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Cities

Population growth, jobs growth and commuting flows—a comparison of Australia's four largest cities

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Foreword

This is the first comparative study of spatial change in population, jobs and commuting patterns within Australia's largest cities. It focuses on recent patterns of change in Sydney, Melbourne, Brisbane and Perth, while also presenting an overview of change in other capital cities and regional cities between 2001 and 2011. The report identifies some common trends and differences across the cities, and investigates the extent to which these recent spatial changes match up to the stated strategic planning goals for the four largest cities. This project has built a detailed evidence base about recent spatial trends in population, jobs, commuting and transport use, which serves as a valuable resource for infrastructure planning.

The study was undertaken by the Bureau's Cities Research team. This comparative report was authored by Leanne Johnson, Dr Afzal Hossain and Dr Catharina Williams.

Gary Dolman
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At a glance

- This report compares recent spatial changes in population, jobs and commuting patterns for Sydney, Melbourne, Brisbane and Perth, and investigates how these changes match up to the strategic planning goals for each city.
- Between 2001 and 2011, Melbourne gained 636 300 new residents, followed by Sydney (477 600), Brisbane (408 900) and Perth (351 500). The Central Business Districts (CBDs) of all four cities had very rapid population growth due to redevelopment with high density housing. However, the Outer sector accommodated much of the population growth in each city—its contribution ranged from 46 per cent of Sydney's growth to 68 per cent of Perth's growth.
- From 2001 to 2011, Melbourne added 302 300 jobs, compared to 223 300 in Brisbane, 184 600 in Sydney and 174 400 in Perth. The Outer sector added the most jobs in Sydney, Melbourne and Perth, while the Middle sector added the most jobs in Brisbane. The Inner sector of all four cities had substantial job growth, with Inner Melbourne adding about 92 000 jobs. Beyond the inner city, the key job growth areas were Ryde in Sydney, Swan and Belmont in Perth, and Craigieburn in Melbourne.
- The broad pattern of commuting flows is similar for each city. Inward flows accounted for 36–45 per cent of total commutes in 2006, and outward flows for 6–10 per cent. The remaining 46–55 per cent of commutes occurred within the home ring, and typically within the home subregion (42–46 per cent). Average commuting distances were similar for residents of Sydney, Melbourne and Brisbane in 2006, and a little lower for Perth.
- From 2001 to 2006, the largest commuting increases were for flows *within* outer suburban subregions. The proportion of inward commutes declined in all four cities. Average commuting distances remained relatively stable.
- Gravity model regressions reveal that the spatial distribution of residents and jobs explains 65–83 per cent of the current commuting pattern in the four cities. Other identified drivers are transport infrastructure and skill mismatch.
- State government population projections anticipate that the Outer sector will have the largest share of projected population growth (65–76 per cent) and job growth (34–55 per cent) in each of the four cities through to 2031. These projections imply that the relative importance of same-subregion commutes will rise (driven by increased commutes within outer suburban subregions) and the proportion of inward commutes will decline.
- Recent metropolitan strategic plans for the four cities specify some common long-term goals that relate to the spatial distribution of population and jobs, and to commuting. There has been some movement in the desired direction for most of the population-related planning goals since 2001. There has also been significant movement towards achieving greater use of public transport and active transport in each city. However, progress was not as strong for the employment-related planning goals, and commuting times have not been heading in the desired direction.

Contents

Executive summary

This report compares spatial patterns of population growth and jobs growth in Sydney, Melbourne, Brisbane and Perth. It explores how commuting behaviour has responded to these changes in population and jobs, and investigates the extent to which these recent spatial changes match up to the long-term strategic planning goals for each city. This report brings together the findings of four recent BITRE Reports (BITRE 2010, 2011, 2012a, 2013a) which provide in-depth case studies of Australia's four largest cities. It provides an overview of relevant statistics across the cities, identifies some common trends (and differences), and highlights the implications of the analysis.

The principal data sources used in this report are the Australian Bureau of Statistics' (ABS) *Estimated Resident Population* time-series data and *Census of Population and Housing* data for 2001, 2006 and 2011. The four individual city reports did not incorporate any information from the 2011 census. However, this comparative report incorporates the 2011 census data in a limited way—enabling aggregate comparisons of change to be made for each city with respect to dwellings, employment, industry and transport use.

The spatial analysis in this report is presented at a range of different levels of disaggregation, to convey an understanding of both the overarching patterns and some of the finer detail. This study compares Australia's four largest cities using ABS Australian Standard Geographical Classification (ASGC) Statistical Division (SD) boundaries for 2006.[1] To understand the distribution of residents and jobs, the SDs have been divided into Inner, Middle and Outer sectors.[2] Other adopted geographies include subregions, Statistical Local Areas (SLAs) and activity centres.

Comparison of major cities[3]

This report presents a summary of changes in population, jobs and commuter transport use for Australia's 18 major cities, which helps place the results for Sydney, Melbourne, Brisbane and Perth within a broader context.

Between 2001 and 2011, the population of the major cities grew at an average of 1.6 per cent per annum, compared to the national average of 1.4 per cent. The number of jobs located in the major cities grew at an annual rate of 1.9 per cent, compared to the national average of 1.7 per cent.

1 While the geographic scope of the capital city strategic plans does not generally correspond to SD boundaries, the individual city reports contain assessments that are more tailored to the geographic coverage of the relevant strategic plan. Chapter 1 includes a discussion of how the scope of recent metropolitan strategies for each city compares to the SD boundaries used in this report.

2 Sectoral classification based on state government classifications where available, or alternatively on ABS' Statistical Subdivision (SSD) boundaries. Map 1.2 illustrates sectoral boundaries for each city.

3 The 18 major cities consist of the 8 capital cities and 10 other cities with populations of more than 100 000 in 2011 (Major Cities Unit 2011).

Gold Coast-Tweed, Cairns and Sunshine Coast had the highest average annual population growth rates between 2001 and 2011 (of 2.6–2.8 per cent), whilst Wollongong and Albury-Wodonga had the lowest growth rates (of 0.6–0.8 per cent). The largest population increases occurred in Melbourne (which added 636 300 new residents), Sydney (477 600), Brisbane (408 900), Perth (351 500) and the Gold Coast (149 900).

Between 2001 and 2011, the largest number of jobs were added in Melbourne (302 300), followed by Brisbane (223 300), Sydney (184 600), Perth (174 400) and Adelaide (66 700). The highest average annual job growth rates (2.8–3.0 per cent) occurred in Gold Coast-Tweed, Brisbane, Perth, Canberra-Queanbeyan and Sunshine Coast. Albury-Wodonga and Sydney grew slowly (about one per cent each) and Launceston stagnated (with zero per cent growth) from 2001 to 2011.

Across all major cities, the private vehicle mode share declined by 1.5 percentage points between 2001 and 2011. This was accompanied by a 1.5 percentage point increase in the public transport mode share, a 0.5 percentage point increase in the active transport mode share and a 0.4 percentage point decline in working from home. The six largest capital cities—Sydney, Melbourne, Brisbane, Perth, Adelaide and Canberra-Queanbeyan—share a common trend of increased public transport and active transport use, and reduced private vehicle use. However, the smaller major cities all experienced reduced active transport use and (apart from Geelong) increased private vehicle use. From 2001 to 2011, the proportion of employed residents who worked from home declined in all 18 major cities.

Residential patterns and trends

In 2011, the population of Sydney stood at 4.61 million, followed by Melbourne (4.11 million), Brisbane (2.04 million) and Perth (1.74 million). In terms of the population distribution, 18 per cent of Sydney residents live over 40km from the Central Business District (CBD), compared to 11 per cent for Melbourne and 6 per cent for Perth and Brisbane. Brisbane had a greater share of its population living within 5km of the CBD at 11 per cent, compared to 6–9 per cent in Sydney, Melbourne and Perth.

Between 2001 and 2011, Melbourne and Sydney gained the most new residents (636 300 and 477 600 persons, respectively), but Perth and Brisbane recorded higher average annual rates of population growth (2.3 per cent each) than Melbourne (1.7 per cent) or Sydney (1.1 per cent).

Due to redevelopment with higher density housing, the CBDs[4] of all four cities experienced very rapid population growth from 2001 to 2011 (averaging more than 3 per cent per annum). The middle suburbs of each city averaged 0.9–1.8 per cent growth per annum, while the outer suburbs of Melbourne, Brisbane and Perth grew more rapidly (2.4–2.9 per cent per annum). This pattern was not repeated in Outer Sydney, which averaged 0.9 per cent per annum growth. Nevertheless, the outer suburbs accommodated much of the population growth in all four cities, contributing 46 per cent of Sydney's growth, compared to 53 per cent for Brisbane, 62 per cent for Melbourne and 68 per cent for Perth.

All of the Australian SLAs that added 25 000 or more new residents from 2001 to 2011 were located in the outer suburbs of the four largest capital cities. The SLAs with the largest

4 Defined as the central LGA for Sydney, Melbourne and Perth, and as the combination of the City Inner and City Remainder SLAs for Brisbane. Based on 2006 boundaries.

population increases were mainly located in Melbourne (e.g. Melton East, Whittlesea North, Cranbourne, Wyndham North) and Perth (e.g. Rockingham, Wanneroo North West). Sydney and Brisbane each had a single SLA which added over 25 000 residents—Blacktown North for Sydney and Ipswich East for Brisbane.

Sydney is Australia's most densely populated city, and the most densely populated SLAs are concentrated in Sydney and to a lesser extent, Melbourne. All four cities recorded density gains in their established inner and middle suburbs between 2001 and 2011. Sydney, Melbourne and Brisbane each experienced a clear shift towards higher density forms of housing—with a significant increase in the proportion of high-rise flats, units and apartments and a significant decline in the proportion of separate houses between 2001 and 2011. All four cities recorded an increase in the residential density of activity centres between 2001 and 2006, although the magnitude of change was limited for Melbourne.

Employment patterns and trends

In 2011, there were 1.87 million jobs located in the Sydney SD, compared to 1.74 million in the Melbourne SD, 0.90 million in the Brisbane SD and 0.73 million in the Perth SD.

Jobs are concentrated in and around the CBDs, with each city having 25–34 per cent of jobs located within 5km of the CBD in 2006. The CBD-based activity centres range in size from 108 700 jobs in Perth to 300 100 jobs in Sydney. While Sydney contains several other activity centres with over 25 000 jobs (e.g. St Leonards, Parramatta, Macquarie Park, Sydney Airport-Mascot), there are no non-CBD centres of this size in the other three cities. The most substantial employment clusters in Melbourne, Brisbane and Perth's middle and outer suburbs are typically industrial areas or transport-specialised centres (e.g. Melbourne Airport, Australia's TradeCoast area of Brisbane, Kewdale-Welshpool in Perth).

Employment growth was most substantial for Melbourne, which added 302 300 jobs between 2001 and 2011, compared to 223 300 in Brisbane, 184 600 in Sydney and 174 400 in Perth. Brisbane and Perth had a more rapid average annual rate of job growth (2.9 and 2.8 per cent, respectively), than did Melbourne (1.9 per cent) or Sydney (1.0 per cent). The Health and community services industry was the main source of job growth in Sydney, Melbourne and Brisbane (and the second largest source in Perth).

From 2001 to 2011, the Inner sector—and particularly the CBD—of all four cities experienced substantial job growth. Inner Melbourne added about 92 000 jobs (80 000 in the CBD), while between 52 000 and 61 000 jobs were added to each of Inner Sydney, Inner Brisbane and Inner Perth. However, the Outer sector recorded the most rapid job growth in all four cities between 2001 and 2011, and added more jobs than the other sectors in Sydney (67 000), Melbourne (107 000) and Perth (76 000). In Brisbane, the Middle sector added the most jobs (82 000).

The SLAs with the largest job growth were inner city locations, such as Southbank-Docklands, Sydney Inner, Perth Inner and Melbourne Inner. Beyond the inner city, the key job growth areas were Ryde in Sydney; Craigieburn and Wyndham North in Melbourne; Pinkenba-Eagle Farm in Brisbane; and Swan, Belmont and Cockburn in Perth.

A common feature of recent job growth in all four cities is the rapid job growth of specialised centres, such as airports and business parks. However, of the four cities, only Brisbane saw an increase in the employment share of its non-specialised activity centres between 2001 and 2006.

Despite the rapid outer suburban job growth that occurred over the 2001 to 2011 period, there continues to be a shortfall of outer suburban jobs (relative to employed residents) in all four cities. This is particularly the case for Perth's outer suburbs, which provided only 53 jobs for every 100 employed residents in 2011, up from 52 in 2001. While there was no general tendency for the outer suburban job gap to widen between 2001 and 2011, the shortfall did become more pronounced in specific outer suburban subregions—such as Outer Western Melbourne and Outer Western Brisbane—where job growth failed to keep pace with local residential growth.

Commuting patterns and trends

Commuter use of transport

In 2011, the private vehicle mode share of commuter travel was highest in Perth (78 per cent), lower in Melbourne and Brisbane (74 per cent), and lowest in Sydney (67 per cent). The public transport mode share was highest for Sydney (22 per cent), followed by Melbourne (16 per cent), Brisbane (15 per cent) and Perth (12 per cent). Active transport mode shares are highest for Sydney residents (5 per cent) and lowest in Perth (4 per cent). Around 4 per cent of employed residents in each city worked from home in 2011.

Private vehicle mode shares are highest for Outer sector residents of each city, and are particularly high for Outer Melbourne (84 per cent in 2011). Active transport and public transport mode shares are highest for Inner sector residents and lowest for Outer sector residents of each city. Commuters mainly use the public transport system to access inner city jobs, with Inner sector workers responsible for 74–82 per cent of total public transport use by commuters.

Between 2001 and 2011, the private vehicle mode share of commuter travel declined in Melbourne (–4.0 percentage points), Perth (–3.3 percentage points), Brisbane (–2.7 percentage points) and Sydney (–0.8 percentage points). While there were pronounced declines for Inner sector residents of each city, the private vehicle mode share increased for Outer Sydney residents.

Over the same period, the public transport mode share rose by 3.4 percentage points in Perth, 3.0 percentage points in Melbourne, 2.4 percentage points in Brisbane and 0.8 percentage points for Sydney. Residents of Inner Perth and the Middle sectors of Melbourne, Perth and Brisbane had the largest increases. All four cities also recorded an increase in the active transport mode share, with the largest increase in Melbourne (1.1 percentage points). The increases in active transport use were concentrated amongst Inner sector residents.

Spatial commuting flows

The overall spatial structure of commuting flows is broadly similar across the four cities. In 2006, 36–45 per cent of commuting flows within each of the four capital city SDs occurred in an inward direction and 6–10 per cent in an outward direction. The remaining 46–55 per cent of flows occurred within the home ring, and typically within the home subregion. Commutes within the home subregion (and ring) are the most prominent type of commuter flow in Sydney (43 per cent), Melbourne (46 per cent) and Brisbane (45 per cent), and the second most prominent category for Perth (43 per cent, against 44 per cent for inward flows).

Inward commutes most often involve commuting to a place of work in the CBD. Between 25 and 42 per cent of Inner sector residents of each city commuted to a CBD workplace in 2006, compared to 15–21 per cent of Middle sector residents and 6–11 per cent of Outer sector residents. In each city, Outer sector residents are most likely to commute to an Outer sector workplace, and are more likely to commute to a place of work in the Middle sector than the Inner sector.

In all four cities, inward flows had a below-average rate of growth from 2001 to 2006, so the proportion of inward commutes declined (by 0.7–1.1 percentage points). In Sydney, Melbourne and Brisbane, outward flows had the most rapid growth, while cross-suburban commutes grew most rapidly in Perth.

Reflecting the concentration of population and jobs growth in the outer suburbs, from 2001 to 2006 the largest increases in commuter flows were for flows *within* outer suburban subregions—such as the 21 230 extra people who commuted within Melbourne's Outer Southern subregion. There were also substantial increases in the number of people commuting *within* the innermost subregions—such as the extra 12 640 people who commuted within Inner Melbourne. The largest increases in commuter flows between different subregions were typically inward flows, such as the extra 6750 commuters from Middle Perth to Inner Perth. Despite this, there was a small decline in the probability that an employed resident of each city would commute to an Inner sector workplace (of 0.5–1.8 percentage points).

Commuting distances and times

Average commuting distances were similar for residents of Sydney, Melbourne and Brisbane in 2006, and a little lower for Perth. In each city, average commuting distances were lowest for Inner sector residents (5–7km), higher for Middle sector residents (8–10km), and highest for Outer sector residents (13–15km).[5] Average commuting distances remained essentially unchanged for all four cities between 2001 and 2006. However, the Sydney *Household Travel Survey* reports a 1.1km net rise in average commuting distances between 2005–06 and 2011–12.

In 2006, Sydney full-time workers took 37 minutes on average to commute to work, compared to 33 minutes for Melbourne and Brisbane, and 28 minutes for Perth. Average commuting times tend to be 4–7 minutes longer for Outer sector residents than for Inner sector residents. Between 2002 and 2010, the HILDA survey identifies substantial net increases in average commuting times for full-time workers in Brisbane (7 minutes) and Perth (6 minutes), with moderate increases for Sydney (4 minutes) and Melbourne (3 minutes). The *Sydney Household*

5 These are straight line commuting distances. The individual city reports for Sydney, Melbourne and SEQ present estimates based on road network distances (BITRE 2011, 2012a, 2013a).

Travel Survey reports a 2 minute net rise in the average commuting trip duration between 2000–01 and 2011–12.

Some drivers of commuting flows

Gravity model regression analysis is used to explore the drivers of origin-destination commuting flows and to describe how commuting behavior has responded to recent spatial patterns of residential and job growth in each city.

For Sydney, Melbourne, Brisbane and Perth, the gravity model is able to explain 67–85 per cent of the variation in origin-destination commuting flows in 2006. The amount of commuting between an origin and destination location tends to increase with the number of employed residents of the origin location and the number of jobs in the destination location, but declines as the distance between the two locations widens. Distance was less of an impediment to travel for origin-destination pairs that had a direct rail connection or a direct freeway connection. Distance was more of an impediment to travel in the larger cities of Sydney and Melbourne than it was in Perth or Brisbane. Also, the greater the alignment between the skills available in the origin and the skills demanded in the destination, the greater the likely commuting flows between those two locations.

The study also identifies the drivers of *change* between 2001 and 2006. The key drivers of growth in commuting flows for an origin-destination pair include the rate of growth in employed residents in the origin location, the rate of growth in jobs at the destination location, distance (reflecting the impact of rising fuel prices over the period), and very large scale expansions of transport infrastructure (such as the series of freeway and tunnel investments that were completed in Sydney between 2001 and 2006).

Outlook[6]

The state government population projections suggest that Sydney and Melbourne will both experience a population increase of around 1.7 million people between 2006 and 2031, with a 1.0 million increase for Brisbane and a 0.9 million increase for Perth.[7] These projections anticipate that the Outer sector of each city will contribute the *largest share of population growth*—from 65 per cent in Melbourne to 76 per cent in Perth. The Outer sector also has the highest projected average annual growth rate in all four cities, with particularly rapid growth in Outer Brisbane and Outer Perth (averaging 2.6 per cent per annum). Relatively slow average annual growth is expected for the Middle sectors of Melbourne (0.8 per cent), Brisbane (0.9 per cent) and Perth (0.9 per cent).

At the subregion scale, the largest increases in population are projected to occur in the South West and North West of Sydney, the Outer South and the Outer West of Melbourne, and the

6 The population and employment projections were prepared by different organisations at different points in time and reflect different underpinning methods and assumptions. The projections used were the most recent available at the time the analysis was undertaken. For Sydney, the population projections used in this study are sourced from BTS (2012a), and not from the updated preliminary set of population projections for LGAs that was released by the NSW Government in August 2013.

7 BITRE has extended the Perth population projections (Western Australian Government 2012) from 2026 to 2031, so that the projections for all four cities can be presented for a common time period.

Outer West of Brisbane. Each of these subregions is projected to add between 320 000 and 425 000 new residents.

The available employment projections anticipate that average annual job growth will be relatively rapid for Brisbane between 2006 and 2031 (2.2 per cent per annum)[8], followed by Perth (1.7 per cent), Sydney (1.4 per cent) and Melbourne (1.3 per cent). The Outer sector is projected to be the *fastest growing* and to contribute a *larger share* of job growth than the Inner and Middle sectors. Perth's Outer sector is projected to contribute 55 per cent of jobs growth, compared to 48 per cent for Outer Sydney, 41 per cent for Outer Melbourne and 34 per cent for Outer Brisbane.

The CBDs are projected to add many additional jobs in Sydney (147 000), Melbourne (142 000) and Brisbane (73 000). However, the share of jobs located in the CBD is projected to fall in Sydney, Brisbane and Perth between 2006 and 2031, and remain stable for Melbourne. Outside the CBDs, Sydney's North West and Melbourne's Outer South subregions are projected to add 150 000 and 141 000 jobs, respectively.

Should these spatial projections of population and job growth be realised, BITRE's exploration of future commuting patterns suggests that the relative importance of same-subregion commutes is likely to rise significantly in all four cities, with same-subregion commutes contributing about half of the increased commuter flows in each city from 2006 to 2031. The spatial projections also imply that commutes *within* the Outer sector will represent a large proportion of the total increase in commutes (34–51 per cent), and that the relative importance of inward commutes is likely to decline. This decline, together with the projections of rapid outer suburban job growth, will pose a challenge to achieving growth in the public transport mode share. However, the increased importance of close-to-home commutes may open an opportunity to increase use of active transport.

Strategic planning

Metropolitan strategic plans are a key element of capital city strategic planning systems and are particularly relevant to the current study, as they articulate a range of strategic objectives that relate to the spatial distribution of population and employment within the metropolitan area, or to commuting patterns and transport use. Sydney, Melbourne, Perth and South East Queensland (SEQ) each had several different metropolitan strategic plans in operation over the 2001 to 2011 period. This report focuses on the most recent strategic plan[9] for each city, namely the *Metropolitan Plan for Sydney 2036* (released in 2010), *Melbourne 2030* and its *Melbourne @ 5 million* update (released in 2002 and 2008, respectively), the *SEQ Regional Plan 2009–2031* (from 2009), and the Perth and Peel plan—*Directions 2031 and beyond* (released in 2010). New metropolitan strategies are currently being prepared for Sydney and SEQ, while the *Plan Melbourne* metropolitan strategy was released by the Victorian Government in October 2013.

The recent metropolitan plans for the four cities specify some common long-term goals, relating to limiting urban sprawl, increasing residential densities around centres, locating employment in

8 BITRE has extended the Brisbane employment projections (NIEIR 2007) from 2026 to 2031, so that the projections for all four cities can be presented for a common time period.

9 This report considers the most recent strategic plan that was available at the time the research was undertaken, in the first half of 2013. It does not consider the new *Plan Melbourne* metropolitan strategy, which was released by the Victorian Government in October 2013.

centres, achieving employment growth in particular suburban locations, achieving greater use of public transport and active transport, concentrating development around public transport, and reducing commuting times and distances.

BITRE's study identifies the actual 'on the ground' changes that have been occurring with respect to these long-term strategic planning goals, identifying whether such movements are in the desired direction and progressing at the targeted pace of change (see Table ES.1). This study does not evaluate the effectiveness of strategic planning systems. Rather, it examines the evidence about recent trends in population, employment, transport use and commuting in each city, which can then be used to inform future planning initiatives.

The available evidence suggests that there has been some movement in the desired direction for most of the population-related planning objectives since 2001. Significant progress is evident with respect to increasing residential densities in centres (in Sydney and Brisbane), shifting the focus of population growth within the city (in Melbourne and Brisbane), and consolidating rural population growth in existing settlements (in Melbourne). With respect to the objective of limiting urban sprawl, all four cities had a significant reduction in the typical size of newly produced lots, and the long-term infill targets for Sydney, Melbourne and Brisbane were exceeded over the past decade. However, for Perth, rates of infill development were well below the strategic planning target.

Recent progress against the employment-related planning goals has been weaker than progress against the population-related goals. While there was a significant increase in the centred employment share in Sydney and Brisbane, there was rather limited progress in growing employment in the targeted suburban areas of Sydney, Melbourne and Brisbane, and in concentrating employment growth within Melbourne's and Perth's centres.

The 2001 to 2011 period saw generally positive progress towards achieving greater use of both public transport and active transport in each city. There was significant progress towards achieving greater public transport use in Melbourne and Perth, but more limited progress for Sydney. Due to mixed evidence, the underlying direction of change was difficult to determine for some of the transport and commuting related planning goals (e.g. concentrating development around public transport nodes, increasing self-containment). For the strategic planning goals of reducing commuting times and distances, the observed changes have generally not been in the desired direction, particularly with respect to commuting times, which increased in all four cities.

Overall, BITRE's analysis shows that the recent spatial trends in Australia's four largest cities have been reasonably well-aligned with some of the strategic planning goals, including the goals of shifting the focus of population growth within the city, increasing residential densities in centres, and increasing active transport and public transport use. The observed changes have generally been incremental in nature, as the accumulated effects of decades of residential and industry development do not reverse in just five to ten years. There are, however, two main areas where recent trends do not match up well to strategic planning goals. Firstly, the recent changes with respect to the employment-related planning goals have generally not been progressing at the required pace (or breadth) of change. Secondly, over the past decade, movements in commuting times have been in the opposite direction to that envisaged by planning authorities.

Table ES.1 Observed changes since 2001 with respect to strategic planning goals that relate to the spatial distribution of population, employment, transport use and commuting flows

Strategic planning goal	Time period to which evidence relates	Extent of progress			
		Sydney	Melbourne	Brisbane	Perth
Population					
1. Limit urban sprawl	2001 to 2011	Over-achieved[a]	Some	Some	Limited
2. Increase residential densities around centres	2001 to 2006	Good[b]	Limited	Good	Some
3. Consolidate rural population growth in existing settlements	2001 to 2006	n/a	Good	Some[c]	n/a
4. Shift the focus of population growth within the city	2001 to 2011	n/a	Good	Good	n/a
Employment					
5. Locate employment in centres	2001 to 2006	Good	Isolated	Good	Isolated
6. Achieve employment growth in suburban locations	2001 to 2011	Limited	Limited	Limited	Some
Transport use					
7. Greater use of public transport	2001 to 2011	Limited	Good	Some	Good
8. Greater use of active transport	2001 to 2011	Some	Some	Some	Some
9. Concentrating residential development and job growth around public transport nodes	2001 to 2006	Mixed[d]	Mixed[e]	Isolated	Mixed
Commuting flows					
10. Increase self-containment	2001 to 2006	Mixed	n/a	Mixed	n/a
11. Reduce commuting distances	2001 to 2012	Negative	Negative	Mixed	No change
12. Reduce commuting times	2002 to 2010	Negative[f]	Negative	Negative	Negative

Notes: The assessments in Table ES.1 sometimes differ from those presented previously in the individual city reports (BITRE 2010, 2011, 2012a, 2013a), due to inclusion of more recent data and use of updated methods to improve consistency of assessment approach across the cities.

n/a = not applicable (i.e. not a stated strategic planning goal for that city)

a Urban sprawl was contained, but the level of new dwelling production in Sydney declined significantly, with implications for affordability and growth.

b Evidence relates to 2001 to 2008 period.

c Evidence relates to 2001 to 2011 period.

d For Sydney, evidence relates to the 2001 to 2010 period.

e For Melbourne, evidence relates to the 2001 to 2007 period.

f For Sydney, evidence relates to 2000–01 to 2011–12 period.

Source: BITRE analysis—details of assessment and sources provided in Chapter 4 (goals 1–4), Chapter 5 (goals 5 and 6), Chapter 6 (goals 7–9) and Chapter 7 (goals 10–12) of this report, and in the individual city reports (BITRE 2010, 2011, 2012a, 2013a).

It is important to recognise that there are wide-ranging interconnections, and in some cases tensions, between the different strategic planning goals. Progress against strategic planning goals also has implications for broader economic, social and environmental policy goals. For example, while recent progress in 'limiting urban sprawl' in Sydney has exceeded expectations, the COAG Reform Council (2012, p.98) notes that the 'goal of a more compact city is a delicate

balancing act. Infill development will help Sydney meet sustainability and competitiveness goals but may have negative effects on affordability and growth'.

Future directions

Over the course of this research project, a detailed evidence base has been built about recent spatial trends in population, employment, commuting and transport use in Australia's four largest cities (see BITRE 2010, 2011, 2012a, 2013a). This evidence base serves as a valuable resource for infrastructure planning and urban policy. However, the current evidence base is by no means comprehensive, and as identified by COAG Reform Council (2012), there is considerable scope for improved performance measurement with respect to strategic planning outcomes. BITRE also sees a need for further analysis of 2011 census data to shed light on recent patterns of growth in Australia's major cities (particularly with respect to employment and industry growth) and for updated estimates and projections of congestion costs in Australia's capital cities.

CHAPTER 1
Introduction

Key points

- This report compares spatial patterns of population growth, jobs growth and commuting in Australia's four largest cities—Sydney, Melbourne, Brisbane and Perth. It also presents an overview of change in other capital cities and regional cities. The analysis considers the 2001 to 2011 period.
- This report summarises the evidence on spatial changes in employment and population in Australia's four largest cities, and explores how commuting behaviour has responded to these changes. It also considers the extent to which these recent trends match up to the stated strategic planning goals for each city.
- The comparative report draws largely on the material presented in the four individual city reports, for which the principal underlying data sources were Australian Bureau of Statistics (ABS) *Census of Population and Housing* data for 2001 and 2006 and *Estimated Resident Population* (ERP) data. However, the population analysis in this report has been updated to incorporate the July 2012 release of ERP data (which has been rebased to 2011 census data on a preliminary basis). Some high-level data from the 2011 ABS Census of Population and Housing on dwellings, employment, industry and transport use has also been incorporated into the comparative report.
- This study compares Australia's four largest cities using Statistical Division (SD) boundaries.
- The spatial analysis in this report is presented at a range of different levels of disaggregation, to convey an understanding of both the overarching patterns and some of the finer detail. The adopted geographies include the capital city SDs, sectors, subregions, Statistical Local Areas (SLAs) and activity centres. This study adopts 2006 Australian Standard Geographical Classification (ASGC) boundaries.

Context

This report compares patterns of population growth, jobs growth and commuting in Australia's four largest cities—Sydney, Melbourne, Brisbane and Perth. It brings together the findings of four recent BITRE Reports:

- Report 119 *Population growth, jobs growth and commuting flows in Perth* (BITRE 2010)
- Report 125 *Population growth, jobs growth and commuting flows in Melbourne* (BITRE 2011)
- Report 132 *Population growth, jobs growth and commuting flows in Sydney* (BITRE 2012a)

- Report 134 *Population growth, jobs growth and commuting flows in South East Queensland* (BITRE 2013a).

These in-depth case studies of Australia's four largest cities provide the basis for this final comparative report, which:

- provides an overview of relevant statistics across the cities
- assembles some common themes that emerge from the individual city studies, as well as the differences
- highlights the implications of the analysis.

This report is the final release in a series of BITRE reports that aim to build an evidence base on the spatial nature of recent changes in population, jobs and commuting flows in our largest capital cities, and how commuting behaviour has responded to these changes. A secondary aim is to investigate the extent to which there has been progress in reshaping each city's spatial development and commuting patterns in the direction envisaged by recent metropolitan plans. Understanding changes in the spatial patterns of major city land uses can assist in the development of urban, infrastructure and local government policy.

Study area

This study compares Australia's four largest cities, based on Statistical Division (SD) boundaries, as defined in the Australian Bureau of Statistics' (ABS) Australian Standard Geographical Classification (ASGC) for 2006.

For many years, it has been standard for statistics relating to Australia's capital cities to be based on SD boundaries. This is set to change in coming years as the ABS' new Australian Statistical Geography Standard (ASGS)—and its Greater Capital City Statistical Area (GCCSA) boundaries—are gradually adopted.

It is important to recognise that the commuting catchment of each of these cities tends to extend well beyond the SD boundaries, and the capital city typically has strong interdependencies with nearby regional cities and peri-urban areas. For this reason, the individual city reports all considered an area extending beyond the SD boundary:

- Sydney—while much of the analysis focused on the Sydney SD, considerable information was also presented for the Sydney Greater Metropolitan Area, which includes Illawarra and the Lower Hunter, in addition to the Sydney SD.
- Melbourne—the analysis related to the Melbourne working zone, which in addition to the Melbourne SD includes a number of adjoining peri-urban areas which have significant commuting connections with the city (e.g. Bacchus Marsh, Mitchell South).
- South East Queensland (SEQ)—the study area extended well beyond the Brisbane SD to include Gold Coast, Sunshine Coast, Toowoomba and West Moreton, and corresponded to the geographic scope of the *SEQ Regional Plan.*
- Perth—the analysis related to the Perth working zone, which in addition to the Perth SD includes the adjoining Peel and Avon Arc regions.

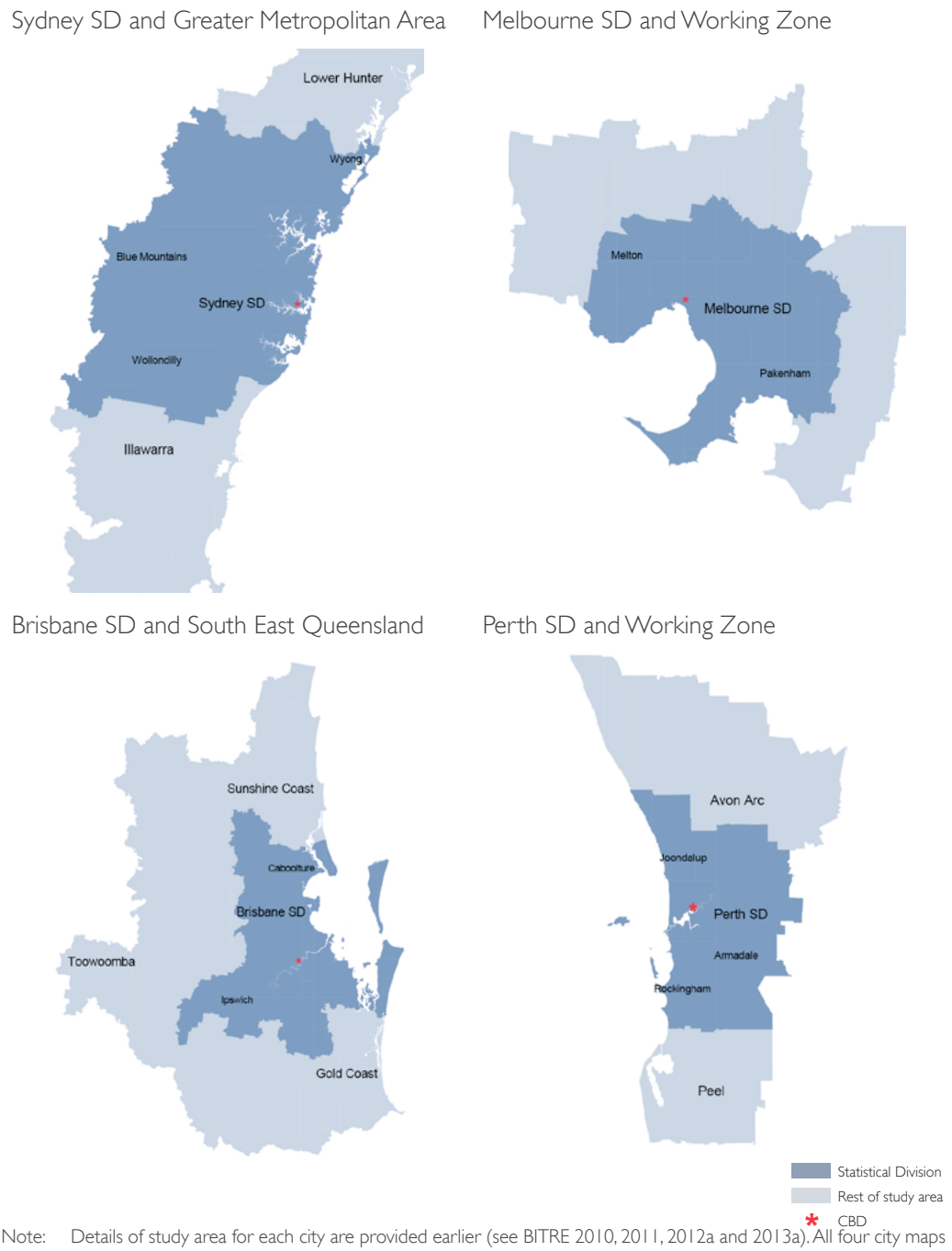
Map 1.1 shows how the SD boundary relates to the study area adopted in BITRE's individual city reports. Readers who wish to gain a broader understanding of interconnections between

the metropolitan SD and surrounding areas are referred to the individual city reports (BITRE 2010, 2011, 2012a, 2013a), which have a broader geographic scope than this comparative report and contain much greater spatial detail.

In this comparative report, the assessment of recent trends against relevant strategic planning goals will be based on trends within the relevant capital city SD. However, the geographic scope of the metropolitan strategic plans does not generally correspond to SD boundaries.[10] The SD-based approach has been adopted to enable cross-city comparisons to be made. The individual city reports contain assessments that are more tailored to the geographic coverage of the relevant strategic plan. For example, the SEQ report presents evidence for SEQ as a whole (rather than just the Brisbane SD).

10 For Melbourne, there is a relatively close match between the geographic scope of recent metropolitan strategies and the SD boundary. The two most recent metropolitan strategies for Sydney have excluded Central Coast (which lies within the Sydney SD) from their scope, while the most recent metropolitan strategy for Perth includes the Peel region in addition to the Perth SD (defined on 2006 ASGC boundaries). The geographic scope of the *SEQ Regional Plan* extends well beyond the Brisbane SD to include Gold Coast, Sunshine Coast, Toowoomba and West Moreton.

Map 1.1 Relationship between statistical division boundary and study area adopted in BITRE's four individual city reports



Note: Details of study area for each city are provided earlier (see BITRE 2010, 2011, 2012a and 2013a). All four city maps are presented at a common scale.

Source: BITRE analysis of ABS 2006 SLA and SD boundaries.

Information sources

The report uses the official population counts (i.e. ABS' *Estimated Resident Population* (ERP) data) and detailed data from the ABS' *Census of Population and Housing* to answer the following research question:

> What are the recent spatial changes in employment and residential patterns in the largest capital cities and how has commuting behaviour responded?

The period of interest for this study is the period from 2001 to 2011. However, the principal focus of the series of four cities reports—covering Sydney, Melbourne, Perth and SEQ—has been the 2001 to 2006 period for which detailed spatial analysis was undertaken based on the ABS *Census of Population and Housing*. The individual city reports did not incorporate any information from the 2011 ABS *Census of Population and Housing,* since the relevant data items were not available at the time the spatial analysis was undertaken.[11]

This comparative report draws together results from the four individual city reports, but the evidence base is updated in two ways:

- While the four individual city reports draw on different releases of ABS ERP data, the population analysis in Chapter 4 of this report is based on the July 2012 release of ABS ERP data (which has been rebased to 2011 census data, on a preliminary basis).
- Some high-level data from the 2011 ABS *Census of Population and Housing* has been incorporated in Chapter 3 (comparison of major cities) and in break-out boxes within Chapters 4, 5 and 6 (on population, employment and transport, respectively). Specifically, information is presented on dwellings, employment, industry and transport use at a city-wide scale, and for the Inner, Middle and Outer sectors. This city-wide analysis of the changes that occurred between 2006 and 2011 will shed some light on whether the patterns of change identified for the 2001 to 2006 period (and detailed in the individual city reports) are ongoing.

Apart from the population analysis, the spatial analysis in this comparative report continues to be largely based on 2001 and 2006 *Census of Population and Housing* data, and drawn from the material presented in the individual city reports. The 2011 census data has only been incorporated in a limited way—to enable aggregate comparisons of change to be made for each city and to identify the main job growth Statistical Local Areas (SLAs) in each city between 2001 and 2011. The 2011 census data has not been used to support other small area comparisons of change[12] or spatially-detailed forms of analysis. Consequently, the analysis of spatial commuting patterns in Chapter 7 does not incorporate any 2011 census data. Similarly, the analysis of changes that have occurred with respect to some of the more spatially-detailed strategic planning goals continues to be based on spatially-detailed data from the 2001 and 2006 censuses, as presented in the individual city reports.

11 The 2011 *Census of Population and Housing* data on employment, industry, transport mode and commuting was released during October and November 2012, while population data was released in June and July 2012.

12 It was a relatively straightforward matter to produce city-wide and sectoral estimates using 2011 census data that were comparable to the 2001 and 2006 data that forms the basis of the individual city reports. ABS provided customised tabulations of the 2011 census place of work data on 2006 SLA boundaries which supported the analysis of employment change in Box 5.2. However, bringing the 2011 census data on to common boundaries with the 2001 and 2006 data at more disaggregated scales (e.g. Destination Zones, activity centres)—so that valid small area change comparisons can be made—is a complex process, and was not considered feasible within the timeframe of this project.

During 2013–14, BITRE intends to produce a range of analytical outputs for cities based on the ABS' 2011 *Census of Population and Housing*. A series of short information sheets are planned which will use 2011 census data to shed light on employment growth within cities and infrastructure-related employment.[13]

While ERP and census data are the principal data sources used in this comparative report, a range of other national data sources are also drawn upon (e.g. ABS dwelling approvals, ABS population projections, Austroads National Performance Indicators). The individual city reports make use of a range of state government data sources, but only limited use has been made of state-specific sources in this report, since such sources are generally not comparable across cities. The principal use of state-specific sources is in Chapter 9 (Outlook), which relies on state government spatial projections of population and jobs.

The individual city reports also incorporate information on longer term trends, to put the current changes into their historical context. However, this comparative report adopts a more exclusive focus on the 2001 to 2011 period (and particularly on the 2001 to 2006 subperiod).

Many of the capital city Central Business District (CBD) councils and state governments have undertaken similar, and sometimes more in-depth, analysis of patterns of residential and jobs growth for their own city. BITRE's multi-city study adds value by jointly considering spatial patterns of population, employment and commuting growth, by bringing together the different cities on a comparable basis, and highlighting commonalities and differences in the ways the cities are evolving over time.

Geography

The spatial analysis in this report is presented at a range of different levels of disaggregation, to convey an understanding of both the overarching patterns and some of the finer detail. The adopted geographies include the capital city SD, sectors, subregions,[14] SLAs and activity centres. This study adopts 2006 ASGC boundaries (ABS 2006).

To better understand the distribution of residents and jobs, each city has been divided into Inner, Middle and Outer sectors, based on state government classifications where available, or alternatively on ABS ASGC boundaries. The sectoral classification generally reflects the history of residential development in the city. Map 1.2 illustrates the definitions of the Inner, Middle and Outer sectors of each city that underpin the sectoral analysis presented in this report.

On occasions, the Inner sector is subdivided into two components—the Central Business District (CBD) and the Rest of the Inner sector. This study adopts a relatively broad definition of the CBD as corresponding to the central LGA in Sydney, Melbourne and Perth,[15] and to the aggregate of the City Inner and City Remainder SLAs in Brisbane.

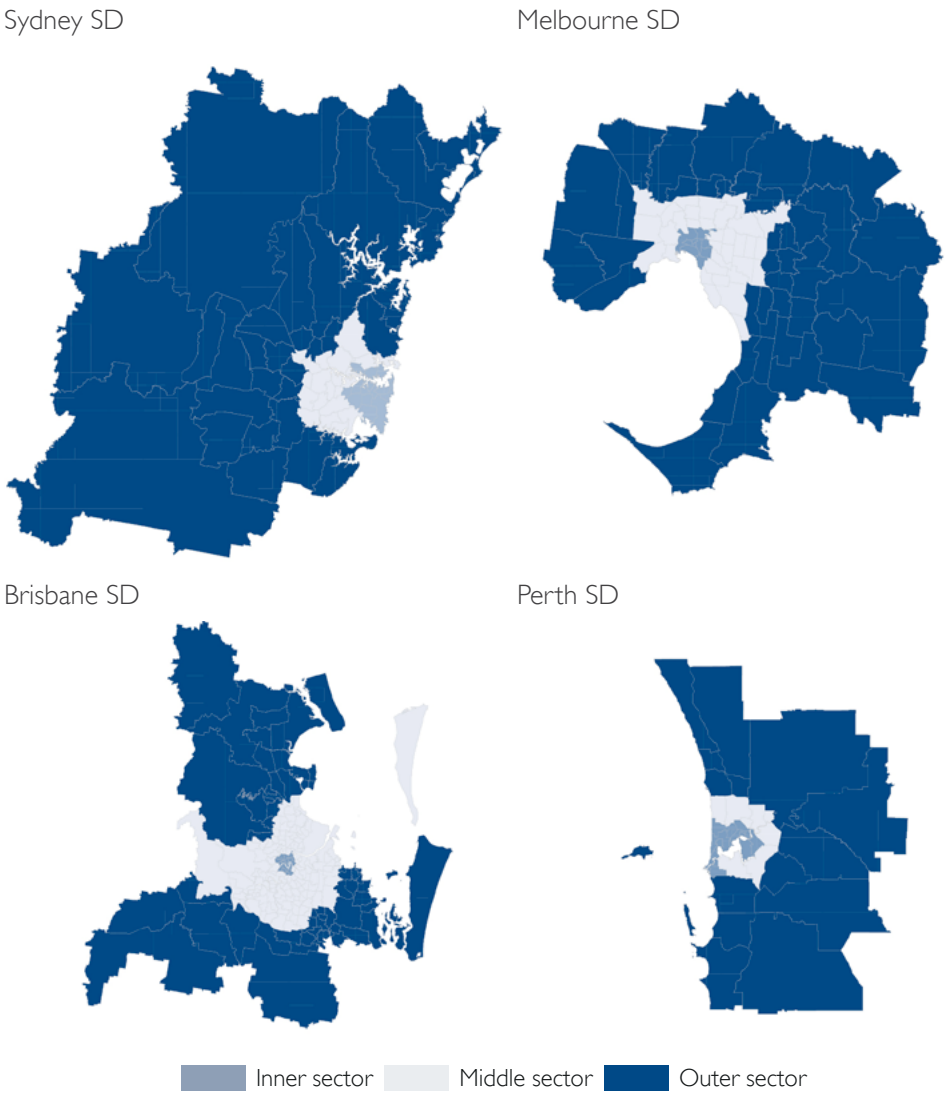
A further method used to compare spatial patterns of development across cities is based on a fixed distance radius around the CBD (e.g. within 5km of CBD, 5–10km, 10–20km, 20–30km and more than 30km).

13 The first of these information sheets to be published was on the topic of *Employment generation and airports* (BITRE 2013c).

14 Appendix A presents maps which illustrate subregion boundaries for each of the four cities.

15 For Sydney, the CBD consists of the Sydney Inner, Sydney East, Sydney West and Sydney South SLAs. For Melbourne, it consists of the Melbourne Inner, Melbourne Remainder and Southbank-Docklands SLAs. For Perth, it consists of the Perth Inner and Perth Remainder SLAs.

Map 1.2 Map displaying Inner, Middle and Outer sectors of Sydney, Melbourne, Brisbane and Perth



Note: All four city maps are presented at a common scale. Each city has been disaggregated into an Inner, Middle and Outer sector, based on state government classifications (where available). Details are provided in BITRE 2010, 2011, 2012a and 2013a.

Source: BITRE analysis of ABS 2006 SLA and SD boundaries.

Much of the spatial analysis in the individual city reports is undertaken at the SLA scale. Where boundary changes occurred over the study period, data was concorded to 2006 SLA boundaries. In 2006, the Perth SD had 38 SLAs, the Melbourne SD had 91 SLAs and the Sydney SD had 64 SLAs. In contrast, the Brisbane SD contained 215 SLAs, meaning that SLA-based analysis is much more spatially detailed for Brisbane than it is for the other cities.

This report also contains spatial analysis based on more highly disaggregated geographies, such as ABS' suburbs and Census Collection Districts (CCDs), and the state government's Destination Zones (DZs) and designated activity centres.

Structure of the report

Chapter 2 of this report provides an overview of strategic planning for Sydney, Melbourne, Brisbane and Perth during the 2001 to 2011 period. Chapter 3 compares some key aggregate measures of population growth, jobs growth and commuter use of transport across Australia's 18 major cities, to place the results for Sydney, Melbourne, Brisbane and Perth within the broader context. This is followed by a more in-depth spatial analysis of residential growth patterns in Australia's four largest cities in Chapter 4, and of employment and industry patterns in Chapter 5. Spatial differences in car, public transport and other transport mode usage are then considered in Chapter 6. This is followed by an investigation of existing commuting flows and changes in these commuter flows in Chapter 7. Chapter 8 considers how changes in commuting flows relate to population growth, job growth and other key drivers. Chapter 9 explores the implications of the available spatial projections of population and jobs for future commuting patterns in cities, while Chapter 10 provides an overview of the main findings and discusses some of the implications for transport infrastructure and strategic planning.

CHAPTER 2
Strategic planning

Key points

- Capital city strategic planning systems consist of institutional and decision making arrangements, as well as a range of strategic planning documents.
- Sydney, Melbourne, Perth and South East Queensland (SEQ) each had several different metropolitan strategic plans in operation during the 2001 to 2011 period. Following recent changes in government, new metropolitan strategies are currently being prepared for Sydney, Melbourne and SEQ. The Victorian Government released its new *Plan Melbourne* metropolitan strategy in October 2013.
- This report focuses on the most recent metropolitan strategic plan that was available for each city at the time the research was undertaken. Specifically, it focuses on the *Metropolitan Plan for Sydney 2036* (released in 2010), *Melbourne 2030* and its *Melbourne @ 5 million* update (released in 2002 and 2008, respectively), the *SEQ Regional Plan 2009–2031* (from 2009) and the Perth and Peel plan—*Directions 2031 and beyond* (released in 2010).
- The Council of Australian Governments (COAG) Reform Council published its review of capital city strategic planning systems in 2012. None of the capital city strategic planning systems were found to be fully consistent with the nine agreed criteria. The COAG review examined structure and processes but did not examine policy outcomes.
- Recent metropolitan plans for all four cities specify some common goals, relating to limiting urban sprawl, increasing residential densities around centres, locating employment in centres, achieving employment growth in particular suburban locations, achieving greater use of public transport and active transport, concentrating development around public transport, and reducing commuting times and distances.
- BITRE's study presents evidence about outcomes for strategic planning goals that relate to the spatial patterns of population and employment growth, or to commuter flows and transport use. It identifies the actual 'on the ground' changes that have been occurring with respect to these strategic planning goals, identifying whether such movements are in the desired direction and progressing at the targeted pace of change. This evidence about the reality of recent trends in population, employment and commuting flows can then be used to inform future planning initiatives.

Context

Capital city strategic planning systems consist of 'institutional and decision making arrangements as well as strategic planning documents' (COAG Reform Council 2012, p.91). The scale and scope of strategic planning documents vary, and may include state strategic plans, metropolitan strategic plans, regional and subregional plans, and infrastructure and transport plans. The metropolitan strategic plans are of most relevance to the current study,[16] as they articulate a range of strategic planning objectives that relate to the spatial distribution of population and employment within the metropolitan area, or to commuting patterns and transport use.

Recent metropolitan strategic plans

The current study considers the 2001 to 2011 period. Australia's capital cities typically had more than one operational metropolitan (or regional) strategic plan during this period. Table 2.1 lists the strategic plans that were in place between 2001 and 2011 in Sydney, Melbourne, Perth and Brisbane/South East Queensland. Following changes of government in recent years, several of the state governments are currently in the process of preparing new metropolitan planning strategies. The Victorian Government released its new *Plan Melbourne* metropolitan strategy in October 2013.

Table 2.1 List of metropolitan strategic plans for Sydney, Melbourne, Perth and South East Queensland from 2001 to 2011

City/Region	Metropolitan strategic plans
Sydney	Shaping our Cities (released in 1999)
	City of Cities—A plan for Sydney's future (released in 2005)
	Metropolitan Plan for Sydney 2036 (released in 2010)
Melbourne	Living suburbs—A policy for Metropolitan Melbourne into the 21st century (released in 1995)
	Melbourne 2030—Planning for sustainable growth (released in 2002)
	Melbourne 2030: a planning update—Melbourne@ 5 million (released in 2008)
South East Queensland	South East Queensland Regional Framework for Growth Management (RFGM) (updated in 2000)
	South East Queensland Regional Plan 2005–2026 (released in 2005)
	South East Queensland Regional Plan 2009–2031 (released in 2009)
Perth and Peel	Metroplan—A planning strategy for the Perth metropolitan region (released in 1990)
	Network City—Community planning strategy for Perth and Peel (released in 2004)
	Directions 2031 and beyond—Metropolitan planning beyond the horizon (released in 2010)

Source: BITRE analysis.

In Sydney, the *Metropolitan Plan for Sydney 2036* sets out the strategic direction for the growth and development of the metropolitan area over a 25 year timeframe (NSW Government 2010). It is an extension and update of the 2005 metropolitan strategy—*City of Cities* (NSW Government 2005). Both *Sydney 2036* and *City of Cities* promote similar principles—liveability, economic competitiveness, fairness, protection of the environment and improved governance—and primarily represent a program of long term economic development to maintain global competitiveness. The plans provide a framework for managing the city's growth over a 25

16 In the context of South East Queensland, it is the SEQ Regional Plan that is most relevant.

year timeframe and structure Sydney as a system of regional cities and major centres which are connected by the rail network, bus corridors and the orbital motorway network. A new metropolitan strategy for Sydney is currently being developed—a draft has recently been released and the final strategy is expected to be released later in 2013.

