life enjoyed by residents, will be placed under pressure. This section identifies the key actions required from governments to maintain and upgrade the infrastructure and services that support the liveability and resilience of our cities.

The full set of recommendations and their supporting rationale can be found in Chapter 6.
Future Cities – 1.

Background and methodology