In Melbourne, the *Melbourne 2030* metropolitan strategy has set the overall strategic direction for the growth and development of the metropolitan area for most of the period covered by this study (Victorian Department of Infrastructure 2002). Its policy directions include achieving a more compact city, better management of metropolitan growth, networks with the regional cities, a more prosperous city, a great place to be, a fairer city, a greener city, better transport links and better planning decisions. Key initiatives to achieve these goals include the Urban Growth Boundary, Growth Areas, the activity centre network, and an upgraded public transport network. The 2008 release of *Melbourne @ 5 million* introduced some policy changes in response to greater than anticipated population growth (Victorian Department of Planning and Community Development 2008). The Victorian Government released its new *Plan Melbourne* metropolitan strategy in October 2013.

Queensland's first statutory plan was released in 2005—the *South East Queensland Regional Plan 2005–2026*. It was replaced by the *South East Queensland Regional Plan 2009–2031* in 2009. The overarching objective of the current regional plan is to achieve 'a future for SEQ which is sustainable, affordable, prosperous, liveable and resilient to climate change' (Queensland Government and COMSEQ 2009, p.10). It is designed to guide regional growth and development in SEQ, and to protect the region from 'inappropriate urban development' (ibid, p.1). Planning is carried out on a metropolitan-wide basis, with the formal governance structure for the SEQ metropolitan region consisting of the 11 local governments, the State government and the Commonwealth government (ACELG 2011). A review of the SEQ Regional Plan will commence in 2013.

Directions 2031 and beyond is a 'high level spatial framework and strategic plan that establishes a vision for future growth of the metropolitan Perth and Peel region; and it provides a framework to guide the detailed planning and delivery of housing, infrastructure and services necessary to accommodate a range of growth scenarios' (Western Australian Planning Commission 2010, p.1). It was preceded by the Network City strategic plan (WAPC 2004) which introduced a focus on a network of activity cities, connected by corridors.

Recent reviews of capital city strategic planning systems

The Council of Australian Governments (COAG) Reform Council in 2012 published its review of capital city strategic planning systems (COAG Reform Council 2012). The review assessed the consistency of strategic planning systems with nine agreed criteria at a particular point in time. This review of capital city strategic planning systems 'examines structure and processes but not effectiveness or outcomes' (ibid, p.91).

Table 2.2 provides an overview of the key findings of COAG Reform Council (2012) with regard to the strategic planning systems of Sydney, Melbourne, Perth and South East Queensland (SEQ)/Brisbane. None of the capital city strategic planning systems were found to be fully consistent with the nine agreed criteria. At the time of the review, both the New South Wales and Victorian strategic planning systems were being reformed, and the COAG Reform Council

points out that the transitional state of the strategic planning systems in these two states affected a number of the findings (ibid, pp. 4–5).

Two of the criteria are particularly relevant to the scope of BITRE's study of spatial patterns of population growth, jobs growth and commuting:

- criteria four on addressing nationally significant policy issues, such as population growth and demographic change, productivity and global competitiveness, and connectivity of people to jobs—Sydney, SEQ and Perth are considered 'largely consistent' with this criteria, while Melbourne is considered 'partially consistent'
- criteria six on providing for planned, sequenced and evidence-based land release and an appropriate balance of infill and greenfields development—Sydney, SEQ and Perth are considered 'consistent' with this criteria, while Melbourne is considered 'largely consistent'.

According to an earlier cross-city comparison of the capital city strategic planning systems (KPMG 2010), Melbourne was ranked most highly, with Brisbane ranked second, Perth ranked fourth and Sydney ranked sixth. Sydney's ranking was due to 'a lack of predictability and certainty in the way the Sydney strategic planning system operates' and 'the apparent failure in the implementation of strategic planning decisions' (ibid, p.10). Melbourne was ranked most highly because it had the strongest representation of a capital city strategic planning system supported by a metropolitan plan, transport plan, land supply program and housing strategy, and due to its strong review process conducted by independent experts (ibid, p.9). This assessment of Melbourne contrasts with that of the COAG Reform Council, which was undertaken following the change of government in Victoria late in 2010, at a time when Melbourne's strategic planning system was in a state of transition (COAG Reform Council 2012).

The Productivity Commission (2011, p.198) identifies Queensland and Victoria (along with South Australia) as being the best placed jurisdictions for infrastructure delivery due to 'detailed infrastructure plans with a level of committed funding from the state budget and a committed delivery timeframe' and 'scope to apply alternative planning processes to infrastructure projects'. The Productivity Commission also points out that better relationships between state and local governments 'are more likely to deliver broad state goals in a more timely and effective way' (ibid, p. xxxvi). Based on a survey of local government, Queensland was identified as having more cooperative relationships between state government and councils than the other states, while councils in New South Wales reported the most difficult relationship with their state government (ibid).

Bunker and Searle (2009) review the metropolitan strategies of the five mainland capital cities, noting that there has been a shift in recent years to include a greater focus on economic competitiveness and sustainability. The focus on improving economic competitiveness and investment is recognised as particularly pronounced for Sydney. While the Sydney and Melbourne metropolitan strategies are considered highly detailed and prescriptive, the SEQ Regional Plan is regarded as somewhat less prescriptive, offering greater flexibility. The strategies 'for Adelaide and Perth chart a more conceptual course', based around a generalised spatial framework (ibid, p.114).

Table 2.2 COAG Reform Council findings of consistency against criteria for Sydney, Melbourne, South East Queensland and Perth

Criteria	Sydney	Melbourne	SEQ/Brisbane	Perth
1. Integration	Partially consistent—reform pending	Partially consistent	Largely consistent	Largely consistent
2. Hierarchy of plans	Partially consistent	Partially consistent	Consistent	Consistent
3. Nationally significant infrastructure	Partially consistent	Partially consistent	Largely consistent	Largely consistent
4. Nationally significant policy issues	Largely consistent	Partially consistent	Largely consistent	Largely consistent
5. Capital city networks	Largely consistent	Largely consistent	Consistent	Largely consistent
6. Planning for future growth	Consistent	Largely consistent	Consistent	Consistent
7. Frameworks for investment and innovation	Partially consistent	Partially consistent	Partially consistent	Partially consistent
8. Urban design and architecture	Largely consistent	Largely consistent	Partially consistent	Partially consistent
9a. Accountabilities, timelines and performance measures	Not consistent—reform pending	Not consistent	Partially consistent	Partially consistent—reform pending
9b. Inter-governmental cooperation	Partially consistent	Largely consistent	Consistent	Partially consistent
9c. Evaluation and review cycles	Partially consistent	Partially consistent	Consistent	Partially consistent—reform pending
9d. Consultation and engagement	Partially consistent	Partially consistent	Partially consistent	Partially consistent
High-level findings	'The system contains strong planning and policy content, however, it lacks the hard-edged accountability, performance and implementation measures to drive these policies. The drive toward densification and making Sydney a 'city of cities' requires a delicate balancing act between affordability and growth, on the one hand, and productivity and sustainability goals on the other.' (p.4)	'Melbourne faces significant challenges accommodating future growth in freight both in terms of port capacity and the infrastructure to support expanded capacity. Strategic policies and underpinning analysis for nominated activity centres is unclear.' (p.5)	'Overall, the Queensland planning system has robust mechanisms to support cross-government coordination and implementation. The 'line of sight' concept provides a useful means for articulating and driving vertical integration . . . While the Queensland planning system has strong integration mechanisms, the same cannot be said about its accountability and performance measurement systems.' (p.6)	'The statutory underpinnings of the strategic planning system are strong, supported by sound mechanisms such as the Western Australian Planning Commission and the corridor reservations in the Metropolitan Region Scheme. . . . Both accountability for and performance monitoring of outcomes and implementation are limited.' (p.7)

Source: COAG Reform Council (2012).

Assessing progress towards strategic planning goals

A key point emerging from the COAG Reform Council (2012) review was 'that consistency with the criteria does not guarantee successful policy outcomes, or that the actions needed to deliver outcomes will be done. The findings on criterion nine—about implementation—highlight this as an issue for governments' (ibid, p.2). The report highlighted the need for ongoing efforts to improve information for cities, measure progress, and provide a sound basis for evidence-based policy interventions (ibid, p.11).

While the COAG Reform Council report does not examine the outcomes of capital city strategic planning systems, BITRE's study does present evidence about outcomes for a subset of strategic planning goals (i.e. those goals that relate to the spatial patterns of population and employment growth, or to commuter flows and transport use). The four underlying reports (BITRE 2010, 2011, 2012a, 2013a) identify the actual 'on the ground' changes that have been occurring with respect to these long-term strategic planning goals, identifying whether such movements are in the desired direction and progressing at the targeted pace of change.

The four in-scope cities have a range of long-term strategic planning goals that relate to the spatial distribution of population and employment, or to commuter flows and transport use. Table 2.3 identifies the goals that are held in common across the four cities, and is based on the most recent (final, not draft) strategic plan that was in place for each city at the time the research was undertaken (in the first half of 2013). The individual city reports provide further detail about how the strategic planning goals have evolved over successive plans.

For all four cities, the metropolitan plans specify goals that relate to:

- Limiting urban sprawl by containing development within designated areas, increasing densities of existing suburbs (through infill development), and increasing densities in greenfield sites
- Increasing residential densities around centres
- Locating employment in centres
- Achieving employment growth in particular suburban locations
- Achieving greater use of public transport, walking and cycling
- Concentrating residential and job growth around public transport
- Reducing commuting times and distances.

In addition, the Melbourne and SEQ strategic plans both aim to consolidate rural population growth within existing settlements and fundamentally shift the focus of population growth within the city/region, while the Sydney and SEQ plans both aim to increase the self-containment of commuting trips.

Table 2.3 Summary of common metropolitan strategic planning goals relevant to BITRE study

Criteria	Sydney	Melbourne	SEQ/Brisbane	Perth
Metropolitan strategy	Metropolitan Plan for Sydney 2036 (released in 2010)^	Melbourne @ 5 million (released in 2008), together with Melbourne 2030—Planning for sustainable growth (released in 2002)*	South East Queensland Regional Plan 2009–2031 (released in 2009)^	Directions 2031 and beyond—Metropolitan planning beyond the horizon (released in 2010)
Spatial patterns of residential development				
Limit urban sprawl	Contain the urban footprint by locating at least 70 per cent of new homes in existing suburbs and by focusing land release in the designated Growth Centres (pp. 6, 44, 114, 160, 249)	The designated Growth Areas will accommodate 47 per cent of new dwellings. Achieve more efficient use of greenfield land with a target of 15 dwellings per hectare (DPCD 2008, pp. 3, 18).	Concentrate development within the urban footprint. Accommodate at least 50 per cent of new SEQ dwellings through infill and redevelopment of existing urban areas. Target 15 dwellings per hectare for greenfield development (pp. 90–91).	Achieve a more compact city by accommodating 47 per cent of new dwellings through infill development. Promote higher densities in greenfield development (p.27).
Increase residential densities around centres	Locate at least 80 per cent of all new homes within the walking catchments of centres. More medium density housing in and around local centres (pp. 6, 63, 117, 248).	Increase density through more intense housing development in and around activity centres (DPCD 2008, p.17).	Focus higher density residential development in and around regional activity centres (pp. 91, 97).	Increased housing supply in and around centres. Locate medium-rise higher density housing in centres and the corridors that link them (pp. 46, 61).
Consolidate rural population growth in existing settlements	n/a	Reduce the share of new housing development in rural areas in order to encourage consolidation into existing settlements (DI 2002, p.75).	Consolidate rural population growth within existing towns and villages. Limit areas allocated for rural residential development (pp. 74, 110).	n/a
Shift the focus of population growth within the city	n/a	In the long term, the focus of growth will need to shift from the south-east to the north and west (DPCD 2008, p.18)	Accommodate an increased share of SEQ's population in the Western and South Western Corridors (p.11).	n/a
Spatial patterns of jobs				
Locate employment in centres	Focus employment in strategic centres. Promote economic development of regional cities, particularly Parramatta (pp. 6, 38, 134, 248, 250)	Concentrate new economic development at activity centres and restrict out of centre development (DI 2002 pp. 46, 55)	Focus employment in accessible regional activity centres (p.96).	Facilitate economic development and employment in activity centres. Focus economic agglomeration in activity centres (pp. 48, 61).
Achieve employment growth in suburban locations	Accommodate half of all new jobs in Western Sydney (pp. 6, 148–49).	Provide more jobs outside Central Melbourne (DPCD 2008, p.7)	Achieve significant employment growth in the Western Corridor (pp. 112, 122).	Increase employment self-sufficiency of outer subregions (p.30).

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Table 2.3 continued

Criteria	Sydney	Melbourne	SEQ/Brisbane	Perth
Commuter transport use and commuting flows				
Greater use of public transport	Increase the public transport mode share (pp. 91, 248)	Increase public transport's share of motorised trips to 20 per cent by 2020 (DI 2002 p.146)	Promote public transport use with new infrastructure, improved services and information (p.139)	Encourage a shift to public transport use (p.55).
Greater use of active transport (walking and cycling)	Promote active transport opportunities (pp. 97, 251)	Encourage cycling and walking (DI 2002 p.160)	Promote walking and cycling with new infrastructure, improved services and information (p.139)	Encourage a shift to walking and cycling (p.55).
Concentrate residential and job growth around public transport	Target development around existing and planned transport capacity (p. 91)	Ensure new residential and economic development is focused in areas that are well served by the public transport system (DI 2002, p.63, 152)	Accommodate residential and job growth in areas with access to high-frequency public transport (pp. 96, 102)	Accommodate mixed use and higher density housing development around transport nodes through transit oriented developments (p.62)
Increase self-containment	Increase employment self-containment in Western Sydney (p. 148)	n/a	Support greater levels of trip self-containment within subregions. Demonstrate employment self-containment in planning decisions (pp. 112, 141).	n/a
Reduce commuting times and distances	Ensure more jobs are located closer to home (pp. 6, 148)#	A better distribution of jobs and activity, so Melbournians can work closer to where they live and spend less time commuting to and from work (DPCD 2008c, pp. 7, 9)	Reduce travel times and distances through urban consolidation. Reduce length of trips by localising access to goods, services and jobs. (pp. 12, 46, 145)	Reduce commuting time and cost by improving the relationship between where people live and work. (pp. 30, 67)

Notes: The table lists the strategic planning goals that relate to the spatial patterns of population and jobs growth or to commuter flows and transport use in each city. Only goals that are common to at least two of the cities are listed. For example, each metropolitan strategic plan contained a range of goals relating to the location of industries, but these are not listed in the table as they varied widely across cities (and over time). More detailed information on relevant strategic planning goals (including the goals of earlier plans and goals unique to the city) is available from the individual city reports (BITRE 2010, 2011, 2012a, 2013a).

Page numbers relate to the metropolitan strategic plan for the city, as provided at the beginning of the table. For Melbourne, where there are two relevant strategic planning documents, the specific reference is given.

n/a—not applicable, DPCD—Victorian Department of Planning and Community Development, DI—Victorian Department of Infrastructure

^ A new metropolitan strategy is in the process of being developed

The NSW 2021 state plan is more specific in its aim to 'reduce travel times' (NSW Government 2011, p.18).

* The Victorian Government released its new *Plan Melbourne* metropolitan strategy in October 2013.

Source: BITRE analysis of NSW Government (2010), Victorian Department of Planning and Community Development (2008), Victorian Department of infrastructure (2002), Queensland Government and COMSEQ (2009), Western Australian Planning Commission (2010).

The metropolitan strategic plans also contain additional population, employment and commuting related goals that are specific to the circumstances of the individual city. For example, the *SEQ Regional Plan* aims to locate government and office-based business employment outside the Brisbane CBD, in specified regional activity centres (Queensland Government and COMSEQ, pp. 96, 111). These city-specific goals are not listed in Table 2.3, but are discussed in BITRE's individual city reports.

The planning objectives from Table 2.3 will be revisited in the chapters that follow, which present measures of the changes that have occurred since 2001. It is important to recognise that such outcome measures on their own do not provide a reliable indication of how effectively government planning systems are working, due to the many other influences that can impact on outcomes (Productivity Commission 2011). Consequently, this study is not attempting to evaluate the performance of capital city strategic planning systems. Rather, the purpose is to provide a solid evidence base about recent trends in the spatial distribution of population, jobs and commuting in these cities, and to investigate whether the observed changes are in the direction envisaged by recent strategic plans. This evidence about the reality of recent trends in population, employment and commuting flows can then be used to inform future planning initiatives.

The current spatial distribution of population and jobs within cities reflects the accumulated pattern of development over many decades, and continues to be shaped and influenced by demographic trends, cultural preferences, economic forces and government interventions. To operationalise strategic planning into development control instruments and infrastructure design and construction can involve 10 to 15 year processes. The changes observed since 2001 with respect to population, jobs and commuting will partly reflect the policies of earlier decades.

CHAPTER 3

Comparison of major cities

Key points

- The 18 major cities consist of the capital cities and 10 other cities with populations of more than 100 000 in 2011. Between 2001 and 2011, the population of the major cities grew at an annual rate of 1.6 per cent (compared to the national average of 1.4 per cent), while the number of jobs grew at an annual rate of 1.9 per cent (compared to the national average of 1.7 per cent).
- Between 2001 and 2011, Gold Coast-Tweed, Cairns and Sunshine Coast had the highest average annual population growth rates (2.6–2.8 per cent), whilst Wollongong and Albury-Wodonga had the lowest growth rates (0.6–0.8 per cent). The largest population gains were in Melbourne (636 300), Sydney (477 600), Brisbane (408 900), Perth (351 500) and the Gold Coast (149 900).
- From 2001 to 2011, the proportion of dwellings in the major cities that are separate houses declined by 2.2 percentage points. There was a shift away from separate houses towards higher density dwellings in 12 of the 18 major cities, and particularly in Sydney, Melbourne and Brisbane.
- Between 2001 and 2011, Gold Coast-Tweed, Brisbane, Perth, Canberra-Queanbeyan and Sunshine Coast had the highest average annual job growth rates (2.8–3.0 per cent), whilst Albury-Wodonga and Sydney grew slowly (about 1 per cent each) and Launceston stagnated. Melbourne added the most jobs (302 300), followed by Brisbane (223 300), Sydney (184 600) and Perth (174 400).
- In 2011, 75 per cent of employed residents of the major cities used a private vehicle to commute to work, while 15 per cent used public transport, 5 per cent used active transport and 4 per cent worked from home. Sydney had the lowest private vehicle mode share (67 per cent), while Toowoomba had the highest (89 per cent). Sydney, Melbourne and Brisbane had the highest public transport mode shares (22, 16 and 15 per cent, respectively).
- Across the major cities, the private vehicle mode share of the commute to work declined by 1.5 percentage points between 2001 and 2011. This was accompanied by a 1.5 percentage point increase in the public transport mode share, a 0.5 percentage point increase in the active transport mode share and a 0.4 percentage point decline in working from home.
- Between 2001 and 2011, the six largest capital cities share a common trend of increased public transport and active transport mode shares, and reduced private vehicle mode shares for the journey to work. However, the smaller major cities all experienced reduced active transport use and (apart from Geelong) increased private vehicle use.

Background

This chapter compares some key aggregate measures of population growth, jobs growth and commuter use of transport modes across Australia's 18 major cities.[17] The remainder of this report focuses solely on Australia's four largest cities, so this chapter helps place the results in a broader context.

The comparison of residential growth across the major cities is based data drawn from the 2001 and 2011 Australian Bureau of Statistics' (ABS) *Census of Population and Housing* and on the July 2012 release of ABS' Estimated Resident Population (ERP) data, which has been rebased to census data (ABS 2012a). The data were concorded to 2006 Australian Standard Geographical Classification (ASGC) boundaries—statistical divisions for most capitals, statistical districts for other cities—to preserve comparability with the analysis presented in the remainder of the report.

The comparison of job growth across the major cities is based on customised place of work data drawn from the ABS *Census of Population and Housing* for 2001 and 2011. Consistent with the analysis of population, the employment analysis is based on 2006 ASGC boundaries. The employment estimates relate to those who reported a fixed place of work within the city boundaries.

The focus of this chapter is to highlight the major cities' relative similarities as well as differences in terms of growth in population, jobs, and journey to work transport modes between 2001 and 2011. The spatial distribution of population, jobs, transport use and commuting patterns for the four largest capital cities is discussed in greater detail in the following chapters.

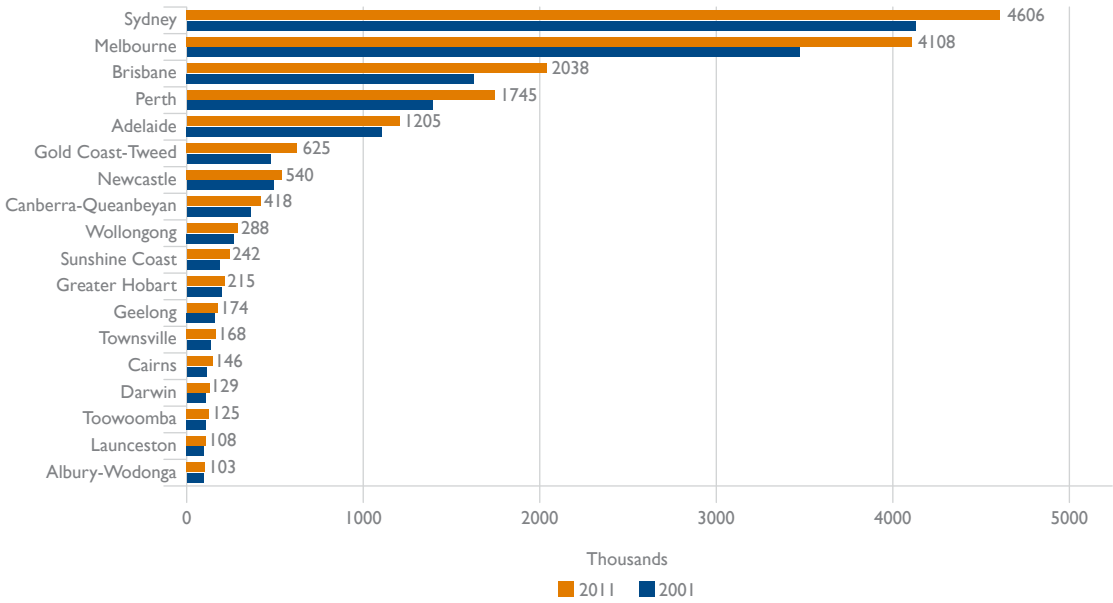
Population and dwellings growth, 2001 to 2011

Australia's two largest cities of Sydney and Melbourne had populations of 4.6 and 4.1 million, respectively, in 2011 (see Figure 3.1). Figure 3.2 shows changes in population between 2001 and 2011, revealing that the greatest population increases occurred in Melbourne (which added 636 300 new residents), Sydney (477 600), Brisbane (408 900), Perth (351 500) and the Gold Coast (149 900).

The overall population of the major cities grew at an average annual rate of 1.6 per cent per annum between 2001 and 2011, compared to the national average of 1.4 per cent and 0.9 per cent average annual growth for the rest of Australia (outside the major cities). Gold Coast-Tweed, Cairns and Sunshine Coast had the highest average growth rates of between 2.6 and 2.8 per cent per annum. In contrast, Albury-Wodonga, and Wollongong grew relatively slowly, with growth rates of between 0.6 and 0.8 per cent per annum.

17 Based on Major Cities Unit (2011) definition of major cities, which includes 18 cities with population larger than 100 000 in 2011.

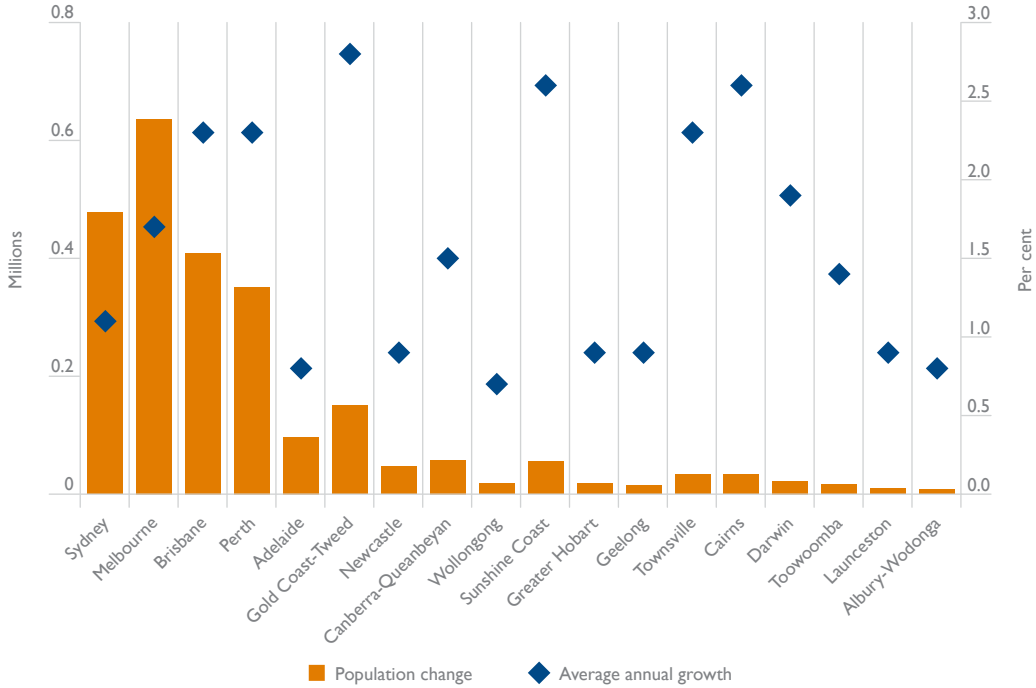
Figure 3.1 Estimated resident population of major cities, 2001 and 2011



Note: Based on 2006 ASGC Statistical Division and Statistical District boundaries.

Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

Figure 3.2 Growth of estimated resident population of major cities, 2001 and 2011



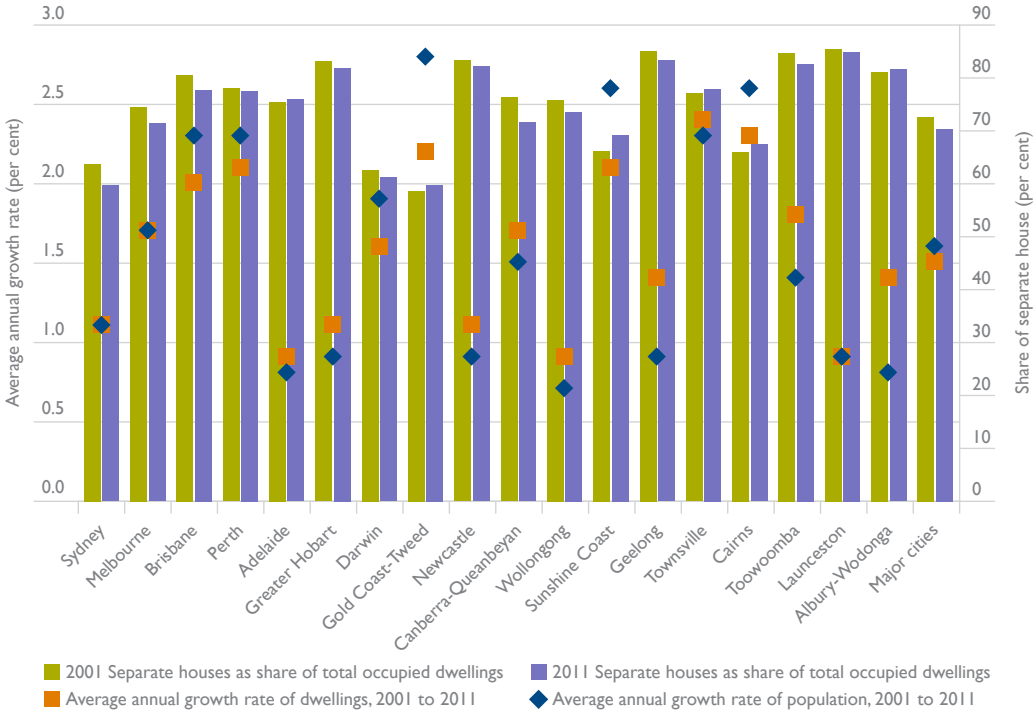
Note: Based on 2006 ASGC Statistical Division and Statistical District boundaries.

Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

Time-series profile data from the ABS *Census of Population and Housing* indicates a shift in the dwelling mix since 2001 for most of the major cities. For the major cities as a whole, the contribution of separate houses to the total stock of occupied dwellings declined by 2.2 percentage points between 2001 and 2011. Figure 3.3 shows a pattern of decreasing shares of separate housing in most of the major cities. The shift away from separate houses and towards higher density dwellings (such as flats, units and apartments, and semi-detached dwellings) was particularly significant in the three largest cities—Sydney, Melbourne and Brisbane. There were some exceptions to this general pattern, with the proportion of separate housing increasing for the Gold Coast-Tweed, Sunshine Coast and Townsville.

Between 2001 and 2011, the average annual growth rates of dwellings in Sydney and Melbourne were 1.1 per cent and 1.7 per cent respectively, which is similar to their population growth rates (Figure 3.3). For Brisbane and Perth, the dwelling growth rates (2.0 and 2.1 per cent respectively) slightly lagged behind the population growth rates (2.3 per cent each annually). Overall, the average annual growth rate of population for Australia's major cities was 1.6 per cent, with a slightly lower growth rate for dwellings (1.5 per cent).

Figure 3.3 Separate housing share and dwelling and population growth rates, major cities, 2001 to 2011



Note: Based on 2006 ASGC Statistical Division and Statistical District boundaries. When deriving the separate house share, the denominator excluded dwelling type not stated.

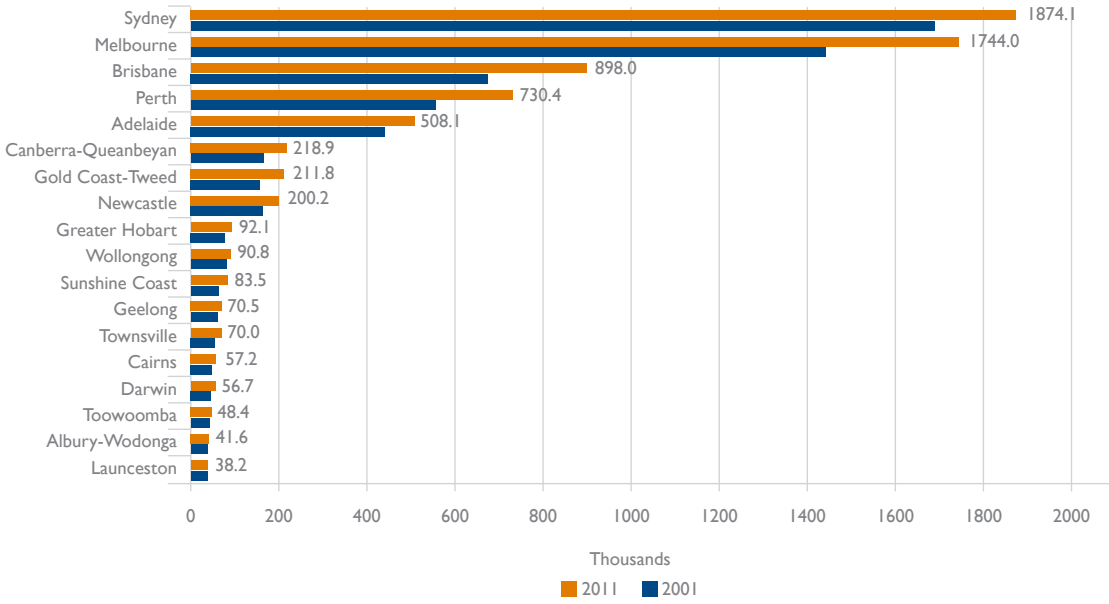
Source: BITRE analysis of 2011 ABS Census of Population and Housing Time Series Profile data (Table 14) and ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

Employment growth, 2001 to 2011

Based on census place of work data, the two largest cities of Sydney and Melbourne had 1.87 and 1.74 million employed persons, respectively, in 2011. The ordering of the 18 major cities in terms of employment in Figure 3.4 is similar to that previously shown for population in Figure 3.1, except that Canberra-Queanbeyan and Greater Hobart are more highly ranked with respect to employment.

Figure 3.5 shows changes in the number of employed persons by place of work between 2001 and 2011, revealing that the most jobs were added in Melbourne (amounting to 302 300 new jobs), followed by Brisbane (223 300), Sydney (184 600) and Perth (174 400). Adelaide, Gold Coast-Tweed and Canberra-Queanbeyan added more than 50 000 jobs each.

Figure 3.4 Employed persons with place of work in major cities, 2001 and 2011

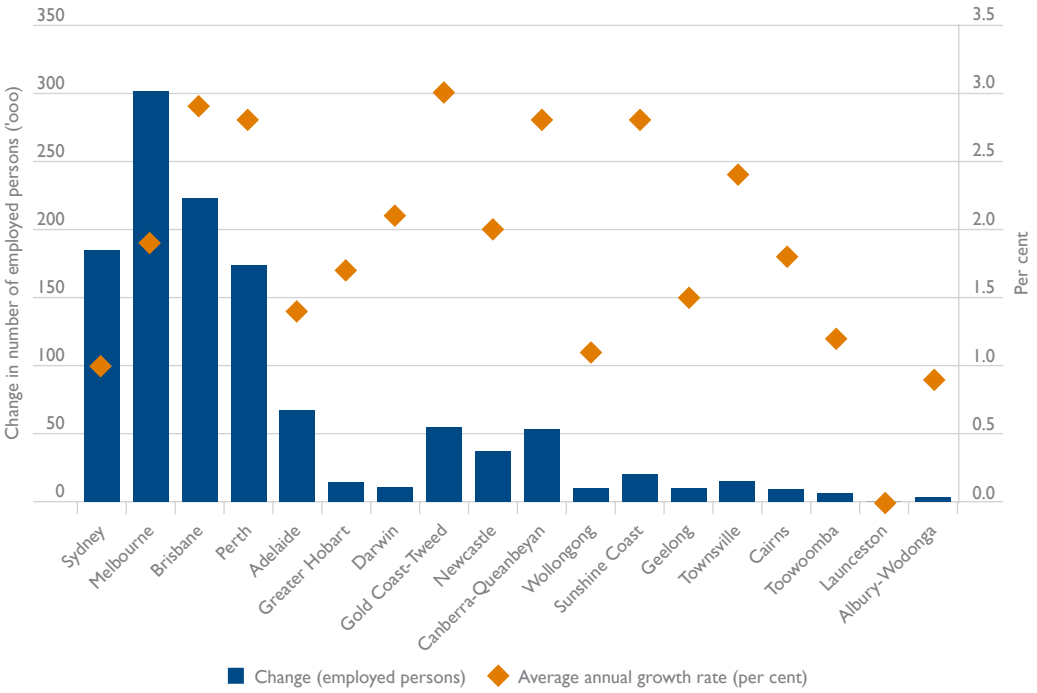


Note: Based on 2006 ASGC Statistical Division and Statistical District boundaries.

Sources: BITRE analysis of ABS Census of Population and Housing customised place of work data for 2001 and 2011.

Overall, for the major cities, employment grew at an average annual rate of 1.9 per cent between 2001 and 2011, compared to the national average of 1.7 per cent and 1.2 per cent average annual growth for the rest of Australia (outside the major cities). Gold Coast-Tweed, Brisbane, Perth, Canberra-Queanbeyan and Sunshine Coast had the highest average annual growth rates of between 2.8 and 3.0 per cent. In contrast, Albury-Wodonga and Sydney grew slowly, at around 1 per cent per annum, whilst Launceston stagnated (with zero per cent growth).

Figure 3.5 Growth in number of employed persons with place of work in major cities, 2001 to 2011



Note: Based on 2006 ASGC Statistical Division and Statistical District boundaries.

Sources: BITRE analysis of ABS Census of Population and Housing customised place of work data for 2001 and 2011.

Commuter use of transport, 2001 to 2011

Commuting trips represent a subset of total transport use, accounting for about 16 per cent of weekday trips in Sydney (Bureau of Transport Statistics 2012c). However, commuting trips represent a major component of peak period transport use (ibid) and are a key focus of this study.

This section considers five main categories—private vehicle, public transport, active transport (walking and cycling), other and worked at home—relating to the journey to work within each major city, using 2001 and 2011 census data by place of usual residence. Even though many commuters use more than one mode of transport to commute to work, and the census records up to three modes, in the results presented here, responses involving multiple modes are assigned to a single mode, based on an established hierarchy.[18]

Overall, in 2011, the most significant mode share for commuter travel in the major cities was private vehicle (75 per cent), followed by public transport (15 per cent) and active transport (5 per cent). On the census day, around 4 per cent of employed people worked at home in the major cities.

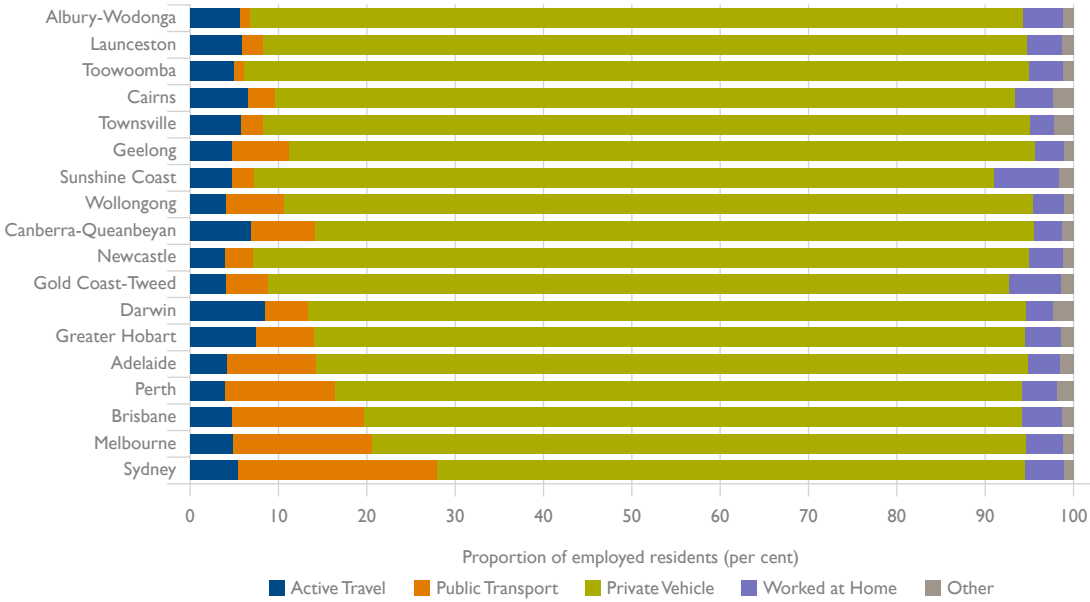
18 BITRE (2012a, p.191) explains the reassignment method and the hierarchy of modes in some detail.

Figure 3.6 shows that private vehicles (including cars, trucks and motorbikes) dominate commuting in each major city, with a mode share ranging from 67 per cent in Sydney to 89 per cent in Toowoomba. In Sydney, Melbourne, Brisbane and Perth, public transport had the second highest mode share after private vehicles (22, 16, 15 and 12 per cent, respectively). The dense cores of cities and densities clustered around transit nodes provide economies of scale to the public transport system (Rickwood and Glazebrook 2009). It follows that the smaller and less densely populated a city, the smaller the public transport mode share tends to be, with Albury-Wodonga, Launceston, Toowoomba, Sunshine Coast and Townsville having the lowest public transport mode shares (less than 3 per cent) amongst the 18 major cities.

In 2011, active transport constituted between 6 and 9 per cent of commuter travel in Greater Hobart, Darwin, Canberra-Queanbeyan and Cairns—the highest active transport mode shares among the major cities. The rest of the major cities had between 3 and 6 per cent using active transport to journey to work.

Working at home has transport implications, because it saves workers the need to travel. In 2011, the proportion of employed residents working from home ranged from 3 per cent in each of Townsville, Newcastle, Canberra-Queanbeyan and Geelong, to 7 per cent in the Sunshine Coast.

Figure 3.6 Transport mode share of employed residents of major cities for journey to work, 2011



Notes: Private vehicle includes car, truck and motorbikes; Public transport includes train, bus, ferry, tram and taxi; Active transport includes walking and cycling; Did not go to work and mode unstated were excluded from mode share calculations. Data concorded by BITRE to 2006 ASGC (statistical division and statistical district) boundaries.

Source: BITRE analysis of 2011 ABS Census of Population and Housing Basic Community Profile (Table 46).

Table 3.1 shows the percentage point change in transport mode share for commuter travel between 2001 and 2011. Overall, across all of the major cities, the private vehicle mode share decreased by 1.5 percentage points, which was accompanied by a 1.5 percentage point increase in the public transport mode share. The active transport mode share increased

by 0.5 percentage points, while the proportion of employed people who worked at home declined by 0.4 percentage points.

The private vehicle mode share decreased in the six largest capital cities: Sydney (–0.8 per cent), Melbourne (–4.0 per cent), Brisbane (–2.7 per cent), Perth (–3.3 per cent), Adelaide (–1.1 per cent) and Canberra-Queanbeyan (–0.6 per cent). At the same time, all of these six capitals increased their public transport mode share. Only Newcastle, Wollongong and Toowoomba experienced notable declines in the public transport mode share (of –0.5, –1.3 and –0.3 percentage points respectively). In these three cities, and Albury-Wodonga, the private vehicle mode share rose by more than 2 percentage points.

Between 2001 and 2011, the active transport mode share increased in Sydney, Melbourne, Brisbane, Perth, Adelaide and Canberra-Queanbeyan by between 0.4 and 1.1 percentage points. The rest of the major cities each experienced a decline in their active transport mode share of between 0.1 and 2.4 percentage points.

Table 3.1 Percentage point change in journey to work transport mode share of employed residents of major cities, 2001 to 2011

	Active transport	Public Transport	Private Vehicle	Worked at Home	Other
Sydney	0.5	0.8	–0.8	–0.2	–0.2
Melbourne	1.1	3.0	–4.0	–0.4	0.2
Brisbane	0.7	2.4	–2.7	–0.4	0.0
Perth	0.6	3.4	–3.3	–0.8	0.1
Adelaide	0.4	1.2	–1.1	–0.5	–0.1
Greater Hobart	–0.3	0.5	0.7	–0.5	–0.4
Darwin	–0.6	0.5	1.2	–0.7	–0.5
Gold Coast-Tweed	–0.5	1.0	0.0	–0.5	0.0
Newcastle	–0.5	–0.5	2.2	–0.8	–0.4
Canberra-Queanbeyan	1.1	0.9	–0.6	–0.8	–0.4
Wollongong	–0.4	–1.3	2.2	–0.1	–0.4
Sunshine Coast	–0.7	0.4	0.4	–0.2	0.1
Geelong	–0.1	1.3	–0.8	–0.4	0.0
Townsville	–2.4	0.5	2.7	–0.7	–0.1
Cairns	–0.9	0.0	1.2	–0.5	0.2
Toowoomba	–0.8	–0.3	2.1	–0.9	–0.1
Launceston	–0.4	0.4	1.2	–0.6	–0.5
Albury-Wodonga	–0.9	0.0	2.2	–1.2	–0.2
Major cities	0.5	1.5	–1.5	–0.4	0.0

Notes: Private vehicle includes car, truck and motorbikes; Public transport includes train, bus, ferry, tram and taxi; Active transport includes walking and cycling; Did not go to work and mode unstated were excluded from mode share calculations. Data concorded by BITRE to 2006 ASGC (statistical division and statistical district) boundaries.

Source: BITRE analysis of 2011 ABS Census of Population and Housing Basic Community Profile (Table 46) and customised ABS census data for 2001.

Each of the major cities also recorded a decline in the share of employed residents who worked at home between 2001 and 2011. Albury-Wodonga experienced the largest decline (–1.2 percentage points).

The six largest capital cities share a common trend of increased public transport and active transport use, and reduced private vehicle use and working from home. However, mode shifts differ for the smaller major cities, which all experienced reduced active transport use and (with the exception of Geelong) increased use of private vehicles.

Summary

This chapter has summarised some key trends relating to population growth, jobs growth and shifts in commuter use of transport modes for Australia's 18 major cities between 2001 and 2011. This information provides the relevant context for the remainder of this report, which focuses solely on Australia's four largest cities—Sydney, Melbourne, Brisbane and Perth.

CHAPTER 4

Residential patterns

Key points

- Sydney's population stood at 4.61 million in 2011, compared to 4.11 million for Melbourne, 2.04 million for Brisbane and 1.74 million for Perth.
- Eighteen per cent of Sydney residents live over 40km from the city centre, compared to 11 per cent for Melbourne and 6 per cent for Perth and Brisbane.
- Melbourne gained 636 300 residents between 2001 and 2011, which compares to a gain of 477 600 for Sydney, 408 900 for Brisbane and 351 500 for Perth. The average annual rate of population growth was 2.3 per cent for Perth and Brisbane, 1.7 per cent for Melbourne and 1.1 per cent for Sydney.
- Between 2001 and 2011, the Central Business Districts (CBDs) of all four cities experienced very rapid growth, due to redevelopment with higher density housing. The middle suburbs of each city recorded average population growth of 0.9–1.8 per cent per annum. The outer suburbs of Melbourne, Brisbane and Perth grew more rapidly (2.4–2.9 per cent).
- All Australian Statistical Local Areas (SLAs) that added over 25 000 new residents from 2001 to 2011 were located in the outer suburbs of the four largest capital cities. The SLAs with the largest population increases were mainly located in Melbourne (e.g. Melton East, Whittlesea North, Cranbourne, Wyndham North), and to a lesser extent, Perth (e.g. Rockingham, Wanneroo North West). Sydney and Brisbane each had a single SLA which added over 25 000 residents—Blacktown North for Sydney and Ipswich East for Brisbane.
- Sydney is Australia's most densely populated city, and the most densely populated SLAs are concentrated in Sydney, and to a lesser extent Melbourne. All four cities recorded density gains in their established inner and middle suburbs between 2001 and 2011, with inner city Melbourne and Brisbane SLAs recording some of the largest gains. All four cities similarly recorded an increase in the residential density of activity centres between 2001 and 2006, although the magnitude of change was limited for Melbourne.
- Both Melbourne and Brisbane have seen progress since 2001 in consolidating rural population growth in existing settlements, and in shifting the focus of population growth towards the targeted areas of each city.
- While rates of infill development in Perth over the past decade have been well below the strategic plan target, Sydney, Melbourne and Brisbane have been tracking above their long-term infill targets. All four cities experienced a significant reduction in the typical size of newly produced lots.

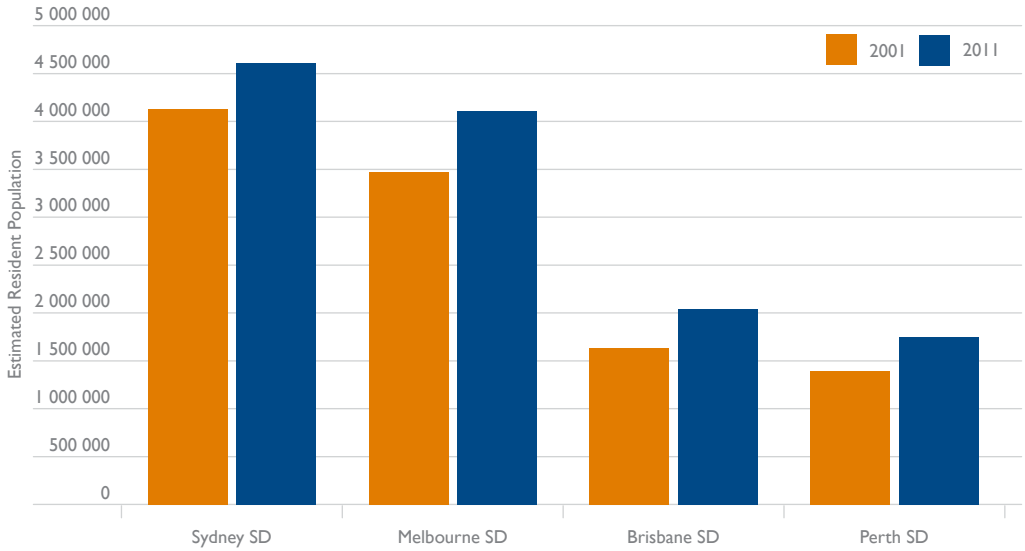
Background

This chapter primarily relies on the June 2012 release of ABS *Estimated Resident Population* (ERP) data (ABS 2012a), concorded to 2006 Australian Standard Geographical Classification (ASGC) boundaries. The 2012 release of ERP data has been rebased to 2011 census data, on a preliminary basis. BITRE's individual city reports relied on earlier releases of the ERP data, which were not benchmarked to the 2011 census results. This chapter also uses usual resident population and dwellings data from the ABS *Census of Population and Housing* to provide a more detailed perspective on the spatial distribution of the residential population. Other relevant sources include ABS dwelling approvals data and state government residential development monitoring systems.

Spatial distribution of population in 2011

Figure 4.1 presents the total population of each of the four capital city Statistical Divisions (SDs), based on ABS ERP data for 2011. Sydney's population stood at 4.61 million in 2011, compared to 4.11 million for Melbourne, 2.04 million for Brisbane and 1.74 million for Perth. While the ranking of the four cities remained the same between 2001 and 2011, the population gap between Sydney and Melbourne narrowed.

Figure 4.1 Estimated resident population of four capital city statistical divisions, 2001 and 2011



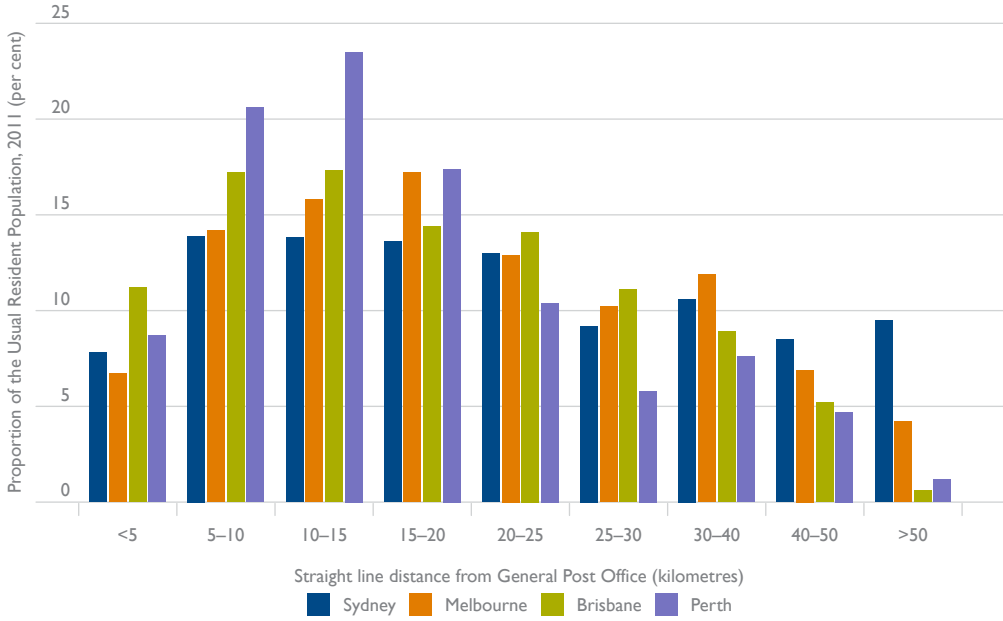
Note: Based on 2006 ASGC Statistical Division boundaries, which differ from 2011 boundaries for Brisbane. Population estimates for 2007 to 2011 remain preliminary.

Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

Figure 4.2 summarises the spatial distribution of population in the four cities, which reflects geographic constraints and the accumulated pattern of development over many decades. Compared to the other cities, Brisbane has a greater share of its population living within 5 kilometres (km) of the Central Business District (CBD) at 11 per cent. In Melbourne, only 7 per cent of residents live within 5km of the CBD. Sydney has a greater share of its population

living more than 40km away (18 per cent), compared to 11 per cent for Melbourne and 6 per cent for Brisbane and Perth. Reflecting Perth's smaller population base, 70 per cent of residents live within 20km of the CBD, compared to 60 per cent for Brisbane, and around half of Sydney and Melbourne residents.

Figure 4.2 Proportion of population living at various distances from Central Business District, 2011

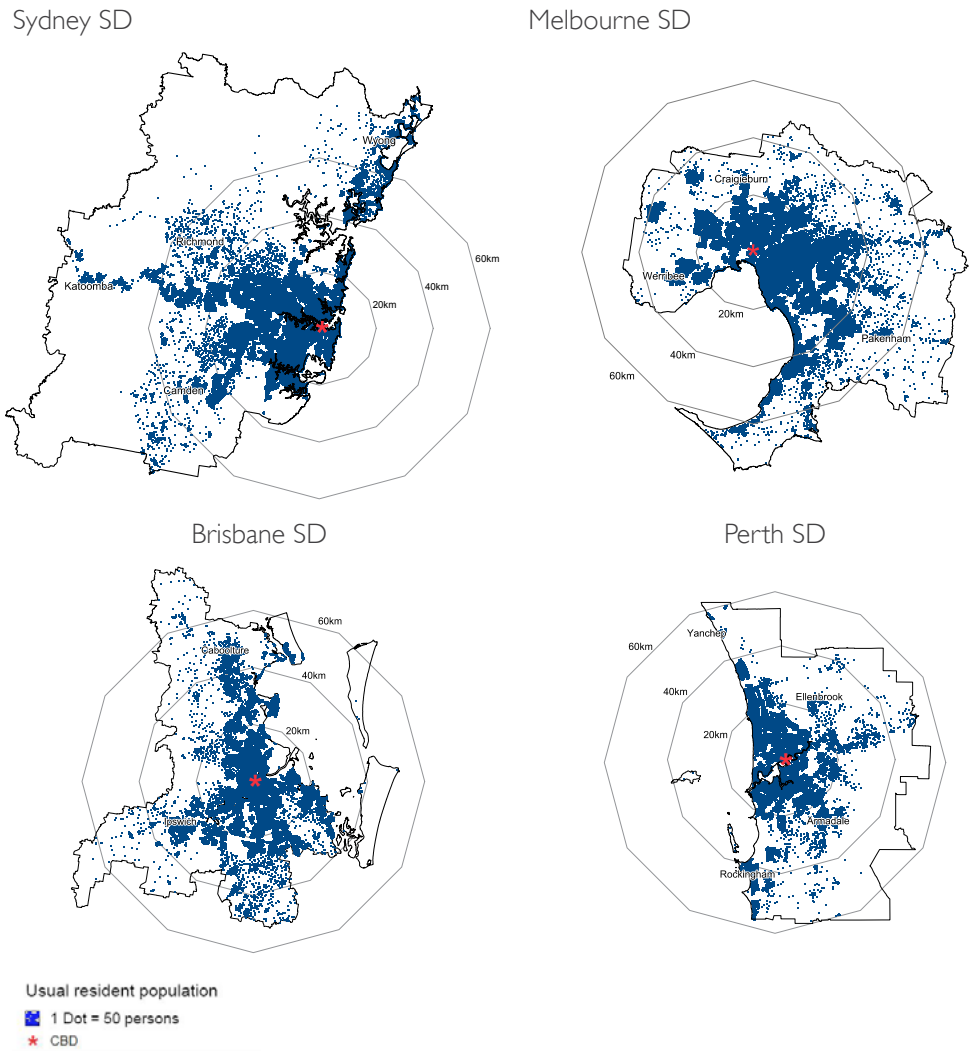


Note: Data for each city relates to all meshblocks that lie within the ABS ASGC 2006 SD boundaries.

Source: BITRE analysis of 2011 ABS Census of Population and Housing usual resident population data for meshblocks.

Map 4.1 uses census meshblock counts of the usual resident population to provide a dot density representation of the current pattern of settlement within each of the four capital city SDs. All four cities are presented at a common scale, which makes it apparent that Sydney has a larger share of its population living more than 60km from the CBD. Much of the western and north-western extent of the Sydney SD contains no population, reflecting the presence of national, state and regional parks. For Melbourne, it can be seen that the distribution of the population is skewed towards the east and south-east, while Perth's population is concentrated near the coast.

Map 4.1 Dot density map of population distribution within four capital city Statistical Divisions, 2011

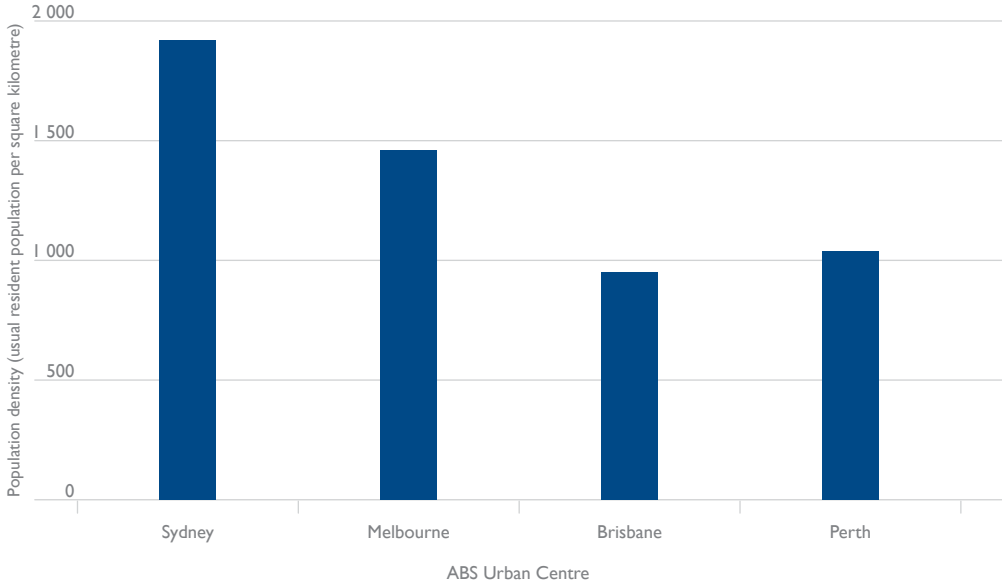


Note: Data for each city relates to all meshblocks that lie within the ABS ASGC 2006 SD boundaries. All four city maps are presented at a common scale.

Source: BITRE analysis of 2011 ABS Census of Population and Housing usual resident population data for meshblocks.

When considering population densities of cities it is appropriate to restrict the focus to the developed urban area. One means of doing this is by using ABS urban centre definitions, as in Figure 4.3, which shows that Sydney has the highest population density, while Brisbane is the least densely populated of the four cities.

Figure 4.3 Population density of four capital city urban centres, 2011



Note: Based on ABS urban centre and locality (UCL) boundaries for 2011.

Source: BITRE analysis of 2011 ABS Census of Population and Housing usual resident population data for ABS urban centres.

The level of population density in an area is dependent on housing density, average household size and the amount of non-residential land in an area. The most densely populated Statistical Local Areas (SLAs) for each city are listed in Table 4.1. The most densely populated SLA is Melbourne Inner which averages almost 9000 persons per km^2 (square kilometre), and the Sydney East SLA is not far behind. The most densely populated SLAs are concentrated in Sydney, which contains five of the seven SLAs with population densities of more than 6000 persons per km^2. There are no SLAs with a population density of more than 4000 persons per km^2 in Perth.

Nearly all of the high population density SLAs listed in Table 4.1 are located in the Inner sector of their respective city. The exceptions are the Middle sector SLAs of Brunswick in Melbourne and Stirling South-Eastern in Perth.

Table 4.1 Statistical Local Areas with highest population density by city, 2011

Rank	Sydney	pers/ km^2	Melbourne	pers/ km^2	Brisbane	pers/ km^2	Perth	pers/ km^2
1	Sydney East	8723	Melbourne Inner	8924	New Farm	5954	Vincent	3145
2	Sydney West	7766	St Kilda	6414	Kangaroo Point	5758	Subiaco	2695
3	Waverley	7453	Prahran	5273	Highgate Hill	5232	East Fremantle	2407
4	North Sydney	6384	Brunswick	4514	City Inner	5041	South Perth	2220
5	Sydney Inner	6186	Richmond	4507	Spring Hill	4969	Stirling South-Eastern	2130

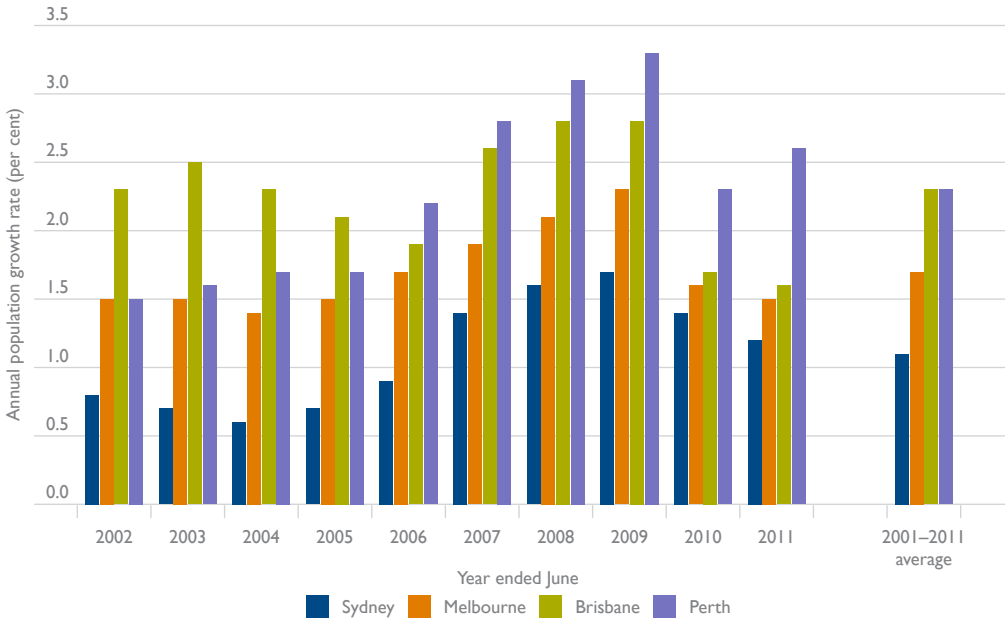
Notes: Based on 2006 ASGC boundaries. Population estimates for 2007 to 2011 remain preliminary.
pers/km^2 = Estimated resident population in 2011 per square kilometre of land area.

Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

Spatial patterns of population growth, 2001 to 2011

Figure 4.4 shows how the annual population growth rate varied between 2001 and 2011. For all four cities, the most rapid population growth occurred in the years ended June 2008 and 2009, and growth has moderated somewhat since then. Brisbane recorded more rapid population growth than the other cities up to 2005, while Perth recorded the most rapid growth in each subsequent year. Sydney recorded the lowest rate of population growth of the four cities in each of the ten years displayed on the chart.

Figure 4.4 Annual growth rate of estimated resident population for four capital city statistical divisions, 2001 to 2011



Note: Based on 2006 ASGC Statistical Division boundaries, which differ from 2011 boundaries for Brisbane. Population estimates for 2007 to 2011 remain preliminary.

Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

When the 2001 to 2011 period is considered as a whole, Perth and Brisbane both experienced average population growth of 2.3 per cent per annum, compared to 1.7 per cent for Melbourne and 1.1 per cent for Sydney (see Table 4.2). However, Melbourne gained the most new residents between 2001 and 2011, with its population increasing by 636 320 persons. This compares to a gain of 477 641 persons for Sydney, 408 905 persons for Brisbane and 351 527 persons for Perth.

Table 4.2 also presents some summary indicators relating to the spatial distribution of that population growth. Map 1.2 previously illustrated the definitions of the Inner, Middle and Outer sectors of each city that underpin this analysis.

Table 4.2 Population growth by sector for four capital city statistical divisions, 2001 to 2011

Indicator	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
Population change, 2001 to 2011	477 641	636 320	408 905	351 527
Average annual rates of growth, 2001 to 2011 (per cent)				
Population of CBD*	3.5	6.5	12.7	9.2
Population of Inner sector (excluding CBD)	0.8	1.6	3.4	1.4
Population of Middle sector	1.3	0.9	1.8	1.4
Population of Outer sector	0.9	2.4	2.6	2.9
Total population	1.1	1.7	2.3	2.3
Spatial distribution of growth, 2001 to 2011 (per cent)				
Proportion of population growth in Inner sector	21.7	12.2	8.0	12.3
Proportion of population growth in Middle sector	32.8	25.7	39.3	19.3
Proportion of population growth in Outer sector	45.5	62.1	52.8	68.4
Total	100.0	100.0	100.0	100.0

Notes: Based on 2006 ASGC Statistical Division boundaries, which differ from 2011 boundaries for Brisbane. Population estimates for 2007 to 2011 remain preliminary. Map 1.2 shows the Inner, Middle and Outer sectors of each city.

* Defined as the central LGA for Sydney, Melbourne and Perth, and as the combination of the City Inner and City Remainder SLAs for Brisbane.

Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

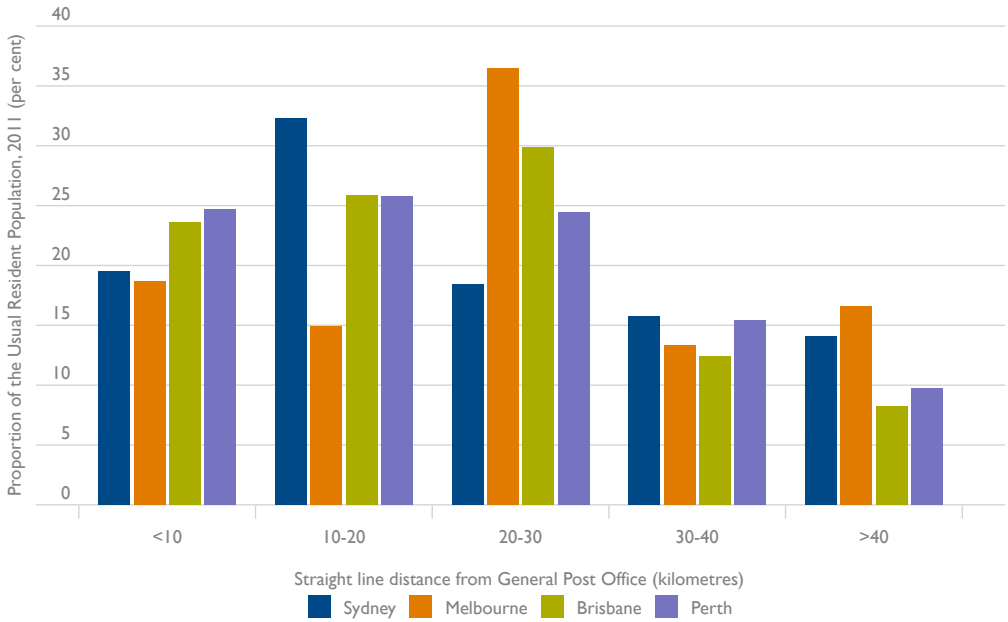
A common characteristic of the four cities is that the CBDs all experienced very rapid growth, coming off a limited population base, due to redevelopment with higher density housing. For example, the City of Perth Local Government Area (LGA) grew rapidly from 7 808 residents in 2001 to reach 18 782 residents in 2011. While this represented just 3.1 per cent of Perth's overall growth, the City of Sydney LGA added 53 798 new residents and accommodated a significant share of Sydney's population growth (11.3 per cent). The City of Melbourne LGA added 44 422 new residents, while the Brisbane CBD (defined as the aggregate of the City Inner and City Remainder SLAs) added 6 543 new residents.

Between 2001 and 2011, the Middle sector of each city recorded average population growth of 0.9–1.8 per cent per annum. The Outer sector of Melbourne, Brisbane and Perth grew more rapidly, with 2.4–2.9 per cent average annual growth. This pattern was not repeated in Sydney's Outer sector, which averaged 0.9 per cent per annum population growth between 2001 and 2011. Nevertheless, the Outer sector accommodated much of the population growth in all four cities, contributing 46 per cent of Sydney's growth, compared to 53 per cent for Brisbane, 62 per cent for Melbourne and 68 per cent for Perth. While some of this outer suburban population growth reflected infill within established suburbs (particularly in Sydney), most was attributable to greenfield developments on the urban fringe.

Figure 4.5 shows the proportion of 2001 to 2011 population growth that occurred at various distances from the CBD of the four capital city SDs. The two smaller cities of Brisbane and Perth had the highest share of population growth occurring within 10km of the CBD (around 24 per cent, compared to about 19 per cent for Sydney and Melbourne), Sydney had a relatively high share of its population growth between 10 and 20km from the CBD (32 per cent), reflecting significant infill development within its middle suburbs. In contrast,

36 per cent of Melbourne's population growth was located 20 to 30km from the CBD—much of this growth was concentrated in the LGAs on Melbourne's western and northern urban fringe that contain the state government's designated Growth Areas (i.e. Wyndham, Melton, Hume and Whittlesea). Melbourne and Sydney had a significantly greater proportion of their growth located more than 40km from the CBD than did the smaller cities of Brisbane and Perth.

Figure 4.5 Proportion of population growth occurring at various distances from Central Business District, 2001 to 2011



Note: The population measure used was the total enumerated population count, excluding overseas visitors, from the 2001 and 2011 censuses. Data for each city relates to all SA1s (for 2011) and all CCDs (for 2001) that lie within the ABS ASGC 2006 SD boundaries.

Source: BITRE analysis of 2011 and 2001 ABS Census of Population and Housing place of enumeration data.

There was also considerable population growth just beyond the SD borders. For example, in South East Queensland (SEQ), the Gold Coast and Sunshine Coast grew strongly between 2001 and 2011, while near Perth, there was substantial population growth in Mandurah. While not considered further in this report, the population growth of surrounding regions is detailed in the individual city reports (BITRE 2010, 2011, 2012a, 2013a).

Table 4.3 lists the SLAs that added more than 25 000 residents between 2001 and 2011, while maps 4.2, 4.3, 4.4 and 4.5 illustrate the spatial distribution of population growth in each of the four cities, based on SLA data.

Table 4.3 Statistical Local Areas which added more than 25 000 new residents between 2001 and 2011

SLA name	City	Sector	Estimated resident population, 2001	Estimated resident population, 2011	Change (number of persons)
Melton East	Melbourne	Outer	16 091	61 159	45 068
Whittlesea North	Melbourne	Outer	13 004	55 186	42 182
Casey–Cranbourne	Melbourne	Outer	51 461	90 345	38 884
Wyndham North	Melbourne	Outer	64 847	10 2123	37 276
Rockingham	Perth	Outer	74 018	109 101	35 083
Hume–Craigieburn	Melbourne	Outer	39 411	72 795	33 384
Wanneroo North-West	Perth	Outer	26 487	57 949	31 462
Wyndham South	Melbourne	Outer	3 836	35 062	31 226
Ipswich East	Brisbane	Outer	40 239	70 750	30 511
Casey–Berwick	Melbourne	Outer	67 800	97 788	29 988
Blacktown North	Sydney	Outer	76 850	106 458	29 608
Wanneroo North-East	Perth	Outer	20 423	50 001	29 578
Swan	Perth	Outer	85 094	114 179	29 085
Gosnells	Perth	Outer	83 474	112 244	28 770
Cockburn	Perth	Outer	69 202	95 316	26 114
Cardinia–Pakenham	Melbourne	Outer	17 990	44 087	26 097

Notes: Based on 2006 ASGC Statistical Division boundaries. Population estimates for 2007 to 2011 remain preliminary. Map 1.2 shows the Outer sector of each city.

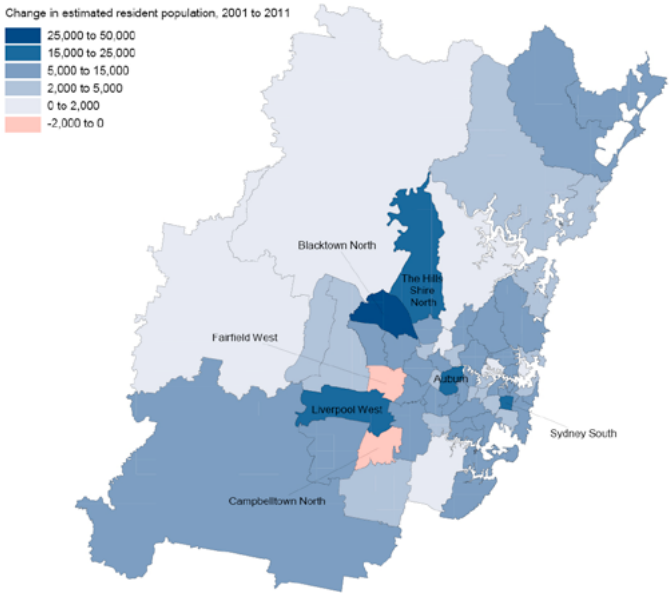
Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

All of the Australian SLAs that added more than 25 000 new residents were located in the four largest capital cities, and more specifically, within the Outer sector of those cities.

Table 4.3 reveals that the SLAs with the largest population increases were predominantly located in Melbourne, and to a lesser extent, Perth. Melbourne's growth was concentrated around the designated Growth Areas located 20–25km from the CBD in a westerly and northerly direction (i.e. Wyndham, Melton-Caroline Springs, Whittlesea, Hume). There was also substantial growth in the Casey-Cardinia Growth Area located 40–50km southeast of the CBD. Perth's population growth was also concentrated in urban fringe developments, particularly those with coastal proximity (e.g. Wanneroo, Rockingham).

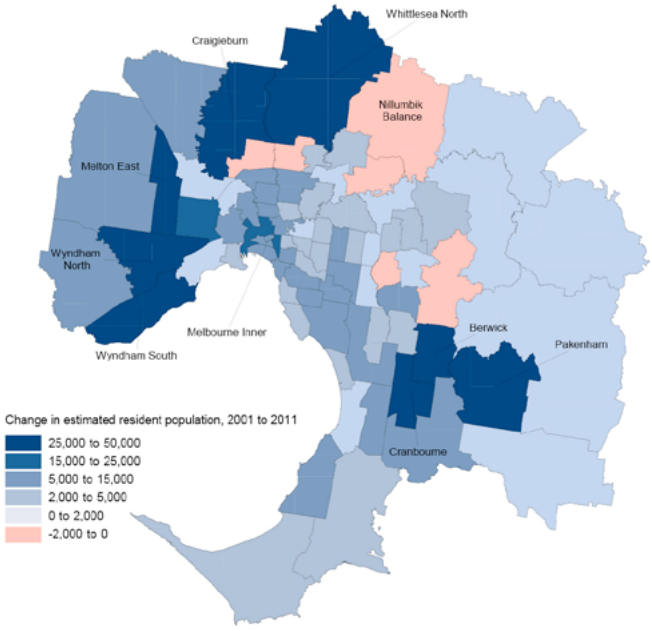
Sydney and Brisbane each had a single SLA which added over 25 000 residents. In Sydney, the main growth area was 30–40km north-west of the CBD (i.e. Blacktown North), but urban consolidation—particularly in the City of Sydney and in the Auburn and Concord SLAs—also played an important role in housing the growing population. In Brisbane, the Ipswich East SLA, which is located 25–30km south-west of the CBD, added the most population. Other key growth areas, which do not feature in Table 4.3 (due to the very disaggregated nature of Brisbane's SLAs), include Griffin-Mango Hill, Beaudesert Part A and Ipswich Central.

Map 4.2 Population change for Statistical Local Areas, Sydney, 2001 to 2011



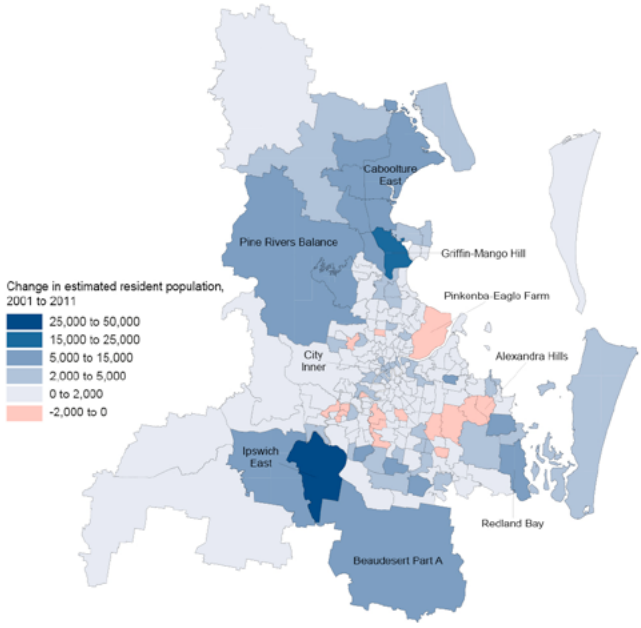
Notes: Based on 2006 ASGC Statistical Division boundaries. Estimates for 2007 to 2011 remain preliminary.
Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

Map 4.3 Population change for Statistical Local Areas, Melbourne, 2001 to 2011



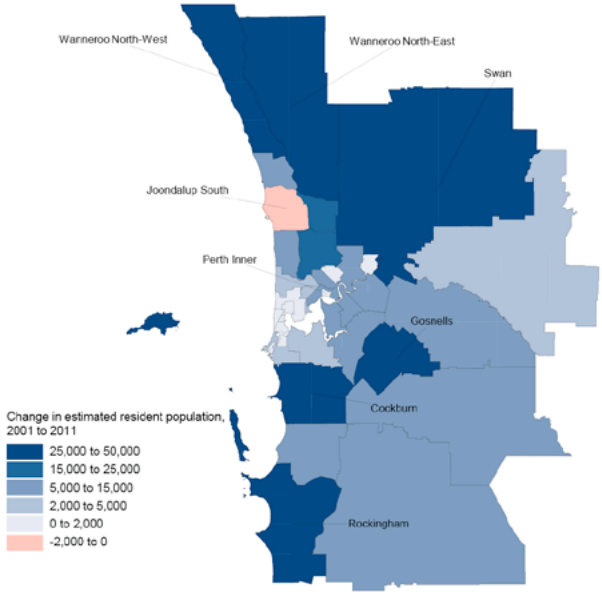
Notes: Based on 2006 ASGC Statistical Division boundaries. Estimates for 2007 to 2011 remain preliminary.
Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

Map 4.4 Population change for Statistical Local Areas, Brisbane, 2001 to 2011



Notes: Based on 2006 ASGC Statistical Division boundaries. Estimates for 2007 to 2011 remain preliminary.
Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

Map 4.5 Population change for Statistical Local Areas, Perth, 2001 to 2011

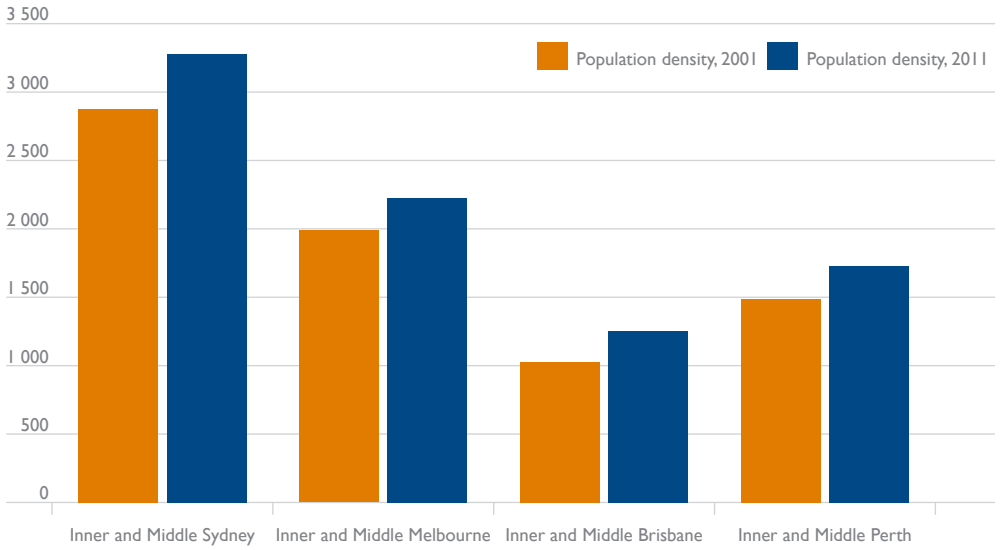


Notes: Based on 2006 ASGC Statistical Division boundaries. Estimates for 2007 to 2011 remain preliminary.
Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

The maps show that a few SLAs in each city lost population between 2001 and 2011. Only five SLAs experienced a significant population loss of more than 1000 people, namely Campbelltown North and Fairfield West in Sydney, Broadmeadows and Whittlesea South-West in Melbourne, and Joondalup South in Perth. All five of these population loss SLAs are located in the Outer sector, but they tend to contain older and more established suburbs than the Outer sector growth SLAs that feature in Table 4.3.

As previously noted, when considering population densities, it is best to focus on the developed urban area, rather than the SD as a whole. Unfortunately, it is not practical to identify changes in population densities using the ABS urban centre classification, as boundary changes drive the results. Figure 4.6 presents population densities for 2001 and 2011 for the combined Inner and Middle sectors of the four capital cities. Sydney recorded the largest increase in density, housing an additional 400 persons per km2 in its established inner and middle suburbs. While Inner sector densities rose strongly for all four cities, Sydney's Middle sector also experienced a substantial increase in its population density between 2001 and 2011. A key contributor to this increase in residential densities is a shift towards higher density forms of housing, which is discussed in more detail in Box 4.1.

Figure 4.6 Population density of combined Inner and Middle sectors of each city, 2001 and 2011



Notes: Based on 2006 ASGC Statistical Division boundaries. Estimates for 2007 to 2011 remain preliminary. Inner and Middle sectors of each city shown in Map 1.2.

^ The Brisbane figures were derived after excluding three geographically large Middle sector SLAs where the land area is primarily national park or state forest (i.e. Moreton Island, Karana Downs-Lake Manchester, Brookfield). This brings the Brisbane figures on to a more common footing with the other cities.

Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

Table 4.4 lists the SLAs that recorded an increase in population density of more than 2000 persons per km^2 (or 20 persons per hectare) between 2001 and 2011. All of the listed SLAs are in the Inner sector, with the CBD SLAs in Sydney, Melbourne and Brisbane recording some of the largest increases in population density during the period. Inner city Brisbane SLAs are particularly well represented in the table. The largest increase for Perth related to the Perth Remainder SLA which increased its population density from 651 to 1536 persons per km^2 between 2001 and 2011.

Table 4.4 Statistical Local Areas where population density increased by more than 2000 persons per square kilometre between 2001 and 2011

SLA name	City	Sector	Population density, 2001 (persons per km^2)	Population density, 2011 (persons per km^2)	Change in population density, 2001 to 2011 (change in persons per km^2)
Melbourne Inner	Melbourne	Inner	3420	8924	5504
City Inner	Brisbane	Inner	1459	5041	3583
Southbank-Docklands	Melbourne	Inner	960	3927	2967
Sydney Inner	Sydney	Inner	3480	6186	2705
City Remainder	Brisbane	Inner	1218	3908	2690
Sydney West	Sydney	Inner	5378	7766	2388
Newstead	Brisbane	Inner	2214	4576	2362
Fortitude Valley	Brisbane	Inner	2219	4391	2172
Spring Hill	Brisbane	Inner	2904	4969	2065

Notes: Based on 2006 ASGC Statistical Division boundaries. Population estimates for 2007 to 2011 remain preliminary.
Source: BITRE analysis of ABS Cat. 3218.0 Estimated Resident Population data for SLAs (July 2012 and July 2007 releases).

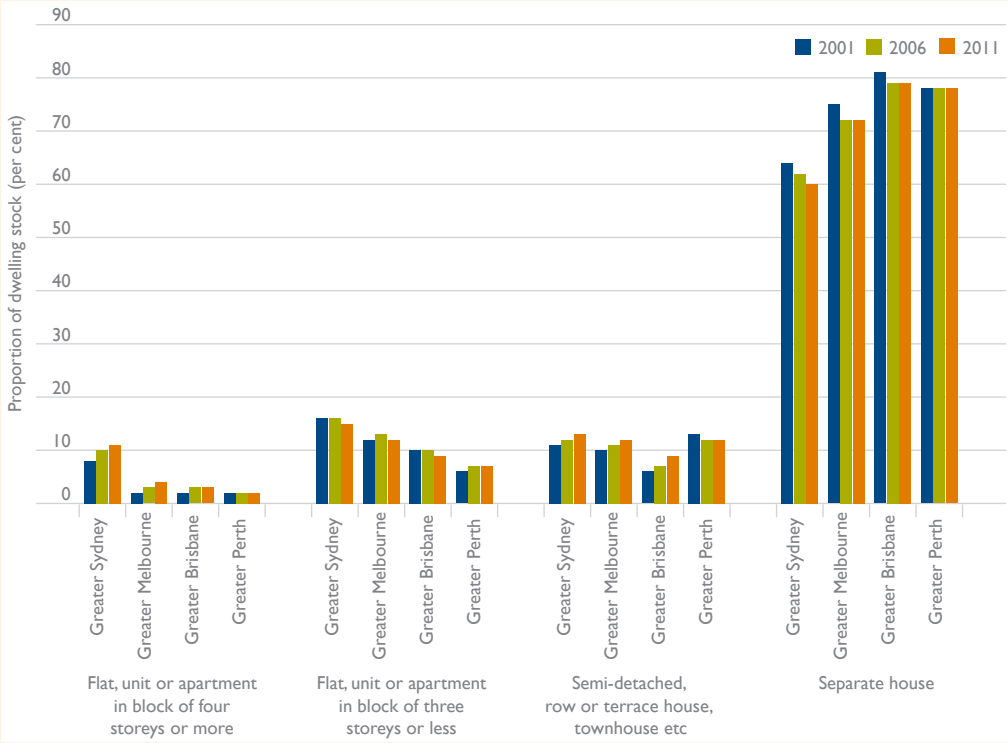
Box 4.1 Changes in the dwelling mix of cities between 2001 and 2011

Time-series profile data from the 2011 ABS *Census of Population and Housing* shows how the dwelling mix has changed since 2001 for the Sydney, Melbourne, Brisbane and Perth Greater Capital City Statistical Areas (which differ from the SD boundaries used elsewhere in this report).

While separate houses dominate the dwelling mix in each of the four cities, Figure 4.7 shows that the proportion of separate houses significantly declined in Sydney, Melbourne and Brisbane between 2001 and 2011. There was a significant increase in the share of high-rise flats, units and apartments (in blocks of four or more storeys) in all four cities. While Sydney, Melbourne and Brisbane each experienced a clear shift towards higher density forms of housing between 2001 and 2011, there was relatively little change in the dwelling mix for Perth.

The shift towards higher density forms of housing was most pronounced in Sydney, where 54 400 new high-rise flats, units and apartments were added between 2001 and 2011, compared to 47 100 separate houses, 41 800 semi-detached dwellings and 20 000 low-rise flats, units and apartments. There were 32 100 high-rise flats, units and apartments added in Melbourne from 2001 to 2011, 13 200 in Brisbane and 6 200 in Perth. The number of separate houses grew by just 5 per cent in Sydney from 2001 to 2011, compared to 15 per cent for Melbourne, 19 per cent for Brisbane and 24 per cent for Perth.

Figure 4.7 Proportion of dwellings of different types for each Greater Capital City Statistical Area in 2001, 2006 and 2011



Source: BITRE analysis of 2011 ABS Census of Population and Housing Time Series Profile data (Table 14).

Strategic planning objectives

This section summarises the recent changes that have occurred with respect to several metropolitan planning goals that relate to the spatial distribution of population within cities, namely:

- limit urban sprawl
- increase residential densities around centres
- consolidate rural population growth in existing settlements
- shift the focus of population growth within the city.

Limit urban sprawl

The strategic metropolitan plans for Sydney, Melbourne, Perth and SEQ pursue a common objective of limiting urban sprawl, which is to be achieved through a combination of increasing densities in existing and new suburbs and restricting the locations in which urban development can occur.

Each of the strategic metropolitan plans contain quantitative targets relating to the proportion of new dwellings that will be accommodated within existing urban areas, as opposed to greenfield developments. There are notable differences in the targets across cities, which range from the *Directions 2031* target to accommodate 47 per cent of new dwellings through infill development, to the *Metropolitan Plan for Sydney 2036* target to locate at least 70 per cent of new homes in existing suburbs (see Table 2.3).

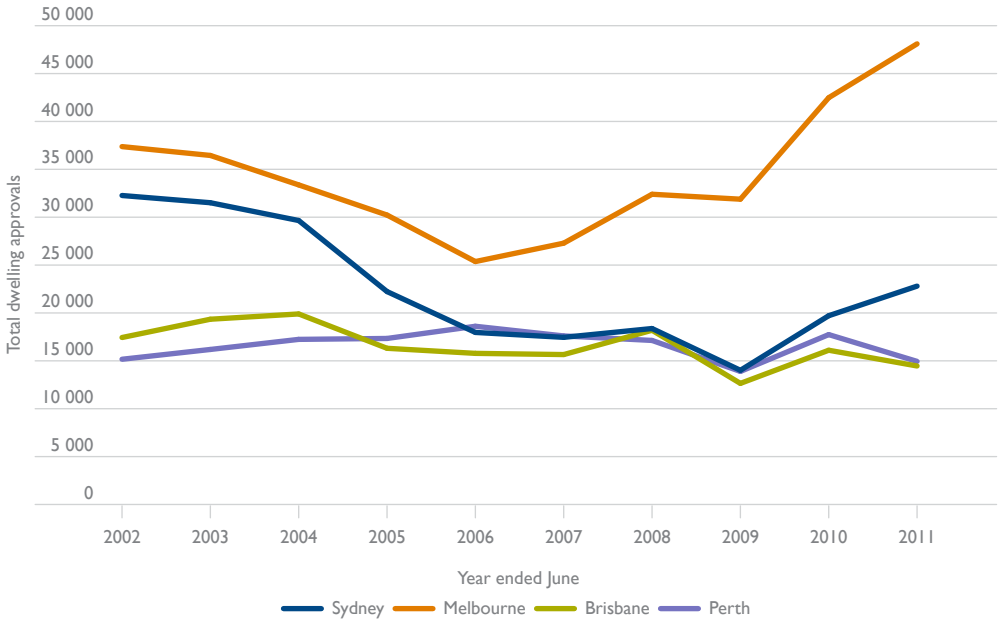
There are also significant differences in the mechanisms put in place to support achievement of this policy goal. For example, *Melbourne 2030* established 'an Urban Growth Boundary to set clear limits to metropolitan Melbourne's outward development' (Victorian Department of Infrastructure 2002, p.60), while the SEQ Urban Footprint similarly 'establishes a boundary for urban development, containing urban growth and promoting a higher density urban form' (Queensland Government and COMSEQ 2009, p.27), but Sydney and Perth have no equivalent. In Melbourne and Sydney, it is intended that new greenfield land releases will be focused in several designated Growth Areas/Growth Centres. The Melbourne, Perth and SEQ strategic plans set a density target of 15 dwellings per hectare for greenfield development. All four cities also aim to increase residential densities by focusing higher density residential development around activity centres—recent patterns of residential development in activity centres are the focus of the following section, and are not considered further in this section.

Earlier in this chapter, it was noted that Melbourne gained more new residents between 2001 and 2011 than Sydney, Brisbane or Perth. Figure 4.8 displays movements in dwelling approvals for each city between 2001 and 2011, and shows that Melbourne consistently had the most dwelling approvals. The cumulative total was 344 900 dwelling approvals for Melbourne between July 2001 and June 2011, compared to 226 000 for Sydney, 165 800 for Brisbane and 165 900 for Perth. While Sydney and Melbourne both experienced a significant decline in dwelling approvals between 2002 and 2006, Melbourne's dwelling approvals have grown strongly since then and now stand well above 2002 levels, whereas Sydney's dwelling approvals have not yet returned to the levels seen at the start of the 2000s. Only 37 per cent of

Sydney's dwelling approvals were for separate houses, compared to 64 per cent for Brisbane, 65 per cent for Melbourne and 80 per cent for Perth (ABS 2012b).

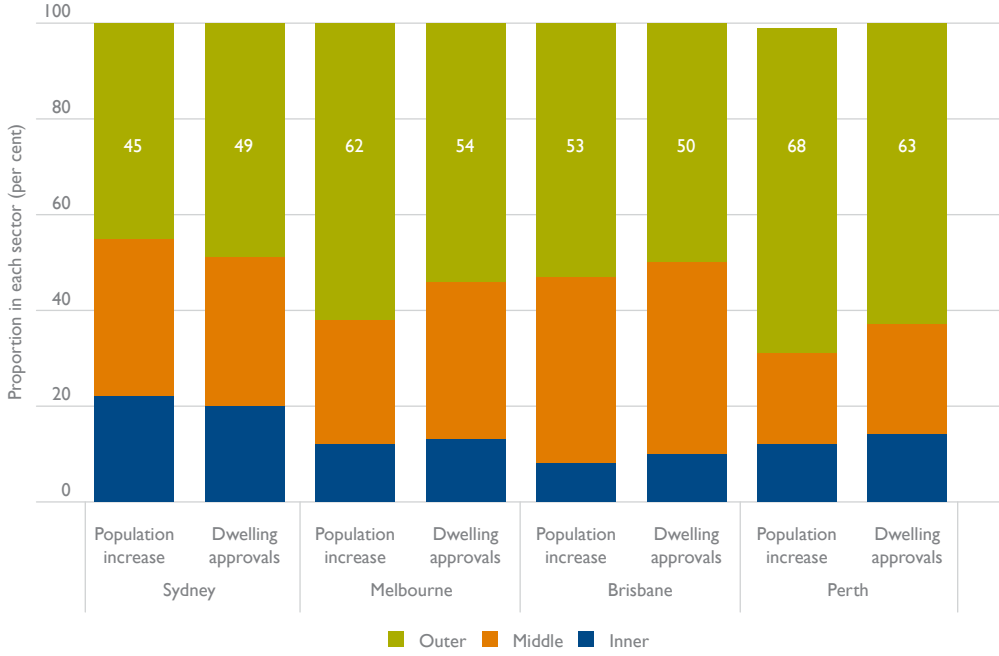
Figure 4.9 shows how these dwelling approvals, and population growth, were split across the Inner, Middle and Outer sectors of each city. Sydney had the smallest proportion of residential growth located in the Outer sector (45–49 per cent), while Perth had the greatest proportion of residential growth in the Outer sector (63–68 per cent). There was a total of 82 800 outer suburban dwelling approvals in Brisbane between 2001 and 2011, compared to 105 300 in Perth, 110 400 in Sydney and 186 400 in Melbourne. The residential growth in the Outer sector reflects a mix of growth in established suburbs and greenfield developments. The distinction is not always straightforward, as there can be delays of many years between an initial land release and a suburb being fully populated, and significant new land releases can occur in an established suburb.

Figure 4.8 Dwelling approvals for capital city statistical divisions, 2001 to 2011



Note: There is a break in series for Brisbane from July 2006, when the SD boundary changed.
Source: BITRE analysis of ABS Cat. 8731.0 Building approvals, Australia, January 2012 (Table 10).

Figure 4.9 Proportion of population increase and dwelling approvals in Inner, Middle and Outer sectors of capital city statistical divisions, 2001 to 2011



Source: BITRE analysis of SLA data from ABS Cat. 3218.0 (July 2012 and July 2007 releases) and ABS Building approvals data, sourced from Cat. 8731.0 (various issues), ABS National Regional Profile (various issues), Victorian DPCD (2011), OESR (2011a) and Queensland Regional Statistical Information System.

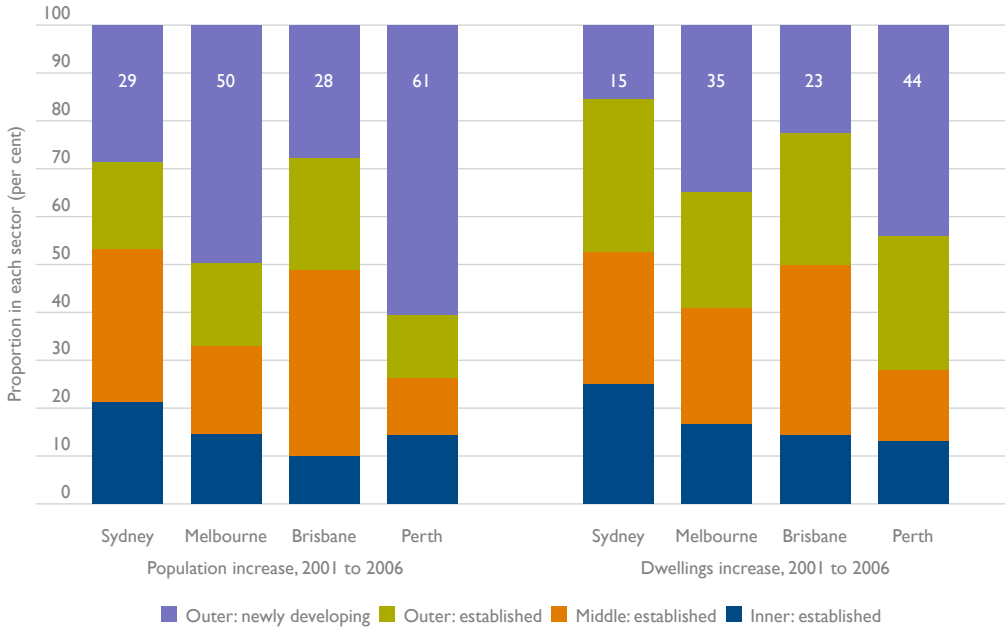
BITRE has developed a census-based methodology for classifying all ABS suburbs within capital city SDs as either a 'newly developing suburb' or part of the 'existing urban area' for the 2001 to 2006 period, depending on whether certain growth criteria were met.[19] The 'newly developing suburb' category captures urban fringe locations with a very rapid increase in the number of dwellings, typically off a low base. Figure 4.10 compares the four cities in terms of the proportion of population and dwellings growth occurring in newly developing suburbs. Sydney had just 15 per cent of its dwelling growth within the newly developing suburbs, compared to 23 per cent for Brisbane, 35 per cent for Melbourne and 44 per cent for Perth. The population share was higher than the dwellings share in all four cities, as the newly developing suburbs tend to have larger household sizes and higher birth rates than established suburbs. The Brisbane figures are relatively low because much of the growth pressure is being absorbed by newly developed suburbs in the rest of SEQ, and particularly in the Gold Coast.

19 Specifically, a newly developing suburb needed to meet one of the following conditions:

- A suburb located in the Outer sector in which the number of occupied private dwellings increased by more than 50 per cent over the period *and* this involved an increase of at least 100 dwellings *and* the growth was fringe development, not urban infill.
- A suburb located in the Outer sector in which the number of occupied private dwellings increased by between 30 and 50 per cent over the period *and* this involved at least 100 additional dwellings *and* at least one CD within the suburb more than doubled its number of dwellings *and* the growth that occurred was fringe development, not urban infill.

The second criterion loosens the growth cut-off a little to ensure the definition is able to capture suburbs which contain some established residential areas, but in which substantial new land releases occurred during or just prior to the period of interest. Further information on this classification is available from the individual city reports (BITRE 2010, 2011, 2012a, 2013a).

Figure 4.10 Proportion of population and dwellings growth in newly developing suburbs of capital city statistical divisions, 2001 to 2006



Notes: The analysis relates to suburbs within capital city SDs. Definitions of newly developing suburbs are provided in BITRE (2013a, Table 3.13), BITRE (2012a, Table 3.12), BITRE (2011, Table 3.18) and BITRE (2010, Table 3.8). Results relate to the usual resident population and to occupied private dwellings. The Perth and Melbourne estimates have been revised slightly, reflecting adoption of a common methodology across all four cities.

Source: BITRE analysis of ABS Census of Population and Housing data for 2001 and 2006.

The state governments typically have their own reporting systems which are used to monitor progress towards infill/greenfields targets. Table 4.5 summarises the evidence for the 2001 to 2011 period. While the four cities adopt different terminology and definitions in measuring the split between infill and greenfield development, it is nevertheless clear that there is wide variation in targets and in outcomes. Sydney's infill target of 'at least 70 per cent' is considerably higher than the targets of the other three cities. For the 2001 to 2011 period, only 19 per cent of Sydney's new dwellings were in greenfield areas, compared to 20–30 per cent for Brisbane, roughly 39 per cent for Melbourne, and 60–70 per cent for Perth.[20]

20 The 39 per cent figure for Melbourne relates to the designated Growth Area municipalities, but there was also significant greenfields development in some other municipalities (e.g. Mornington Peninsula) (BITRE 2011). A figure of 24 per cent is obtained for Brisbane for the 2001 to 2011 period as a whole if BITRE's newly developing suburbs data for the 2001 to 2006 period (Figure 4.10) is combined with the 24 per cent figure for the 2006 to 2011 period from Table 4.5. The 60–70 per cent range for Perth reflects the figures provided in Table 4.5.

Table 4.5 Observed changes since 2001 with respect to urban infill targets, based on state government reporting systems

City	Target	Evidence
Sydney	Contain the urban footprint by locating at least 70 per cent of new homes to 2036 in existing suburbs and up to 30 per cent in greenfield areas (NSW Government 2010, pp. 7, 44, 114)	According to *Metropolitan Development Program* data, 81 per cent of Sydney's dwelling completions occurred within the existing urban area between July 2001 and June 2011, with only 19 per cent relating to greenfield developments. The target was exceeded because '[h]ousing production in new release areas has been well below expectations in recent years' (NSW Government 2010. p.106). Dwelling production in the existing urban area also fell below expectations (BITRE 2012a, p.88).
Melbourne	The Growth Areas will accommodate 47 per cent of new dwellings over the next 20 years, with the remaining 53 per cent in established areas (Victorian DPCD 2008, pp. 3, 18).	According to *Residential Land Bulletin* data, 39 per cent of Melbourne's dwelling approvals occurred in the designated Growth Area municipalities between July 2001 and June 2011, with the remaining 61 per cent occurring in established municipalities. However, a quarter of this growth in established municipalities occurred in outer suburban locations (particularly the Frankston and Mornington Peninsula LGAs), and partly relates to new houses being built on recently subdivided land near the urban fringe (BITRE 2011, pp. 82–83).
Brisbane^	Accommodate at least 52 per cent^ of new dwellings to 2031 through infill and redevelopment of existing urban areas (Queensland Government and COMSEQ 2009, pp. 90–91).	According to the *SEQ Growth Management Program* and OESR reporting, 76 per cent of Brisbane dwelling approvals between July 2006 and June 2011 occurred within the Existing Urban Area boundary and were classed as infill. However, some of this 'infill' relates to new houses built on recently subdivided land near the urban fringe, rather than to redevelopment of established suburbs (BITRE 2013a).
Perth and Peel#	Achieve a more compact city by accommodating 47 per cent of new dwellings to 2031 through infill development (WAPC 2010, p.27).	The *Urban Growth Monitor 2012* reports that the historical 20-year average rate of infill development for Perth and Peel is 32 per cent. As of December 2010, 36 per cent of lots with conditional approval for residential subdivision were in the urbanised area (i.e. infill), with 64 per cent in greenfield areas (WAPC 2011).

Notes: # The infill target relates to Perth and Peel (rather than the Perth SD), and infill targets for individual subregions are not specified within the *Directions 2031* strategic plan.

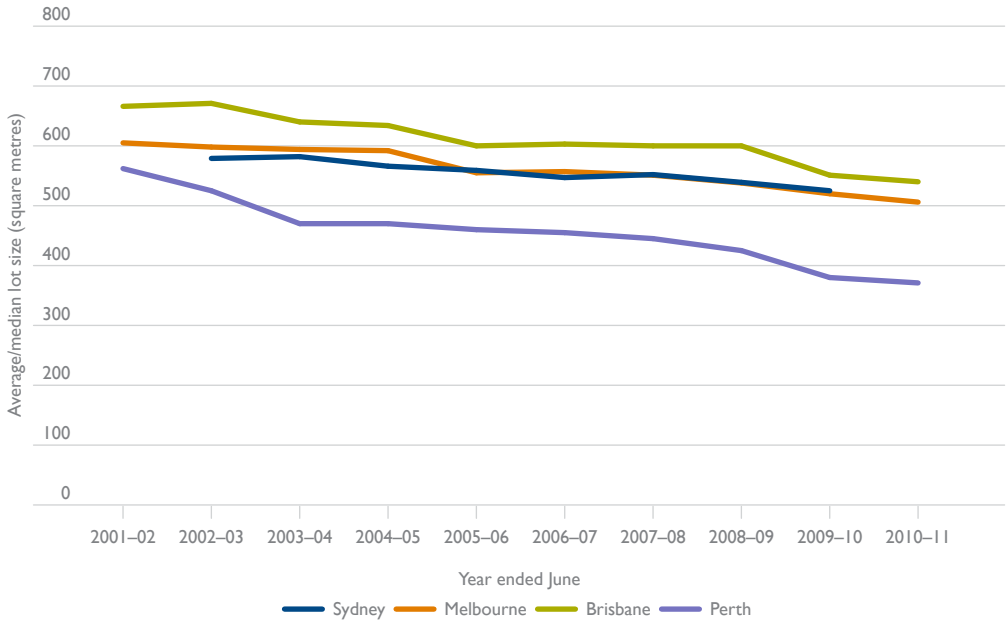
^ While SEQ has an overall infill target of 'at least 50 per cent', the detail of the *SEQ Regional Plan 2009–2031* specifies an infill target of at least 52 per cent for the combined LGAs within the Brisbane SD (i.e. the Brisbane, Logan, Redland, Ipswich and Moreton Bay LGAs). The state government reporting relates to the individual LGAs as well as SEQ as a whole.

Sources: BITRE analysis of NSW *Metropolitan Development Program* (DPI 2011a,b), Victorian DPCD *Residential Land Bulletin* (various issues), Growth Management Queensland (2011), OESR (2011b) and WAPC (2011, 2012).

Table 4.5 indicates that the rate of infill development needs to rise significantly in order for Perth's strategic planning target to be achieved, whereas Sydney, Melbourne and Brisbane are currently surpassing the targeted long-term rate of infill development.

The objective of limiting urban sprawl in these cities is to be achieved through increasing residential densities through both infill development in existing suburbs and through reduced lot size in greenfield developments. Figure 4.11 shows a downward trend in the median/average size of newly created lots in each city over the last decade. The decline in lot size was most pronounced for Perth and least pronounced for Sydney.

Figure 4.11 Median/average lot size for newly produced lots in capital city statistical divisions, 2001 to 2011



Notes: Melbourne and Sydney data are averages, Brisbane and Perth data are medians. Sydney data not available for 2001–02 and 2010–11. While a target of 15 dwellings per hectare in theory corresponds to 667 square metres per dwelling, the state government targets are often based on densities per hectare of developable land, rather than on the total land area.

Source: UDIA State of the Land report, 2012 and 2013 issues.

Table 4.6 assesses progress against the goal of limiting urban sprawl for each city, based on the evidence presented in this section, and additional city-specific evidence discussed in the individual city reports. Perth experienced only limited progress with respect to this strategic planning goal between 2001 and 2011 because rates of infill development fell well below the 47 per cent target, even though increased residential densities were achieved in new housing developments. In contrast, the infill targets for Brisbane, Sydney and Melbourne were exceeded over the past decade. In Sydney, the targets were exceeded because housing production in new release areas has been well below expectations. COAG Reform Council (2012, p.98) notes that the 'goal of a more compact city is a delicate balancing act. Infill development will help Sydney meet sustainability and economic competitiveness goals but may have negative effects on affordability and growth'.

Table 4.6 Observed changes with respect to objective of limiting urban sprawl, 2001 to 2011

City	Extent of progress	Comments
Sydney	Over-achieved	*Sydney 2036's* long term target for at least 70 per cent of new homes to be located in existing suburbs was met and exceeded between 2001 and 2011, when 81 per cent of new housing development occurred within the existing urban area. The average size of newly produced lots declined over the period. While the *Sydney 2036* urban infill percentage target was exceeded and urban sprawl was contained, aggregate dwelling production declined considerably over the period, with implications for housing affordability and for Sydney's growth.
Melbourne	Some	The Urban Growth Boundary was introduced to set clear limits on Melbourne's outward development, but has been expanded several times. From 2001 to 2011, fringe development was mainly directed to the Growth Area municipalities (which accounted for 72 per cent of outer suburban dwelling approvals) and the average size of newly produced lots declined. The Growth Area municipalities contributed 39 per cent of dwelling approvals, with established municipalities contributing 61 per cent, which exceeds the current 53 per cent long-term target. However, some of the recent growth in established municipalities relates to new houses built on recently subdivided land near the urban fringe.
Brisbane	Some	From 2001 to 2011, about half of Brisbane's population and dwellings growth was in the outer suburbs, but the great majority of residential development (over 90 per cent) was contained within the Urban Footprint boundary, and residential densities increased in new detached housing developments. From 2006 to 2011, 76 per cent of dwelling approvals were within the Existing Urban Area boundary, which exceeds Brisbane's long-term infill target of 52 per cent. However, some of this 'infill' relates to new houses built on recently subdivided land near the urban fringe, rather than to redevelopment of established suburbs.
Perth	Limited	Perth continued its outward expansion, with 68 per cent of population growth and 63 per cent of dwellings growth from 2001 to 2011 occurring in the outer suburbs, much of that in new growth areas on the urban fringe. The current rate of infill development in Perth is 30–40 per cent, which is below the long-term *Directions 2031* target to accommodate 47 per cent of new dwellings through infill development. However, Perth did experience a significant reduction in the median size of newly created lots between 2001 and 2011.

Notes: For more detail on data and methods underlying this assessment, see BITRE (2010, 2011, 2012a, 2013a), as well as Figures 4.8, 4.9, 4.10 and 4.11 and Table 4.5 of this report. The overall assessment for Melbourne in Table 4.5 differs from that in BITRE (2012a), which was based largely on the 2001 to 2006 period and used the previous (higher) infill target from *Melbourne 2030*.

Sources: BITRE analysis of NSW DPI *Metropolitan Development Program* (2011a,b), Victorian DPCD *Residential Land Bulletin* (various issues), Growth Management Queensland (2011), OESR (2011), WAPC (2011, 2012), UDIA (2012, 2013), ABS Cat. 8731.0, ABS Cat. 3218.0, and ABS Census of Population and Housing data for 2001, 2006 and 2011.

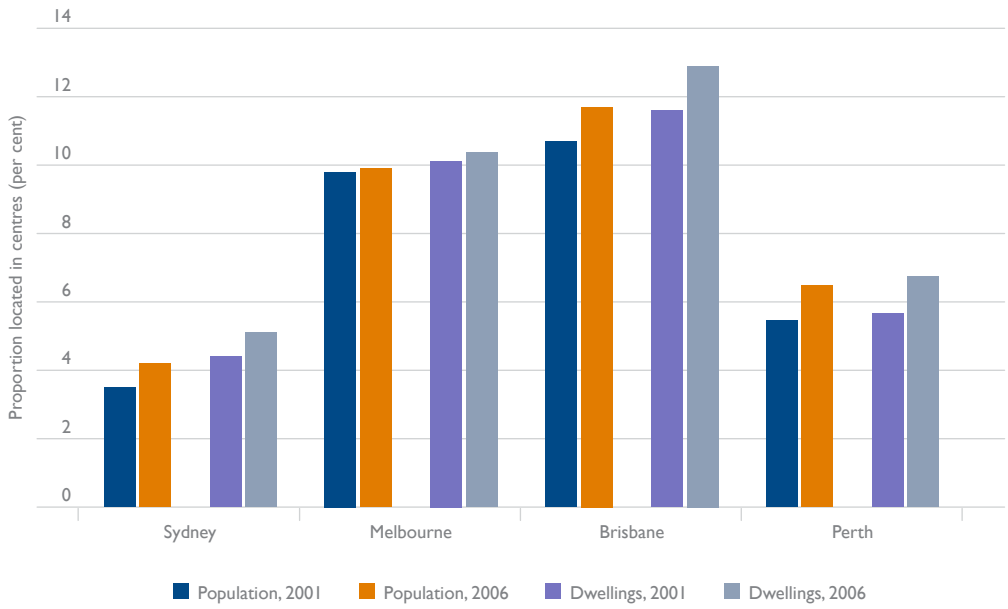
Increase residential densities around centres

All four cities aim to increase residential densities in and around activity centres. There are differences in the phrasing of the objectives across the cities, particularly with regard to the preferred density level of new housing development, and the centre types to which the objective applies (see Table 2.3). The *Metropolitan Plan for Sydney 2036* sets a target to 'locate at least 80% of all new homes within the walking catchments of existing and planned centres' (NSW Government 2010, p.6). *Melbourne 2030* targeted 41 per cent of new dwellings being located in strategic redevelopment sites, particularly principal and major activity centres, between 2001 and 2030 (Victorian Department of Infrastructure 2002, p.30). Perth and SEQ have established quantitative guidelines for minimum residential density levels in different types of activity centres.

Figure 4.6 showed that the each of the four cities experienced a significant increase in residential densities between 2001 and 2011. To what extent was this increase in residential densities attributable to higher densities in activity centres?

Figure 4.12 presents information on how the estimated proportion of population and dwellings located in activity centres has changed from 2001 to 2006. The focus is on the top few tiers of the activity centre hierarchy for each city, with specialised centres excluded. The *Metropolitan Plan for Sydney 2036* identifies a limited number of non-specialised strategic centres, which contributes to the centred share of population being lower than the other cities. Activity centre boundaries were defined based on destination zone (DZ) boundaries, with details provided in the individual city reports (BITRE 2010, 2011, 2012a, 2013a).

Figure 4.12 Proportion of population and dwellings in activity centres of each capital city statistical division, 2001 and 2006



Notes: Activity centre boundaries were defined based on DZ boundaries. Population and occupied private dwellings data for CCDs on a place of enumeration basis was aggregated to the DZ scale and used to produce estimates for centres. For some activity centres, the DZ containing the centre is significantly larger than the activity centre itself. The adopted centre definitions tend to be relatively encompassing, and will often incorporate a significant amount of detached housing.

A total of 18 centres are included in the analysis for Sydney, 27 for Melbourne, 23 for Brisbane and 28 for Perth, based on the top few tiers of the current activity centre hierarchy in each city. The included centre types are: Sydney—Global Sydney, Regional Cities, existing Major Centres (not planned or potential); Melbourne—Central Activity Districts and Principal Activity Centres; Brisbane—Primary, Major Regional and Principal Regional Activity Centres; Perth—Capital City, Strategic Metropolitan Centres and Secondary Centres (excluding emerging centres).

Sources: BITRE analysis of ABS Census of Population and Housing data for CCDs for 2001 and 2006 and NSW Bureau of Transport Statistics online tabulations of ERP at DZ scale.

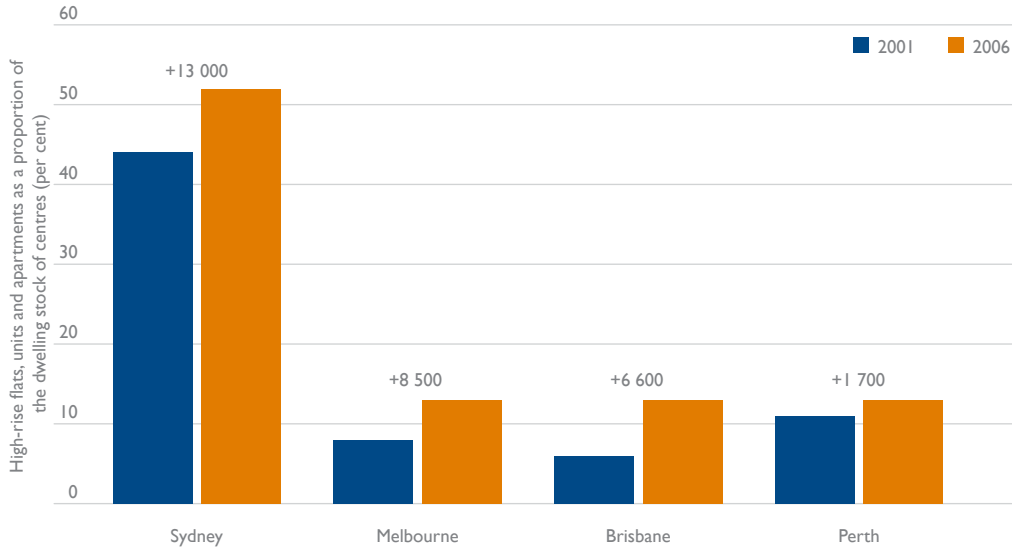
Figure 4.12 reveals that each of the cities experienced an increase in the proportion of population and dwellings located in these top-tier activity centres between 2001 and 2006, and since the land areas of the centres are fixed (and the total population and dwellings counts increased), this means there was an increase in the average residential density of centres. For Melbourne, population and dwellings became only marginally more concentrated in centres

between 2001 and 2006. The shift was much more pronounced in Sydney, Brisbane and Perth. In these three cities, the population of centres grew at a considerably faster rate than did the population of the rest of the city.

The population density of Melbourne's top-tier activity centres grew at an average annual rate of just 1.3 per cent between 2001 and 2006, well below the growth rates of Brisbane (3.9 per cent), Sydney (4.7 per cent) and Perth (5.1 per cent). The number of occupied private dwellings per square kilometre also rose more slowly for Melbourne's centres (2.3 per cent per annum), than it did for Sydney (4.3 per cent), Brisbane (4.3 per cent) or Perth (5.5 per cent[21]).

Box 4.1 showed that Sydney, Melbourne and Brisbane each experienced a shift towards higher density forms of housing between 2001 and 2006 (as well as between 2001 and 2011), while there was relatively little change in the dwelling mix for Perth. Much of the higher density housing added between 2001 and 2006 was built in the top-tier activity centres, which accounted for between 48 per cent (for Sydney) and 76 per cent (for Brisbane) of the additional stock of high-rise flats, units and apartments. Between 2001 and 2006, Sydney, Melbourne and Brisbane all experienced a notable increase in the contribution that high-rise flats, units and apartments made to the total dwelling stock of the top-tier activity centres (see Figure 4.13). The increase was relatively modest for Perth's centres.

Figure 4.13 High rise flats, units and apartments as a proportion of the total dwelling stock of activity centres, 2001 and 2006



Notes: The number displayed in the chart represents the net increase in the number of high-rise flats, units and apartments in the top-tier activity centres between 2001 and 2006. High-rise flats, units and apartments are defined as those in blocks of 4 storeys or more. Total dwelling stock includes dwelling type not stated. Based on capital city statistical divisions. For information on activity centre definitions, see notes to Figure 4.12.

Sources: BITRE analysis of ABS Census of Population and Housing data for CCDs for 2001 and 2006.

21 The observed increase is partly due to activity centres being defined based on DZs, which tend to cover a relatively large area in Perth's outer suburbs. The greenfield residential development occurring in the DZs which contained some outer suburban centres (e.g. Ellenbrook, Clarkson, Cockburn) made an important contribution to the observed increase in the residential density of Perth's centres, alongside densification of the CBD-based activity centre.

Densification of the CBD-based activity centre was responsible for much of the increased population and dwellings share of centres. For example, between 2001 and 2006, Brisbane's top-tier activity centres added 6600 high-rise flats, units and apartments, of which 6000 were located in the Brisbane CBD primary activity centre. While densification tended to be focused around the CBD, there was also a notable increase in population and dwellings for some activity centres located in outer suburban growth areas (e.g. Narre Warren-Fountain Gate in Melbourne) and inner city urban renewal sites (e.g. Green Square in Sydney). The more established activity centres in the middle and outer suburbs experienced limited densification between 2001 and 2006, which is consistent with the observation of Birrell et al (2005) that demographic trends mean there is likely to be limited market demand for high density dwellings in suburban activity centres.

BITRE's individual city reports present a more in-depth analysis of residential development in centres, drawing on city-specific sources where available (BITRE 2011, 2012a, 2013a). Of particular note is that 23 per cent of Sydney's dwelling production between 2003–04 and 2007–08 was in strategic centres and 27 per cent was in the smaller local centres, so that about half of all dwelling production was in centres (NSW Department of Planning 2010, BITRE 2012a). Even though the residential density of Sydney's strategic centres rose significantly, with a marked shift towards higher density dwellings (see Figure 4.13), this has not occurred at sufficient pace or been sufficiently widespread to meet the state government's target to 'accommodate 80 per cent of Sydney's new housing within the walking catchments of existing and planned centres' (NSW Government 2010, p.63).

In summary, the census-based evidence shows that residential densities increased for centres between 2001 and 2006 in all four cities, with centres experiencing more rapid residential growth than the capital city SDs as a whole. This reflects a shift towards higher density forms of housing, with many new high-rise flats, units and apartments being built in activity centres (primarily within the CBD-based activity centres). Compared to the other cities, Melbourne experienced limited (but still positive) progress in increasing residential densities in centres.

Consolidate rural population growth in existing settlements

Melbourne 2030 and the *SEQ Regional Plan* both aim to consolidate rural population growth within existing settlements. '*Melbourne 2030* proposes to reduce the proportion of new housing development provided in rural areas in order to encourage consolidation into existing settlements where the investment in physical and community infrastructure and services has already been made' (Victorian Department of Infrastructure 2002 p.75). The *SEQ Regional Plan 2009–2031* aims to 'consolidate future rural population growth within existing towns and villages' and 'contain and limit areas allocated for rural residential development' (Queensland Government and COMSEQ 2009, pp. 74, 110). The metropolitan plans for Perth and Sydney do not articulate a goal of this sort.

Table 4.7 summarises the data that BITRE used to assess trends for this planning objective, which shows that both Melbourne and Brisbane have seen progress in consolidating rural population growth in existing settlements since 2001.

Table 4.7 Observed changes since 2001 in consolidating rural population growth in existing settlements, Melbourne and Brisbane

Data source	Melbourne	Brisbane
ABS census data, 2001 and 2006	The population and dwelling counts of the Melbourne SD 'rural balance' both declined by about 2 per cent from 2001 to 2006. Some previously rural areas were reclassified as urban, reflecting urban expansion. Some new rural residential development did occur just beyond the SD's borders in the surrounding peri-urban areas (e.g. Mitchell South), but contributed less than 1 per cent of new housing development in the Melbourne working zone.	The 'rural balance' of the Brisbane SD added about 7200 people and 2200 dwellings. This represented a population increase of 9 per cent, which was less than the 12 per cent growth of the Brisbane SD as a whole. The population of rural localities of 200–999 persons rose by just 6 per cent. The 'rural balance' contributed 4 per cent of Brisbane's population growth and 3 per cent of dwellings growth. The great majority of this 'rural balance' growth related to the Beaudesert Part A SLA, and this was largely low density rural residential development. Beyond the Brisbane SD's borders, parts of the Sunshine Coast had significant 'rural balance' growth.
OESR data on lot approvals and lot registrations	n/a	There were about 1550 low density lot registrations in Brisbane in the year ended September 2004, but the number of registrations has been much lower in recent years, with an average of about 700 registrations per year from 2009 to 2011. The number of rural residential lot approvals has also declined since 2004.
Overall assessment	Rural residential development appears to have been limited, with growth consolidated into existing settlements.	While 3–4 per cent of Brisbane's growth between 2001 and 2006 occurred in rural areas (outside of existing towns and villages), the declines in low density lot registrations and rural residential lot approvals since 2004 suggest that rural residential development is starting to be curtailed.^

Notes: Details of assessment available from BITRE (2011, 2013a). BITRE has used the ABS section of state classification, and specifically the 'rural balance' category of this classification to investigate changes in the rural population from 2001 to 2006. The 'rural balance' category captures settlements of less than 200 people, farms and lifestyle acreages, and will capture a great deal of rural residential development. The OESR data for the Brisbane, Moreton Bay, Ipswich, Logan and Redland LGAs were aggregated to provide approximate results for the Brisbane SD.

^ Since October 2004, regulatory provisions have limited the areas in which rural residential development can occur in SEQ (Queensland Government 2008b).

Sources: ABS Census of Population and Housing data for CCDs for 2001 and 2006 and OESR *Residential land development activity profile* for various LGAs (September quarter 2012 issue).

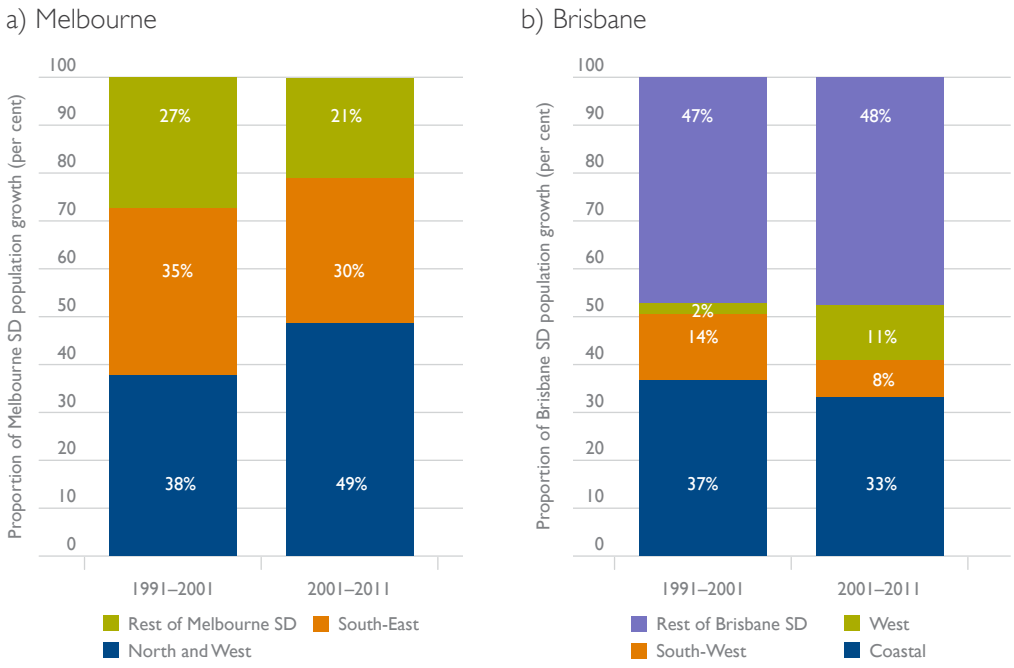
Shift the focus of population growth within the city

For both Melbourne and SEQ, the long term strategy is to fundamentally shift the focus of population growth within the region. Melbourne's development pattern has been heavily skewed towards the south and east (see Map 4.1), with nearly three quarters of its population living east of a line running north-south through the CBD as of 2006 (Victorian DPCD 2010). Both *Melbourne 2030* and *Melbourne @ 5 million* identify a long term need to shift the focus of growth from the south-east to the north and west of the city (Victorian Department of Infrastructure 2002 p.33, Victorian DPCD 2008 p.18). In SEQ, population growth has tended to be focused along the coast. According to the *SEQ Regional Plan 2009–2031*, an 'increased proportion of the region's future population will be accommodated in the Western Corridor and South Western Corridor, making use of significant areas of available land and reducing pressure on the coast' (Queensland Government and COMSEQ 2009, p.11).

Figure 4.14a reveals a pronounced shift in the focus of population growth towards the north and west of Melbourne since 2001. The south-eastern corridor continues to account for a

substantial, albeit declining, share of Melbourne's growth. Figure 4.14b shows that there has been a partial redirection of Brisbane's population growth away from the coast and towards the Western Corridor (but not, as yet, towards the South Western corridor, which remains a longer term objective). Therefore, since 2001, both Melbourne and Brisbane have seen good progress in redirecting population growth to the targeted locations.

Figure 4.14 Changes in the spatial distribution of population growth for Melbourne and Brisbane, 1991 to 2001 and 2001 to 2011



Notes: For Melbourne, North and West were defined as the aggregation of the Middle North, Outer North, Middle West and Outer West sectors. South-East was defined as the aggregation of the Middle South and Outer South sectors. Details of sector boundaries provided in BITRE (2011). Brisbane coastal areas defined as SLAs which either adjoin the coast or have a population-weighted centroid within 10km of coast. Western Corridor defined as equivalent to Ipswich LGA. A listing of South Western Corridor SLAs is provided in Chapter 3 of BITRE (2013a).

Source: BITRE analysis of ABS Cat. 3218.0 ERP data for SLAs (July 2012 release, and earlier releases).

Overview of progress against strategic planning goals

Outcome measures on their own do not provide a reliable indication of how effectively government planning systems are working, due to the many other influences that can impact on outcomes (Productivity Commission 2011). As a result, the analysis presented on the preceding pages does not represent an attempt to evaluate the effectiveness of the capital city strategic planning systems, Rather, the purpose is to provide evidence about the actual on-the-ground changes that have been occurring with respect to these strategic planning goals, identifying whether such movements are in the desired direction and progressing at the required pace of change. Table 4.8 summarises BITRE's assessment of recent changes with regard to the population-related goals of recent capital city strategic plans.

Table 4.8 Observed changes since 2001 with respect to strategic planning goals that relate to the spatial distribution of population

Strategic planning goal	Time period to which evidence relates	Extent of progress			
		Sydney	Melbourne	Brisbane	Perth
Limit urban sprawl	2001 to 2011	Over-achieved#	Some	Some	Limited
Increase residential densities around centres	2001 to 2006	Good~	Limited	Good	Some
Consolidate rural population growth in existing settlements	2001 to 2006	n/a	Good	Some^	n/a
Shift the focus of population growth within the city	2001 to 2011	n/a	Good	Good	n/a

Notes: ^ Evidence relates to 2001 to 2011 period.

~ Evidence relates to 2001 to 2008 period.

Urban sprawl was contained, but the level of new dwelling production in Sydney declined significantly, with implications for affordability and growth.

n/a—objective not applicable to this city.

Source: BITRE analysis—details of assessment and sources provided earlier in this chapter and in individual city reports (BITRE 2010, 2011, 2012a, 2013a).

Table 4.8 shows that there has been at least some movement in the desired direction for each of these planning goals since 2001. There has been significant progress in the desired direction for some of these planning objectives, particularly with respect to increasing residential densities in centres (for Sydney and Brisbane), shifting the focus of population growth within the city (in Melbourne and Brisbane), and consolidating rural population growth in existing settlements (in Melbourne). This is consistent with the beliefs of state and territory governments that the population-related strategic planning objectives—such as managing greenfield development, accommodating population growth, and transitioning to higher densities—are most able to be influenced by planning (Productivity Commission 2011).

CHAPTER 5

Employment and industry

Key points

- The 2006 census identified a total of 1.74 million jobs located within Sydney, 1.55 million in Melbourne, 0.79 million in Brisbane and 0.62 million in Perth. Retail trade was the top employing industry in Melbourne, Brisbane and Perth, while Property and business services was the top employer in Sydney.
- Between 25 and 34 per cent of jobs in each city are located within 5 kilometres of the Central Business District (CBD), while between 40 and 51 per cent are located within 10 kilometres of the CBD. There is a shortfall of outer suburban jobs in all four cities, but particularly in Perth's outer suburbs which provided only 52 jobs for every 100 employed residents in 2006.
- The CBD-based activity centres are the dominant job location in each city, ranging in size from 108 700 jobs in Perth to 300 100 jobs in Sydney. Sydney contains several other centres with over 25 000 jobs (e.g. St Leonards, Parramatta, Macquarie Park, Sydney Airport-Mascot), but there are no non-CBD centres of this size in the other three cities. The 2001 to 2006 period saw jobs increasingly concentrating within Sydney and Brisbane's activity centres, while the centred employment share fell for Melbourne and Perth.
- Brisbane gained 119 200 jobs from 2001 to 2006, compared to a gain of 108 100 for Melbourne, 65 700 for Perth and 47 300 for Sydney. Health and community services was the main source of job growth in all four cities.
- Most of Sydney's employment increase occurred in the outer suburbs (76 per cent), compared to around half of Melbourne and Perth's increase, and around one-third of Brisbane's increase. This strong outer suburban job growth reduced centralisation of employment for all four cities from 2001 to 2006.
- Over the full 2001 to 2011 period, Melbourne added 302 300 jobs, compared to 223 300 in Brisbane, 184 600 in Sydney and 174 400 in Perth. All four capital city CBDs had substantial job growth, with the Melbourne CBD adding about 80 000 jobs. Beyond the inner city, the key job growth areas were Ryde in Sydney, Swan and Belmont in Perth, and Craigieburn in Melbourne.
- The 2001 to 2011 period saw limited progress in growing employment in the targeted suburban areas of Sydney, Melbourne and Brisbane, but strong job growth resulted in slightly increased self-sufficiency for outer suburban Perth.

Background

This chapter focuses on the location of jobs and job growth within the four capital city Statistical Divisions (SDs). It is based on the analysis contained within BITRE's individual city reports (BITRE 2010, 2011, 2012a, 2013a), and relies on place of work data from the ABS *Census of Population and Housing* for 2001 and 2006. The analysis is based on 2006 Australian Standard Geographical Classification (ASGC) boundaries and the 1993 Australian and New Zealand Standard Industrial Classification (ANZSIC). Some information from the 2011 *Census of Population and Housing* is also presented in order to shed light on whether the patterns of change identified for the 2001 to 2006 period are ongoing.

The ABS *Census of Population and Housing* is the only data source that provides comparable nationwide information on job location at a small-area level. However, census-based estimates are subject to census undercount, and the census total for employed persons is about 10 per cent below the ABS *Labour Force Survey* estimate for the equivalent period (ABS 2007). In addition, some employed people do not respond to the census place of work question and about 5 per cent of responses could not be coded to a Statistical Local Area (SLA) (ibid). These limitations should be kept in mind when making use of the data presented here.

Place of work employment—2006 snapshot

Profile of employment[22]

Table 5.1 presents the total employed persons count for each of the four capital city SDs for 2006, together with some information on the characteristics of the employed. The 2006 census identified a total of 1.74 million jobs located within the Sydney SD, compared to 1.55 million for Melbourne, 0.79 million for Brisbane and 0.62 million for Perth.

Table 5.1 **Employed persons working in the four capital city statistical divisions—some summary indicators, 2006**

Indicator	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
Number of employed persons	1 736 825	1 549 747	793 852	621 690
Females as share of employment (per cent)	47.6	47.6	48.2	48.0
Part-time employed as share of employment (per cent)	28.3	30.6	29.8	32.1
People with bachelor degree or higher qualifications as share of employment (per cent)	29.9	29.0	24.1	23.7
People working from home (per cent)	4.1	3.9	4.2	3.8

Notes: Part-time employed share calculated after excluding those who were away from work and those who did not provide information on hours worked. Those who worked 35 or more hours in all jobs in the week prior to the census are considered full-time workers. Bachelor degree or higher qualification category includes bachelor degrees, graduate diplomas, graduate certificates and postgraduate qualifications

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2006, extracted from Working Population Profile and TableBuilder.

22 Box 5.1, which appears later in this chapter, presents an updated profile of employment, based on 2011 census data, but using Greater Capital City Statistical Areas (GCCSAs), rather than SDs.

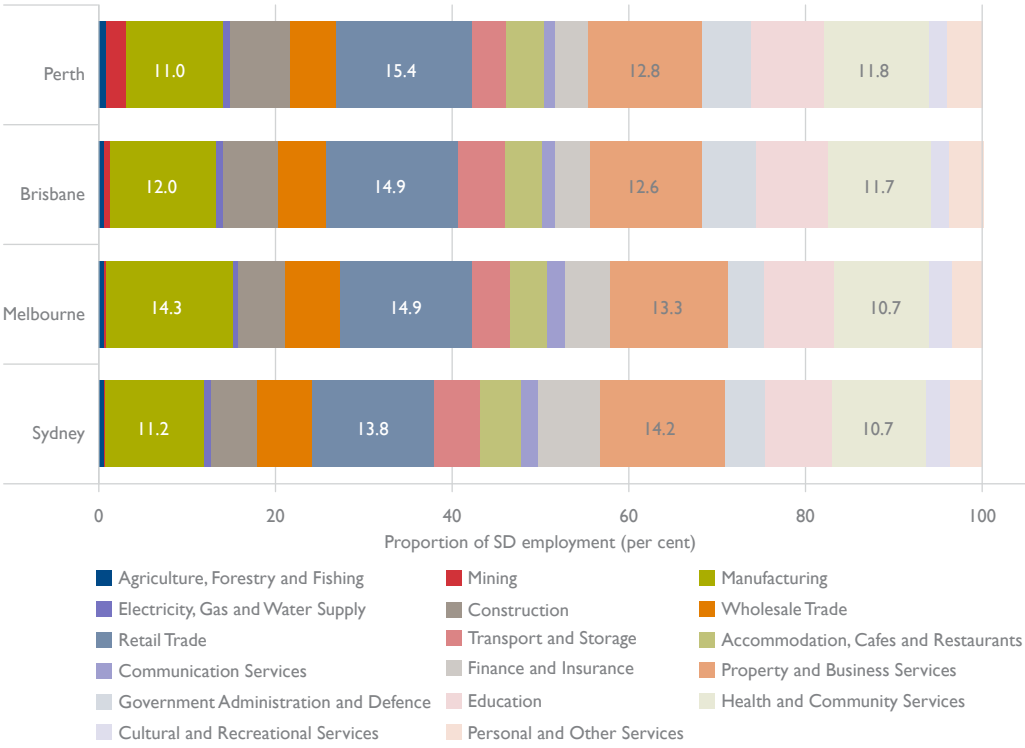
Females accounted for 48 per cent of employment in all four cities, while Sydney had a slightly lower proportion of people employed on a part-time basis than the other three cities. Bachelor degree and higher qualifications were more common amongst Sydney and Melbourne workers, than they were for Brisbane and Perth workers. About 4 per cent of employed people worked from home in each city.

The main industry contributors to employment are broadly similar across the cities (see Figure 5.1). Retail trade was the top employing industry in Melbourne, Brisbane and Perth, while Property and business services was the main employing industry in Sydney. For all four cities, the top four employing industries were Retail trade, Property and business services, Manufacturing and Health and community services.

There are some notable differences in the relative contributions of the different industries across cities:

- The Mining and Construction industries made a more significant contribution to employment in Perth, than to the other cities
- Manufacturing remains a more important source of employment in Melbourne than in the other cities
- The employment contribution of the Finance and insurance and Property and business services industries was highest for Sydney, but was also higher for Melbourne than it was for Brisbane or Perth
- Brisbane (and to a lesser extent, Perth) had a relatively high share of employment in the Government administration and defence industry.

Figure 5.1 Industry structure of employment for those who work in capital city statistical divisions, 2006

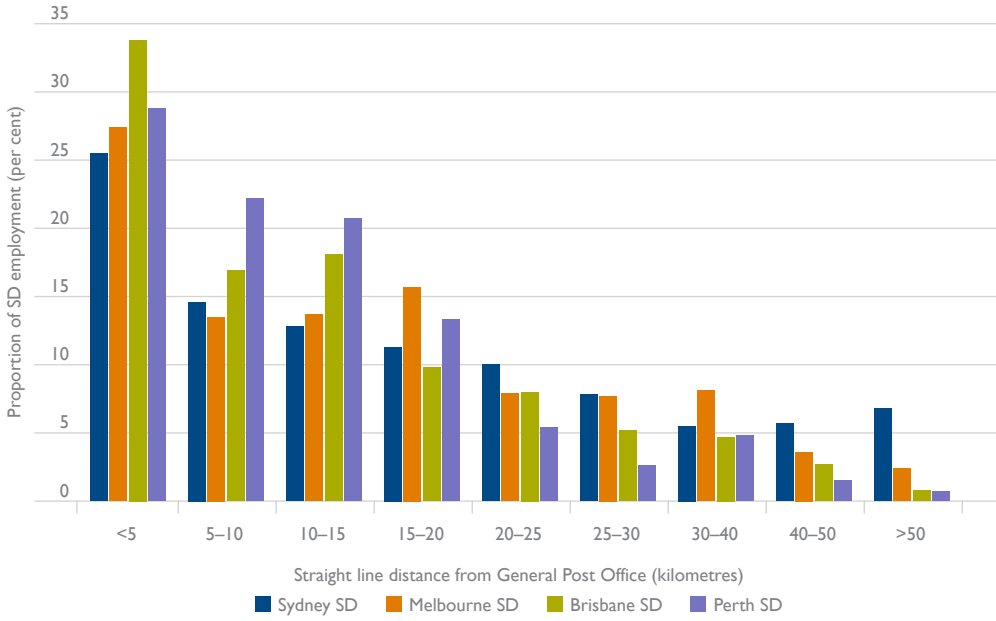


Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2006, extracted from TableBuilder.

Spatial distribution of employment in 2006

Figure 5.2 summarises the spatial distribution of jobs in the four cities. Between 25 and 34 per cent of jobs in each city are located within 5 kilometres of the Central Business District (CBD), while between 40 and 51 per cent are located within 10 kilometres of the CBD. Brisbane has the greatest proportion of its employment located near the CBD, and Sydney the lowest. Compared to the other cities, Sydney has a much greater share of its employment located over 40 kilometres from the CBD.

Figure 5.2 Proportion of jobs at various distances from Central Business District, 2006

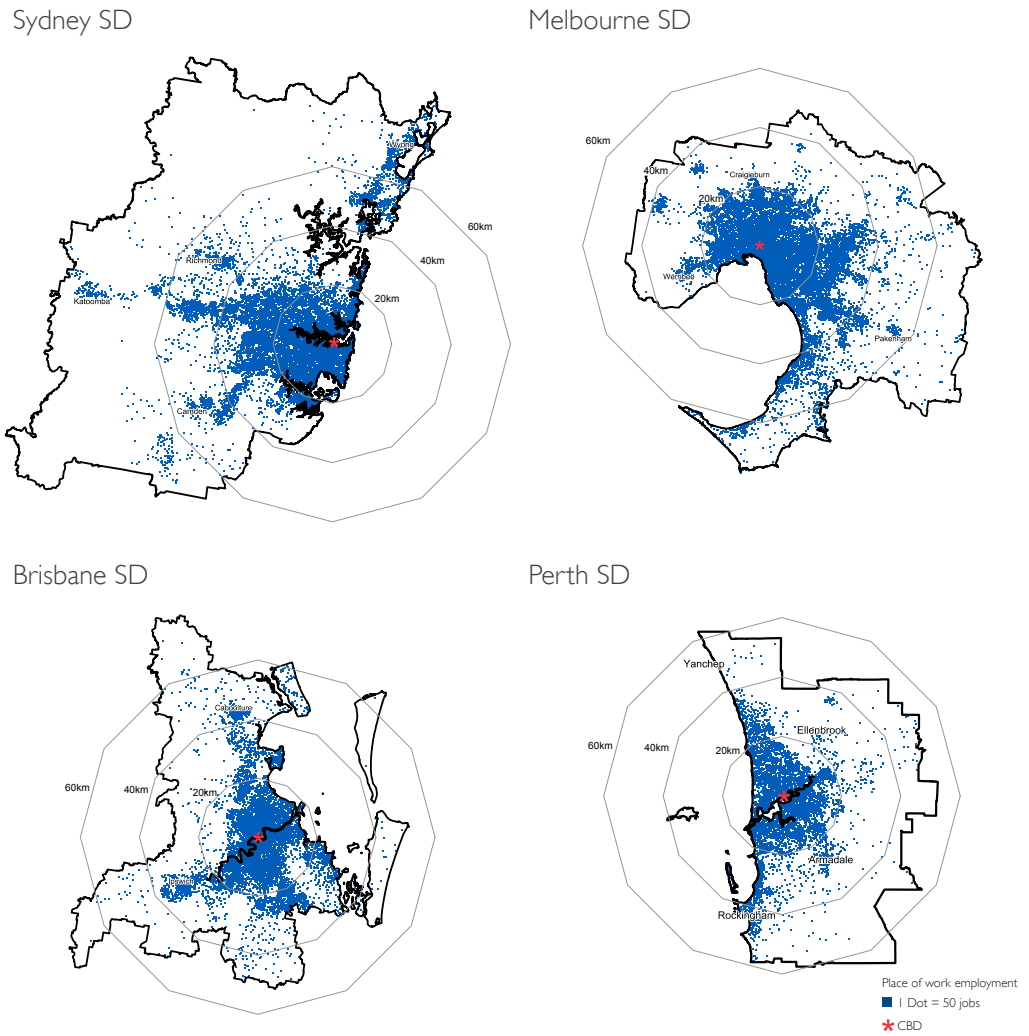


Note: The GPO is assumed as the central point of the CBD.

Source: BITRE analysis of 2006 ABS Census of Population and Housing place of work data for destination zones.

Map 5.1 uses census destination zone counts of place of work employment to provide a dot density representation of the current spatial distribution of employment within each of the four capital city SDs. All four cities are presented at a common scale, and Sydney's much greater proportion of jobs located over 40km from the CBD is apparent. The employment distribution looks broadly similar to the population distribution displayed in previous chapter (see Map 4.1), although there are differences in the spatial detail, with some areas being employment dominated, and other areas being predominantly residential. For example, a comparison of maps 5.1 and 4.1 identifies areas such as Outer Northern Brisbane that have relatively few jobs, despite having a substantial residential population.

Map 5.1 Dot density map of job distribution within four capital city Statistical Divisions, 2006



Note: Data for each city relates to all destination zones that lie within the ABS ASGC 2006 SD boundaries. All four city maps are presented at a common scale.

Source: BITRE analysis of 2006 ABS Census of Population and Housing place of work counts for destination zones.

Each of the three cities have a substantial agglomeration of jobs in the CBD, with the central LGA contributing 13–21 per cent of employment. This central agglomeration is largest in Sydney, both in relative terms and absolute terms, with 358 000 jobs located in the City of Sydney LGA in 2006, compared to 297 000 in Melbourne, 110 000 in Perth and 106 000 in the Brisbane CBD.[23] In each city there are other significant employment locations in the inner suburbs, such as North Sydney, Prahran-South Yarra, South Brisbane and Subiaco. The Inner sectors of all four cities contain many more jobs than employed residents (see Table 5.2), and tend to attract significant commuting inflows from the middle and outer suburbs.

23 CBD defined as the central LGA for Sydney, Melbourne and Perth, and as the combination of the City Inner and City Remainder SLAs for Brisbane.

Beyond this agglomeration of jobs in the inner city, employment tends to be fairly widely dispersed throughout the middle and outer suburbs, which together account for 62–73 per cent of jobs. There are a number of significant employment agglomerations in Sydney's middle and outer suburbs, including Parramatta-Westmead, and the Macquarie Park and Norwest business parks. The most substantial employment clusters in Melbourne, Brisbane and Perth's middle and outer suburbs are typically industrial areas or transport-specialised centres (e.g. Tullamarine Airport and Altona-Laverton in Melbourne, the Australia's TradeCoast area which includes Brisbane Airport and the Port of Brisbane, and Kewdale-Welshpool and Osborne Park in Perth).

Three different types of industries can be distinguished in terms of location preferences:

- High order services (e.g. finance, government, business services) favour central locations
- Other services (e.g. retail, education, personal services) are more dispersed and tend to follow the distribution of the population
- Some industries (e.g. manufacturing, transport, wholesale) locate in places that meet their specific infrastructure and land use requirements (WAPC 2003).

The Property and business services industry tends to be very concentrated around the CBD, and is the main Inner sector employer for all four cities, with an employment share that ranges from 19.7 per cent (in Perth) to 23.2 per cent (for Melbourne). Retail trade was the top employing industry in the Middle sector of all four cities, and in the Outer sectors of Sydney, Brisbane and Perth, while Manufacturing was the top employing industry in Outer Melbourne in 2006.

Table 5.2 presents employment self-sufficiency ratios for sectors. For each city, the Inner sector contains many more jobs than employed residents—Brisbane's Inner sector is the most employment-oriented, containing 4.6 jobs for each employed resident. The Middle sector tends to be somewhat residentially oriented (except in Sydney, where the number of employed residents and jobs is in approximate balance). There is a significant shortfall of outer suburban jobs compared to employed residents in all four cities, but particularly in Perth's outer suburbs which provided only 0.52 jobs per employed resident in 2006.

Table 5.2 Employment self-sufficiency ratios for Inner, Middle and Outer sectors of four capital city statistical divisions, 2006

Sector	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
Inner	1.68	3.02	4.63	2.14
Middle	0.93	0.75	0.81	0.86
Outer	0.63	0.68	0.57	0.52
SD total	0.91	0.92	0.92	0.88

Notes: The self-sufficiency ratio is the ratio of people who work in the region to the number of employed people who live in the region. The ratio for each SD is less than one due to non-response to the place of work question and no fixed place of work responses. Map 1.2 shows the Inner, Middle and Outer sectors of each city.

Source: BITRE analysis of ABS Census of Population and Housing place of work and place of usual residence data for 2006.

Sydney's West Central subregion, which contains Parramatta, is the only middle or outer suburban subregion which contains more jobs than employed residents (1.04 jobs per employed resident). In each city, there are particular subregions[24] which provide very limited opportunities for residents to work close to home:

- Sydney—self-sufficiency ratios are particularly low for the South subregion (0.55) and the North subregion (0.56)
- Melbourne—the Outer West subregion contains only 0.53 jobs per employed resident, which is considerably lower than the ratio for Melbourne's other subregions
- Brisbane—self-sufficiency ratios are particularly low for the Outer East and Outer North subregions (0.52 each)
- Perth—self-sufficiency ratios are particularly low for the North West subregion (0.42) and the South East subregion (0.43).[25]

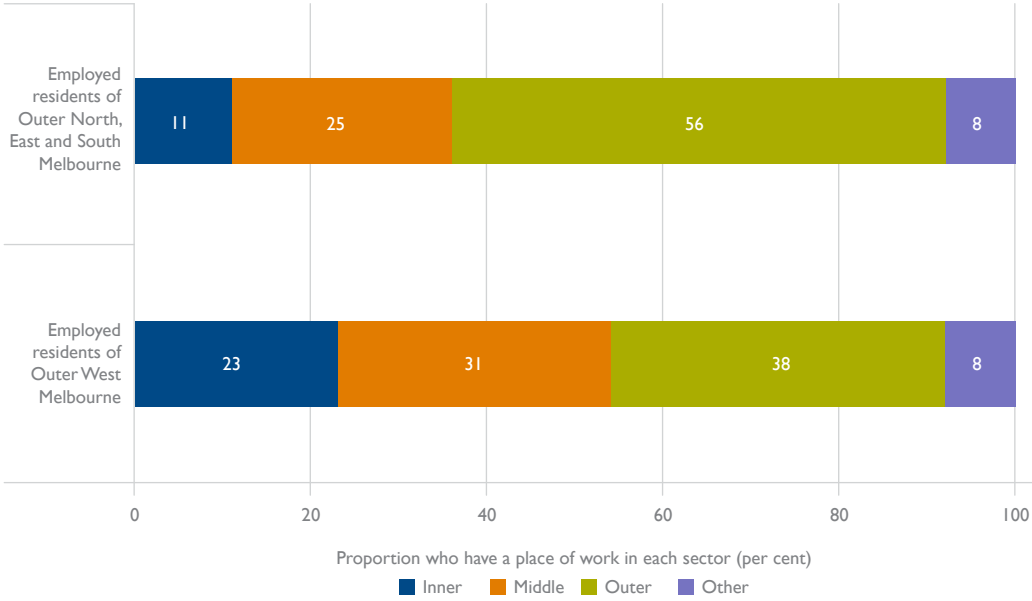
It is noteworthy that some of the subregions that are currently most deficient in employment opportunities are expected to accommodate a large share of the city's future residential growth (e.g. Outer Western Melbourne, Outer Northern Brisbane, North West Perth), according to the state government population projections that are outlined in Chapter 9. Without matching employment growth, the existing imbalances will widen, with implications for commuting patterns, travel times and infrastructure.

To illustrate the commuting implications of these spatial imbalances between employed residents and jobs, Figure 5.3 compares the commuting patterns of employed residents of Outer Western Melbourne to those of the rest of Outer Melbourne. A much greater proportion of Outer Western residents commute to Inner and Middle sector workplaces, reflecting the lack of local employment opportunities and the relative proximity of the CBD. Amongst people who commuted from Outer Western Melbourne to Inner Melbourne for work in 2006, 28 per cent chose to travel by public transport (BITRE 2011), and they mainly travelled by train. In recent years, the rapid population growth in Outer Western Melbourne—in combination with large-scale CBD job growth and high petrol prices—has generated increased demand on the rail network, with patronage on the Werribee and Sydenham lines increasing by over 70 per cent between 2004 and 2009 (Department of Transport 2010). The $4.8 billion Regional Rail Link project (co-funded by the Victorian and Australian Governments) is being undertaken to address rail capacity constraints in Melbourne's west.

24 Details of subregion boundaries are provided in Appendix A and in the individual city reports (BITRE 2010, 2011, 2012a, 2013a).

25 Several new growth areas—such as Melton East and Wyndham West in Melbourne and Wanneroo North West in Perth—contain less than 1 local job for every 3 employed residents.

Figure 5.3 Commuting patterns of employed residents of Outer Melbourne, 2006



Notes: Remainder category includes no fixed place of work responses, those who work in an undefined location and those who work in known locations outside the Melbourne SD. Inner, Middle and Outer sectoral boundaries are shown in Map 1.2. Outer Western Melbourne consists of the Wyndham and Melton LGAs.

Source: BITRE analysis of ABS Census of Population and Housing 2006 unpublished data.

Table 5.3 identifies the Statistical Local Areas (SLAs) with the most jobs in each of the capital city SDs. The top locations for jobs are the CBDs of each city, where employment is concentrated in Property and business services, and for Sydney, in Finance and insurance. Other inner city locations, such as North Sydney, Port Phillip West and South Brisbane, also feature prominently in terms of employment. Beyond the inner city, the most prominent SLAs are Parramatta Inner (with 65 901 jobs) and Ryde (58 314 jobs) in Sydney, Kingston North (61 302 jobs) in Melbourne, and Canning in Perth (47 344 jobs). Several of the suburban SLAs with high employment have Manufacturing as the top employing industry (e.g. Kingston North, Ipswich Central, Canning). Later in this chapter, Box 5.1 (and specifically Table 5.7) presents updated information on the top employment locations in each city, based on 2011 census data.

Table 5.3 Statistical Local Areas with highest employment in each city, 2006

Rank	Sydney	Jobs	Top employing industry	Melbourne	Jobs	Top employing industry
1	Sydney Inner	231 562	Finance and insurance	Melbourne Inner	153 394	Property and business services
2	Parramatta Inner	65 901	Health and community services	Melbourne Remainder	106 150	Health and community services
3	North Sydney	60 047	Property and business services	Kingston North	61 302	Manufacturing
4	Ryde	58 314	Property and business services	Port Phillip West	47 985	Property and business services
5	Willoughby	45 545	Property and business services	Waverley West	39 454	Manufacturing
Rank	**Brisbane**	**Jobs**	**Top employing industry**	**Perth**	**Jobs**	**Top employing industry**
1	City Inner	66 333	Property and business services	Perth Inner	61 787	Property and business services
2	City Remainder	40 161	Government administration and defence	Perth Remainder	47 905	Property and business services
3	Ipswich Central	29 263	Manufacturing	Canning	47 344	Manufacturing
4	Pinkenba-Eagle Farm	23 306	Transport and storage	Stirling Central	43 503	Retail trade
5	South Brisbane	16 152	Health and community services	Swan	37 817	Manufacturing

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2006.

Table 5.4 lists the SLAs with the highest employment densities. Job densities are at their highest in the CBDs of each city, and are particularly high for the Brisbane and Melbourne CBDs. Comparison to Table 4.1 shows that the CBDs have much higher employment densities than population densities. All of the high job density SLAs listed in Table 5.4 are located in the Inner sector of their respective city, with job densities tending to be much lower in the middle and outer suburbs.

Table 5.4 Statistical Local Areas with highest employment density by city, 2006

Rank	Sydney	jobs/ km²	Melbourne	jobs/ km²	Brisbane	jobs/ km²	Perth	jobs/ km²
1	Sydney Inner	55 003	Melbourne Inner	79 893	City Inner	94 263	Perth Inner	33 949
2	Sydney West	7 314	Southbank-Docklands	7 991	City Remainder	26 367	Fremantle Inner	6 404
3	Sydney East	7 159	Port Phillip West	4 050	Spring Hill	11 595	Perth Remainder	4 423
4	North Sydney	5 719	Richmond	4 032	Fortitude Valley	11 108	Subiaco	2 862
5	Sydney South	3 839	Melbourne Remainder	3 590	Milton	9 582	Vincent	1 413

Notes: Based on 2006 ASGC boundaries.
jobs/km2 = Place of work employment in 2006 per square kilometre of land area.
Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2006.

Each of the cities have activity centre policies in place, which seek to concentrate economic development and employment within a set of designated activity centres. In the individual city reports (BITRE 2010, 2011, 2012a, 2013a), BITRE has defined activity centre boundaries based on destination zone boundaries for the top few tiers of the activity centre hierarchy of each city. Table 5.5 identifies the activity centres in each city that contained the most jobs in 2006, based on BITRE's definitions of centres and census place of work data.

The CBD-based activity centres typically contain about ten times as many jobs as the next largest activity centre in each city. While there are several additional centres in Sydney with more than 25 000 jobs, there are no non-CBD activity centres of this size in the remaining three cities. Melbourne, Brisbane and Perth do not contain any suburban centres of the same scale as Parramatta (which contained over 34 000 jobs and 2.0 per cent of Sydney's employment in 2006[26]), and their business parks also tend to be of a smaller scale than Macquarie Park and Norwest in Sydney.

Beyond the CBD, other inner city activity centres also feature strongly in the table (e.g. North Sydney, Prahran-South Yarra, Parkville Medical and Bioscience Precinct, Herston-Kelvin Grove, Subiaco, Victoria Park). Several specialised activity centres also rank relatively highly in terms of employment, particularly:

- the airport based activity centres in Sydney, Melbourne and Brisbane[27]
- health and/or education specialised centres, such as St Leonards in Sydney, Parkville in Melbourne, Herston-Kelvin Grove in Brisbane, and UWA-QEII in Perth.

26 These figures exclude jobs in the adjacent Westmead specialised centre.

27 While Perth Airport does not feature as one of the highest employing centres in 2006, it has grown rapidly and contained about 11 000 jobs in 2011. BITRE (2013c) provides a more detailed analysis of employment at major Australian airport sites.

Table 5.5 Activity centres with highest employment by city, 2006

Rank	Sydney	Jobs	Melbourne	Jobs	Brisbane	Jobs	Perth	Jobs
1	Central Sydney	300 100	Melbourne CAD	216 300	Brisbane CBD primary centre^	196 900	Perth capital city	108 700
2	North Sydney	35 800	Prahran-South Yarra	16 100	Caboolture-Morayfield	10 900	Subiaco	11 900
3	St Leonards	34 400	Parkville Medical & Bioscience Precinct	14 900	Strathpine	10 700	UWA-QEII	11 800
4	Parramatta	34 200	Dandenong CAD	14 600	Brisbane Airport	10 400	Victoria Park	10 300
5	Macquarie Park	32 000	Box Hill CAD	13 600	Herston-Kelvin Grove	10 000	Joondalup	8 000
6	Sydney Airport-Mascot	28 200	Melbourne Airport	13 200	Upper Mount Gravatt	7 700	Midland	6 800

Notes: Activity centre boundaries were defined based on destination zone (DZ) boundaries. For some activity centres, the DZ containing the centre is significantly larger than the activity centre itself. The adopted centre definitions tend to be relatively encompassing. Note that results differ from those in the individual city reports as the airport-based activity centre definitions were revised to reflect the definitions adopted in BITRE (2013c), while the Perth activity centre definitions were revised to reflect the new *Directions 2031* activity centre hierarchy. A total of 18 centres are included in the analysis for Sydney, 27 for Melbourne, 23 for Brisbane and 28 for Perth, based on the top few tiers of the current activity centre hierarchy in each city. The included centre types are: Sydney—Global Sydney, Regional Cities, existing Major Centres (not planned or potential), Specialised Centres; Melbourne—Central Activity Districts and Principal Activity Centres, Specialised Activity Centres; Brisbane—Primary, Major Regional, Principal Regional and Specialist Activity Centres; Perth—Capital City, Strategic Metropolitan Centres and Secondary Centres (excluding emerging centres), and Specialised Centres.

CAD = Central Activities District.

^ Includes the frame area described in Queensland Government and COMSEQ 2009 p.97, and thus extends well beyond the City Inner and City Remainder SLAs.

Sources: BITRE analysis of ABS Census of Population and Housing place of work data for destination zones for 2006 and BITRE (2013c) data on airport employment.

Box 5.1 Latest census information on place of work for 2011

Place of work data from the 2011 ABS *Census of Population and Housing* shows the location of jobs in 2011 for the Sydney, Melbourne, Brisbane and Perth Greater Capital City Statistical Areas (GCCSAs). As the GCCSA boundaries differ from the SD boundaries used elsewhere in this chapter, this information is only useful as a snapshot of the current state of employment (as of 2011), and is *not* suitable for comparison to the 2006 data presented previously in this chapter.

Table 5.6 presents some summary indicators of employment for each city for 2011, Females accounted for just under half of employment in all four cities, while about 30 per cent of employment was part-time and 4 per cent involved working from home. Bachelor degree and higher qualifications were more common amongst Sydney and Melbourne workers, than they were for Brisbane and Perth workers.

Table 5.6 Employed persons working in the four Greater Capital City Statistical Areas—some summary indicators, 2011

Indicator	Sydney GCCSA	Melbourne GCCSA	Brisbane GCCSA	Perth GCCSA
Number of employed persons	1 874 117	1 756 405	925 388	751 805
Females as share of employment (per cent)	48.0	48.0	48.9	48.7
Part-time employed as share of employment (per cent)	29.4	31.9	30.6	32.8
People with bachelor degree or higher qualifications as share of employment (per cent)	35.0	33.7	28.3	27.8
People working from home (per cent)	4.2	3.9	4.3	3.8

Notes: Part-time employed share calculated after excluding those who were away from work and those who did not provide information on hours worked. Those who worked 35 or more hours in all jobs in the week prior to the census are considered full-time workers. Bachelor degree or higher qualification category includes bachelor degrees, graduate diplomas and certificates and postgraduate qualifications.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2011, extracted from Tablebuilder.

Figure 5.4 shows the industry mix of employment for each city in 2011, based on the 2006 ANZSIC. The Health care and social assistance industry is the main contributor to employment in all four cities, and is particularly important for Brisbane. The Retail trade, Professional, scientific and technical services, Manufacturing and Education and training industries round out the top five industries for each city. Manufacturing makes a comparatively large contribution to employment in Melbourne, while the Financial and insurance services industry is relatively significant for Sydney, Public administration and safety is relatively significant in Brisbane, and the Mining and Construction industries are more significant to Perth than the other cities.

Table 5.7 identifies the top locations for employment in each GCCSA, based on Statistical Area Level 2 (SA2) boundaries. The CBD-based SA2 dominates employment for each city. The Sydney-Haymarket-The Rocks SA2 contains about 251 000 jobs, compared to 186 000 for the Melbourne SA2, 134 000 for the Perth City SA2 and 116 000 for the Brisbane City SA2. Other inner city SA2s also feature strongly with respect to employment (e.g. North Sydney-Lavender Bay, Southbank, Docklands, South Brisbane, Subiaco-Shenton Park).

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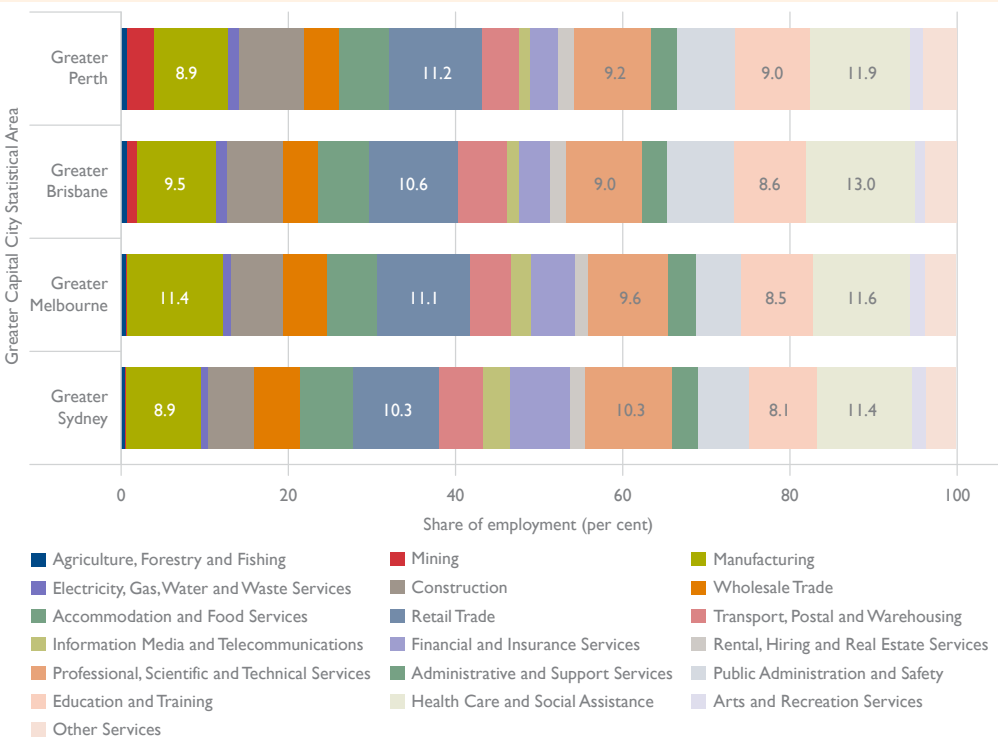
Box 5.1 continued

Figure 5.4 Industry structure of employment for those who work in Greater Capital City Statistical Areas, 2011



Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2011, extracted from Tablebuilder.

Table 5.7 Areas with most employment in each capital city, 2011

Rank	Greater Sydney	Jobs	Greater Melbourne	Jobs	Greater Brisbane	Jobs	Greater Perth	Jobs
1	Sydney-Haymarket-The Rocks	251 452	Melbourne	186 129	Brisbane City	116 133	Perth City	134 275
2	North Sydney-Lavender Bay	43 021	Dandenong	54 232	Rocklea-Acacia Ridge	24 004	Subiaco – Shenton Park	22 062
3	Parramatta-Rosehill	42 625	Southbank	33 992	South Brisbane	22 759	Osborne Park Industrial	20 977
4	Macquarie Park-Marsfield	38 627	Docklands	32 037	Fortitude Valley	20 109	Welshpool	17 946
5	Pyrmont-Ultimo	29 691	Richmond	29 975	Paddington-Milton	16 759	Nedlands-Dalkeith-Crawley	17 713

Notes: Based on 2011 SA2 boundaries. Excludes undefined place of work in capital city.
Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2011, extracted from Tablebuilder.

In the middle and outer suburbs of our cities, the main employment locations tend to be industrial areas in which the Manufacturing industry is the main employer—such as Dandenong, Rocklea-Acacia Ridge and Welshpool (see Table 5.7). However, in Sydney, the key suburban job locations do not fit this profile. Public administration and safety and Financial and insurance services are the dominant employing industries for Parramatta-Rosehill, while Wholesale trade and Information, media and telecommunications are the principal industries at Macquarie Park-Marsfield.

Changes in employment from 2001 to 2006

This section identifies key changes in capital city employment and its spatial distribution, using ABS *Census of Population and Housing* data for 2001 and 2006 and ASGC 2006 spatial boundaries.

Box 5.2 provides a high-level overview of what the latest 2011 census data reveals about more recent changes in the number and type of jobs located within Sydney, Melbourne, Brisbane and Perth.

City-wide jobs growth from 2001 to 2006

Table 5.8 compares jobs growth across the four capital city SDs. Brisbane added the most jobs to its employment base between 2001 and 2006 (an extra 119 200 jobs), followed by Melbourne with an additional 108 100 jobs. The average annual rate of employment growth was also highest for Brisbane (3.3 per cent), followed by Perth (2.3 per cent). Sydney experienced lower growth in employment than the other cities between 2001 and 2006, in both relative and absolute terms.

Table 5.8 Change in number of employed persons who work in Sydney, Melbourne, Brisbane and Perth, 2001 to 2006

	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
Change in employed persons	47 300	108 100	119 200	65 700
Average annual rate of job growth (per cent)	0.6	1.5	3.3	2.3

Note: SD totals for place of work employment include unknown place of work within capital city SD.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2006.

Between 2001 and 2006, the proportion of jobs that involved working from home declined in all four cities. For example, it declined from 4.1 to 3.8 per cent of jobs in Sydney (BITRE 2012a) and from 4.4 to 4.1 per cent in Brisbane (BITRE 2013a).

Since industries have different preferences as to where they locate, the industry mix of job growth in each city has implications for the spatial distribution of employment, and in turn, for commuting patterns. Table 5.9 identifies the principal industry contributors to employment growth and decline between 2001 and 2006. The Health and community services industry added the most jobs in all four cities, and Government administration and defence was the second most important contributor to job growth in three of the four cities. The more prominent contribution of the Construction industry in Brisbane and Perth reflects the more rapid rate of residential growth in these cities (see Figure 4.4). Manufacturing was the main industry source of job losses for Sydney and Melbourne between 2001 and 2006, while Agriculture, forestry and fishing was the main job loss industry for the Brisbane and Perth SDs.

Table 5.9 Principal industry contributors to employment change for Sydney, Melbourne, Brisbane and Perth, 2001 to 2006

	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
Industry with most jobs added	Health and community services	Health and community services	Health and community services	Health and community services
Industry with 2nd most jobs added	Government administration and defence	Government administration and defence	Property and business services	Government administration and defence
Industry with 3rd most jobs added	Education	Education	Construction	Construction
Industry with most job losses	Manufacturing	Manufacturing	Agriculture, forestry and fishing	Agriculture, forestry and fishing

Note: Based on 1993 ANZSIC.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2006, and NSW BTS online tabulations for 2001 (table 19) and 2006 (table 8).

Spatial patterns of job growth from 2001 to 2006

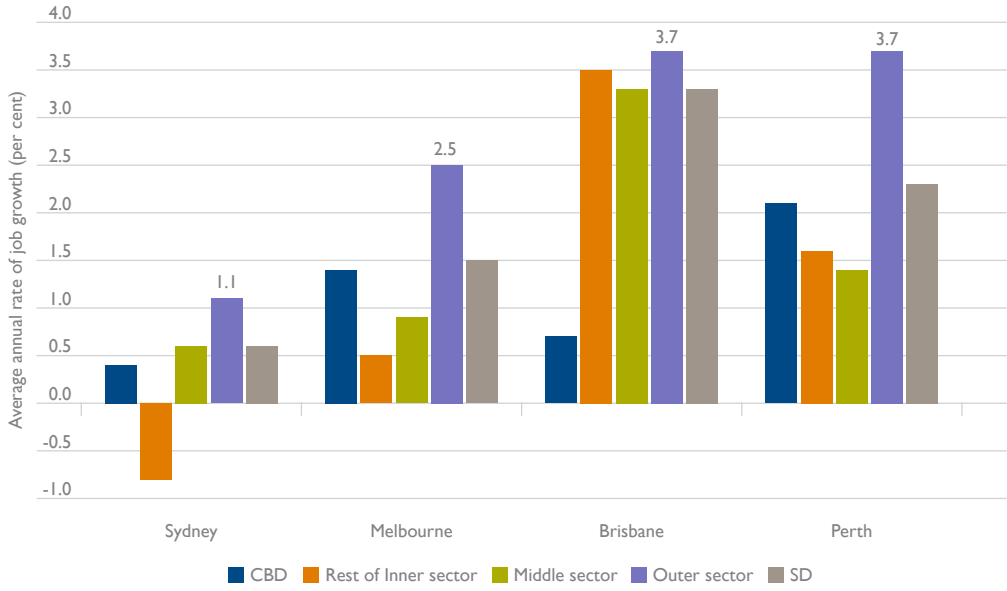
Figure 5.5 and Table 5.10 summarise the spatial distribution of job growth for the four cities. Between 2001 and 2006, the number of jobs located in the outer suburbs grew more rapidly than inner and middle suburban jobs. Outer suburban job growth was particularly rapid in Brisbane and Perth (averaging 3.7 per cent per annum). The gain in Outer sector jobs was 57 000 for Melbourne, 35 500 for Sydney and Brisbane, and 32 600 for Perth. The great majority of Sydney's employment increase occurred in the Outer sector (76 per cent), compared to around half of Melbourne and Perth's employment increase and around one-third of Brisbane's employment increase. The Health and community services industry was the principal industry contributor to employment growth in Outer Sydney and Outer Melbourne during this period, while Retail trade was the principal contributor in Outer Brisbane and Manufacturing was the principal contributor in Outer Perth.

The Middle sector made a significant contribution to employment growth in all four cities between 2001 and 2006. It contributed 18–29 per cent of employment growth in Sydney, Melbourne and Perth, but was particularly important for Brisbane, where 54 000 Middle sector jobs were added, representing 46 per cent of the city's employment growth. The Health and community services industry was the principal industry contributor to Middle sector employment growth in all four cities during this period.

The CBD was responsible for a further 15–19 per cent of job growth in Sydney, Melbourne and Perth, but only 2 per cent of job growth in Brisbane. Rates of CBD job growth were consistently below the overall capital city job growth rate. More than 20 000 jobs were added to Melbourne's CBD between 2001 and 2006, compared to 11 000 for Perth's CBD, 7400 for Sydney's CBD and 2300 for Brisbane's CBD. The remainder of Brisbane's Inner sector (including CBD-frame suburbs such as South Brisbane and Fortitude Valley) experienced substantial job growth from 2001 to 2006. By contrast, there was a net loss of jobs in Sydney's Inner sector between 2001 and 2006. This reflects job losses around the Green Square redevelopment (as land was converted from employment to residential purposes) and in North Sydney (as its office market was impacted by new office construction in the Sydney CBD and increased competition from lower cost, large scale office development at Macquarie Park).[28]

28 NSW Department of Planning (2007, p.42).

Figure 5.5 Employment growth in different parts of Sydney, Melbourne, Brisbane and Perth, 2001 to 2006



Note: CBD defined as the central LGA for Sydney, Melbourne and Perth, and as the combination of the City Inner and City Remainder SLAs for Brisbane. Map 1.2 shows the Inner, Middle and Outer sectors of each city. Statistical Division total includes unknown place of work within capital city SD.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2006 and BTS online journey to work tabulations for 2001 (table 19) and 2006 (table 1).

Table 5.10 Employment growth occurring in each sector of capital city statistical divisions, 2001 to 2006

Sector	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
CBD	7 400	20 100	2 300	11 000
Rest of Inner sector (excluding CBD)	–9 800	3 800	25 800	9 400
Middle sector	13 300	26 300	54 000	12 300
Outer sector	35 500	57 000	35 500	32 600
Total	47 300	108 100	119 200	65 700

Notes: CBD defined as the central LGA for Sydney, Melbourne and Perth, and as the combination of the City Inner and City Remainder SLAs for Brisbane. Map 1.2 shows the Inner, Middle and Outer sectors of each city. Sectoral components do not sum to SD total, as SD total also includes unknown place of work within capital city SD.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2006 and BTS online journey to work tabulations for 2001 (table 19) and 2006 (table 1).

The Government administration and defence industry was the principal industry contributor to Inner sector job growth in all four cities during the 2001 to 2006 period. Government administration and defence was also the main source of CBD job growth for Melbourne, Brisbane and Perth between 2001 and 2006. However, the principal contributor to job growth in Sydney's CBD was the Finance and insurance industry.

Box 5.2 Latest census data on job growth from 2001 to 2011

The job growth data presented in this box is based on a customised ABS tabulation which converted the 2011 census place of work data on to 2006 ASGC boundaries. This converted 2011 data was then compared to the 2001 census place of work data that is analysed elsewhere in this chapter (and relates to 2006 ASGC boundaries).

Table 5.11 shows the extent of job growth in the Sydney, Melbourne, Brisbane and Perth SDs between 2001 and 2011. Melbourne added 302 300 jobs between 2001 and 2011, compared to 223 300 in Brisbane, 184 600 in Sydney and 174 400 in Perth. Brisbane and Perth had a relatively rapid average annual rate of job growth (2.9 and 2.8 per cent, respectively), which exceeded each city's average annual rate of population growth over the same period (2.3 per cent, see Table 4.2). The number of jobs in Sydney rose by only 1.0 per cent per annum, which was similar to the city's average annual rate of population growth over the period (1.1 per cent).

Table 5.11 Change in number of employed persons who work in Sydney, Melbourne, Brisbane and Perth, 2001 to 2011

	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
Change in employed persons	184 600	302 300	223 300	174 400
Average annual rate of job growth (per cent)	1.0	1.9	2.9	2.8

Note: SD totals for place of work employment include unknown place of work within capital city SD. Based on 2006 ASGC SD boundaries.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2011.

Table 5.12 identifies the industries that added the most jobs between 2001 and 2011, for each of the four capital city SDs. Health and community services was the main contributor to job growth in Sydney, Melbourne and Brisbane. The Property and business services industry added the most jobs in Perth, and was also a significant contributor to Brisbane's job growth. The Construction and Education industries also made important contributions across several cities. Between 2001 and 2011, the Manufacturing industry was the major job loss industry in Melbourne and Sydney, while Agriculture, forestry and fishing recorded the largest net job loss in Brisbane and Perth.

Table 5.12 Principal industry contributors to employment change for Sydney, Melbourne, Brisbane and Perth, 2001 to 2011

	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
Industry with most jobs added	Health and community services	Health and community services	Health and community services	Property and business services
Industry with 2nd most jobs added	Education	Construction	Property and business services	Health and community services
Industry with 3rd most jobs added	Government administration and defence	Education	Construction	Construction
Industry with most job losses	Manufacturing	Manufacturing	Agriculture, forestry and fishing	Agriculture, forestry and fishing

Note: Based on 1993 ANZSIC and 2006 ASGC SD boundaries. Includes unknown place of work within capital city SD.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2011, and NSW BTS online tabulations for 2001 (table 19).

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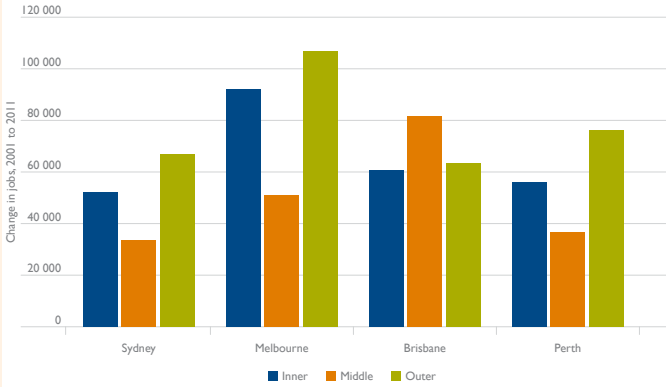
Box 5.2 continued

Figure 5.6 shows how job growth was distributed across city sectors and identifies the main contributing industries for each sector. In all four cities, all sectors recorded substantial job gains, but Outer Melbourne was the standout, adding 107 000 jobs from 2001 to 2011. The Outer sector added the most jobs in Sydney, Melbourne and Perth, while the Middle sector added the most jobs in Brisbane. Job growth was most rapid in the Outer sector of each city, particularly in Outer Perth (averaging 3.9 per cent per annum). The 92 000 additional jobs added to Melbourne's Inner sector was enough to slightly boost Inner Melbourne's share of jobs (from 29.1 to 29.4 per cent), but strong outer suburban job growth led to a small decline in the centralisation of employment within the Inner sectors of Sydney and Brisbane from 2001 to 2011, and a larger decline for Perth.

Figure 5.6 Employment change by city and sector, 2001 to 2011



Sector	Main industry contributor to job growth
Inner	Property and business services in Melbourne, Brisbane and Perth.
	Finance and insurance in Sydney
Middle	Health and community services in Sydney, Melbourne and Brisbane.
	Construction in Perth.
Outer	Health and community services in Sydney, Melbourne and Brisbane.
	Retail trade in Perth.

Notes: Chart excludes undefined place of work category for each capital city SD, so sectoral components do not sum to SD total. The number of respondents in this undefined category was much larger in 2011 than it was in 2001. Map 1.2 shows the inner, Middle and Outer sectors of each city.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2011, and BTS online journey to work tabulations for 2001 (table 19).

Table 5.13 identifies the SLAs that added the most jobs between 2001 and 2011, across the Sydney, Melbourne, Brisbane and Perth SDs. The top four job growth locations were all CBD locations, with Melbourne's CBD adding about 80 000 jobs over the period. Key suburban job growth locations include Ryde (home to the Macquarie Park specialised centre) in Sydney, Swan and Belmont in Perth, Craigieburn and Wyndham North in Melbourne, and Pinkenba-Eagle Farm in Brisbane. Job growth at airports was an important factor for the Belmont, Craigieburn and Pinkenba-Eagle Farm SLAs (BITRE 2013c). Between 2001 and 2011, the principal job loss locations were the Lane Cove and Willoughby SLAs in Sydney's Inner North.

Table 5.13 Statistical Local Areas that added the most jobs, 2001 to 2011

Rank	Inner sector SLAs	City	Job growth	Middle and Outer sector SLAs	City	Job growth
1	Southbank-Docklands	Melbourne	38 500	Ryde	Sydney	16 800
2	Sydney Inner	Sydney	30 300	Swan	Perth	15 600
3	Perth Inner	Perth	27 100	Hume–Craigieburn	Melbourne	11 300
4	Melbourne Inner	Melbourne	26 800	Belmont	Perth	10 900
5	Melbourne Remainder	Melbourne	14 700	Wyndham North	Melbourne	10 500
6	Sydney West	Sydney	12 300	Cockburn	Perth	10 200
7	City Inner	Brisbane	11 000	Pinkenba-Eagle Farm	Brisbane	10 100
8	South Brisbane	Brisbane	10 500	Rockingham	Perth	9 700

Note: Covers SLAs in Sydney, Melbourne, Brisbane and Perth SDs only. 2001 and 2011 data converted to 2006 ASGC boundaries.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2011, and BTS online journey to work tabulations for 2001 (table 19).

While the CBDs have traditionally dominated capital city employment, jobs dispersed to suburban locations in the 1970s and 1980s, and the employment share of the CBD declined (Pfister et al. 2000, NSW Government 2005, O'Connor 2006, Stimson and Taylor 1999). For example, Inner Melbourne's employment share declined from 54 per cent in 1971 to 29 per cent in 1991 and 28 per cent in 2001 (O'Connor 2006), reflecting a process where 'the central region has maintained its dominance of new economy employment but has relinquished some of the retail, medical and other services it once provided to suburbanites' (O'Connor and Rapson 2003, p.51). Table 5.14 presents some measures of changes in employment centralisation for the 2001 to 2006 period. The table shows a shift towards reduced centralisation of employment for all four cities, which is a result of strong outer suburban employment growth between 2001 and 2006 (see Figure 5.5, Table 5.10). This decentralisation of employment is most pronounced when using the broadest measure (i.e. the share of employment located within 10km of the CBD). The CBD's employment share declined by very modest amounts in Sydney, Melbourne and Perth from 2001 to 2006, but fell significantly in Brisbane.

Table 5.14 Changes in centralisation of capital city employment, 2001 to 2006

	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
		(per cent)		
CBD employment				
Employment share, 2001	20.8	19.3	14.5	17.8
Employment share, 2006	20.7	19.2	13.5	17.7
Change in employment share, 2001 to 2006	–0.1	0.0	–1.0	–0.1
Inner sector employment				
Employment share, 2001	35.9	29.2	28.4	38.8
Employment share, 2006	34.8	28.7	27.4	38.0
Change in employment share, 2001 to 2006	–1.1	–0.5	–0.9	–0.8
Employment located within 5km of CBD				
Employment share, 2001	26.1	27.1	34.7	29.0
Employment share, 2006	25.5	26.7	33.8	28.8
Change in employment share, 2001 to 2006	–0.6	–0.4	–0.9	–0.2
Employment located within 10km of CBD				
Employment share, 2001	41.5	40.7	52.4	53.7
Employment share, 2006	40.1	39.9	50.7	51.0
Change in employment share, 2001 to 2006	–1.3	–0.8	–1.7	–2.7

Notes: CBD defined as the central LGA for Sydney, Melbourne and Perth, and as the combination of the City Inner and City Remainder SLAs for Brisbane. Map 1.2 shows the Inner sector of each city.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2006 and BTS online journey to work tabulations for 2001 (table 19) and 2006 (table 1).

Table 5.15 lists the SLAs that added more than 5000 jobs between 2001 and 2006, while maps 5.2 to 5.5 illustrate the spatial distribution of job growth in each of the four cities, based on SLA data.

Of the 13 SLAs that added more than 5000 new jobs between 2001 and 2006, there were four in each of Sydney and Melbourne, three in Perth, and two in Brisbane. Six of the SLAs were in the Inner sector, two in the Middle sector, and four in the Outer sector.

The top employment growth area was the Perth Inner SLA which added 13 900 jobs, with the Property and business services, Mining and Government administration industries making important contributions to its growth. Several other Inner sector SLAs also experienced very substantial growth in employment between 2001 and 2006. Job growth in the Sydney Inner and Southbank-Docklands SLAs was driven primarily by growth in the Finance and insurance industry, while job growth in the Melbourne Inner and Brisbane City Remainder SLAs was driven by the Government administration and defence industry. Education was the key source of job growth for the Sydney West SLA, which is home to the University of Sydney and the University of Technology, Sydney.

Table 5.15 Statistical Local Areas which added more than 5000 new jobs between 2001 and 2006

SLA name	City	Sector	Main industry contributor to employment growth	Increase in number of employed persons
Perth Inner	Perth	Inner	Property and business services	13 900
Southbank-Docklands	Melbourne	Inner	Finance and insurance	10 500
Sydney Inner	Sydney	Inner	Finance and insurance	8 600
Wyndham North	Melbourne	Outer	Manufacturing	8 000
Melbourne Inner	Melbourne	Inner	Government administration and defence	7 300
City Remainder	Brisbane	Inner	Government administration and defence	6 800
Swan	Perth	Outer	Manufacturing	6 600
Ryde	Sydney	Middle	Wholesale trade	6 100
Pinkenba-Eagle Farm	Brisbane	Middle	Transport and storage	5 700
Greater Dandenong Balance	Melbourne	Outer	Manufacturing	5 500
Sydney West	Sydney	Inner	Education	5 100
Rockingham	Perth	Outer	Government administration and defence	5 100
Baulkham Hills Central	Sydney	Outer	Retail trade	5 100

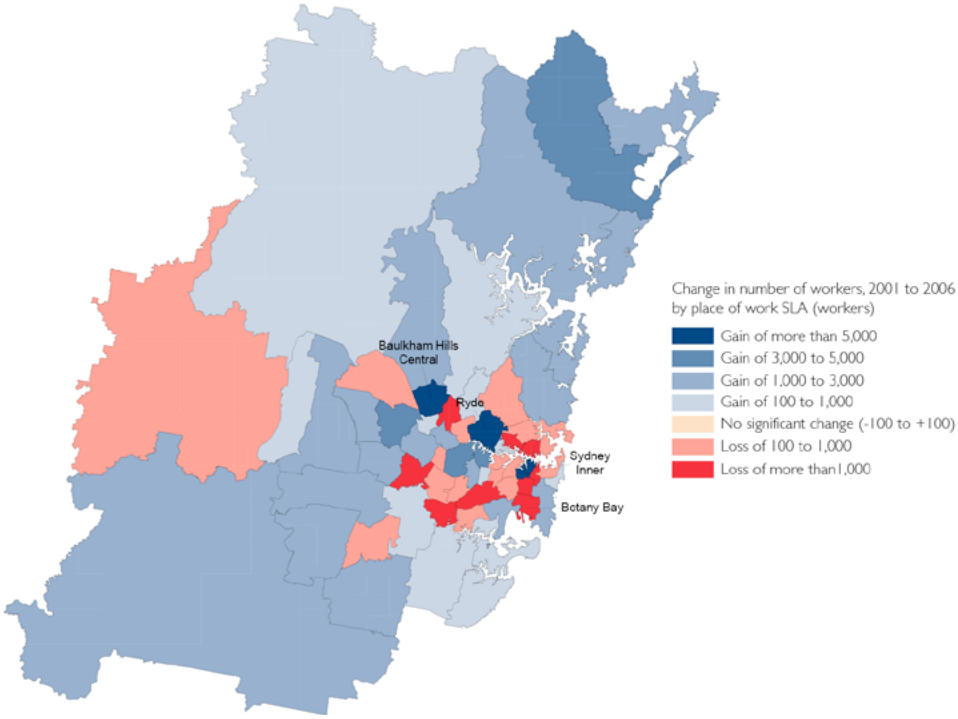
Notes: Map 1.2 shows the Inner, Middle and Outer sectors of each city.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2006 and BTS online journey to work tabulations for 2001 (table 19) and 2006 (table 1).

In the Middle sector, the two key growth locations were the Ryde SLA in Sydney (which is home to the Macquarie Park specialised centre) and the Pinkenba-Eagle Farm SLA in Brisbane (which is home to the Brisbane Airport specialised centre). Both added about 6000 jobs, with the key growth industries reflecting the specialisations of each centre.

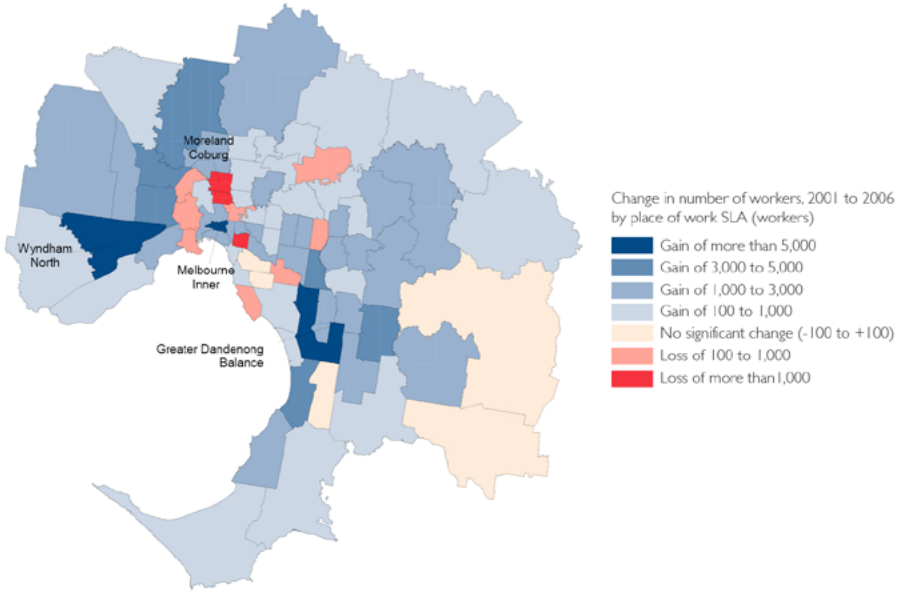
Several outer suburban areas also gained more than 5000 jobs. This outer suburban jobs growth reflects a combination of growth in jobs which service the local population (e.g. retail, health) and an outward shift of manufacturing, transport and warehousing operations. The Rockingham SLA is a special case, with job growth principally being driven by the Government administration and defence industry, which reflects an expansion of employment at Fleet Base West (previously HMAS Stirling).

Map 5.2 Change in employed persons by Statistical Local Area of work, Sydney, 2001 to 2006



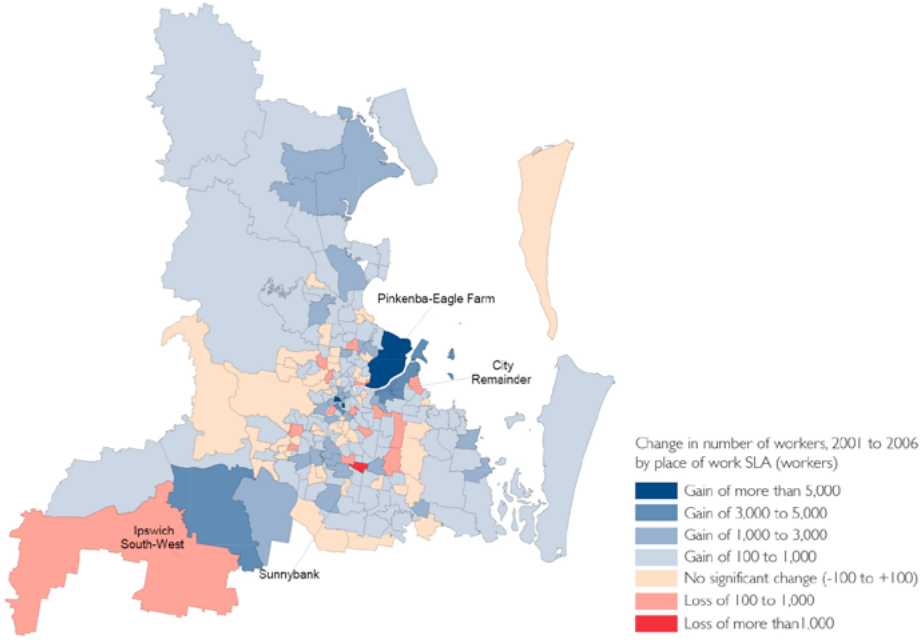
Source: BITRE analysis of BTS online journey to work tabulations for 2001 (table 19) and 2006 (table 1).

Map 5.3 Change in employed persons by Statistical Local Area of work, Melbourne, 2001 to 2006



Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2006.

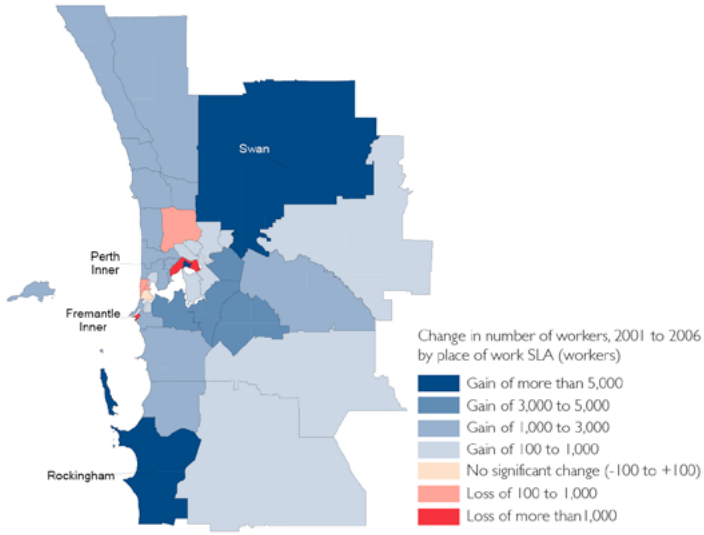
Map 5.4 Change in employed persons by Statistical Local Area of work, Brisbane, 2001 to 2006



Note: Between 2001 and 2006, there were some substantial changes to SLA boundaries in Brisbane. Affected SLAs were merged into larger aggregate regions with consistent boundaries for 2001 and 2006, and data for these aggregate SLA regions is mapped. The Beaudesert aggregate region (or LGA) lies partly within (but mainly outside) the Brisbane SD and has been excluded from the map. Details of the aggregate SLA regions are provided in BITRE (2013a).

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2006.

Map 5.5 Change in employed persons by Statistical Local Area of work, Perth, 2001 to 2006



Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2001 and 2006.

Suburban industrial areas grew particularly strongly in Melbourne, Brisbane and Perth between 2001 and 2006. In Melbourne, the West and South Industrial Nodes both added over 8000 jobs (BITRE 2011). The Australia's Trade Coast area of Brisbane—which includes the Port of Brisbane, Brisbane Airport and surrounding industrial areas—added about 13 000 jobs (BITRE 2013a). In Perth, the Kewdale-Welshpool and Malaga industrial areas both added over 3500 jobs (BITRE 2010).

As can be seen from Map 5.2 in particular, not all areas recorded an increase in employment between 2001 and 2006. There was a decline of more than 1000 jobs in several areas of Sydney (e.g. Lane Cove, Fairfield East, Sydney South, North Sydney and Canterbury). Some employment declines also occurred in parts of Melbourne (Coburg, Brunswick, Prahran), Brisbane (Sunnybank) and Perth (Perth Remainder, Fremantle Inner). Many of these employment declines reflect processes of urban infill and gentrification, as employment uses make way for increased residential densities.

Strategic planning objectives

Recent metropolitan strategic plans for Sydney, Melbourne, Brisbane and Perth contain some common goals relating to the spatial distribution of employment—the plans aim to locate employment within activity centres, and to achieve employment growth in particular suburban locations. The remainder of this chapter considers recent changes with respect to these two employment-related planning goals.

There are also a range of employment-related goals which are specific to particular cities. For example, the *Metropolitan Plan for Sydney 2036* plans to locate 20 per cent of jobs in employment lands (NSW Government 2010, p.140), while the *SEQ Regional Plan 2009–2031* aims to relocate manufacturing and logistics employment from Inner Brisbane and to locate government and office-based business employment outside the Brisbane CBD (Queensland Government and COMSEQ 2009, pp. 112, 122). These city-specific goals are not considered further here, but an assessment of recent trends is available from the individual city reports (e.g. BITRE 2012a, 2013a).

Locate employment in centres

The strategic plans of all four cities aim to focus employment and economic development within activity centres (see Table 2.3). Concentrating activity within centres is seen to have a range of benefits, including reducing travel times and car dependence and making better use of existing public transport infrastructure and government services. Out-of-centre development is discouraged, as it 'can diminish the vitality of activity centres and detract from economic growth by diluting public and private investment in centre-related activities, facilities and infrastructure' (Queensland Government and COMSEQ 2009, p.71).

The *Metropolitan Plan for Sydney 2036* targets an increase in the share of jobs in strategic centres from 39 per cent in 2006 to 42 per cent by 2036 (NSW Government 2010, p.135), and there is a strong emphasis on the economic role of the regional cities, particularly Parramatta. Quantitative targets are not provided for the other cities.

Activity centre policies have been in place for many years and the challenges of attempting to concentrate job growth in centres have been widely noted in the literature. Past reviews for Perth have identified a lack of success in encouraging employment to concentrate in centres (State Planning Commission 1987, Hill 2005), with WAPC (2003, p.37) concluding that 'strategic and regional centres were supposed to be employment centres but in practice they turned out to be no more than shopping centres'. For Sydney, NSW Government (2005) identifies Liverpool, Campbelltown, Blacktown, Gosford and Wyong as outer suburban centres that have underperformed in terms of job growth. Birrell et al (2005, p.02–1) point out that 'the activity centre strategy does not come to grips with the economic realities of job location in contemporary Melbourne', which 'shows a strong trend towards dispersal rather than concentration.' The commercial imperatives faced by developers represent a further challenge:

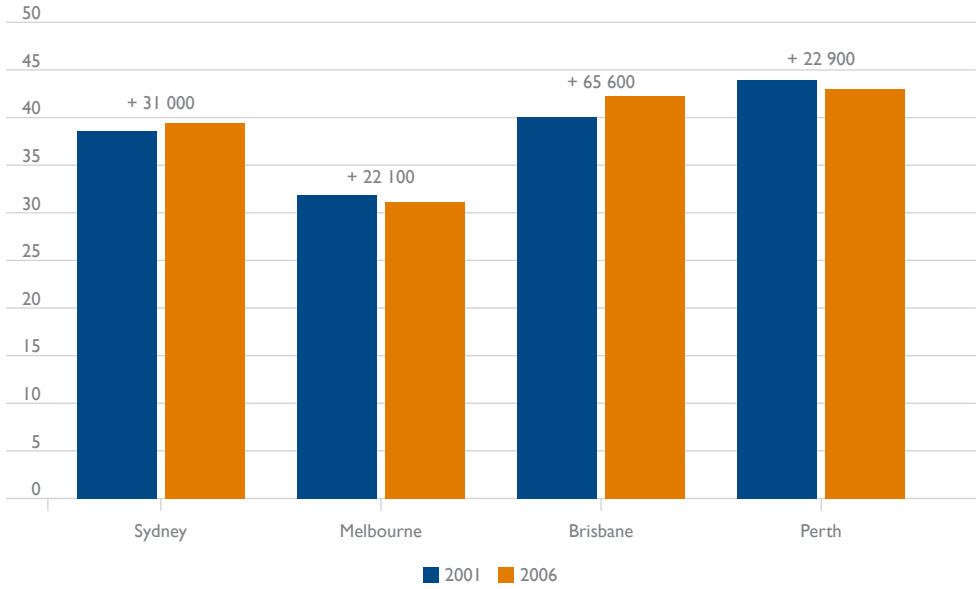
> '[f]or some years, the rate of return for developers of medium to high density residential development in centres has been greater than the rates of return from commercial development. It is important that strategic centres offer sufficient sites for employment as well as residential development' (NSW Government 2005, p.87)

> 'larger corporate users are avoiding [activity centres] due to greater traffic congestion, higher parking costs and the typical prevalence of secondary grade buildings. More importantly, new commercial developments in activity centres are failing to materialise due to the higher acquisition costs of site consolidation and resultant required development rents to make them feasible' (Charter Keck Cramer 2006, p.2).

Figure 5.7 presents information on how the estimated proportion of jobs located in activity centres has changed from 2001 to 2006. The focus is on the top few tiers of the activity centre hierarchy for each city (including specialised centres, which are often significant contributors to employment). Activity centre boundaries were defined based on destination zone boundaries, with details provided in the individual city reports (BITRE 2010, 2011, 2012a, 2013a). As of 2006, the proportion of city-wide employment located in these top-tier activity centres ranged from 31 per cent for Melbourne to 43 per cent for Perth.

Between 2001 and 2006, Brisbane experienced the largest increase in centred employment, both in absolute terms (with a gain of 65 600 jobs in centres), and in relative terms (with its centred employment share rising from 40.1 to 42.3 per cent). Sydney added 31 000 jobs in centres, and with limited job growth outside centres, the centred employment share increased by 0.7 percentage points. This shift is broadly in line with the target to raise Sydney's centred employment share by 3 percentage points between 2006 and 2036. Melbourne and Perth both added around 22 000 jobs in their top-tier activity centres, but because out-of-centre job growth outpaced centred job growth, the centred employment share declined for both cities (by 0.8 and 1.0 percentage points, respectively). About two-thirds of Sydney's job growth was concentrated in centres between 2001 and 2006, compared to 55 per cent for Brisbane, 35 per cent for Perth and just 20 per cent for Melbourne.

Figure 5.7 Change in proportion of city-wide employment located in activity centres, 2001 to 2006



Notes: The number provided for each city in the chart represents the change in the number of persons employed in activity centres between 2001 and 2006. Activity centre boundaries were defined based on destination zone (DZ) boundaries. For some activity centres, the DZ containing the centre is significantly larger than the activity centre itself. The adopted centre definitions tend to be relatively encompassing. Note that results differ from those in BITRE (2010) as the Perth activity centre definitions were revised to reflect the *Directions 2031* activity centre hierarchy. A total of 18 centres are included in the analysis for Sydney, 27 for Melbourne, 23 for Brisbane and 28 for Perth, based on the top few tiers of the activity centre hierarchy in each city. The included centre types are: Sydney—Global Sydney, Regional Cities, existing Major Centres (not planned or potential), Specialised Centres; Melbourne—Central Activity Districts, Principal Activity Centres, Specialised Activity Centres; Brisbane—Primary, Major Regional, Principal Regional and Specialist Activity Centres; Perth—Capital City, Strategic Metropolitan Centres and Secondary Centres (excluding emerging centres), and Specialised Centres.

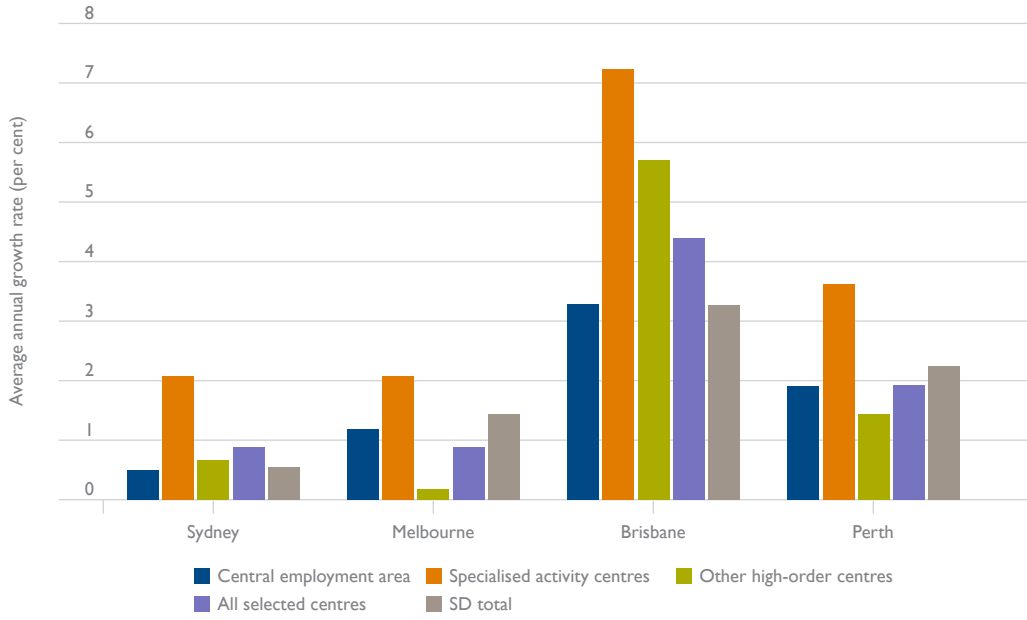
Source: BITRE analysis of ABS Census of Population and Housing place of work data for destination zones and BTS online journey to work tabulations for 2001 and 2006.

Figure 5.8 shows how rates of job growth varied across the different types of activity centres. Brisbane stands out as having a particularly high rate of job growth across all the different centre types. The central employment area grew at a slightly lower rate than the city-wide rate of employment growth in Sydney, Melbourne and Perth. Nevertheless, the CBD-based activity centre was an important source of job growth in all four cities, adding 29 600 jobs in Brisbane,[29] 13 000 jobs in Melbourne, 10 600 jobs in Sydney, and 9 900 jobs in Perth.

Moving beyond the CBD, the standout suburban job growth centres were Norwest, Macquarie Park and Olympic Park-Rhodes in Sydney, which added 6300, 5300 and 5000 jobs respectively. Brisbane contains several centres that added between 2500 and 3200 jobs between 2001 and 2006 (i.e. Brisbane Airport, Herston-Kelvin Grove, Strathpine, Upper Mount Gravatt). Apart from the CBD-based activity centre, there were no job growth centres of equivalent magnitude in either Melbourne or Perth.

29 The Brisbane primary centre includes the frame area described in Queensland Government and COMSEQ 2009 p.97, and thus extends well beyond the City Inner and City Remainder SLAs.

Figure 5.8 Job growth in different types of activity centres, 2001 to 2006



Note: Other high-order centres defined as: Perth—Strategic Metropolitan Centres and Secondary Centres; Brisbane—Primary, Major Regional and Principal Regional Activity Centres; Melbourne—Central Activities Districts and Principal Activity Centres; Sydney—Regional Cities and Major Centres. Excludes emerging, planned and potential centres.

The Brisbane primary centre (central employment area) includes the frame area described in Queensland Government and COMSEQ 2009 p.97, and so extends well beyond the City Inner and City Remainder SLAs.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for destination zones and BTS online journey to work tabulations for 2001 and 2006.

A common feature of job growth in the four cities was the rapid employment increase in specialised activity centres, which include facilities such as airports, business parks, hospitals and universities. For each city, the rate of job growth for specialised centres was well above the average annual rate of job growth for the city as a whole (see Figure 5.8). The specialised centres with the most job growth were Norwest, Macquarie Park and Olympic Park-Rhodes in Sydney. In the other cities, the specialised centres with the largest employment gains were the airports as well as inner city centres specialising in health and education (e.g. UWA-QEII in Perth, Herston-Kelvin Grove in Brisbane, Parkville Medical and Bioscience Precinct in Melbourne).

Of the four cities, only Brisbane recorded an increase in the employment share of the non-specialised activity centres between 2001 and 2006. The performance of the larger suburban non-specialised centres was mixed, with some experiencing significant job losses (e.g. Gosford, Dandenong, Doncaster Hill, Wynnum Central, Morley), and others growing strongly (e.g. Campbelltown-Macarthur, Narrewarren-Fountain Gate, Chadstone, Strathpine, Joondalup). A deficit of infrastructure (transport, communications, cultural and recreational) is perceived to be constraining outer suburban strategic centres in Sydney (Fagan and Dowling 2005, SGS 2004, O'Neill 2010).

In summary, the census-based evidence shows that all four cities recorded significant gains in the number of jobs located in the top-tier activity centres between 2001 and 2006. The

majority of Brisbane's job growth from 2001 to 2006 was concentrated in centres, which may reflect a relatively strict adherence to activity centre policy—Productivity Commission (2011) points out that more development applications were refused on the basis of activity centre policy (i.e being located at unsuitable sites) in Queensland than in any other state. Sydney also recorded an increased concentration of jobs in centres, with the specialised centres of Norwest, Macquarie Park and Olympic Park-Rhodes responsible for over half of this job growth. In contrast, the proportion of employment located in Melbourne and Perth's top-tier activity centres declined over the period. In both cases the CBD-based activity centre added a large number of jobs, but there were no suburban activity centres with large-scale job growth—while roughly half of all job growth was in the outer suburbs, this growth was typically in industrial areas or dispersed through newly developing suburbs, rather than concentrated in the designated top-tier activity centres.

Achieve employment growth in suburban locations

The strategic metropolitan plans for all four cities aim to direct employment growth to particular suburban locations, with the priority locations for job growth being specific to each city. The *Metropolitan Plan for Sydney 2036* aims to accommodate half of all new jobs in Western Sydney (NSW Government 2010, pp. 148–149), while the *SEQ Regional Plan 2009–2031* aims to achieve significant employment growth in the Western Corridor (Queensland Government and COMSEQ 2009, pp. 112, 122). The Perth and Melbourne plans pursue employment decentralisation in a less spatially targeted manner, with *Melbourne @ 5 million* aiming to provide more jobs outside Central Melbourne (Victorian Department of Planning and Community Development 2008, p.7) and *Directions 2031* and beyond aiming to increase the employment self-sufficiency of outer suburban subregions (WAPC 2010, p.30).

Table 5.16 summarises the data that BITRE used to assess trends between 2001 and 2011 for this planning objective. It shows that all four cities experienced a significant increase in the number of jobs located in the relevant suburban locations. However—with the exception of Perth—the job growth in the targeted suburban locations did not keep pace with job growth for the city as a whole, resulting in a decline in the suburban area's share of city-wide employment (although the decline was marginal for Brisbane's Western Corridor). Furthermore—again with Perth being the exception—job growth did not keep pace with residential growth in the targeted suburban area, resulting in a decline in employment self-sufficiency. Brisbane's Western Corridor experienced a particularly marked decline in employment self-sufficiency from 76 to 67 jobs per 100 employed residents. Thus, between 2001 and 2011, there was only limited progress in growing employment in the targeted areas of Sydney, Melbourne and Brisbane, which was coupled with a decline in the employment self-sufficiency of these suburban areas.

Table 5.16 Observed changes with respect to achieving employment growth in specified suburban locations, 2001 to 2011

City	Objective	Evidence—2001 to 2011 change
Sydney	Half of Sydney's job growth to 2036 will be in Western Sydney. The long term target of 384 000 extra jobs would boost Western Sydney's job share from 34 per cent in 2006 to 39 per cent in 2036.	Western Sydney added 55 000 jobs between 2001 and 2011, but this level of job creation is modest compared to the longer term target to create 384 000 new jobs between 2006 and 2036.^ The proportion of Sydney's employment located in Western Sydney was 33.7 per cent in 2001, but had fallen to 33.3 per cent in 2011. Western Sydney contributed 30 per cent of Sydney's job growth from 2001 to 2011, which was well below the long-term target of 50 per cent. Employment growth did not keep pace with residential growth in Western Sydney, with self-sufficiency declining from 77 to 74 jobs per 100 employed residents.
Melbourne	Provide more jobs outside Central Melbourne, so as to address an imbalance between where people live and the location of jobs.	From 2001 to 2011, about 158 000 jobs were added outside of Central Melbourne (but within the Melbourne SD), while about 92 000 jobs were added in Central Melbourne. Jobs growth averaged 1.4 per cent per annum outside of Central Melbourne, compared to 2.1 per cent in Central Melbourne. Consequently, the proportion of jobs located outside Central Melbourne fell from 72.4 to 71.1 per cent. While Central Melbourne has over 3 times as many jobs as employed residents, there were 68 jobs per 100 employed residents outside of Central Melbourne in 2011, down from 72 in 2001.
Brisbane	Implement programs that support economic development of the Western Corridor. Achieve significant job growth in the Western Corridor.	The Western Corridor gained about 12 000 jobs between 2001 and 2011. The average annual rate of job growth in the Western Corridor (2.7 per cent) was similar to that for the Brisbane SD (2.9 per cent), and the proportion of jobs located in the Western Corridor fell slightly from 5.8 to 5.7 per cent. Employment growth did not keep pace with residential growth in the Western Corridor, with self-sufficiency declining from 76 to 67 jobs per 100 employed residents.
Perth	Deliver improved employment self-sufficiency across the outer subregions.	The Outer subregions of Perth gained 76 000 jobs between 2001 and 2011, which represented 44 per cent of the Perth SD's job growth. The average annual rate of job growth in Outer Perth (3.9 per cent) was higher than that for the Perth SD (2.8 per cent), so Outer Perth's job share rose from 29.5 to 32.9 per cent. Employment growth slightly outpaced residential growth in Outer Perth, with self-sufficiency rising from 52 to 53 jobs per 100 employed residents. Self-sufficiency improved strongly for the Eastern subregion, and modestly for the North West subregion, but declined for the South West and South East subregions.

Notes: Western Sydney comprises three planning subregions—West Central, North West and South West. Central Melbourne is defined (in *Melbourne 2030*) as consisting of the Melbourne, Yarra and Port Phillip LGAs, and 'Melbourne undefined' was excluded from all calculations, so employment change figures do not sum to match Melbourne total change from Table 5.11. In SEQ, the Western Corridor corresponds to the Ipswich LGA. Based on 2006 ASGC boundaries.

^ O'Neill (2013) analyses job growth in Western Sydney between the 2006 and 2011 censuses, concluding that 'Western Sydney's supply of jobs has grown only by 26,074. The targets say jobs should have grown by three times this amount'.

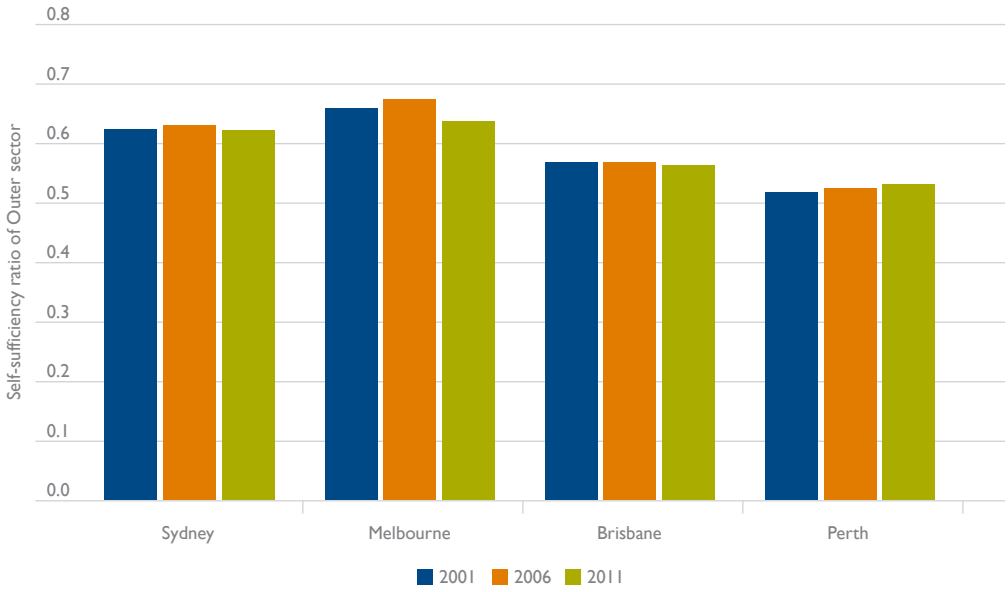
Sources: BITRE analysis of ABS Census of Population and Housing place of work and place of usual residence data for 2001, 2006 and 2011 and BTS online journey to work tabulations for 2001 and 2006, as well as NSW Government (2010), Victorian DPCD (2008), Queensland Government and COMSEQ (2009) and WAPC (2010).

In contrast, Perth's Outer subregions not only experienced a substantial increase of about 76 000 jobs, but also experienced more rapid job growth than the Perth SD as a whole, and recorded (in aggregate) a modest rise in self-sufficiency between 2001 and 2011. The underlying pattern of change was mixed, with a significant improvement in the self-sufficiency of the Eastern subregion (from 63 to 69 jobs per 100 employed residents) being largely offset by a deterioriation in the self-sufficiency of the South West subregion (from 66 to 61 jobs per

100 employed residents), Nevertheless, when taken as a whole, the evidence suggests that some positive progress was made towards the objective of delivering improved employment self-sufficiency across the Outer subregions of Perth.

Figure 5.9 compares movements in the Outer sector's self-sufficiency ratio for Sydney, Melbourne, Brisbane and Perth. While Perth's Outer sector continues to have a lower self-sufficiency ratio than the other cities, it was the only city where the Outer sector became more self-sufficient with respect to employment between 2001 and 2011. The declines in self-sufficiency were modest for the Outer sectors of Sydney and Brisbane.[30] Melbourne's Outer sector recorded a significant decline in self-sufficiency between 2006 and 2011, which was largely due to the reduced self-sufficiency of the Outer Western subregion. As was the case in Outer Western Brisbane (see Table 5.16), job growth did not keep pace with the very rapid residential growth occurring in Outer Western Melbourne, and self-sufficiency declined from 55 to 45 jobs per 100 employed residents between 2001 and 2011. While the shortfall of outer suburban jobs (relative to employed residents) became more pronounced in specific outer suburban subregions, such as Outer Western Melbourne and Outer Western Brisbane, Figure 5.9 shows that there was no general tendency for the outer suburban job gap to widen between 2001 and 2011.

Figure 5.9 Outer sector self-sufficiency ratio by city, 2001 to 2011



Notes: The self-sufficiency ratio is the ratio of people who work in the region to the number of employed people who live in the region. The ratio for each SD is less than one due to non-response to the place of work question and no fixed place of work responses. There was a marked increase in the number of respondents coded to an unidentified location in each capital city SD between 2006 and 2011, which contributed to negative movements in self-sufficiency ratios. Map 1.2 shows the Outer sector of each city.

Sources: BITRE analysis of ABS Census of Population and Housing place of work and place of usual residence data for 2001, 2006 and 2011 and BTS online journey to work tabulations for 2001 and 2006,

30 That is, the large decline in self-sufficiency for Brisbane's Western Corridor (highlighted in table 5.16), was not typical of the rest of Outer Brisbane.

Overview of progress against strategic planning goals

The analysis presented on the preceding pages does not represent an attempt to evaluate the effectiveness of the capital city strategic planning systems, but rather aims to provide evidence about the actual changes that have been occurring with respect to these strategic planning goals, identifying whether such movements are in the desired direction and progressing at the required pace of change. Table 5.17 summarises BITRE's assessment of recent changes for the capital city strategic planning goals that relate to the spatial distribution of employment.

Table 5.17 Observed changes since 2001 with respect to strategic planning goals that relate to the spatial distribution of employment

Strategic planning goal	Time period to which evidence relates	Extent of progress			
		Sydney	Melbourne	Brisbane	Perth
Locate employment in centres	2001 to 2006	Good	Isolated	Good	Isolated
Achieve employment growth in suburban locations	2001 to 2011	Limited	Limited	Limited	Some

Notes: The overall assessment in Table 5.17 for the centres objective for Perth differs from that in BITRE (2010), which was based on the draft *Directions 2031* activity centre hierarchy. The overall assessment for the suburban employment growth objective differs from that in the individual city reports (BITRE 2013a, 2012a, 2011, 2010), which were based on the 2001 to 2006 period

Source: BITRE analysis—details of assessment and sources provided earlier in this chapter and in individual city reports (BITRE 2010, 2011, 2012a, 2013a).

Table 5.17 shows that progress against these employment-related planning goals has been mixed since 2001. There has been significant progress in the desired direction for the centred employment goal in Sydney and Brisbane, and some positive progress towards achieving the desired outer suburban employment growth in Perth. However, there was rather limited progress in growing employment in the targeted suburban areas of Sydney (i.e. Western Sydney), Brisbane (i.e. the Western Corridor) and Melbourne (i.e. outside Central Melbourne), and in concentrating employment growth within Melbourne and Perth's centres (despite isolated examples of centres with substantial job growth existing in both cities). Recent progress against these employment-related planning goals has been generally weaker than progress against the population-related planning goals (as summarised in Table 4.8).

CHAPTER 6

Transport mode

Key points

- In 2006, the private vehicle mode share of commuter travel was highest in Perth (81 per cent) and lowest in Sydney (69 per cent). Melbourne and Brisbane had very similar private vehicle mode shares (of around 76 per cent).
- In 2006, Sydney had the highest public transport mode share (21 per cent), compared to about 14 per cent for Melbourne and Brisbane, and 10 per cent for Perth. In all four cities, the public transport mode share was higher for Inner sector residents than it was for Middle or Outer sector residents.
- Commuters mainly use the public transport system to access inner city jobs, with Inner sector workers responsible for between 74 and 82 per cent of total public transport use by commuters in the four cities.
- Active transport (walking and cycling) shares are highest for Sydney residents, followed by Melbourne and Brisbane, and lowest for Perth. Both cycling and walking mode shares were greatest in the Inner sectors of all four cities.
- Between 2001 and 2011, the private vehicle mode share of commuter travel fell in Melbourne (–4.0 percentage points), Perth (–3.3 percentage points), Brisbane (–2.7 percentage points) and Sydney (–0.8 percentage points). For all four cities, there were pronounced declines in the Inner sector. Outer suburban Sydney residents increased their rate of private vehicle use.
- The public transport mode share rose by 3.4 percentage points in Perth between 2001 and 2011, 3.0 percentage points in Melbourne, 2.4 percentage points in Brisbane, and 0.8 percentage points for Sydney. Inner Perth and the Middle sectors of Melbourne, Perth and Brisbane had the largest increases.
- Melbourne recorded the largest increase in the active transport mode share between 2001 and 2011 (1.1 percentage points), compared to 0.7 percentage points for Brisbane and 0.5 percentage points for Sydney and Perth.
- All four cities experienced a decline in the proportion of employed residents who reported working from home between 2001 and 2011.
- Since 2001, some progress has been made against the strategic planning goals of achieving greater public and active transport use in all four cities, while progress in concentrating residential development and job growth around public transport nodes has been mixed.

Background

This chapter compares spatial differences in the usage of various transport modes by employed people in Sydney, Melbourne, Brisbane and Perth, using the journey to work data collected by the ABS in its *Census of Population and Housing*. Even though many commuters use more than one mode of transport to commute to work, and the census records up to three modes, in the results presented here, responses involving multiple modes are assigned to a single mode, based on an established hierarchy.[31] The chapter contains three sections on:

- the spatial distribution of transport use by commuters
- recent changes in transport mode use, and
- analysis of recent trends with respect to the strategic planning objectives of increasing public transport use, increasing active transport use, and concentrating development around public transport nodes.

This chapter is based on the analysis contained within BITRE's individual city reports (BITRE 2010, 2011, 2012a, 2013a), and so relies largely on data from the ABS *Census of Population and Housing* for 2001 and 2006. Some high-level information from the 2011 *Census of Population and Housing* is also presented in order to shed light on whether the patterns of change identified for the 2001 to 2006 period are ongoing. Except where otherwise noted, the analysis is on a place of usual residence basis and adopts 2006 Australian Standard Geographical Classification (ASGC) boundaries.

Spatial distribution of transport use

Commuter use of transport in 2006

City wide transport mode split

The analyses in this section and elsewhere in this chapter focus on those who attended work and provided information on their mode of travel. The mode share calculation differs from the usual method in that those who worked at home were retained in the analysis.

In 2006, employed residents of Sydney, Melbourne, Brisbane and Perth depended largely on private vehicles (i.e. cars, trucks or motorbikes) for the commute to work (Figure 6.1). Nearly 81 per cent of Perth residents used private vehicles, while 69 per cent of residents in Sydney used private vehicles. The private vehicle mode share for employed residents of Melbourne and Brisbane were very similar, at around 76 per cent.

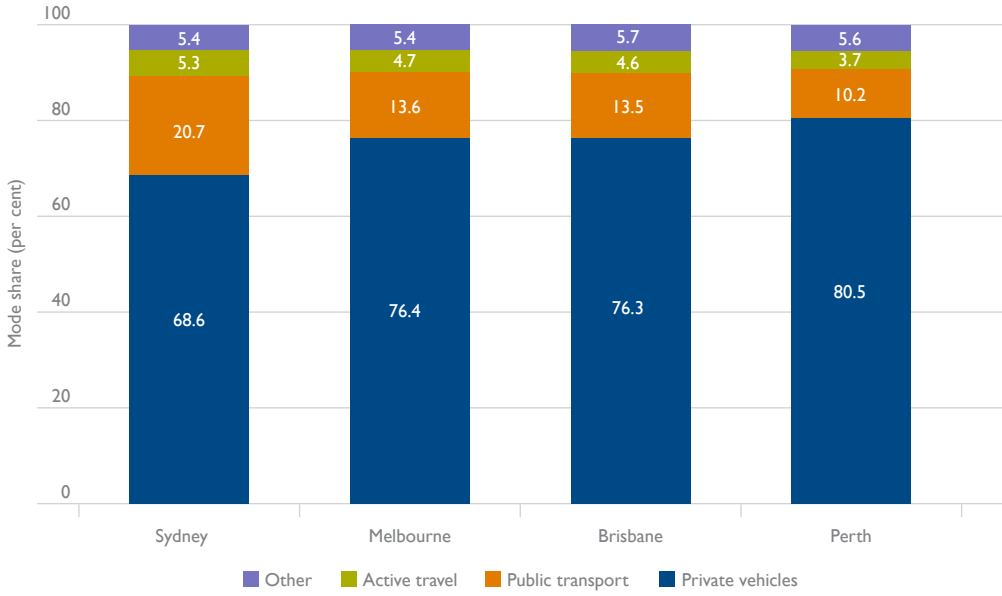
Sydney has by far the highest overall mode share for public transport (i.e. bus, train, taxi, tram/light rail or ferry), at 21 per cent, compared to about 14 per cent for Melbourne and Brisbane, and 10 per cent for Perth.

Active transport (i.e. walking and cycling) shares are also greatest for Sydney's commuters, followed by Melbourne and Brisbane, and lower for Perth. Between 5.4 and 5.7 per cent of working residents in all four cities stated that they used other modes of transport to get to

31 BITRE (2012a, p.191) explains the reassignment method and the hierarchy of modes in some detail.

work or worked from home. The proportion who worked from home was fairly stable across cities (ranging from 4.1 per cent to 4.5 per cent).

Figure 6.1 Transport mode share for commuters in Sydney, Melbourne, Brisbane and Perth, 2006



Notes: 'Private vehicles' includes car (as driver and passenger) and other private vehicles, 'Public transport' includes train, bus, ferry, tram and taxi, 'Active transport' includes bicycle and walking, and 'Other' includes work from home and other transport mode. 'Did not go to work' and 'mode unstated' were excluded from mode share calculations. Individual figures may not sum to totals due to rounding.

Sources: BITRE analysis of ABS Census of Population and Housing place of usual residence data for 2006.

An overview of the latest census data (based on the ABS' 2011 *Census of Population and Housing*) on commuter use of the various transport modes is presented in Box 6.1 for Sydney, Melbourne, Brisbane and Perth.

Box 6.1 Profile of journey to work transport mode shares in 2011

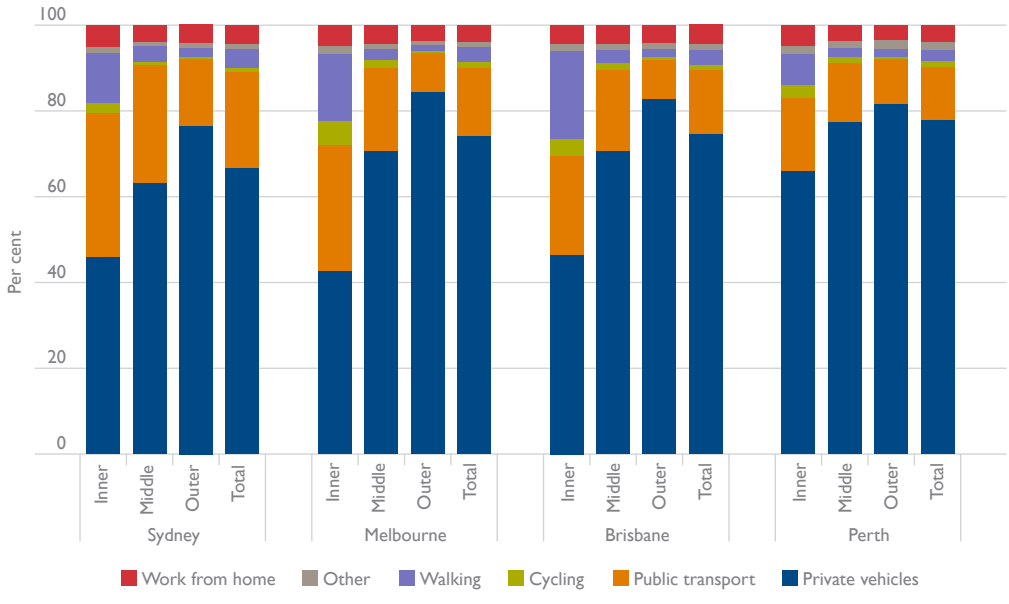
Figure 6.2 shows modal shares as a percentage of all commuter travel to work in the Inner, Middle and Outer sectors of Sydney, Melbourne, Brisbane and Perth in 2011. The city-wide information was previously summarised in Figure 3.6.

Among the four cities, Perth had the highest private vehicle use (78 per cent), and Sydney the lowest (67 per cent), while Melbourne and Brisbane had similar private vehicle mode shares (74 per cent each). Perth's Inner sector has higher private vehicle use (66 per cent) than the Inner sector of the other three cities (where 42–47 per cent used private vehicles). Residents of Melbourne's Outer sector have the highest private vehicle mode share (84 per cent) in Figure 6.2.

The public transport mode share was highest for Sydney (22 per cent) and lowest for Perth (12 per cent). In all four cities, the public transport mode share was much higher in the Inner sector than it was in the Middle or Outer sectors. Sydney had the highest public transport mode share for Inner sector residents (34 per cent), followed by Melbourne (30 per cent), Brisbane (23 per cent) and Perth (17 per cent). Public transport mode shares were lowest in the Outer sector of each city, with residents of Outer Melbourne and Outer Brisbane having particularly low mode shares (9 per cent each).

In 2011, the walking mode share ranged from a low of 2.6 per cent in Perth to a high of 4.6 per cent for Sydney. The cycling mode share was just over 1 per cent for Melbourne, Brisbane and Perth, and a little lower for Sydney (0.8 per cent). In each of the four cities, roughly 4 per cent worked from home.

Figure 6.2 Transport mode share for journey to work by sector of residence for Sydney, Melbourne, Brisbane and Perth, 2011



Notes: Converted by BITRE to match ABS 2006 Statistical Division and sectoral boundaries. Map 1.2 shows the Inner, Middle and Outer sectors of each city. Private vehicle includes car, truck and motorbikes; Public transport includes train, bus, ferry, tram and taxi; Did not go to work and mode unstated were excluded from mode share calculations.

Source: BITRE analysis of ABS Census of Population and Housing 2011 place of usual residence data.

Transport use by sector of residence

This section discusses the various transport modes used by employed persons to commute to work in 2006, and how that varies by sector of residence.

As shown in Table 6.1, Perth had the highest car dependency (79 per cent) in 2006, followed by Melbourne (75 per cent) and Brisbane (73 per cent), with the car mode share at its lowest in Sydney (67 per cent). The Inner sector of Perth had a relatively high car dependency (69 per cent), while the Inner sectors of the other three cities had much lower shares (between 45 and 50 per cent). Generally, car use increases with distance from the CBD, while public transport use decreases. Mode shares of 'other private vehicle' were similarly lowest in the Inner sector and increased with distance from the CBD in all four cities.

The public transport mode share was highest in Sydney and lowest in Perth. Rail was the dominant public transport mode for commuters in Sydney and Melbourne, and the train mode share was also somewhat higher than the bus mode share for Brisbane. However, in Perth there were more commuters using the bus to get to work than the train, as of 2006.

For all four cities, the public transport share was highest in the Inner sector and lowest in the Outer sector. Sydney had the highest public transport mode share for Inner sector residents (32 per cent), followed by Melbourne (26 per cent), Brisbane (21 per cent) and Perth (14 per cent). The public transport mode share for Middle sector and Outer sector residents was also at its highest in Sydney.

The cycling mode share was just over 1 per cent for Melbourne, Brisbane and Perth, and a little lower for Sydney (0.6 per cent). In contrast, the walking mode share was highest for Sydney (4.7 per cent) and lowest for Perth (2.5 per cent). Inner sector employed residents had the highest cycling and walking mode shares in all four cities. The higher take-up of these modes in the Inner sector of each city reflects their nature as short-distance methods of travel. Xu, Milthorpe and Tsang (2011) examined mode share data in terms of journey length for Sydney, finding that walking dominated trips of less than 5 kilometres (with just under half of all journeys), but this share dropped to virtually nothing for longer journeys. The percentage of the Inner sector working population who walked to work was particularly high in Brisbane (19.4 per cent) and Melbourne (15.8 per cent), and relatively low for Perth (6.3 per cent). The percentage of the Inner sector working population who cycled to work was also at its highest in Melbourne and Brisbane.

Around 5 per cent of residents in the Inner sectors of all four cities worked from home, and the shares were lower for the Middle and Outer sectors.

Table 6.1 Transport mode share for journey to work by sector of residence, Sydney, Melbourne, Brisbane and Perth, 2006

City	Sector	Car	Other private vehicles	Public transport	Cycling	Walking	Other modes	Worked at home
		Per cent						
Sydney	Inner	46.7	1.3	32.4	1.5	11.8	1.3	5.1
	Middle	63.9	1.7	25.0	0.5	4.1	0.9	4.0
	Outer	74.9	2.5	14.3	0.4	2.6	0.9	4.4
	Total	66.5	2.1	20.7	0.6	4.7	1.0	4.4
Melbourne	Inner	46.2	0.9	26.0	4.4	15.8	1.7	5.0
	Middle	72.6	1.3	16.6	1.5	2.7	1.1	4.3
	Outer	83.4	2.0	7.6	0.4	1.8	1.0	3.9
	Total	74.9	1.6	13.6	1.3	3.4	1.1	4.2
Brisbane	Inner	49.1	1.7	20.6	3.1	19.4	1.4	4.7
	Middle	70.6	2.3	17.1	1.3	3.0	1.1	4.6
	Outer	79.7	3.7	8.3	0.6	2.0	1.2	4.4
	Total	73.4	2.9	13.5	1.1	3.5	1.2	4.5
Perth	Inner	68.9	1.2	14.1	2.6	6.3	1.3	5.6
	Middle	78.8	1.6	11.1	1.4	2.0	1.3	3.8
	Outer	81.4	2.2	8.6	0.5	1.7	1.7	3.8
	Total	78.7	1.9	10.2	1.1	2.5	1.5	4.1

Notes: Map 1.2 shows the Inner, Middle and Outer sectors of each city. Due to rounding, components may not add to 100. 'Public transport' includes train, bus, ferry, tram and taxi. Modal shares were estimated by excluding (a) those who did not state the mode of travel and (b) those who did not work.

Sources: BITRE analysis of ABS Census of Population and Housing place of usual residence data for 2006.

Transport use by sector of work

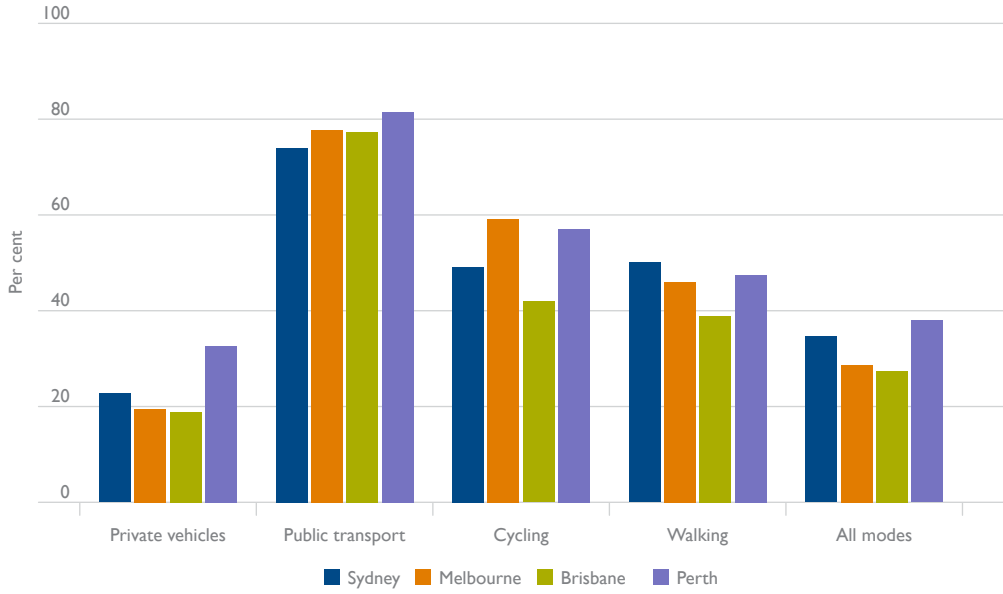
The public transport system in these four cities facilitates travel to and from the city centre, but does not necessarily provide easy access to jobs in other areas.

Figure 6.3 shows the contribution that those commuting to Inner sector jobs make to total commuter use of each of the different transport modes in Sydney, Melbourne, Brisbane and Perth. The Inner sector's share of city-wide employment (represented by the 'all modes' category in Figure 6.2) ranges between 27 and 38 per cent. However, Inner sector workers make up the great majority of commuter use of public transport (between 74 and 82 per cent). More specifically, while between 13 and 21 per cent of jobs are located in the Central Business District (CBD) of each city (see Chapter 5), around 60 per cent[32] of commuter public transport use is due to CBD workers. Commuters mainly use the public transport system to access inner city jobs, which reflects the public transport systems (and particularly the rail systems) being primarily designed to facilitate radial journeys to and from each city centre. Inner sector

32 The proportion ranges from a low of 57 per cent for Brisbane to a high of 67 per cent for Perth, with the CBD defined consistent with the approach outlined in Chapter 5.

workers also account for a disproportionately high share of active transport use, but are under-represented with respect to private vehicle use.

Figure 6.3 Inner sector workers as a proportion of total workers using each transport mode, by city, 2006



Note: The 'all modes' figure represents the contribution of the Inner sector to the employment total for the relevant capital city Statistical Division. Map 1.2 shows the Inner sector of each city. Private vehicle includes cars, trucks and motorbikes; Public transport includes train, bus, ferry, tram and taxi.

Source: BITRE analysis of ABS Census of Population and Housing place of work data for 2006.

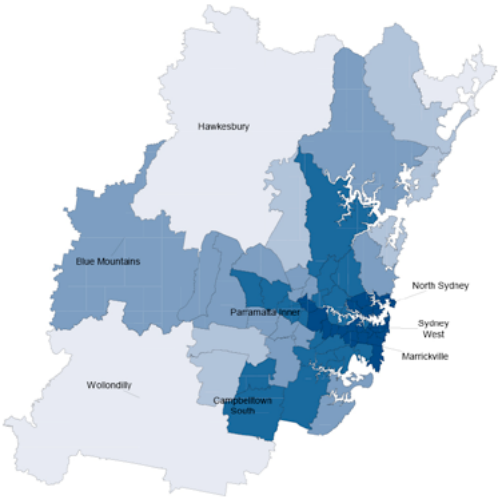
A very high proportion of outer suburban jobs are accessed by private vehicle (ranging between 84 and 88 per cent across the four cities). The public transport mode share is typically very low for outer suburban jobs, standing at 2–3 per cent for Perth, Brisbane and Melbourne, and 5 per cent in Sydney. This reflects the dispersed nature of outer suburban employment, the prominence of tradespersons for whom public transport is not a practical alternative to the car (Parliament of Victoria 2008), and limitations in the frequency, connectivity and spatial coverage of public transport services in the outer suburbs of Australian cities.

Transport mode shares by Statistical Local Area

Map 6.1 illustrates how the public transport mode shares differ across the Statistical Local Areas (SLAs) of residence in each of the capital city Statistical Divisions (SDs) in 2006. Generally, public transport use was highest amongst residents of SLAs close to the main urban rail corridors or close to the city centre, while public transport use was lowest in outlying areas away from regular urban passenger train services.

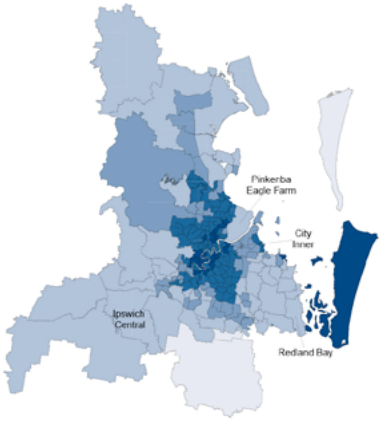
Map 6.1 Percentage of employed persons commuting by public transport by Statistical Local Area of residence, Sydney, Melbourne, Brisbane and Perth, 2006

Sydney SD



Melbourne SD

Brisbane SD



Perth SD

Public transport share 2006 (per cent)

- 25 to 35
- 15 to 25
- 10 to 15
- 5 to 10
- 0 to 5

Note: Maps relate to 2006 ASGC Statistical Divisions. All maps have same geographic scale.
Public transport includes train, bus, ferry, tram and taxi. Did not go to work and mode unstated were excluded from mode share calculations.

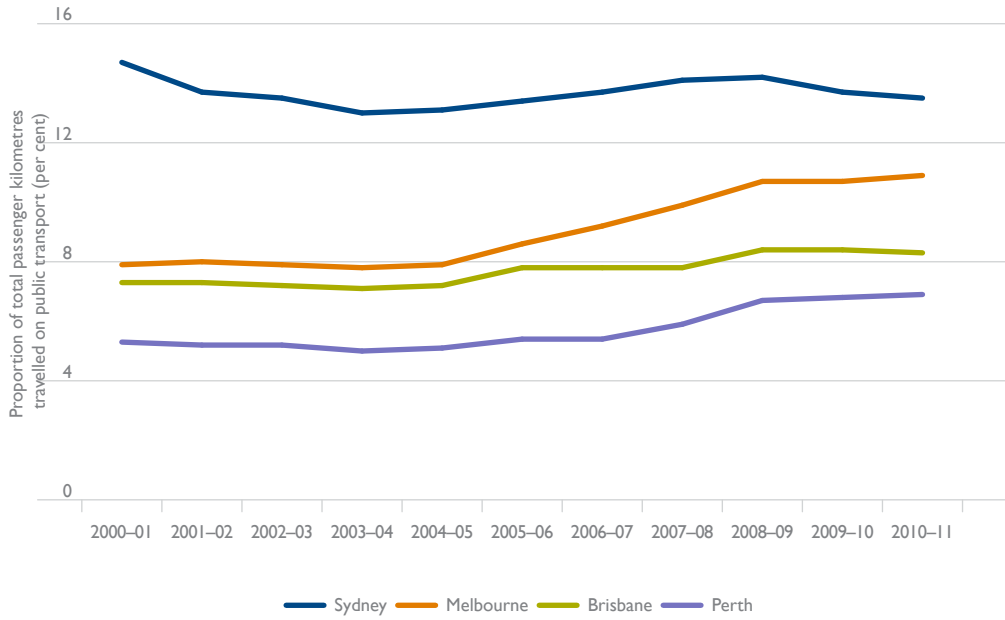
Source: BITRE analysis of ABS Census of Population and Housing place of usual residence data for 2006.

Changes in transport use

Trends in public transport mode usage, 2001 to 2011

Between 2000–01 and 2010–11, the public transport mode share of motorised passenger transport increased in Melbourne, Brisbane and Perth, while it decreased in Sydney (Figure 6.4). However, the public transport mode share rose in all four cities between 2004–05 and 2008–09, particularly significantly in Melbourne (from 7.9 per cent to 10.7 per cent), moderately in Brisbane and Perth, and slightly in Sydney (from 13.1 per cent to 14.2 per cent). During this period, public transport use increased from 4.0 billion passenger-kilometres (pkm) to 5.6 billion pkm in Melbourne, an average annual growth rate of 8.7 per cent. In Perth, public transport use increased from 1.1 to 1.5 billion pkm (or 8.6 per cent per annum), while it increased from 1.8 to 2.2 billion pkm in Brisbane (or 5.0 per cent per annum) (BITRE unpublished data). According to Gaymer (2010), the recent surge in public transport patronage in Melbourne was largely due to high population growth, CBD employment growth and increased petrol prices. BITRE (2013b) points to the role of 'budget squeeze' pressures (i.e. petrol prices, interest rates) in contributing to these increases in the public transport mode share.

Figure 6.4 Public transport mode shares for Sydney, Melbourne, Brisbane and Perth, 2000–01 to 2010–11



Note: Chart relates to all passenger use of motorised transport, not just to use for commuter travel.
Source: BITRE Urban Public Transport (UPT) estimates (unpublished data).

The significant increase in the public transport mode share in Melbourne was largely due to increased rail use, with the number of passenger journeys on Melbourne's heavy rail system growing by 47 per cent, from 145.1 million passenger journeys in 2004–05 to 213.7 million passenger journeys in 2008–09 (BITRE 2013b). During the same period, the heavy rail

passenger task in Melbourne increased by 10.7 per cent per annum, from 2.5 to 3.7 billion pkm (BITRE unpublished data).

Similarly, the increase in the public transport mode share in Perth and Sydney between 2004–05 and 2008–09 was largely due to increased heavy rail use. In Perth, the passenger rail task approximately doubled from 0.44 to 0.87 billion pkm, and a key contributor to this growth was the opening of the Mandurah line in 2007 (BITRE 2012b). In Brisbane, the increased public transport mode share primarily reflected increased bus use, which saw an average annual increase of 6.9 per cent between 2004–05 and 2008–09 (BITRE unpublished data).

Changes in commuter use of transport modes, 2001 to 2006

This section discusses changes between 2001 and 2006 in the modes of transport used by employed people journeying to work, based on their place of residence. As place of usual residence data was not available from the 2001 census, place of enumeration data for both 2001 and 2006 was used as the basis for comparison. Although this is slightly different data to that used in the initial part of this chapter, it allows a like-for-like comparison to be made while not substantially affecting the interpretation of the results.

While this section focuses on summarising the results of BITRE's individual city studies (BITRE 2010, 2011, 2012a, 2013) for the 2001 to 2006 period, Box 6.2 provides an updated picture of changes in transport mode shares between 2001 and 2011, using data from the ABS' 2011 *Census of Population and Housing* Basic Community Profile.

City total and sectors

Table 6.3 presents changes in transport mode shares for each of the four cities and by sector. Focusing on the city-wide changes, the car mode share increased significantly in Sydney (1.4 percentage points), while it decreased in Melbourne (–1.5 percentage points), Brisbane (–0.9 percentage points) and Perth (–0.4 percentage points) between 2001 and 2006. The opposite pattern was observed for public transport mode shares. The walking mode share increased in all four cities (particularly Melbourne), while Melbourne was the only city to experience a notable increase in the cycling mode share. The proportion of employed residents who reported working at home declined in all four cities between 2001 and 2006.

Box 6.2 Change in transport mode shares for the journey to work by city and sector, 2001 to 2011

Table 6.2 shows that between 2001 and 2011 the private vehicle mode share decreased considerably in Melbourne (–4.0 percentage points), Perth (–3.3 percentage points) and Brisbane (–2.7 percentage points), while it decreased by only 0.8 percentage points in Sydney. The decreases in the private vehicle mode share were greatest in the Inner sector of each city.

The public transport mode share increased in all four cities, although the increase was more modest for Sydney (0.8 percentage points) than for the other three cities (between 2.4 and 3.4 percentage points). The increases in the public transport mode share were largest for Inner Perth and the Middle sectors of Melbourne, Perth and Brisbane. The Outer sector of Sydney went against the overall trend, with an increase in the private vehicle mode share and a slight decline in the public transport mode share.

Each of the four cities experienced increases in the cycling and walking mode shares between 2001 and 2011. The percentage point changes were highest in Melbourne (0.6 percentage points for each of cycling and walking), although the walking mode share also increased by 0.6 percentage points in Brisbane. In each city, the increases in the cycling and walking mode shares primarily reflected increased use of these modes by inner city residents. Changes in the active transport mode shares were much more modest (and often negative) for Middle and Outer sector residents.

Between 2001 and 2011, there was a general decline (across almost all cities and sectors) in the proportion of employed residents who worked from home.

Table 6.2 Percentage point change in transport mode share by sector of residence, Sydney, Melbourne, Brisbane and Perth, 2001 to 2011

City	Sector	Private vehicles	Public transport	Cycling	Walking	Other	Work from home
Sydney	Inner	–3.5	0.4	1.2	1.9	–0.1	0.1
	Middle	–1.9	2.4	0.2	–0.2	–0.2	–0.3
	Outer	1.0	–0.1	0.0	–0.3	–0.3	–0.3
	Total	–0.8	0.8	0.3	0.2	–0.2	–0.2
Melbourne	Inner	–9.6	2.6	2.2	4.5	0.8	–0.5
	Middle	–5.9	4.4	0.9	0.4	0.3	–0.1
	Outer	–1.0	2.0	–0.1	–0.2	0.0	–0.7
	Total	–4.0	3.0	0.6	0.6	0.2	–0.4
Brisbane	Inner	–9.4	2.8	0.9	6.8	–0.5	–0.6
	Middle	–3.8	3.5	0.3	0.3	0.0	–0.2
	Outer	–0.5	1.4	–0.2	–0.1	0.1	–0.6
	Total	–2.7	2.4	0.1	0.6	0.0	–0.4
Perth	Inner	–7.1	5.2	1.0	1.7	0.0	–0.7
	Middle	–4.1	4.0	0.4	0.3	0.0	–0.6
	Outer	–2.0	2.7	0.0	0.1	0.2	–0.9
	Total	–3.3	3.4	0.2	0.3	0.1	–0.8

Notes: Data concorded by BITRE to 2006 SD boundaries. Map 1.2 shows the Inner, Middle and Outer sectors of each city. Private vehicle includes car, truck and motorbikes; Public transport includes train, bus, ferry, tram and taxi; Did not go to work and mode unstated were excluded from mode share calculations.

Source: BITRE analysis of 2011 ABS Census of Population and Housing Basic Community Profile (Table 46) and customised ABS census data for 2001.

While the sectoral mode shifts for car and public transport use varied across the four cities, there were some commonalities in the mode shifts from 2001 to 2006:

- the walking mode share increased strongly in the Inner sector of all four cities, and more modestly in the Middle and Outer sectors
- each of the cities experienced a small overall increase in the cycling mode share, with the increase most pronounced for the Inner sector
- each of the cities experienced a small overall decline in the proportion using other private vehicles to commute to work, with the negative shift most pronounced for the Outer sector
- there were across the board declines in the proportion of people who reported working from home.

Table 6.3 Sectoral changes in transport mode share for journeys to work, Sydney, Melbourne, Brisbane and Perth, 2001 to 2006

City	Sector	Car	Other private vehicles	Public transport	Cycling	Walking	Worked at home
		Percentage point change					
Sydney	Inner	–0.77	0.11	–1.33	0.26	1.75	–0.09
	Middle	0.78	–0.24	–0.32	0.07	0.29	–0.21
	Outer	2.35	–0.37	–1.36	0.01	0.04	–0.29
	Total	1.36	–0.24	–1.09	0.07	0.43	–0.23
Melbourne	Inner	–5.10	0.19	–1.02	1.01	4.75	–0.34
	Middle	–2.31	–0.15	1.64	0.47	0.42	–0.21
	Outer	0.24	–0.19	0.43	0.01	0.03	–0.48
	Total	–1.53	–0.13	0.85	0.33	0.71	–0.34
Brisbane	Inner	–4.82	0.28	0.24	0.22	5.22	–0.53
	Middle	–1.41	0.01	1.41	0.04	0.36	–0.27
	Outer	0.35	–0.27	0.55	–0.09	0.07	–0.47
	Total	–0.91	–0.09	0.93	0.00	0.60	–0.37
Perth	Inner	–2.96	0.12	2.16	0.32	1.15	–0.32
	Middle	–0.96	–0.09	1.50	0.16	0.27	–0.50
	Outer	0.52	–0.20	0.59	–0.05	0.04	–0.71
	Total	–0.42	–0.10	1.08	0.06	0.26	–0.59

Notes: Map 1.2 shows the Inner, Middle and Outer sectors of each city. The modal shares have been estimated by excluding those who did not state the mode of travel and those who did not work. Percentages are of total employed persons who attended work on census day. Components will not sum to 0 because change in mode share for 'other modes' is not shown.

Sources: BITRE analysis of ABS Census of Population and Housing place of enumeration data for 2001 and 2006.

Between 2001 and 2006, the public transport mode share declined in all sectors of Sydney. Despite the substantial drop in mode share, the absolute number of trips to work by public transport remained relatively constant. The overall 1.4 percentage point increase in Sydney's car mode share was largely attributable to an increased proportion of Outer sector residents

using a car to journey to work. Car use also increased in the Middle sector, but declined for the Inner sector. Inner Sydney had a modest increase in cycling and a significant increase in walking.

In Melbourne, the reduction in the mode share of car travel between 2001 and 2006 was most pronounced in the Inner sector, but was also significant in the Middle sector, while the Outer sector experienced a small increase in the car mode share. The public transport mode share also declined in the Inner sector, but the proportion of journey to work trips undertaken solely by foot or by cycling increased considerably. In the Middle sector of Melbourne, the reduction in the car vehicle mode share was accompanied by an increase in the public transport mode share, reflecting increased train use (BITRE 2011).

There was a similar pattern in Brisbane, where the car mode share decreased in the Inner (–4.8 percentage points) and Middle (–1.4 percentage points) sectors, and increased slightly in the Outer sector (0.4 percentage points). In the Inner sector, the large decrease in car use was offset by a similarly large increase in the walking mode share. In the Middle sector, car use decreased by a similar magnitude to the increase in public transport use. However, both car and public transport mode shares rose in the Outer sector, while the share of people working from home declined. The growth in Brisbane's public transport mode share was concentrated amongst Middle South residents and was driven by growth in bus use, reflecting the new Busway routes (BITRE 2013a).

Between 2001 and 2006, the car mode share declined in the Inner and Middle sectors of Perth, whilst the public transport mode share increased. The Outer sector experienced increases in both the car and public transport mode shares, accompanied by a fall in the proportion of residents who worked from home.

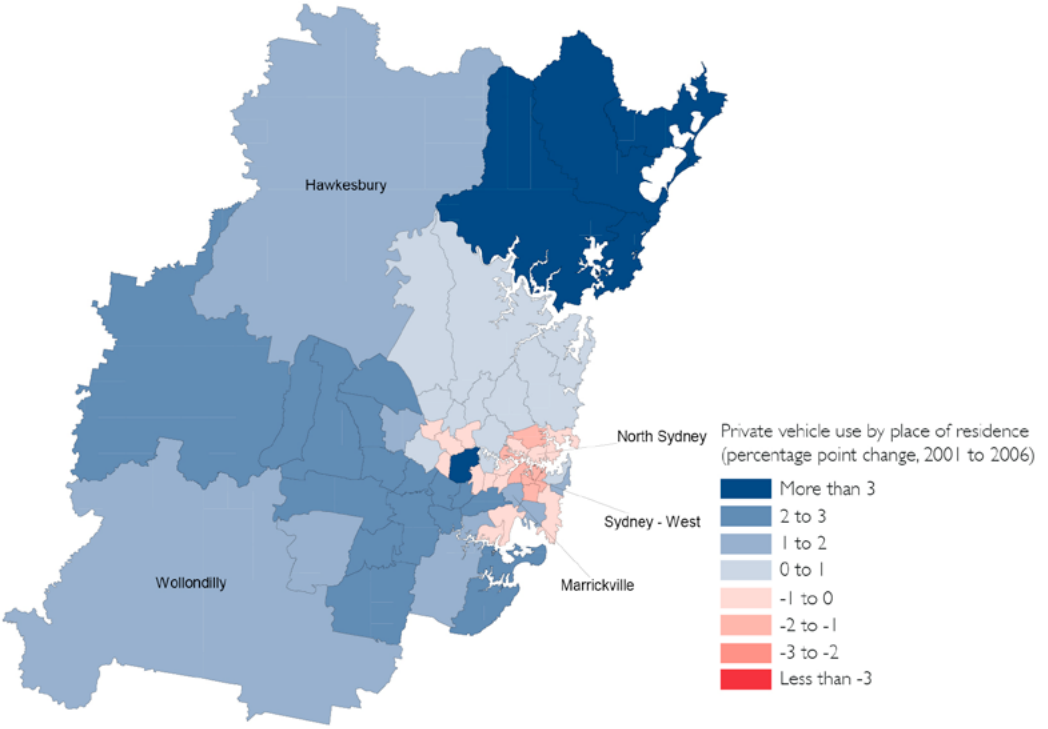
Statistical Local Areas

The comparison between the 2001 and 2006 census results at the SLA scale is complicated by changes to the boundaries of some SLAs during this period. In particular, some 2001 SLAs in Sydney and Brisbane were split into two or more SLAs in the 2006 classification. To avoid reporting changes caused by SLA redefinitions, some SLAs have been grouped together into 'aggregate SLAs' that have a common boundary for 2001 and 2006, prior to calculating the change in mode share. Details are provided in the individual city reports (BITRE 2012a, 2013a).

Maps 6.2 to 6.5 show how the private vehicle mode share has changed at the SLA scale in Sydney, Melbourne, Brisbane and Perth SDs between 2001 and 2006. Maps 6.6 to 6.9 show the public transport mode share changes in all four SDs during the same period.[33] Sydney stands out from the other cities since the private vehicle mode share increased for most of its SLAs and the public transport mode share fell for most SLAs. Melbourne and Brisbane saw widespread declines in the private vehicle mode share between 2001 and 2006, while the majority of SLAs in Melbourne, Brisbane and Perth had increases in their public transport mode share.

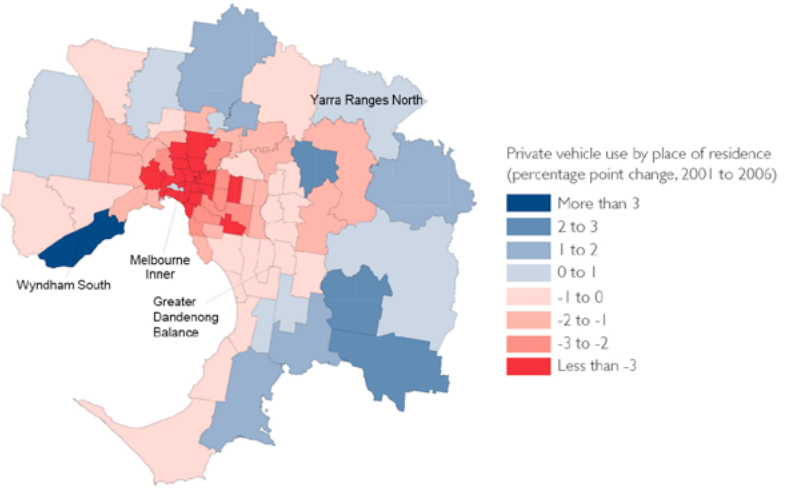
33 Note that mode share calculations underlying Maps 6.2 to 6.9 exclude did not go to work and not stated responses. Private vehicles include cars, trucks and motorbikes. Public transport includes train, tram, bus, ferry and taxi.

Map 6.2 Percentage point change in private vehicle mode share of journey to work by Statistical Local Area, Sydney, 2001 to 2006



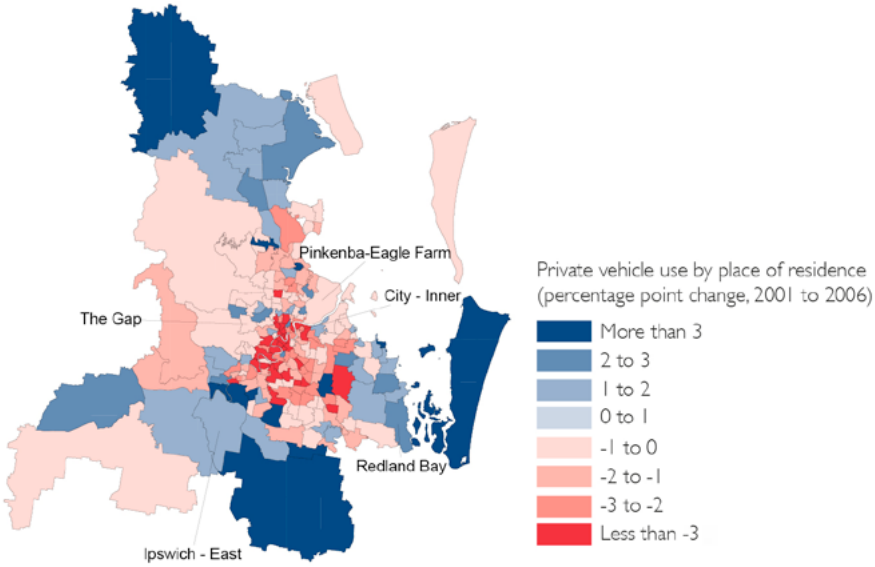
Source: BITRE analysis of ABS 2001 and 2006 *Census of Population and Housing* place of enumeration data.

Map 6.3 Percentage point change in private vehicle mode share of journey to work by Statistical Local Area, Melbourne, 2001 to 2006



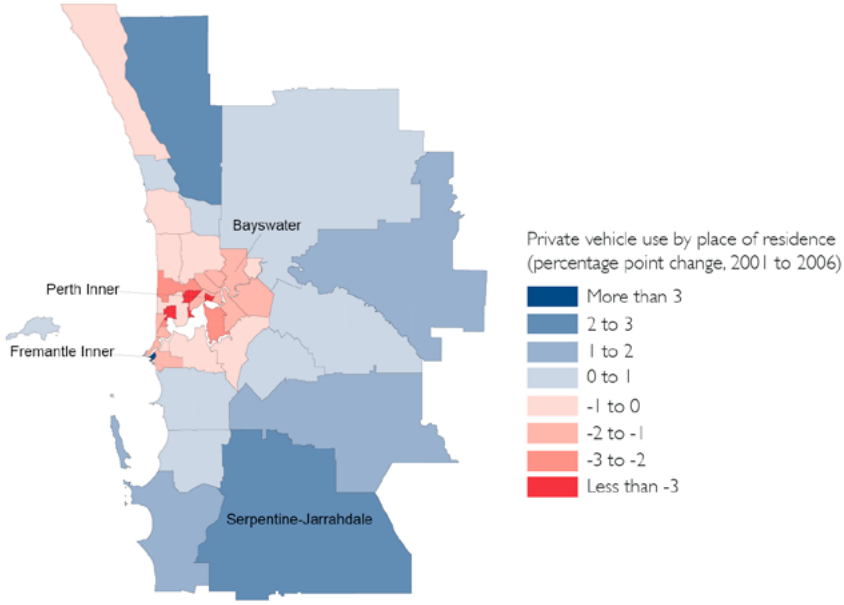
Source: BITRE analysis of ABS 2001 and 2006 *Census of Population and Housing* place of enumeration data.

Map 6.4 Percentage point change in private vehicle mode share of journey to work by Statistical Local Area, Brisbane, 2001 to 2006



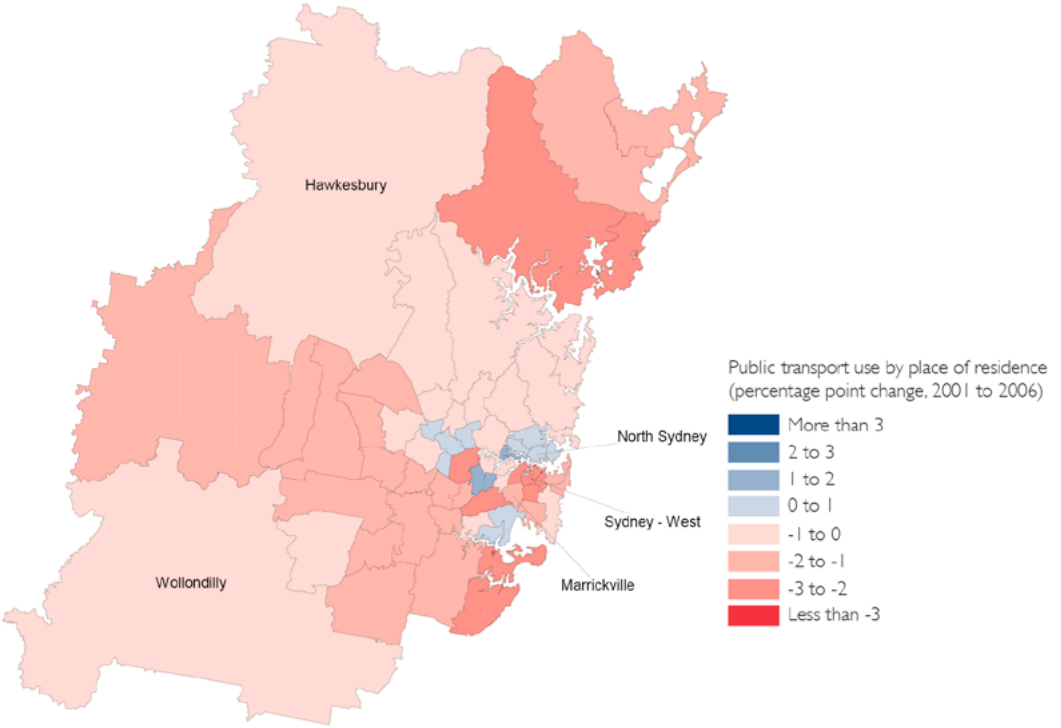
Source: BITRE analysis of ABS 2001 and 2006 *Census of Population and Housing*place of enumeration data.

Map 6.5 Percentage point change in private vehicle mode share of journey to work by Statistical Local Area, Perth, 2001 to 2006



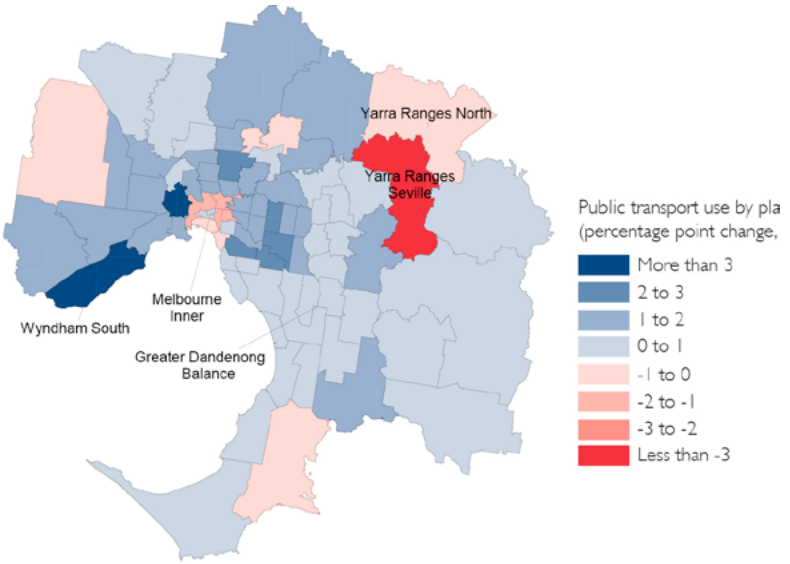
Source: BITRE analysis of ABS 2001 and 2006 *Census of Population and Housing* place of enumeration data.

Map 6.6 Percentage point change in public transport mode share of journey to work by Statistical Local Area, Sydney, 2001 to 2006



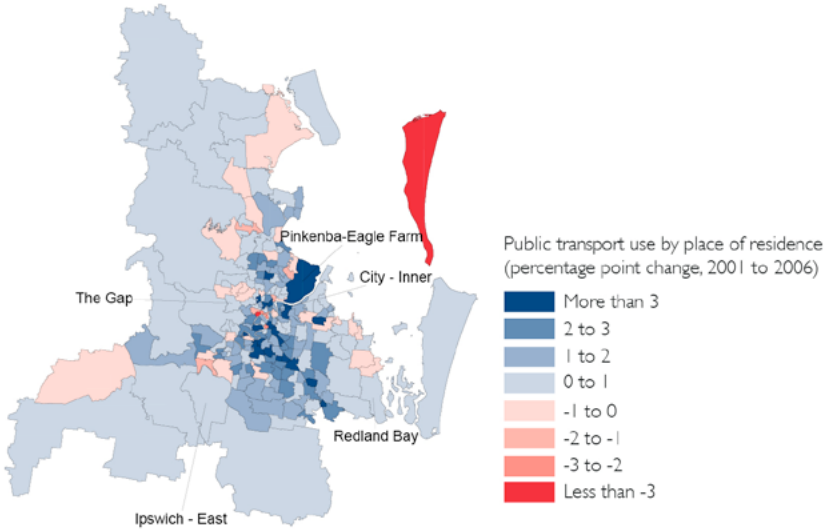
Source: BITRE analysis of ABS 2001 and 2006 *Census of Population and Housing* place of enumeration data.

Map 6.7 Percentage point change in public transport mode share of journey to work by Statistical Local Area, Melbourne, 2001 to 2006



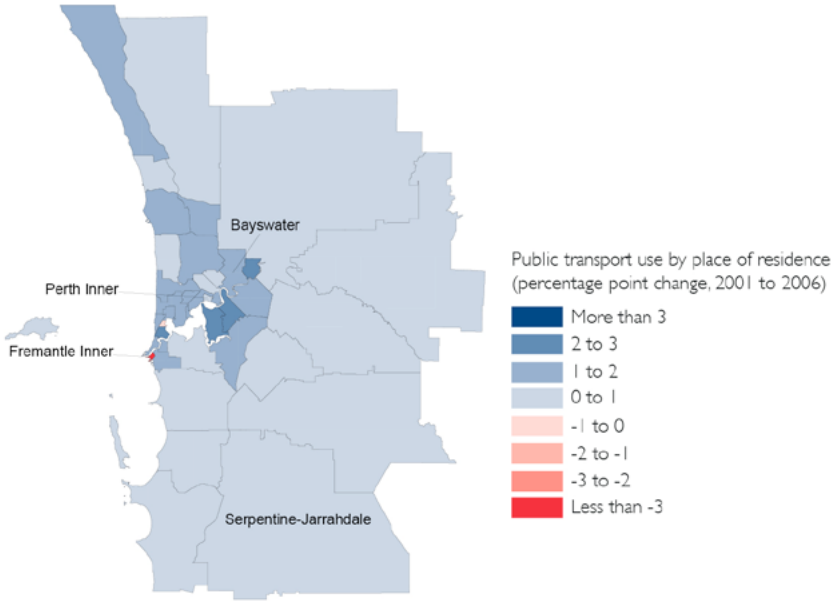
Source: BITRE analysis of ABS 2001 and 2006 *Census of Population and Housing* place of enumeration data.

Map 6.8 Percentage point change in public transport mode share of journey to work by Statistical Local Area, Brisbane, 2001 to 2006



Source: BITRE analysis of ABS 2001 and 2006 *Census of Population and Housing* place of enumeration data.

Map 6.9 Percentage point change in public transport mode share of journey to work by Statistical Local Area, Perth, 2001 to 2006



Source: BITRE analysis of ABS 2001 and 2006 *Census of Population and Housing* place of enumeration data.

Strategic planning objectives

This section examines and compares the recent changes that have occurred since 2001 with respect to several metropolitan planning goals that relate to transport use within cities, namely:

- greater use of public transport
- greater use of active transport (walking and cycling)
- concentrating residential and job growth around public transport.

Greater use of public transport

A common objective of the strategic metropolitan plans for Sydney, Melbourne, SEQ and Perth is to promote the use of public transport, in order to increase its mode share. Specific quantitative targets for the public transport mode share are set for Sydney, Melbourne and SEQ in either the metropolitan plan or the associated transport or state plans:

- The *Metropolitan Plan for Sydney 2036* aimed to 'increase the public transport mode share' (NSW Government 2010, pp. 91, 248). *NSW 2021* (and its predecessors) sets out a quantitative target to increase the public transport mode share of journeys to work in Sydney to 28 per cent by 2016 (NSW Government 2011). Actions to help achieve this target include improved public transport connections for centres, improved timetabling, and the introduction of an electronic ticketing system (ibid).
- The Victorian state government aims to increase public transport's share of motorised trips within Melbourne to 20 per cent by 2020 (Victorian Department of Infrastructure 2002), compared to the quoted share of 9 per cent at the time the target was set. Strategies put in place to help achieve this mode share target include expansions of public transport infrastructure, integrated transport and land use planning, and Travelsmart, which aims to reduce people's car dependency and encourage alternative travel options through travel planning (Victorian Department of Transport 2009a).
- The *Connecting SEQ 2031* plan sets a target of increasing the public transport mode share in the Brisbane LGA from 10 per cent in 2006 to 20 per cent in 2031 for all trips, and from 18 per cent in 2006 to 35 per cent in 2031 for work-related trips. For SEQ as a whole, the aim is to increase the public transport mode share of all trips from 7 per cent in 2006 to 14 per cent in 2031 (Queensland Department of Transport and Main Roads 2011a).

For Perth, *Directions 2031* 'emphasises the need to encourage alternatives to private car travel' such as public transport (Western Australian Planning Commission 2010, p.55). However, no quantitative target is presented for the public transport mode share.

Table 6.4 summarises changes in public transport use between 2001 and 2011, based on BITRE Urban Public Transport (UPT) data. This data relates to all public transport use, and not specifically to commuter travel. Both public transport patronage and the public transport passenger task increased considerably between 2001 and 2011 in Melbourne, Brisbane and Perth (with average annual growth of between 3 and 6 per cent). Increases were much more modest for Sydney, averaging just 0.3 per cent per annum. During the 2001 to 2011 period, the public transport mode share (measured in terms of pkm) increased by 3.0 percentage points for Melbourne, 1.7 percentage points for Perth and 1.0 percentage points for Brisbane. Although Sydney has the highest public transport mode share of the four cities, its mode share

declined by 1.2 percentage points between 2001 and 2011. It should, however, be noted that there was an atypical rise in public transport use in 2000–01 due to the Sydney Olympics, and the public transport mode share declined by just 0.2 percentage points between 2002 and 2011 (BITRE 2012a).

Table 6.4 Changes in public transport patronage, passenger task and mode share for Sydney, Melbourne, Brisbane and Perth, 2001 to 2011

Financial year ended June	Sydney	Melbourne	Brisbane	Perth
Public transport patronage (million passenger journeys)				
2001	602.1	347.7	99.5	83.8
2011	616.2	519.8	151.6	136.0
Average annual growth rate (per cent), 2001 to 2011	0.3	4.6	4.8	5.5
Public transport passenger task (billion passenger kilometres)				
2001	7.6	3.7	1.6	1.0
2011	7.8	6.0	2.2	1.6
Average annual growth rate (per cent), 2001 to 2011	0.3	5.5	3.6	5.4
Public transport passenger task mode share (per cent)				
2001	14.7	7.9	7.3	5.3
2011	13.5	10.9	8.3	6.9

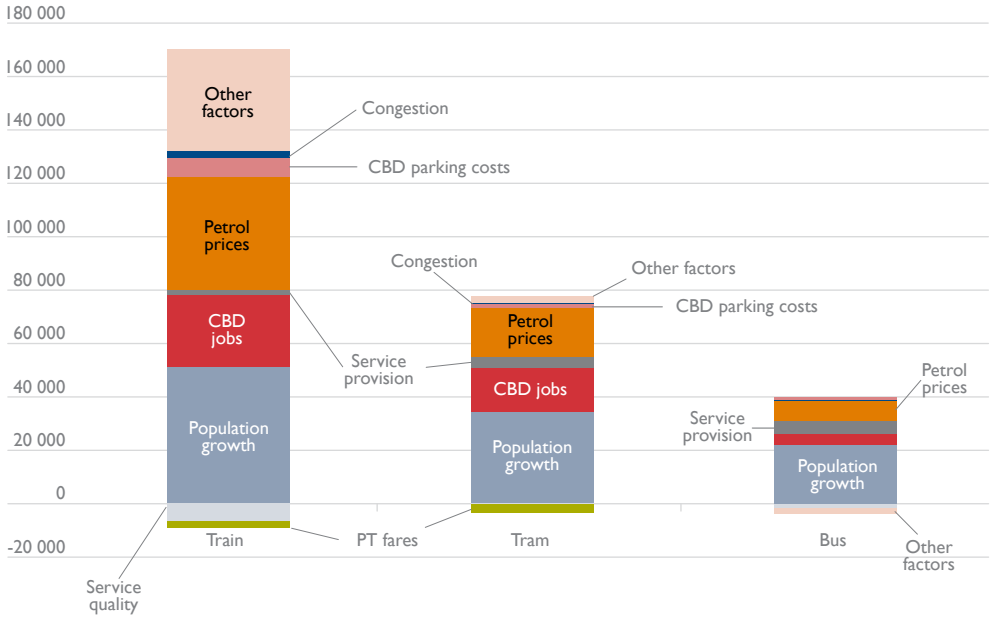
Note: BITRE's UPT dataset calculates mode share on a passenger kilometres basis, rather than a trips basis. Public transport mode share is the share of the total motorised urban transport task, measured in billions of passenger kilometres. Data relates to all trip types, not specifically to commuter travel.

Source: BITRE UPT estimates (unpublished data).

The increase in Brisbane's public transport mode share was largely due to increased bus usage, which rose from 0.69 to 1.17 billion pkm between 2001 and 2011, reflecting the opening of new busways (BITRE 2013a) and the introduction of an integrated ticketing system in 2007 (TransLink 2007). In both Perth and Melbourne, the increase in the public transport mode share can largely be attributed to increased use of heavy rail. In Perth, the passenger rail task more than doubled from 0.41 to 0.94 billion pkm, and a key contributor to this growth was the opening of the Mandurah line in 2007 (BITRE 2012b). In Melbourne, the heavy rail task increased from 2.19 to 3.98 billion pkm (BITRE 2013b).

The Victorian Department of Transport has investigated the factors contributing to the increase in public transport patronage in Melbourne between 2002 and 2007. Three principal drivers were identified—population growth, CBD jobs growth and the increase in petrol prices (Gaymer 2010). Changes in public transport service levels, CBD parking costs and congestion made a modest contribution (ibid). Figure 6.5 illustrates the results of this exercise for the three principal public transport modes.

Figure 6.5 Factors affecting public transport patronage growth in Melbourne, 2002 to 2007

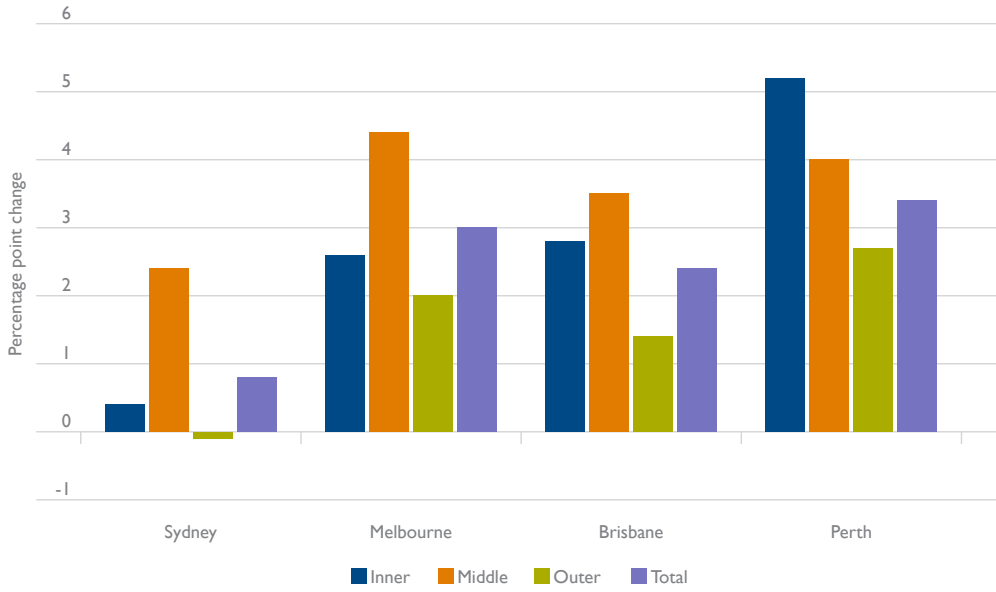


Source: Gaymer (2010, p.4).

Figure 6.6 shows the percentage point change in mode share for journey to work trips in Sydney, Melbourne, Brisbane and Perth between 2001 and 2011. The public transport mode share of journey to work trips rose considerably for Perth (3.4 percentage points), Melbourne (3.0 percentage points) and Brisbane (2.4 percentage points), while Sydney recorded a more modest increase (0.8 percentage points). The increase in the public transport mode share was largest for residents of Inner Perth. In Sydney, Melbourne and Brisbane, the increase was largest for Middle sector residents. The only sector to record a decline in the public transport mode share was the Outer sector of Sydney.

Table 6.5 summarises how the recent changes relate to the quantitative public transport mode share targets for Sydney, Melbourne and Brisbane/SEQ. Each city has seen some progress in the desired direction. However, in Sydney, the increase in public transport use between 2001 and 2011 was modest, and a much larger increase will be required over the next five years in order to meet the 2016 target. For Melbourne and Brisbane, the 2001 to 2011 period saw more significant progress towards the longer-term public transport mode share targets.

Figure 6.6 Percentage point change in public transport mode share for journey to work by sector and city, 2001 to 2011



Note: Map 1.2 shows the Inner, Middle and Outer sectors of each city.

Source: BITRE analysis of ABS Census of Population and Housing place of usual residence data for 2001 and 2011.

Table 6.5 Observed changes with respect to public transport mode share target, 2001 to 2011

City	Objective	Evidence—2001 to 2011 change
Sydney	Increase the proportion of total journeys to work by public transport in the Sydney metropolitan region to 28 per cent by 2016.	According to the ABS Census of Population and Housing, the public transport mode share of journey to work travel in the Sydney SD rose slightly from 21.7 per cent in 2001 to 22.5 per cent in 2011.^
Melbourne	Increase public transport's share of motorised trips within Melbourne to 20 per cent by 2020 (from around 9 per cent in 2002)	According to BITRE UPT data, public transport's share of the motorised passenger task (measured in billions of pkm) increased from 7.9 per cent in 2001 to 10.9 per cent in 2011. Public transport's share of all motorised trips in the Melbourne SD is estimated to have risen from around 8.5 per cent to 10.9 per cent over the same period.
SEQ/ Brisbane	Increase the public transport mode share for work trips in the Brisbane LGA from 18 per cent in 2006 to 35 per cent in 2031.	According to the ABS Census of Population and Housing, the public transport mode share of journey to work trips in the Brisbane LGA rose from 16.1 per cent in 2001 to 19.5 per cent in 2011.^
	Increase the mode share of public transport trips in SEQ (Brisbane LGA) from 7 (10) per cent in 2006 to 14 (20) per cent in 2031.	According to BITRE UPT data, public transport's share of the Brisbane SD's motorised passenger task (measured in billions of pkm) increased from 7.3 per cent in 2001 to 8.3 per cent in 2011. Public transport's share of all motorised trips in the Brisbane SD is estimated to have risen from around 5.9 per cent to 7.1 per cent over the same period.

Note: The analysis focuses on data sources that are available on a consistent basis across the cities, namely the ABS Census of Population and Housing and BITRE UPT data. It does not consider state government travel surveys which are often used to assess progress against these targets, but are not comparable across cities. No quantitative public transport mode share target is presented for Perth in *Directions 2031 and beyond*.
^ Did not go to work and mode unstated were excluded from census-based mode share calculations, while working from home responses were retained.

Sources: BITRE analysis of ABS Census of Population and Housing place of usual residence data for 2001 and 2011, BITRE UPT time-series data, NSW Government (2011), Victorian Department of Infrastructure (2002) and Queensland Department of Transport and Main Roads (2011a).

While Sydney continues to have a higher public transport mode share than the other cities, over the last decade only modest progress was made towards the objective of achieving greater use of public transport, whether assessed in comparison to other cities or in comparison to the state government's mode share target. Positive progress was made towards the objective of achieving greater use of public transport in Brisbane, and even moreso, in Melbourne and Perth, which both experienced substantial increases in the public transport mode share of commuter travel and total travel between 2001 and 2011.

Greater use of active transport

Promoting greater use of walking and cycling (active transport) is a key strategic planning goal for Sydney, Melbourne, Brisbane and Perth. The *Metropolitan Plan for Sydney 2036* aims to promote active transport opportunities (NSW Government 2010), with the *NSW 2021* state plan containing targets to more than double the mode share of bicycle trips and increase the walking mode share to at least 25 per cent by 2016 (NSW Government 2011). *Melbourne 2030* 'promotes non-motorised travel for short trips, and public transport for longer trips', through initiatives such as walking and bicycle action plans, development of the Principal Bicycle Network, the Travelsmart program and review of car parking policies (Victorian Department of Infrastructure 2002, p.160). The *SEQ Regional Plan 2009–2031* also supports the promotion of walking and cycling through provision of new infrastructure, improved services and information (Queensland Government and COMSEQ 2009), while *Connecting SEQ 2031* specifies a target to increase the active transport mode share from 10 per cent in 2006 to 20 per cent by 2031 (Queensland Department of Transport and Main Roads 2011a). For Perth, *Directions 2031 and beyond* encourages a shift to walking and cycling (Western Australian Planning Commission 2010).

The active transport targets for Sydney and SEQ relate to all types of trips, rather than specifically to travel for commuting purposes. However, nationally comparable cycling and walking mode share data is not readily available across all trip types. This section focuses on the journey to work mode share data from the ABS *Census of Population and Housing* to provide a guide to changes in the use of the active transport modes between 2001 and 2011.

Table 6.6 shows the mode share of active transport (walking and cycling) journey to work trips in 2001, 2006 and 2011 and the percentage point change over the period for Sydney, Melbourne, Brisbane and Perth. Sydney had the highest active transport mode share in both 2001 and 2011, while Perth had the lowest active transport mode share in both years. All four cities recorded an increase in the active transport mode share between 2001 and 2011. In Sydney and Perth, the active transport mode share rose by 0.5 percentage points, while the increases were larger for Brisbane (0.7 percentage points) and Melbourne (1.1 percentage points). The increase in Brisbane's active transport mode share was dominated by increases in walking, but for the other three cities, both cycling and walking made important contributions to the overall increase in the active transport mode share (see Figure 6.7).

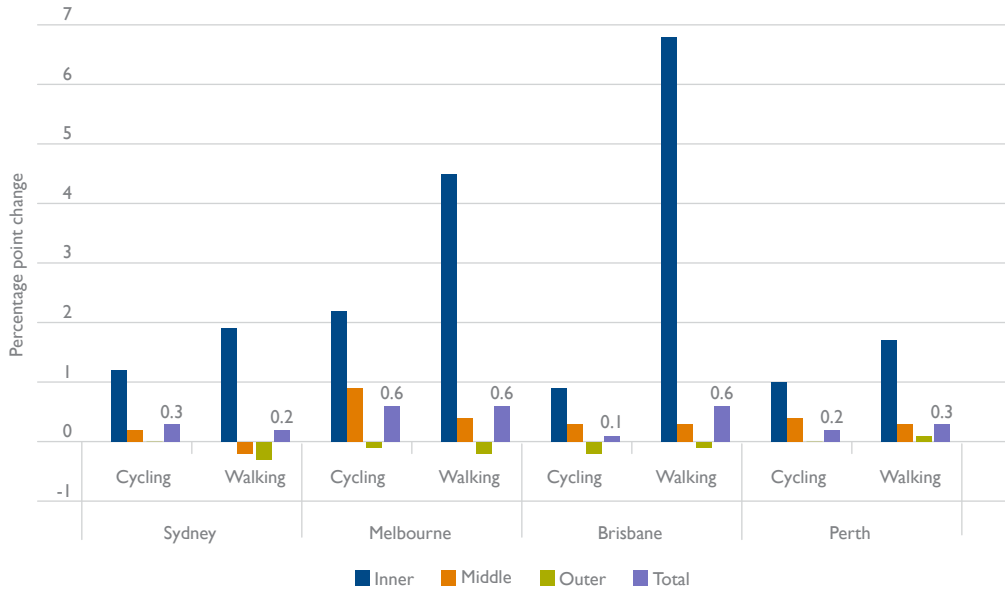
Table 6.6 Active transport (walking and cycling) mode share in Sydney, Melbourne, Brisbane and Perth for 2001, 2006 and 2011

City	Active transport mode share (per cent)			Percentage point change (2001–2011)
	2001	2006	2011	
Sydney	4.9	5.3	5.4	0.5
Melbourne	3.7	4.7	4.8	1.1
Brisbane	4.0	4.6	4.7	0.7
Perth	3.4	3.7	3.9	0.5

Source: BITRE analysis of ABS Census of Population and Housing place of usual residence data for 2001, 2006 and 2011.

Table 6.6 also reveals that the increase in the active transport mode share was heavily concentrated in the earlier 2001 to 2006 subperiod for Sydney, Melbourne and Brisbane. The 2006 to 2011 subperiod saw only very modest increases in the active transport mode share (of around 0.1 percentage point) in these three cities.

Figure 6.7 Percentage point change in walking and cycling mode shares for journey to work by city and sector, 2001 to 2011



Note: Map 1.2 shows the Inner, Middle and Outer sectors of each city.

Source: BITRE analysis of ABS Census of Population and Housing place of usual residence data for 2001 and 2011.

The increases in active transport use from 2001 to 2011 were largely the result of a shift towards active transport modes by inner city residents. Likely contributors to this shift include increased residential and job densities in the inner city, as well as attitudinal changes relating to environmental awareness and awareness of health and fitness benefits (Gaymer 2010). As shown in Figure 6.7, there were particularly significant increases in the proportion of Inner Brisbane and Inner Melbourne employed residents who walked to work. However, over the same period, there were small declines in the proportion of Outer Brisbane, Outer Melbourne and Outer Sydney residents who used active transport to get to work.

Despite this spatial variation *within* cities, when each of the four cities is considered as a whole, the census-based evidence shows that some progress has been made in increasing the active transport mode share of commuter travel during the last decade.

Concentrate residential and job growth around public transport

In recent years, the strategic plans for Sydney, Melbourne, Perth and SEQ have all contained goals relating to focusing future residential development and job growth around public transport nodes. The *Metropolitan Plan for Sydney 2036* targets development around existing and planned transport capacity (NSW Government 2010, p.91). *Melbourne 2030* aims to ensure new residential development is focused in designated Growth Areas that are served by high-capacity public transport, as well as aiming to make jobs more accessible by focusing development in areas which have good public transport access (Victorian Department of Infrastructure 2002, pp. 63, 152). The *SEQ Regional Plan 2009–2031* emphasises the need to ensure that residential and employment growth occurs close to high-frequency public transport (primarily rail and busways) and to apply transit oriented development principles to precincts 'within a comfortable 10-minute walk of a transit node' (Queensland Government and COMSEQ 2009, p.101). *Directions 2031 and beyond* emphasises the need to accommodate mixed use and higher density housing development around transport nodes through transit oriented developments (Western Australian Planning Commission 2010, p.62).

The different cities each have their own take on this objective. For example, in Melbourne, there is a strong focus on the designated Growth Areas (i.e. greenfield sites), while in Sydney the focus is on urban renewal sites. The Perth and SEQ goals specifically reference transit oriented development principles. Melbourne is the only city to frame the issue largely from an accessibility perspective.

Reflecting these differences, BITRE's individual city reports assessed recent trends in a way that was tailored to the way the objective was framed in each city (BITRE 2010, 2011, 2012a, 2013a). There were, however, some commonalities in the approaches adopted for Sydney, Brisbane and Perth. In each of these cities, assessment of this objective was at least partly based on the observed changes in the proportion of population and employment concentrated within a given distance of public transport nodes between 2001 and 2006. A summary of this analysis is presented in Table 6.7. Note that the choice of public transport nodes differs across cities, while the Perth distance catchment differs from the catchments adopted in Sydney and Brisbane.

Table 6.7 Changes in population and employment around transport nodes in Sydney, Brisbane and Perth, 2001 to 2006

Area around	Population			Employment		
	2001	2006	Percentage point change	2001	2006	Percentage point change
		Per cent			Per cent	
Sydney (around railway stations)						
Percentage within 500 metres	10.5	11.1	0.7	30.4	29.7	–0.7
Percentage within 1000 metres	29.3	29.9	0.6	52.1	50.8	–1.3
Brisbane (around railway stations, busway stations and major bus interchanges)						
Percentage within 500 metres	9.0	9.0	0.0	28.3	28.3	0.0
Percentage within 1000 metres	26.7	26.0	–0.6	50.6	50.3	–0.3
Perth (around railway stations and major bus interchanges)						
Percentage within 800 metres	10.7	10.5	–0.2	31.2	31.4	0.2

Note: Details of methodology provided in individual city reports (BITRE 2010, 2012a, 2013a).

Source: BITRE analysis of ABS Census of Population and Housing place of usual residence and place of work data for 2001 and 2006 and BTS online journey to work tabulations for 2001 and 2006.

The evidence was mixed for Sydney and Perth. From 2001 to 2006, there was an increase in the extent to which Sydney's population was concentrated around railway stations, and a decline in the concentration of employment around railway stations. This reflects the strong job growth occurring in outer suburban industrial areas and non-rail-connected specialised centres, and also the substantial job losses around Inner North rail stations (BITRE 2012a). Perth saw much more modest changes, with a slight tendency for population to become less concentrated around transport nodes, and employment to become more concentrated.

For Brisbane, there was no change in the proportion of population and jobs located within 500m of transport nodes, and a decline in the proportion of population and jobs located within one kilometre of transport nodes. Thus, between 2001 and 2006, residential and job growth did not become more concentrated around Brisbane's public transport nodes.

BITRE's individual city reports used a wider range of evidence to assess progress against this objective, which is summarised in Table 6.8. The evidence for Perth and Brisbane is restricted to the 2001 to 2006 period, while more recent evidence was available for Melbourne (to 2007) and Sydney (to 2010).

Table 6.8 Observed changes with respect to concentrating residential and job growth around public transport

City	Objective	Evidence—post-2001 change
Sydney	Target development around existing and planned transport capacity. Accommodate urban renewal in locations where there is existing transport capacity.	According to the NSW Government's *Metropolitan Development Program,* between 2000–01 and 2009–10, 42 per cent of Sydney's residential development was concentrated near public transit nodes, and there was a net rise in this proportion over the decade. Although recent residential development has been concentrated near Sydney's rail network, economic development and jobs growth have not (see Table 6.7).
Melbourne	Make jobs more accessible by focusing development in areas which have good public transport access. Ensure new residential development is focused in designated Growth Areas that are served by high-capacity public transport.	Significant residential and economic development has occurred in the City of Melbourne LGA, which is very well served by public transport. The residential development and job growth in Melbourne's outer suburbs is less well served, with about half of population and jobs in the selected Growth Areas being more than 500 metres away from a public transport stop with at least half hourly peak services. For new housing in the designated Growth Areas, Goodman et al (2007) reports that the median distance to a train station has been gradually rising and stood at 3.3km in 2007.
Brisbane	Accommodate residential and job growth in areas with access to high-frequency public transport.	From 2001 to 2006, the share of Brisbane's population living within 1km of public transport nodes fell from 26.7 to 26.0 per cent, while the share living within 500m remained unchanged. The proportion of jobs located within 1km of these nodes declined, while the proportion located within 500m remained unchanged (see Table 6.7). Particular station catchments did experience strong population growth (e.g. the CBD-based transport nodes) or strong job growth (e.g. Caboolture, Ipswich).
Perth	Accommodate mixed use and higher density housing development around transport nodes through transit oriented developments	Up to 2006, there was limited achievement of land use change around rail stations in Perth (Curtis 2005, Planning Institute of Australia 2005). Important exceptions include the Subiaco and East Perth transit oriented developments, which have high and growing density, following redevelopment. From 2001 to 2006, population became slightly less concentrated around public transport nodes, while jobs became slightly more concentrated (see Table 6.7).

Notes: For details of each assessment, see individual city reports (BITRE 2010, 2011, 2012a, 2013a),

Sources: BITRE analysis of ABS Census of Population and Housing place of work and place of usual residence data for 2001 and 2006 and BTS online journey to work tabulations for 2001 and 2006, as well as NSW Government (2010), NSW Department of Planning (2010), NSW Department of Planning and Infrastructure (2011a), Victorian Department of Infrastructure (2002), Goodman et al (2007), Queensland Government and COMSEQ (2009), WAPC (2010), Curtis (2005) and Planning Institute of Australia (2005).

The data presented in Table 6.8 provides mixed evidence as to progress for Sydney, Melbourne and Perth. In each case, there is evidence of positive progress with regard to at least one aspect of the objective, and evidence of negative progress with regard to another aspect. For example, in Sydney, there is evidence from multiple sources that residential development has become increasingly concentrated around transit nodes since 2001, but there is also evidence that employment has become less concentrated around railway stations. The available evidence was more clearcut for Brisbane in showing that residential and job growth did not generally become more concentrated around public transport nodes between 2001 and 2006, even though some isolated exceptions were identified.

Overview of progress against strategic planning goals

Table 6.9 summarises BITRE's assessment of recent changes with regard to the capital city strategic planning goals that relate to transport use. There has been generally positive progress in achieving greater use of both public transport and active transport since 2001. There was significant progress towards achieving greater public transport use in Melbourne and Perth, but rather limited progress for Sydney. All four cities achieved some positive progress towards greater active transport use between 2001 and 2011. However, no general trend could be identified as to whether residential and job growth was being concentrated around public transport nodes in each city (see Table 6.7).

Table 6.9 Observed changes since 2001 with respect to strategic planning goals that relate to transport use

Strategic planning goal	Time period to which evidence relates	Extent of progress			
		Sydney	Melbourne	Brisbane	Perth
Greater use of public transport	2001 to 2011	Limited	Good	Some	Good
Greater use of active transport (walking and cycling)	2001 to 2011	Some	Some	Some	Some
Concentrating residential development and job growth around public transport nodes	2001 to 2006	Mixed^	Mixed#	Isolated	Mixed

Note: The overall assessment in Table 6.9 for the public transport objective for Sydney differs from that in BITRE (2012a), which did not reflect 2011 census data. For Sydney, Melbourne and Perth, the assessment of whether development was concentrated around public transport nodes was revised from 'some' (in BITRE 2010, 2011, 2012a) to 'mixed' to better reflect the varied evidence.

^ For Sydney, evidence relates to the 2001 to 2010 period.

For Melbourne, evidence relates to the 2001 to 2007 period.

Source: BITRE analysis—details of assessment and sources provided earlier in this chapter and in individual city reports (BITRE 2010, 2011, 2012a, 2013a).

CHAPTER 7

Commuting patterns

Key points

- In 2006, there were significant long distance commuting flows from Gold Coast to Brisbane (22 491 persons), from Illawarra to Sydney (19 696 persons) and from Brisbane to Gold Coast (12 582 persons).
- In 2006, 36–45 per cent of commuting flows within each of the four capital city Statistical Divisions (SDs) occurred in an inward direction and 6–10 per cent in an outward direction. The remaining 46–55 per cent of flows occurred within the home ring, and typically within the home subregion.
- From 6–11 per cent of Outer sector residents in each city commuted to a Central Business District (CBD) workplace in 2006, compared to 15–21 per cent of Middle sector residents and 25–42 per cent of Inner sector residents.
- Average commuting distances were similar for residents of Sydney, Melbourne and Brisbane, and a little lower for Perth. Average straight line commuting distances were lowest for Inner sector residents (5–7km), higher for Middle sector residents (8–10km), and highest for Outer sector residents (13–15km).
- In 2006, Sydney full-time workers took 37 minutes on average to commute to work, compared to 33 minutes for Melbourne and Brisbane, and 28 minutes for Perth. Average commuting times tend to be 4–7 minutes longer for Outer sector residents compared to Inner sector residents.
- Between 2001 and 2006, inward flows had a below-average rate of growth in all four cities, so the proportion of inward commutes declined (by 0.7–1.1 percentage points). In Sydney, Melbourne and Brisbane, outward flows grew most rapidly, while cross-suburban commutes grew most rapidly in Perth.
- The largest increases in commuter flows from 2001 to 2006 were flows *within* outer suburban subregions—such as the 21 230 extra people who commuted within Melbourne's Outer Southern subregion. The largest increases between different subregions were typically inward flows, such as the extra 6800 commuters from Middle Perth to Inner Perth. Despite this, there was a small decline in the probability that an employed resident of each city would commute to an Inner sector workplace (of 0.5–1.8 percentage points).
- Since 2001, the observed changes in commuting times and distances have generally not been in the desired direction, particularly with respect to average commuting times, which increased in all four cities. Between 2001 and 2006, Sydney and Brisbane recorded a mix of increases and decreases in self-containment rates across the targeted subregions.

Background

A 'commuting flow' refers to the number of people who travel from a particular place of residence to a particular place of work. This chapter on commuting flows thereby connects the residential location analysis of Chapter 4 with the job location analysis of Chapter 5. The aims of the chapter are three-fold:

- to identify the main commuting flows within the Sydney, Melbourne, Brisbane and Perth Statistical Divisions (SDs) in 2006, and the main changes between 2001 and 2006
- to summarise spatial differences in average commuting distances and times in 2006 and the trends since 2001
- to assess progress towards those strategic planning goals that relate to commuting flows, commuting distances and commuting times.

This chapter presents an overview of the main findings—more detailed results are available from the four individual city reports (BITRE 2013a, 2012a, 2011, 2010). The primary source of data on commuting flows is the origin-destination journey to work matrices that are constructed from the 2001 and 2006 ABS *Census of Population and Housing* data. These matrices compare a commuter's place of usual residence to their place of work. A range of other data sources have also been used to shed light on commuting distances and times (e.g. NSW Bureau of Transport Statistics' (BTS) *Household Travel Survey;* South East Queensland (SEQ) *Household Travel Survey* customised data provided by Queensland Department of Transport and Main Roads (DTMR); Victorian Department of Transport VISTA survey data; HILDA customised data, provided by the National Centre for Social and Economic Modelling (NATSEM)).

Urban commuting patterns in 2006

Long distance commutes

Table 7.1 shows the number of long distance commuters to and from the capital cities of Sydney, Melbourne, Brisbane and Perth in 2006. For Sydney, Melbourne and Brisbane, the inward commuting flows to the capital city SDs tend to be larger in magnitude than the outward flows from the capital city SDs. However, outward commuting flows are quite significant for Perth, reflecting the important role played by the mining industry and the use of fly-in fly-out practices.

The greatest inward flows were from Gold Coast to Brisbane (22 491 persons) and from Illawarra (which includes Wollongong) to Sydney (19 696 persons). Other significant inward flows were from Barwon to Melbourne (11 244 persons), Loddon to Melbourne (9 288 persons) and Hunter to Sydney (8 765 persons).[34]

The greatest outward commuting flow was from Brisbane to the Gold Coast (12 582 persons). This was followed by commuting flows from Sydney to Hunter (5 279 persons), Perth to South West Western Australia (around 4 495 persons), Perth to the Pilbara (4 339 persons) and Sydney to Illawarra (4 063 persons).

34 Barwon SD includes Geelong. Loddon SD includes Bendigo. Hunter SD includes Newcastle.

Table 7.1 Inward and outward long distance commuters to/from Sydney, Melbourne, Brisbane and Perth Statistical Divisions, 2006

Inward flow to capital city			Outward flow from capital city		
Statistical Division		Number of commuters	Statistical Division		Number of commuters
Sydney	Illawarra – NSW	19 696	Sydney	Hunter – NSW	5 279
	Hunter – NSW	8 765		Illawarra – NSW	4 063
	Melbourne – VIC	2 134		Melbourne – VIC	1 793
	Central West – NSW	1 382		Central West – NSW	1 131
	Brisbane – QLD	1 293		Canberra – ACT	1 016
Melbourne	Barwon – VIC	11 244	Melbourne	Barwon – VIC	3 147
	Loddon – VIC	9 228		Gippsland – VIC	2 191
	Goulburn – VIC	7 454		Sydney – NSW	2 134
	Central Highlands – VIC	6 608		Loddon – VIC	1 674
	Gippsland – VIC	4 900		Goulburn – VIC	1 671
Brisbane	Gold Coast – QLD	22 491	Brisbane	Gold Coast – QLD	12 582
	Sunshine Coast – QLD	6 664		West Moreton – QLD	2 392
	West Moreton – QLD	6 281		Sunshine Coast – QLD	2 132
	Darling Downs – QLD	1 022		Sydney – NSW	1 293
	Sydney – NSW	754		Darling Downs – QLD	918
Perth	South West – WA	5 517	Perth	South West – WA	4 495
	Midlands – WA	2 371		Pilbara – WA	4 339
	Melbourne – VIC	380		South East – WA	3 287
	Sydney – NSW	331		Central – WA	2 056
	South East – WA	312		Midlands – WA	1 865

Note: Based on flows between 2006 Statistical Divisions. Excludes unidentified locations.

Source: BITRE analysis of ABS Census of Population and Housing 2006 data, extracted from TableBuilder.

Different types of commuter flow

BITRE has categorised the commuting flows that occur within each capital city SD into five flow types, based on whether the flow occurs either within a 'ring'[35] or across rings. If the flow involves travel across rings, it is classified as occurring in either an inward direction (e.g. Outer to Middle) or an outward direction (e.g. Middle to Outer), with the City Inner[36] Statistical Local Area (SLA) used as the central point of reference for determining the direction of flow. Commuting flows that take place within the boundaries of one of the rings are treated as ambiguous in direction and allocated to one of the following categories of commuter flow:

- within the home SLA

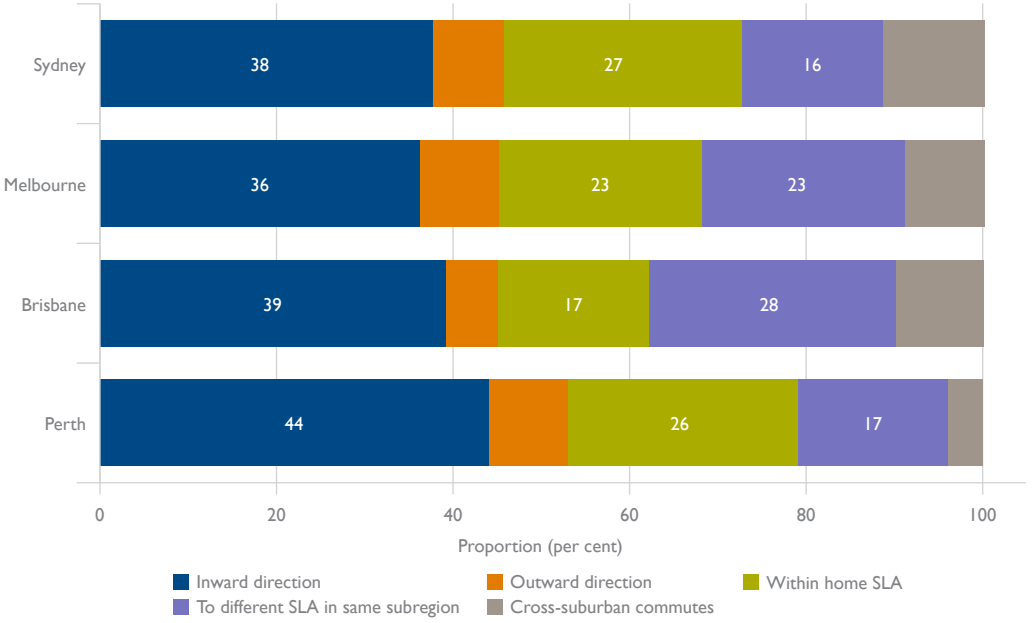
35 The geographic entities referred to as rings are the same as the sectors displayed in Map 1.2, except that the Inner sector has been split into three rings—the City Inner SLA, the rest of the Central Business District (CBD), and the Rest of the Inner sector. Throughout this report, the CBD is defined as the central LGA for Sydney, Melbourne and Perth, and as the combination of the City Inner and City Remainder SLAs for Brisbane.

36 More specifically, the central point of reference is the Sydney Inner SLA for Sydney, the Melbourne Inner SLA for Melbourne, the City Inner SLA for Brisbane and the Perth Inner SLA for Perth.

- to a different SLA within the home subregion[37] and ring
- to a different subregion within the home ring (referred to as 'cross suburban commutes').

The proportion of commuting flows in each flow type category differs between the SDs of Sydney, Melbourne, Brisbane and Perth, as shown in Figure 7.1. Inward commuting flows represent 44 per cent of all commutes in Perth, 39 per cent in Brisbane, 38 per cent in Sydney and 36 per cent in Melbourne. The inward flows category includes commutes to a workplace in the CBD (e.g. from Randwick to the Sydney CBD) and other journeys to work that operate in an inward direction (e.g. from Gosnells in Perth's Outer South East subregion to Canning in the Middle subregion). Outward commuting flows are much less significant, accounting for 9 per cent of all flows in Melbourne and Perth, 8 per cent in Sydney and 6 per cent in Brisbane.

Figure 7.1 Commuting flows within Sydney, Melbourne, Brisbane and Perth Statistical Divisions by type of flow, 2006



Note: Based on commutes that have an origin and destination within SD. Inward commutes include commutes to workplaces in the CBD from elsewhere in SD, from Outer sector residences to Middle or Inner workplaces and from Middle sector residences to Inner workplaces. The opposing flows are categorised as outward commutes (e.g. from Middle to Outer). Cross-suburban commutes involve travel to a different subregion in the home ring (e.g. from Melbourne's Outer North to its Outer West). Appendix A provides details of subregion boundaries.

Source: BITRE analysis of ABS *Census of Population and Housing 2006* (unpublished data).

The majority of the commuting flows (54–55 per cent) within Sydney, Melbourne and Brisbane are ambiguous in direction (i.e. the majority of flows occur within a ring). For Perth, 47 per cent of commutes occur within a ring.

37 Appendix A maps the subregions for each city.

Between 42 and 46 per cent of commutes in each city involved a place of work in the home subregion (either in the home SLA or in a different SLA within the same subregion and ring). The proportion of home SLA commutes was highest in Sydney (27 per cent), followed by Perth (26 per cent) and Melbourne (23 per cent), and lowest in Brisbane (17 per cent). In contrast, Brisbane had the highest proportion of people who commuted to a different SLA within the home subregion (28 per cent).[38]

Cross-suburban commuting flows accounted for 12 per cent of all commutes in Sydney, compared to 10 per cent for Brisbane, 9 per cent for Melbourne and 4 per cent for Perth.[39]

Sector and subregion flows

Table 7.2 presents commuter flows between the broadly defined sectors (i.e. Inner, Middle and Outer) of the Sydney, Melbourne, Brisbane and Perth SDs for 2006. Within-sector commuting flows tend to dominate for each city. Sydney had the highest proportion of within-sector flows (i.e. sum of all diagonal highlighted proportions) at 63 per cent, while Melbourne had 58 per cent, Brisbane had 56 per cent and Perth had 51 per cent. Commutes within the Outer sector were prominent in all four cities (contributing between 21 and 34 per cent of all commuter flows), while Melbourne and Brisbane also had a high proportion of total commutes occurring within their Middle sector (26 and 31 per cent, respectively).

Inward commuting from the Middle and Outer sectors to a place of work in the Inner sector accounted for 19 per cent of all Sydney commutes, 22 per cent of Melbourne commutes, 24 per cent of Brisbane commutes and 26 per cent of Perth commutes (see Table 7.2). Inward commutes from the Outer sector to a place of work in the Middle sector represented a further 11–14 per cent of commutes in each of the four cities. In total, these inward cross-sector flows account for 30 per cent of all commutes within Sydney, 34 per cent within Melbourne, 38 per cent within Brisbane and 40 per cent within Perth.[40] Cross-sectoral flows operating in an outward direction contributed between 6 and 10 per cent of total commutes in each city.

38 Home SLA commutes accounted for a much smaller share of total commutes in Brisbane, compared to the other three cities, due to the much greater spatial disaggregation of SLAs within the Brisbane SD. This also contributes to Brisbane's higher proportion categorised as commuting to a different SLA within the home subregion.

39 The comparatively low representation for Perth is influenced by the less spatially disaggregated subregion classification for Perth, and specifically by the lack of disaggregation of Perth's Middle sector into multiple subregions. Appendix A maps subregions for each city.

40 These numbers differ from those in Figure 7.1, which is based on five rings (rather than three sectors). The flow type classification underlying Figure 7.1 classifies a commute to a place of work in the CBD from a place of residence located elsewhere in the Inner sector as an inward commute.

Table 7.2 Summary of commuter flows between sectors of four capital city Statistical Divisions, 2006

City	Sector of residence	Commuter flows to sector of work (per cent) Inner	Middle	Outer	Total
Sydney SD	Inner	15.8	2.8	0.8	19.4
	Middle	10.0	13.7	3.3	27.0
	Outer	8.9	11.4	33.4	53.6
	Sydney SD total	34.7	27.8	37.5	100.0
Melbourne SD	Inner	6.7	1.9	0.5	9.0
	Middle	16.1	26.5	6.4	49.0
	Outer	5.8	11.7	24.5	42.0
	Melbourne SD total	28.6	40.0	31.4	100.0
Brisbane SD	Inner	3.9	1.5	0.2	5.6
	Middle	17.5	30.6	4.4	52.5
	Outer	6.2	13.9	21.8	41.9
	Brisbane SD total	27.6	46.0	26.5	100.0
Perth SD	Inner	11.8	3.0	1.4	16.2
	Middle	13.1	14.1	4.6	31.8
	Outer	13.1	13.4	25.5	52.0
	Perth SD total	38.1	30.5	31.5	100.0

Note: Based on those with a known place of residence within capital city SD and a known fixed place of work within capital city SD.

Source: BITRE analysis of ABS *Census of Population and Housing 2006* (unpublished data).

Table 7.3 provides more detail about inward commuting flows by showing the proportion of employed residents of each sector who commute to work in the CBD of each of the four cities. Commuting to work in the CBD is much more common for inner suburban residents than it is for middle or outer suburban residents. From 6 to 11 per cent of Outer sector residents commute to a workplace in the CBD, compared to 15 to 21 per cent of Middle sector residents and between 25 and 42 per cent of Inner sector residents.

Table 7.3 Proportion of employed residents of each sector who work in Central Business District of each city, 2006

Proportion of employed residents of sector who work in the CBD (per cent)	Sydney	Melbourne	Brisbane	Perth
Inner sector	41	41	27	26
Middle sector	21	20	15	18
Outer sector	9	8	6	11

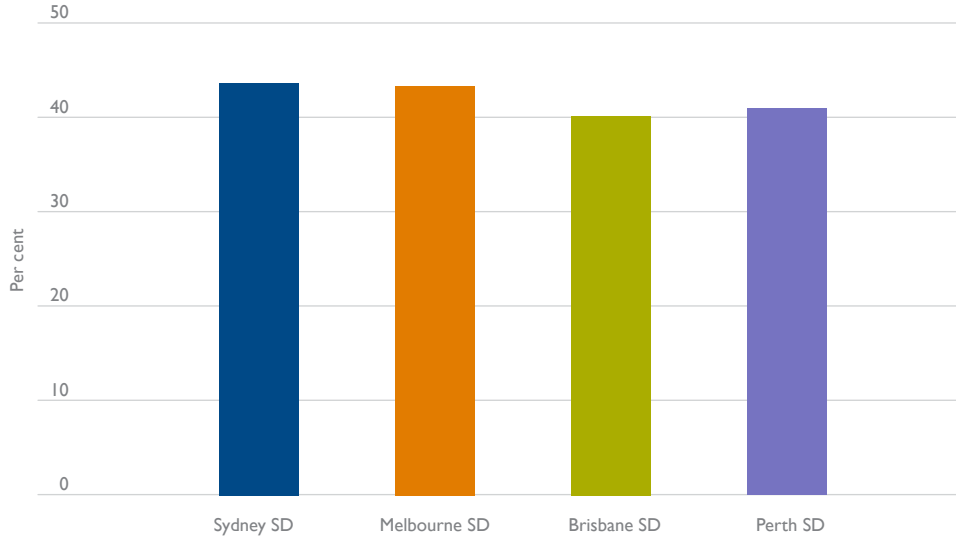
Note: CBD defined as central Local Government Area (LGA) for Sydney, Melbourne and Perth, and as combination of City Inner and City Remainder SLAs for Brisbane.

Source: BITRE analysis of ABS *Census of Population and Housing 2006* (unpublished data).

Figure 7.2 shows the subregional self-containment rate[41] in each city. In 2006, 44 per cent of employed residents of Sydney worked in their home subregion, while the corresponding self-containment rates for Melbourne, Brisbane and Perth were 43 per cent, 40 per cent and 41 per cent, respectively.

The innermost subregions have some of the highest self-containment rates—including Inner Melbourne (68 per cent), Inner Perth (65 per cent), Inner Brisbane (62 per cent) and City of Sydney (60 per cent). The Central Coast subregion, to the north of Sydney, is also highly self-contained, with 65 per cent of employed residents working within the home subregion. Subregions with particularly low rates of self-containment include Sydney's Inner West (25 per cent), Perth's South East (29 per cent), and Melbourne's Middle North (29 per cent) and Outer West (30 per cent).

Figure 7.2 Self-containment rate at subregion scale by city, 2006



Note: The self-containment rate is calculated as the proportion of employed residents of a subregion who report a fixed place of work in the home subregion.

Source: BITRE analysis of ABS *Census of Population and Housing 2006* (unpublished data).

Table 7.4 lists the most common origin-destination flows of commuters at the subregion scale for each city. The largest volume flow in each city is a same-subregion flow, such as the 156 907 residents of Melbourne's Outer South who commuted to a place of work in Melbourne's Outer South, or the 117 718 residents of Sydney's North West who commuted to a place of work within the North West subregion. All of the listed high volume flows between different subregions are inward commutes, such as the 79 987 people who commuted from Perth's Middle subregion to its Inner subregion, and the 75 727 people who commuted from Melbourne's Middle East subregion to its Inner subregion. While the highest volume flows between different subregions typically involve a place of work in the inner city, Table 7.4 also features some inward commutes to a place of work in the Middle sector (e.g. 32 404 persons commuted from Outer North Brisbane to Middle North Brisbane).

41 The self-containment rate measures the proportion of employed residents who work in the home area (e.g. the home SLA or planning subregion).

Table 7.4 Origin-destination pairs with most common commuter flows at subregion scale, by city, 2006

	Same subregion flows			Different subregion flows		
Statistical Division	Origin subregion	Destination subregion	Number of people	Origin subregion	Destination subregion	Number of people
Sydney	North West	North West	117 718	South	City of Sydney	66 019
	South	South	110 756	East	City of Sydney	46 933
	West Central	West Central	108 897	Inner North	City of Sydney	40 687
Melbourne	Outer South	Outer South	156 907	Middle East	Inner	75 727
	Middle East	Middle East	107 575	Middle North	Inner	56 564
	Inner	Inner	100 491	Middle South	Inner	55 284
Brisbane	Outer North	Outer North	64 214	Middle North	Inner	48 779
	Middle North	Middle North	63 067	Outer North	Middle North	32 404
	Middle South	Middle South	38 397	Middle South	Inner	29 828
Perth	Middle	Middle	85 483	Middle	Inner	79 987
	Inner	Inner	71 862	North West	Inner	32 263
	North West	North West	44 200	North West	Middle	27 243

Note: Those who work in an undefined part of each Statistical Division are excluded from the analysis.

Source: BITRE analysis of ABS *Census of Population and Housing 2006* (unpublished data).

Flows within and between Statistical Local Areas (SLAs)

At the SLA scale, the origin-destination pairs with the largest number of commuters were same-SLA flows. All of the top ten largest volume origin-destination flows in Sydney and Melbourne were same-SLA flows, as were the top eight flows in Perth and the top four flows in Brisbane. In 2006, the single largest commuting flow in each city was:

- Sydney—27 314 employed residents of Warringah commuted to a place of work in the Warringah SLA in Sydney's North East subregion
- Melbourne—12 963 employed residents of Kingston North commuted to a place of work in the Kingston North SLA in Melbourne's Middle South subregion
- Brisbane—15 412 employed residents of Ipswich Central commuted to a place of work in the Ipswich Central SLA in Brisbane's Outer West
- Perth—14 194 persons employed residents of Rockingham commuted to a place of work in the Rockingham SLA in Perth's (Outer) South West subregion.

Each of these SLAs contain a substantial residential and employment base, with at least 30 000 employed residents and 19 000 jobs in 2006. Ipswich Central has high self-containment, with around half of all employed residents working in the local area. The remaining SLAs also have higher than average self-containment rates[42] of between 30 and 40 per cent.

Maps 7.1, 7.2, 7.3 and 7.4 illustrate the main commuting flows between different SLAs of residence and work in the Sydney, Melbourne, Brisbane and Perth SDs in 2006. For each city, most of the mapped origin-destination flows operate in an inward direction, typically to a place

42 SLA-based self-containment rates range from a low of 15 per cent for the Brisbane SD to a high of 24 per cent for the Sydney SD—much lower than the subregion self-containment rates in Figure 7.2.

of work in the CBD. Commutes between neighbouring SLAs in the middle and outer suburbs also feature for each city.

In Sydney, 20 of the 33 inter-SLA flows involving more than 4000 commuters were inward flows to a place of work in the Sydney Inner SLA (Map 7.1). The greatest commuting flows to the Sydney Inner SLA were from Randwick (10 959 persons), North Sydney (10 355 persons), Ku-ring-gai (8331 persons) and Sydney East (8287 persons). Other relatively large flows include the 7784 persons who commuted from Sutherland Shire West to Sutherland Shire East and the 7189 persons who commuted from Gosford East to Gosford West.

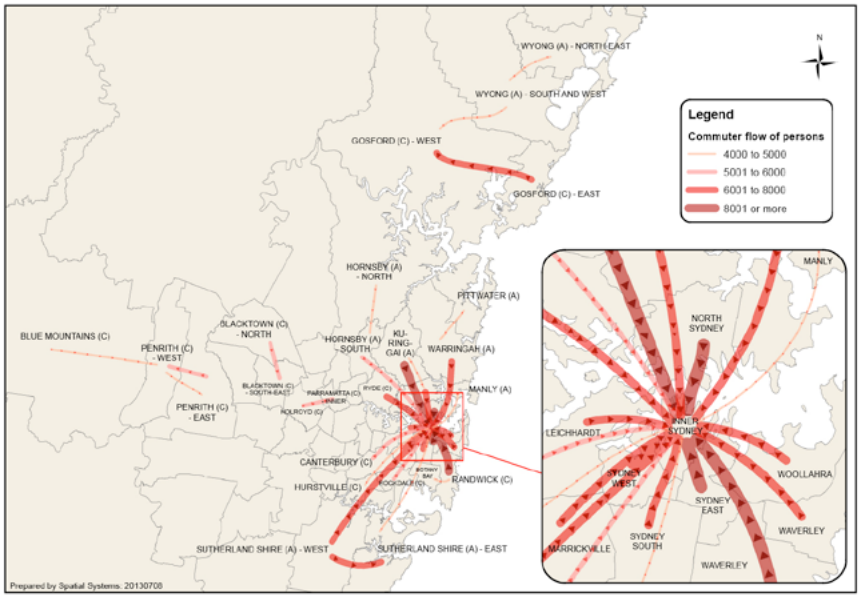
In Melbourne, 20 of the 34 inter-SLA flows that involved more than 3000 commuters were inward flows to a place of work in the CBD (Map 7.2). The largest commuter flows were to the Melbourne Inner SLA from Melbourne Remainder (5534 persons), Yarra North (5025 persons) and Prahran (5016 persons). Other relatively large flows include commutes from Craigieburn to Broadmeadows (4594 persons), from Kingston South to Kingston North (4457 persons), and from Frankston East to Frankston West (4302 persons). While the flows into the CBD are the dominant feature of Map 7.2, the map also identifies several suburban job hubs, which attract more than 3000 commuters from multiple locations (e.g. Kingston North, Dandenong).

Map 7.3 for Brisbane differs from the preceding two maps in that it features two principal commuting focal points—the CBD and Ipswich.[43] The two largest volume inter-SLA commuting flows are from Ipswich East to Ipswich Central (2228 persons) and the reverse flow from Ipswich Central to Ipswich East (2031 persons). Other prominent flows include commutes from Ipswich East to Wacol (1446 persons), Ipswich North to Ipswich Central (1345 persons), and from Toowong to the City Inner SLA (1279 persons). Map 7.3 also identifies additional employment hubs in Brisbane's North that attract significant commuter flows from multiple locations (i.e. Caboolture Central, Strathpine-Brendale).

Most of the inter-SLA flows in Perth involving more than 2500 persons operate in an inward direction (Map 7.4). The largest inter-SLA flow was from the Outer sector SLA of Gosnells to the Middle sector SLA of Canning, involving 8496 persons. Other prominent flows include commutes from Joondalup South to Stirling Central (5665 persons), from Joondalup South to Perth Inner (5069 persons), and from Stirling Central to Perth Inner (4656 persons). While the flows into the CBD are a prominent feature of Map 7.4, the map also identifies several suburban job hubs, which attract more than 2500 commuters from multiple locations (e.g. Stirling Central, Canning).

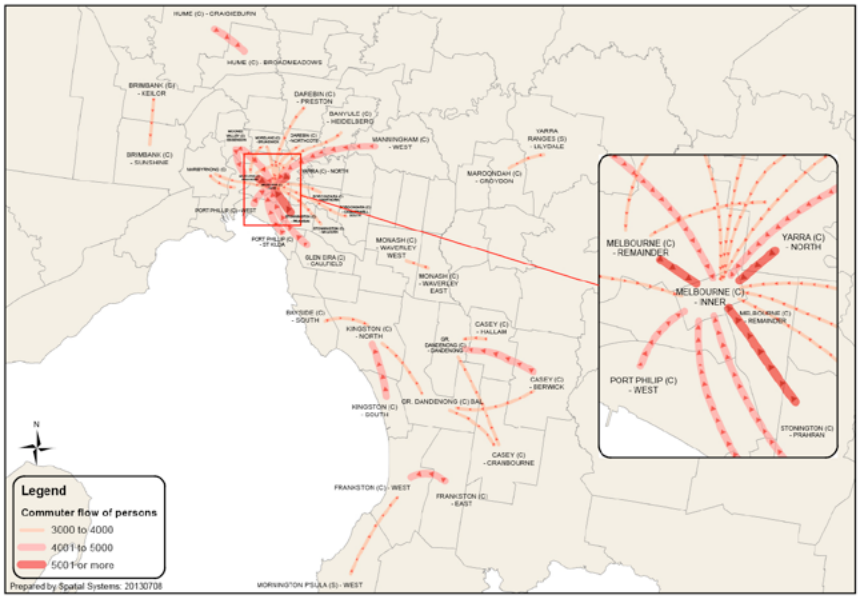
43 The SLAs in the Ipswich LGA are more broadly defined than SLAs in Inner and Middle Brisbane, with Ipswich Central and Ipswich East being the only SLAs in the Brisbane SD with more than 20 000 employed residents. This inconsistency of scale contributes to the relative prominence of Ipswich in Map 7.3.

Map 7.1 Commuting flows between different Statistical Local Areas of residence and work, Sydney, 2006



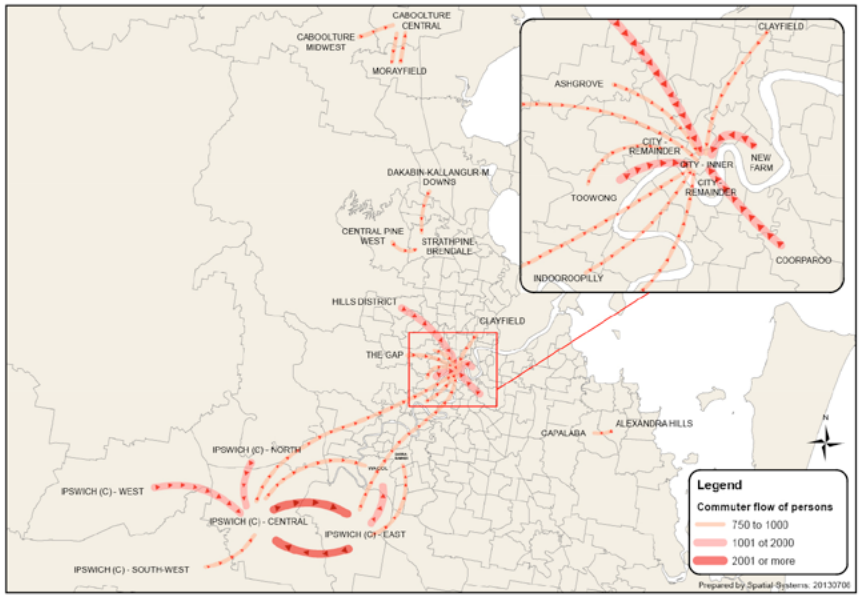
Source: BITRE analysis of ABS *Census of Population and Housing 2006* (unpublished data).

Map 7.2 Commuting flows between different Statistical Local Areas of residence and work, Melbourne, 2006



Source: BITRE analysis of ABS *Census of Population and Housing 2006* (unpublished data).

Map 7.3 Commuting flows between different Statistical Local Areas of residence and work, Brisbane, 2006



Source: BITRE analysis of *Census of Population and Housing 2006* (unpublished data).

Map 7.4 Commuting flows between different Statistical Local Areas of residence and work, Perth, 2006

Source: BITRE analysis of ABS *Census of Population and Housing 2006* (unpublished data).

Commuting distances and times

This section examines the geographic patterns of average commuting distances and average commuting times for the Sydney, Melbourne, Brisbane and Perth SDs. The analysis focuses on data sources that provide a comparable estimate across the different cities. The individual city reports present additional information on commuting distances and times, drawn from state-specific data sources (BITRE 2010, 2011, 2012a, 2013a).

Cross-city comparisons of commuting distance

Table 7.5 shows the comparison of average commuting distances for Sydney, Melbourne, Brisbane and Perth SDs in 2006. The straight line distance measure is based on the population-weighted centroid of the origin SLA and the job-weighted centroid of the destination SLA. The road network distance measure is based on road distance data for origin-destination pairs, sourced from state governments. The road network distance estimates are about one-third higher than the straight line distance estimates. Both measures suggest that average commuting distances are very similar for Sydney, Melbourne and Brisbane (and both measures have the same ordering across these cities). Average straight line commuting distances are a little lower in Perth than in the other cities.

Table 7.5 Comparison of average commuting distances for employed residents of Sydney, Melbourne, Brisbane and Perth, 2006

	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
Average road network commuting distance (km)	15.0	14.8	14.9	na
Average straight line commuting distance^ (km)	11.4	11.1	11.3	10.7

Notes: Distance measures relate to those with a place of residence in the capital city SD. The Perth report (BITRE 2010) used only the straight line commuting distance measure. For the other three cities, both straight line and road network distance measures were constructed. For Perth and Melbourne, those who work outside the BITRE working zone are excluded, for Sydney those who work outside the Greater Metropolitan Area (GMA) are excluded, and for Brisbane those who work outside SEQ are excluded.

^ The straight line distance measure was based on the population-weighted centroid of the origin SLA and the job-weighted centroid of the destination SLA.

na = not available

Sources: BITRE analysis of ABS Census of Population and Housing for 2006, NSW BTS Strategic Travel Model distance outputs, ABS-VicRoads road distance data, and Queensland DTMR road network distance dataset.

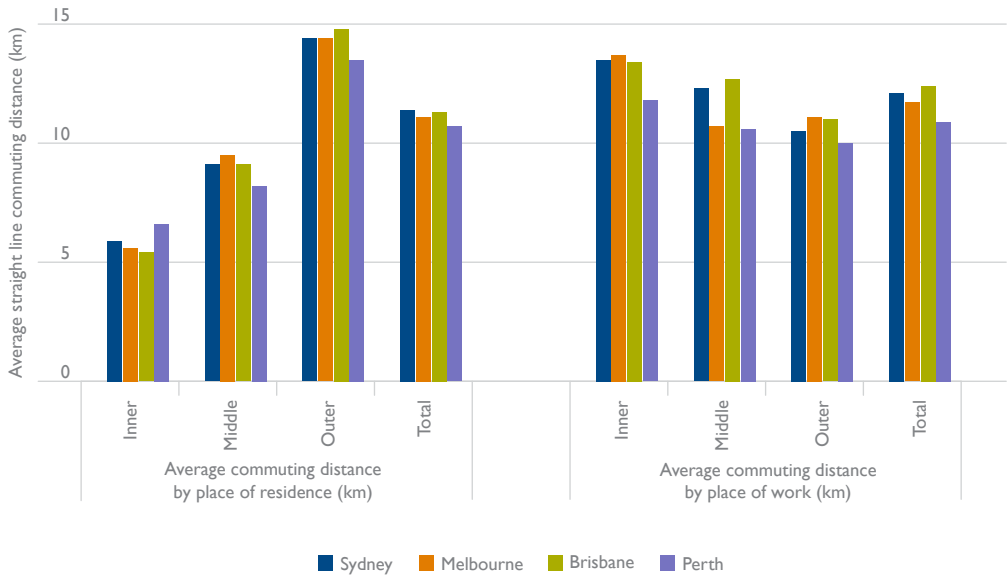
Average commuting distances for those who work in the capital city SD tend to be a little higher than average commuting distances for residents of the SD (see Figure 7.3). The gap is largest for Brisbane (12.4 versus 11.3km), reflecting the significant number of people who commute reasonably long distances to work in the Brisbane SD from surrounding areas, such as the Gold Coast.

Spatial differences in commuting distances

Figure 7.3 shows the average distance of commuter travel within Sydney, Melbourne, Brisbane and Perth SDs in 2006, based on the sector of residence and sector of work. Straight line

distance measures are used, so that Perth can be included in the comparisons.[44] For each of the cities, the average commuting distances by place of residence were lowest for Inner sector residents, somewhat higher for Middle sector residents and higher again for Outer sector residents. Inner sector residents typically commuted 5–7km, compared to 8–10km for Middle sector residents, and 13–15km for Outer sector residents.

Figure 7.3 Average commuting distances by sector for Sydney, Melbourne, Brisbane and Perth Statistical Divisions, 2006



Notes: Based on straight line commuting distance between population-weighted centroid of the origin SLA and the job-weighted centroid of the destination SLA. Place of residence distance measures relate to those with a place of residence in the relevant sector or capital city SD, while place of work distance measures relate to those with a place of work in the relevant sector or capital city SD. Only commutes within the Sydney GMA, Melbourne working zone, SEQ and Perth working zone contribute to distance measures. Map 1.2 shows sectoral boundaries.

Source: BITRE analysis of ABS *Census of Population and Housing* for 2006.

The sectoral differences were less pronounced on a place of work basis, although the average commuting distance was highest for Inner sector workers in all four cities because the large number of CBD jobs—and the specialised and high-income nature of many of those jobs—attract workers from more distant areas.

Map 7.5 shows how average commuting distance varies by SLA of residence for Sydney, Melbourne, Brisbane and Perth SDs in 2006. Straight line distance measures are used for comparison purposes.[45] Map 7.5 shows a systematic pattern of layered rings in each city—residents of the CBD commute the least average distance to work, followed by residents of other Inner sector SLAs, then the Middle sector SLAs, with residents of the Outer sector SLAs tending to have the highest commuting distances.

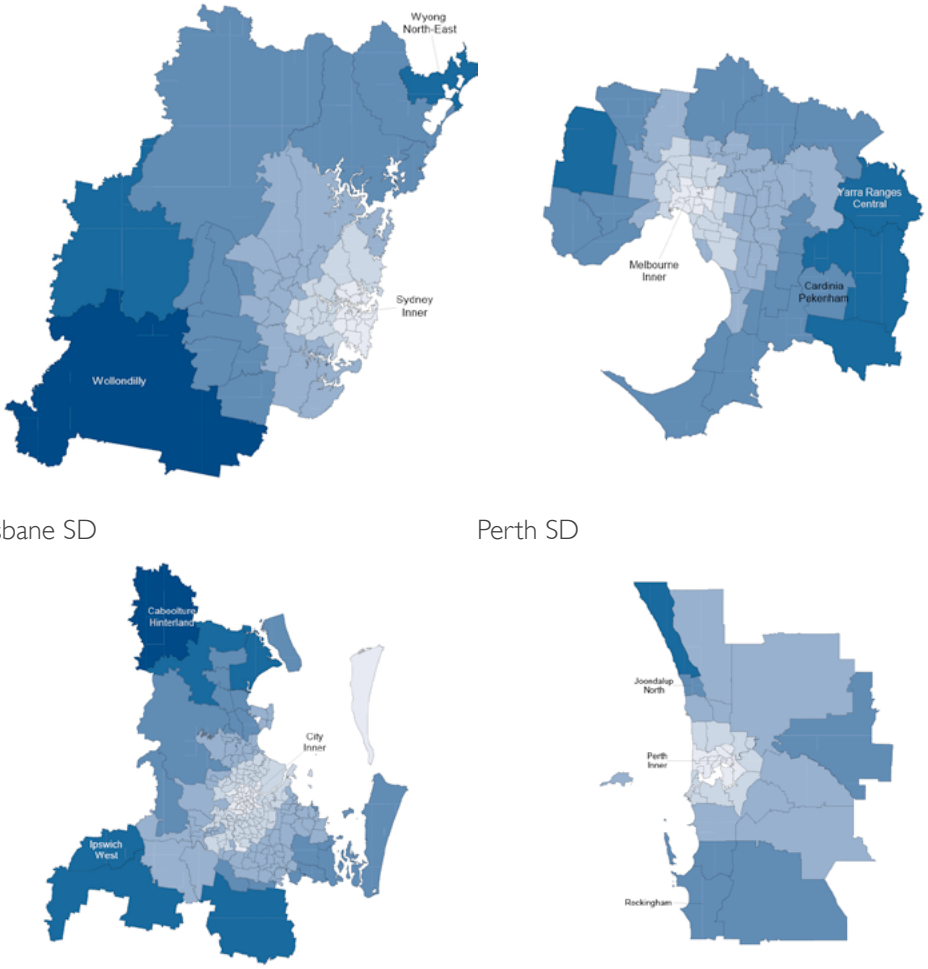
44 The overall spatial patterns (e.g. the tendency for average commuting distance to be lowest for Inner sector residents and highest for Outer sector residents) remain very similar for Sydney, Melbourne and Brisbane, irrespective of whether a road network or straight line distance measure is used.

45 The individual city reports for Sydney, Melbourne and SEQ present equivalent maps based on the road network distance measure (BITRE 2012a, 2011, 2013a), which display the same basic pattern.

Map 7.5 Average commuting distances by Statistical Local Area of residence, Sydney, Melbourne, Brisbane and Perth Statistical Divisions, 2006

Sydney SD

Melbourne SD



Notes: Based on straight line commuting distance between population-weighted centroid of the origin SLA and the job-weighted centroid of the destination SLA. Only those with a place of work in the Sydney GMA, Melbourne working zone, SEQ and Perth working zone contribute to distance measures. All maps are presented using a common scale.

Source: BITRE analysis of ABS Census of Population and Housing for 2006.

Cross-city comparisons of commuting times and speeds

The aim of this section is to discuss travel time involved in commuting to work in Sydney, Melbourne, Brisbane and Perth, with some emphasis on its spatial variability. Table 7.6 presents some summary measures of average commuting times, average peak period road travel speeds and peak period traffic delays.

The HILDA survey estimates that employed residents of Sydney took 37 minutes on average for the journey to work in 2006. This was longer than the average time taken by Melbourne and Brisbane residents (33 minutes each), and significantly longer than the average commuting time of Perth residents (28 minutes).[46] These cross-city differences in average commuting time are much more pronounced than the underlying differences in average commuting distance shown in Table 7.5, reflecting differences in average travel speeds across the cities (which in turn reflect differences in mode share and the average speed of each mode). As of 2006–07, the AustRoads indicators show that morning peak road travel speeds averaged 35km/hour in Sydney and Melbourne, 40km/hour in Brisbane and 41km/hour in Perth. Sydney and Melbourne had considerably greater peak period traffic delays than Brisbane and Perth, while Brisbane experienced greater delays than Perth in the morning peak, but similar delays in the afternoon peak.

Table 7.6 Comparison of commuting times, peak period road travel speeds and congestion delays for Sydney, Melbourne, Brisbane and Perth in 2006

Indicator	Sydney	Melbourne	Brisbane	Perth
HILDA average one-way commuting time for full-time workers, 2006 (minutes)	37	33	33	28
Morning peak delay from traffic conditions which do not permit travel at posted speed, 2006–07 (minutes/km)	0.82	0.82	0.70	0.59
Afternoon peak delay from traffic conditions which do not permit travel at posted speed, 2006–07 (minutes/km)	0.64	0.69	0.40	0.41
Morning peak average road travel speed, 2006–07 (km/hour)	35	35	40	41
Afternoon peak average road travel speed, 2006–07 (km/hour)	40	38	47	47

Notes: The HILDA Project was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (MIAESR). The findings and views reported here, however, are those of the authors and should not be attributed to either FaHCSIA or the MIAESR.

Sources: BITRE analysis of HILDA customised data, provided by National Centre for Social and Economic Modelling (NATSEM,) and AustRoads (2013).

Spatial differences in commuting times

Table 7.7 presents information from state government travel surveys on how average commuting times vary within Sydney, Melbourne and Brisbane. While Outer sector residents have the highest average commuting time and Inner sector residents have the lowest average commuting time, the gap in commuting times across the sectors is reasonably modest. Outer

46 Productivity Commission (2011) presents estimates of the median commuting time in peak hour for each city in 2010, which show a similar pattern of spatial variation, despite the medians being systematically lower than the HILDA averages. The median peak hour commuting time was 35 minutes for the Sydney SD, 30 minutes for the Melbourne SD and the 'Brisbane total' region (which extends beyond the Brisbane SD, to include the Scenic Rim, Somerset and Lockyer Valley LGAs), and 25 minutes for the Perth and Peel region.

sector residents spend an average of 4 minutes more than Inner sector residents in Sydney, 6 minutes more in Melbourne and 7 minutes more in Brisbane.

The average commuting distance travelled by Outer sector residents was more than double that of Inner sector residents in all four cities (see Figure 7.3). These longer trip distances do not fully translate into longer trip durations for Outer sector residents, due to the greater speed of travel. For example, average commuting trip speeds are 38km/hour for Outer Melbourne residents, compared to just 17km/hour for Inner Melbourne residents (BITRE 2011). The lower trip speeds for Inner sector residents are likely to reflect higher levels of traffic congestion and differences in mode choice.

Table 7.7 Comparison of average commuting time by sector of residence for Sydney, Melbourne and Brisbane

Statistical Division	Source and year	Inner	Middle	Outer	Total SD
Sydney^	BTS Household Travel Survey 2007 five year pooled dataset	30	32	35	33
Melbourne#	VISTA-07 data for 2007–08	32	36	38	36
Brisbane~	SEQ Household Travel Survey 2009	28	32	35	33

Notes: Map 1.2 shows sectoral boundaries.

^ Average work trip duration (i.e. commuting trips and other work-related business trips)

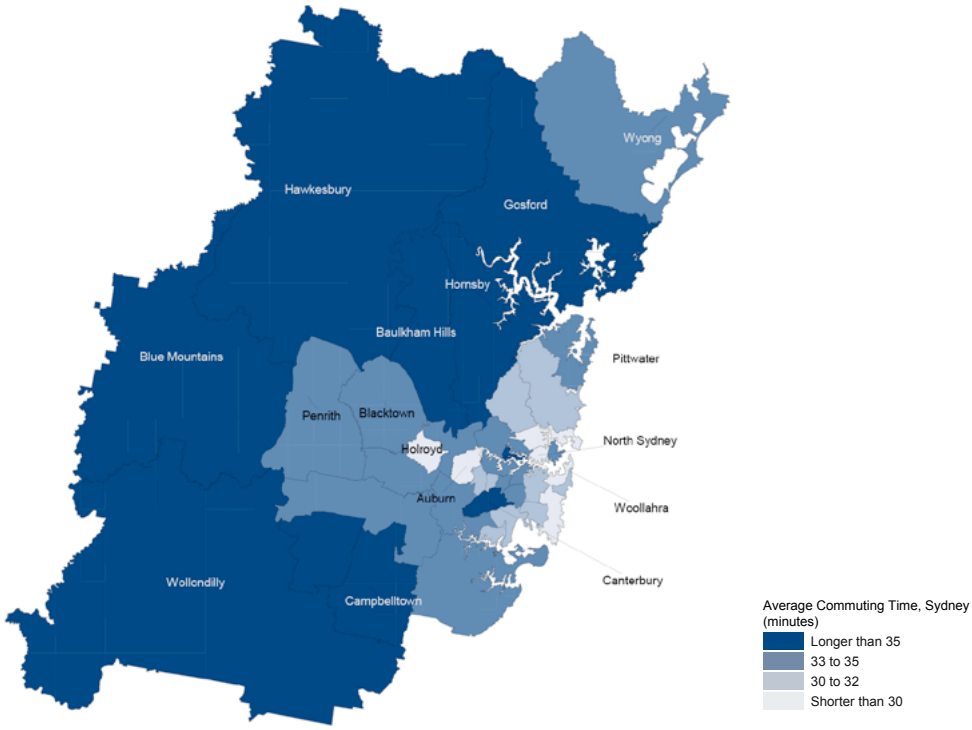
May 2007 to mid-June 2008 survey data expanded to 2006 ABS Census of Population and Housing figures

~ The Brisbane SD estimates were derived by Queensland DTMR Modelling Data and Analysis Centre (MDAC) to include Brisbane, Moreton Bay, Ipswich, Redland and Logan LGAs. Sectoral definitions match those in Map 1.2.

Sources: BITRE analysis of LGA data in TDC (2009), unpublished VISTA-07 data supplied by Victorian Department of Transport, and customised data from SEQ Household Travel Survey 2009 provided by Queensland DTMR MDAC.

Map 7.6 illustrates how the average duration of work trips varies across Sydney's LGAs, based on TDC (2009). For the Sydney SD, the average work trip duration was 33 minutes. Of the 47 LGAs, 33 had average work trip durations of between 30 and 36 minutes. There is a tendency for the outermost LGAs to have the longest trip durations, with Wollondilly, Campbelltown, Camden, Blue Mountains, Hawkesbury and Gosford residents all having durations of 36 minutes or more. However, the spatial pattern for trip duration is much less pronounced than the very systematic pattern of increasing commuting distances as one moves further from the CBD (as shown in Map 7.5). The LGAs with average work trip durations of under 30 minutes are more centrally located, and include Manly, North Sydney, Woollahra, Randwick and Holroyd. The average work trip duration for City of Sydney residents at 30 minutes was only slightly below the city-wide average, reflecting slow door-to-door travel speeds (about 14km/hour, on average).

Map 7.6 Average work trip duration by Local Government Area of residence, Sydney, 2007



Note: Work trips include commutes and other work-related business trips.

Source: BITRE analysis of TDC (2009), which is based on the *Household Travel Survey* 2007 five year pooled dataset.

Changes in commuting patterns, 2001 to 2006

This section describes the main changes in commuting flows between 2001 and 2006. First changes in long distance commuting are discussed, followed by an investigation of the changes occurring in commuter flows within capital city SDs at the subregion and SLA scales.

The analysis is based on comparing the origin-destination commuter flow matrices from the ABS *Census of Population and Housing* for 2001 and 2006. The ABS' 2001 commuting matrix is subject to some coding problems, as outlined in BITRE (2010, p.75). These quality concerns have constrained our analysis of changes in long distance commutes and required BITRE to adapt its analysis of commuting flows within the Sydney, Brisbane and Perth SDs, using the methods described in the individual city reports (BITRE 2012a, 2013a, 2010).[47]

47 BITRE sourced adjusted Sydney commuting flow matrices from the BTS' online JTW tables and used the corrected 2001 matrix supplied by the WA Government for Perth. For Brisbane, the coding issues were dealt with through the formation of aggregate SLA regions in known problem areas, such as Mount Gravatt. Coding issues were less pronounced for Melbourne, so the original ABS 2001 commuting matrix was used as the basis of the change comparisons.

Changes in long-distance commutes

Between 2001 and 2006, BITRE (2012a) identified the following key changes in long distance commuting flows to and from the Sydney SD:

- There was an increase of 856 Sydney residents commuting to a workplace in Lower Hunter. This was driven by Central Coast residents increasingly commuting to a place of work in the Lower Hunter.
- There were also 585 extra Sydney residents who commuted to a workplace in the Illawarra, mainly from the South West and South subregions.
- There were 540 additional Lower Hunter residents who commuted to a place of work in Sydney, reflecting increased commuter flows from the Lower Hunter to the Central Coast.

Long distance commutes both into and out of Melbourne increased between 2001 and 2006 (BITRE 2011). Much of the increase in commuter flows related to Melbourne residents commuting outward, particularly towards Geelong, Sydney and the Latrobe Valley. The largest increase in commuter flows towards Melbourne was the 452 extra residents of Sydney who commuted to a place of work in the Melbourne working zone in 2006, compared to 2001 (ibid).

For long distance commutes to a place of work in the Brisbane SD, there was an increase of 5 218 persons commuting from the Gold Coast between 2001 and 2006, with 1 470 additional persons commuting from the Sunshine Coast and 1087 from West Moreton (BITRE 2013a). The increases in outward commuting from Brisbane were smaller, with 3 530 additional commuters from Brisbane to Gold Coast (ibid).

Commuting flows between the Perth SD and the neighbouring Peel region[48] grew strongly between 2001 and 2006, with roughly 1200 additional commutes in each direction (BITRE 2010). The rapid growth of Western Australia's mining industry and a shift to fly-in fly-out operations has resulted in a marked increase in commuter flows by Perth residents to remote mine site workplaces, such as those in the Pilbara. However, the number of Perth residents commuting to a workplace in Bunbury declined significantly between 2001 and 2006 (ibid).

Growth by type of commuter flow for each city

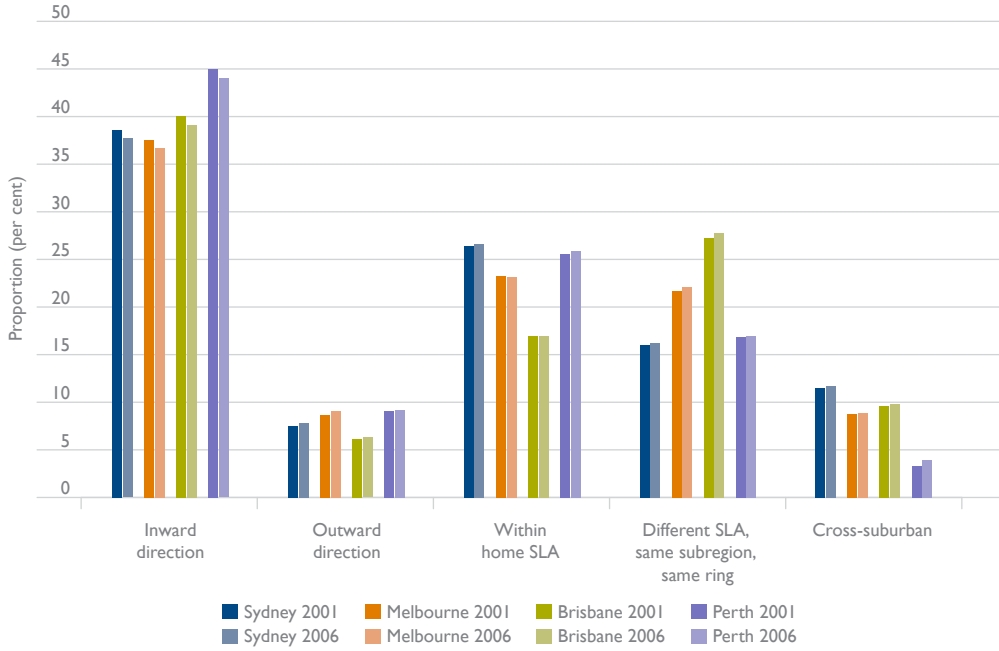
Figure 7.4 focuses on commuting flows within each capital city SD and shows how the relative contribution of each type of commuter flow has changed between 2001 and 2006, using the same flow type classification that underlies Figure 7.1. There have been some notable shifts in the relative importance of the different types of flows across cities:

- The proportion of inward commutes has declined in all cities, by between 0.7 and 1.1 percentage points.
- Cross-suburban commutes and outward commutes recorded a small increase in their share of total flows in all four cities, as did commutes to a different SLA in the home subregion (all increases were 0.6 percentage points or less).
- Changes in the proportion of same-SLA commutes were also small, but mixed in direction.

48 The Waroona SLA was excluded from the analysis in BITRE (2010), so that the Peel region consisted of only the Murray and Mandurah SLAs.

Note that in all four cities, each of the five flow type categories recorded an increase in commuter numbers between 2001 and 2006. The largest increase in commuter numbers occurred for the flows *within* the home SLA in Sydney, while for Melbourne the largest increase occurred for the flows *between* different SLAs in the same subregion. For Perth and Brisbane, inward flows recorded the largest increase in the number of commuters (despite accounting for a declining share of total commutes).

Figure 7.4 Proportion of commuters by type of flow, Sydney, Melbourne, Brisbane and Perth Statistical Divisions, 2001 to 2006

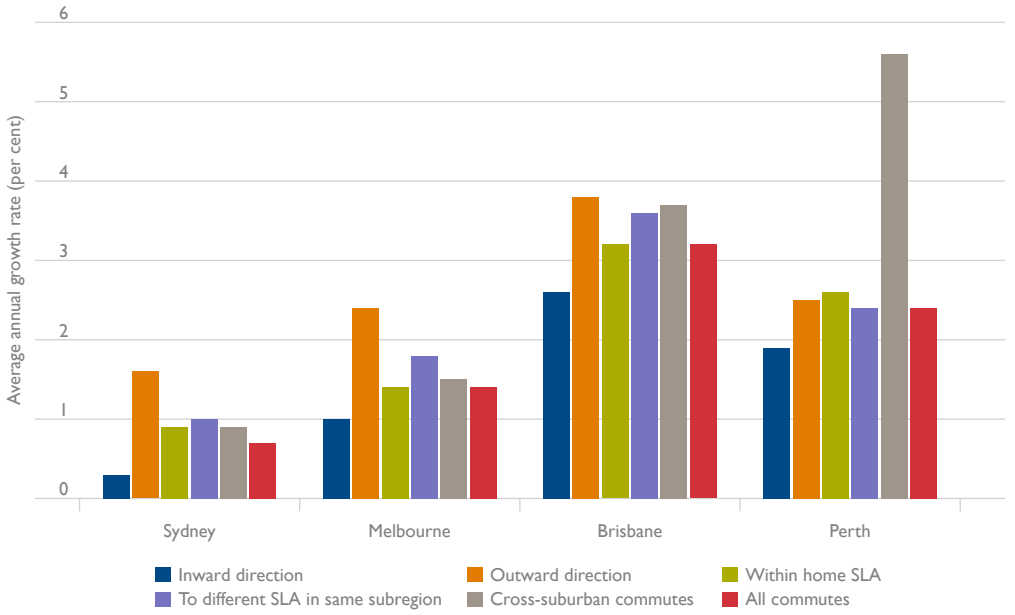


Note: Based on commutes that have an origin and destination within SD. Inward commutes include commutes to workplaces in the CBD from elsewhere in SD, from outer suburban residences to Middle or Inner workplaces and from Middle sector residences to Inner workplaces. The opposing flows are categorised as outward commutes (e.g. from Middle to Outer). Cross-suburban commutes involve travel to a different subregion in the home ring (e.g. from Melbourne's Outer North to its Outer West). Appendix A provides details of subregion boundaries.

Source: BITRE analysis of ABS *Census of Population and Housing* 2006 and 2001 (unpublished data), BTS JTW 2001 (table 2) and 2006 (table 7) data, and corrected 2001 commuting matrix provided by Western Australian Department of Planning and Infrastructure (DPI).

Figure 7.5 compares the average annual growth rate of each flow type for Sydney, Melbourne, Brisbane and Perth between 2001 and 2006. The average annual rate of growth in total commuting flows in Brisbane exceeded growth in the other cities (particularly Sydney). In all of the cities, inward flows experienced the lowest rate of growth of the five flow type categories. In Sydney, Melbourne and Brisbane, outward flows experienced the most rapid rate of growth, while cross-suburban commutes grew most rapidly for Perth.

Figure 7.5 Average annual growth rate of commuters by type of flow for Sydney, Melbourne, Brisbane and Perth Statistical Divisions, 2001 to 2006



Notes: See notes to Figure 7.4.

Sources: BITRE analysis of ABS *Census of Population and Housing* 2006 and 2001 (unpublished data), BTS JTW 2001 (table 2) and 2006 (table 7) data, and corrected 2001 commuting matrix provided by Western Australia DPI.

Changes in commuting within and between subregions

Changes in self-containment rates

Changes in the degree of self-containment of subregions between 2001 and 2006 are shown in Table 7.8. At the SD scale, the changes in subregional self-containment rates were positive for Sydney and Brisbane and negative for Melbourne and Perth. Between 2001 and 2006, the degree of subregional self-containment of commuting flows increased by 0.2 percentage points in Sydney and by 0.6 percentage points in Brisbane. The proportion of Melbourne residents working in their home subregion dropped by 0.2 percentage points, compared to a decline of 1.0 percentage points for Perth.

Between 2001 and 2006, there were large increases in the self-containment of Sydney's Central Coast subregion (2.6 percentage points), the Inner Melbourne subregion (2.5 percentage points) and Brisbane's Middle West subregion (2.1 percentage points). Melbourne's Middle West subregion and Brisbane's Outer West subregion both experienced a 2.1 percentage point decline in the subregional self-containment rate over the period.

Table 7.8 Subregional self-containment rates (per cent) for Sydney, Melbourne, Brisbane and Perth Statistical Divisions, 2001 and 2006

	Sydney				Melbourne		
Subregion	2001	2006	Change	Subregion	2001	2006	Change
City of Sydney	56.4	55.8	–0.6	Inner	65.9	68.3	2.5
East	38.6	38.0	–0.6	Middle East	39.5	39.4	–0.1
Inner North	44.4	43.2	–1.2	Middle North	30.5	29.1	–1.4
Inner West	25.7	25.0	–0.7	Middle South	39.2	38.4	–0.9
South	38.2	37.8	–0.4	Middle West	39.6	37.5	–2.1
North	32.0	32.4	0.4	Outer East	47.5	47.5	0.0
North East	49.8	50.8	1.0	Outer North	37.2	37.5	0.3
West Central	43.7	42.4	–1.3	Outer South	53.8	54.5	0.7
North West	48.6	49.3	0.8	Outer West	30.6	29.8	–0.8
South West	43.9	44.6	0.6				
Central Coast	63.9	66.6	2.6				
Sydney SD	43.7	43.9	0.2	Melbourne SD	43.6	43.4	–0.2
	Brisbane				**Perth**		
Subregion	2001	2006	Change	Subregion	2001	2006	Change
Inner	61.6	62.1	0.5	Inner	66.0	65.4	–0.6
Middle East	31.7	32.4	0.7	Middle	40.7	38.9	–1.8
Middle North	41.5	41.6	0.1	North-West	32.2	33.4	1.2
Middle South	34.9	34.7	–0.3	Eastern	36.2	35.6	–0.5
Middle West	35.4	37.5	2.1	South-East	30.2	29.1	–1.1
Outer East	38.3	40.0	1.6	South-West	44.1	42.5	–1.6
Outer North	41.9	43.1	1.2				
Outer South	34.9	33.9	–0.9				
Outer West	51.3	49.2	–2.1				
Brisbane SD	39.7	40.3	0.6	Perth SD	42.0	41.0	–1.0

Notes: Appendix A provides details of subregion boundaries.

Sources: BITRE analysis of ABS *Census of Population and Housing* 2006 and 2001 (unpublished data), BTS JTW 2001 (table 2) and 2006 (table 7) data, and corrected 2001 commuting matrix provided by Western Australian DPI.

Changes in commuter flows within and between subregions

Table 7.9 lists the top ten changes in commuting flows within and between subregions from 2001 to 2006. The ten largest changes were all same-subregion flows, involving an increase of at least 7000 commuters. Six of the top seven increases were flows *within* an Outer subregion—for example, the largest increase related to commutes within Melbourne's Outer Southern subregion (21 230 persons), while substantial increases were also recorded for commutes within Outer Northern Brisbane (13 880 persons), North West Sydney (12 650 persons) and North West Perth (8800 persons). Between 2001 and 2006, there was also a very substantial increase in the number of persons commuting within Inner Melbourne (12 640 persons), and to a lesser extent within Inner Brisbane, Inner Perth and the City of Sydney (just over 7000 persons each).

With respect to changes in commuting flows between different subregions, all of the largest changes related to commutes in an inward direction, and most involved a place of work in the innermost subregion (i.e. the CBD and its surrounds). An additional 6750 commuters travelled from a place of residence in Perth's Middle subregion to a place of work in its Inner subregion in 2006, compared to 2001. Other large changes in commuting flows between different subregions were:

- an additional 5780 persons commuting from Outer Western Melbourne to Middle West Melbourne
- an additional 5520 persons commuting from Outer Western Melbourne to Inner Melbourne
- an additional 5260 persons commuting from Outer Northern Brisbane to the Middle North of Brisbane.

Table 7.9 Top ten largest changes in commuting flows within and between subregions of Sydney, Melbourne, Brisbane and Perth, 2001 to 2006

Statistical Division	Subregion-origin	Subregion-destination	Change (numbers)
Same Subregion			
Melbourne	Outer South	Outer South	21 230
Brisbane	Outer North	Outer North	13 880
Sydney	North West	North West	12 650
Melbourne	Inner	Inner	12 640
Perth	North West	North West	8 800
Sydney	Central Coast	Central Coast	8 230
Melbourne	Outer West	Outer West	7 710
Brisbane	Inner	Inner	7 220
Perth	Inner	Inner	7 160
Sydney	City of Sydney	City of Sydney	7 050
Different Subregion			
Perth	Middle	Inner	6 750
Melbourne	Outer West	Middle West	5 780
Melbourne	Outer West	Inner	5 520
Brisbane	Outer North	Middle North	5 260
Melbourne	Middle North	Inner	4 120
Brisbane	Middle North	Inner	3 840
Brisbane	Middle South	Inner	3 630
Perth	North West	Inner	3 480
Brisbane	Middle West	Inner	3 390
Sydney	Inner West	City of Sydney	2 840

Notes: Appendix A provides details of subregion boundaries. Commuting numbers have been rounded to nearest 10.

Sources: BITRE analysis of ABS *Census of Population and Housing* 2006 and 2001 unpublished data, BTS JTW 2001 (table 2) and 2006 (table 7) data, and corrected 2001 commuting matrix provided by Western Australian DPI.

The largest changes (as summarised in Table 7.9) all involved increased numbers of commuters. However, there were also subregion pairs which experienced a decline in the number of

commuters from 2001 to 2006. In Sydney, there were notable declines in the number of people commuting within the East subregion (–1330 persons) and from the North East to the Inner North subregion (–1250 persons) (BITRE 2012a). In Melbourne, there were notable declines in the number of people commuting from the Middle East subregion to the Inner subregion (–1650 persons) and from the Outer Eastern subregion to the Inner subregion (–1370 persons) (BITRE 2011). There were no significant declines for subregion pairs in either Perth or Brisbane from 2001 to 2006.

Changes in probability of commuting to the Inner sector

Between 2001 and 2006, there was a small decline in the likelihood that an employed resident of each city would commute to a place of work in the inner city. Employed residents of the Sydney SD were 1.1 percentage points less likely to commute to a place of work in the Inner sector (reflecting a decline in the probability from 32.2 per cent in 2001 to 31.1 per cent in 2006). The declines were 0.5 percentage points for the Melbourne SD, 0.8 percentage points for the Brisbane SD and 1.8 percentage points for the Perth SD. These probability declines are modest in magnitude but are widespread, affecting all Sydney and Perth subregions, and eight of the nine subregions in Melbourne and Brisbane.

Despite these widespread declines in the probability that an employed resident would commute to an inner city workplace, most subregions[49] still recorded an increased number of people commuting to Inner sector workplaces, as the effect of the probability decline was outweighed by the growth in employed residents. However, the number of Outer Sydney residents commuting to a place of work in Inner Sydney declined by 4200 persons from 2001 to 2006 (BITRE 2012a), reflecting the net loss of jobs in Sydney's Inner sector (see Table 5.10).

Changes in commuting within and between Statistical Local Areas

Table 7.10 lists the top ten changes in commuting flows within and between SLAs from 2001 to 2006. The four largest changes all related to same-SLA flows. The greatest change in the number of commuters occurred in Perth's Rockingham SLA, where an extra 3650 commuters travelled within the home SLA. Other large changes within SLAs were:

- an extra 2460 persons commuting within the Berwick SLA in Melbourne
- an extra 2360 persons commuting within Wyndham North in Melbourne
- an extra 2190 persons commuting within the Swan SLA in Perth.

It is noteworthy that all of the same-SLA pairs identified in Table 7.10 as experiencing a large increase in commuter numbers involve Outer sector SLAs. The increased commuting volumes within the SLAs of Rockingham and Swan (in Perth) and Berwick and Wyndham North (in Melbourne) reflect large-scale residential growth,[50] due to greenfield development, coupled with a substantial expansion of the local job base[51] in these outer suburban SLAs. The ongoing greenfield residential development on the outskirts of our cities would be expected to lead to a continuation of this trend toward increased commuter flows within outer suburban SLAs.

49 Four of the 11 Sydney subregions recorded an increased number of commuters to the Inner sector between 2001 and 2006, as did 7 of the 9 Melbourne subregions, and all Brisbane and Perth subregions.

50 Each of the four listed SLAs increased its population by at least 12 000 persons from 2001 to 2006.

51 Wyndham North added around 8000 jobs from 2001 to 2006, while Swan added 6600 jobs, Rockingham added 5100 and Berwick added 5000.

The bottom half of Table 7.10 features two distinct types of origin-destination pairs. Many of the origin-destination pairs that experienced strong growth in the number of commuters involve a place of work in the CBD. For example, there were notable increases in the number of people commuting from Sydney South to Sydney Inner (1810 persons) and from Southbank-Docklands to Melbourne Inner (1410 persons). The other type of origin-destination pair that experienced strong growth involves commutes between neighbouring SLAs in the middle and outer suburbs. For example, there were notable increases in the number of people commuting from Frankston East to Frankston West in Melbourne (1280 persons) and from Gosnells to Canning in Perth (970 persons).

Table 7.10 Top ten largest changes in commuting flows within and between Statistical Local Areas of Sydney, Melbourne, Brisbane and Perth, 2001 to 2006

Statistical Division	SLA-Origin	SLA-Destination	Change (numbers)
Same SLA			
Perth	Rockingham	Rockingham	3650
Melbourne	Casey–Berwick	Casey–Berwick	2460
Melbourne	Wyndham North	Wyndham North	2360
Perth	Swan	Swan	2190
Sydney	Baulkham Hills North	Baulkham Hills North	1710
Sydney	Wyong South and West	Wyong South and West	1600
Sydney	Wyong North East	Wyong North East	1560
Brisbane	Ipswich Central	Ipswich Central	1530
Brisbane	Ipswich East	Ipswich East	1420
Melbourne	Craigieburn	Craigieburn	1360
Different SLA			
Sydney	Sydney South	Sydney Inner	1810
Melbourne	Southbank-Docklands	Melbourne Inner	1410
Melbourne	Frankston East	Frankston West	1280
Sydney	Sydney West	Sydney Inner	1200
Melbourne	Hume–Craigieburn	Hume–Broadmeadows	1110
Melbourne	Casey–Cranbourne	Greater Dandenong balance	1090
Perth	Stirling Coastal	Perth Inner	1030
Perth	Joondalup South	Perth Inner	1030
Perth	Gosnells	Canning	970
Sydney	Sydney East	Sydney Inner	940

Notes: Commuting numbers have been rounded to nearest 10.

Sources: BITRE analysis of ABS *Census of Population and Housing* 2006 and 2001 (unpublished data), BTS JTW 2001 (table 2) and 2006 (table 7) data, and corrected 2001 commuting matrix provided by Western Australia DPI.

Changes in commuting distances and times since 2001

This section examines the evidence regarding the changes that have occurred since 2001 in average commuting distances, average commuting times and average congestion delays for Sydney, Melbourne, Brisbane and Perth. The analysis focuses on data sources that provide a comparable estimate across the different cities, paying limited attention to state-specific data sources, which are covered in more depth in the underlying reports for each city (BITRE 2010, 2011, 2012a, 2013a).

Table 7.11 shows the changes in average commuting distances for Sydney, Melbourne, Brisbane and Perth SDs between 2001 and 2006, based on census commuting flow data. Changes were minimal for all four cities.[52]

Table 7.11 Changes in average journey-to-work travel distance of Sydney, Melbourne, Brisbane and Perth residents, 2001 to 2006

	Sydney SD	Melbourne SD	Brisbane SD	Perth SD
Change in average road network distance (km)	0.0	0.1	0.1	na
Change in average straight line distance^ (km)	–0.1	0.1	–0.1	–0.1

Notes: Distance measures relate to those with a place of residence in the capital city SD. The Perth report (BITRE 2010) used only the straight line commuting distance measure. For the other three cities, both straight line and road network distance measures were constructed. For Perth and Melbourne, those who work outside the BITRE working zone are excluded, for Sydney those who work outside the GMA are excluded, and for Brisbane those who work outside SEQ are excluded. na = not available.

^ The straight line distance measure was based on the population-weighted centroid of the origin SLA and the job-weighted centroid of the destination SLA.

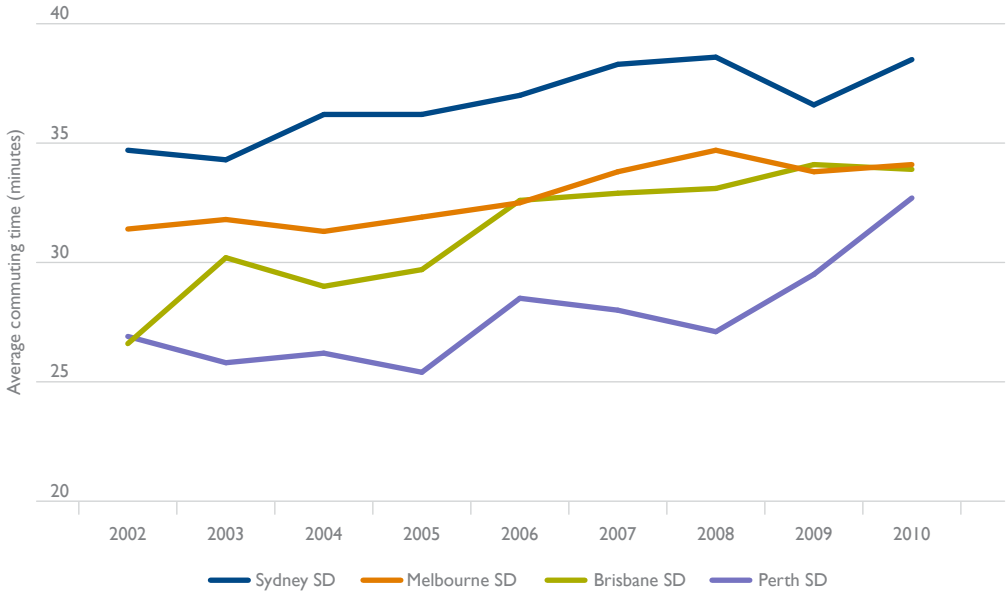
Sources: BITRE analysis of ABS *Census of Population and Housing* for 2001 and 2006, NSW BTS JTW 2001 (table 2) and 2006 (table 7) data and Strategic Travel Model distance outputs, corrected 2001 commuting matrix provided by Western Australian DPI, ABS-VicRoads road distance data, and Queensland DTMR road network distance dataset.

Changes in average commuting times can be assessed on a comparable basis for Sydney, Melbourne, Brisbane and Perth using HILDA survey data (Figure 7.6). All four cities saw an increase in average commuting times between 2002 and 2010. The increase in commuting times was largest for Brisbane (7 minutes) and smallest for Melbourne (3 minutes), so that by the end of the decade Brisbane has caught up to Melbourne in terms of the average commuting trip duration.

Focusing on the 2002 to 2006 subperiod in which commuting distances were essentially stable, Figure 7.6 shows moderate rises in average commuting times for Sydney, Melbourne and Perth (between 1 and 3 minutes) and a more significant rise for Brisbane (6 minutes). This implies that average commuting speeds declined in each of the cities—this is supported by evidence from AustRoads (2013) that both morning and afternoon peak period average road travel speeds declined in all four cities between 2001–02 and 2005–06.

52 The BTS *Household Travel Survey* similarly finds that average commuting distances remained quite stable in Sydney over this period, standing at 14.8km in 2000–01 and 14.6km in 2005–06, before rising to 15.7km in 2011–12 (BTS 2012).

Figure 7.6 Average commuting times for full-time workers in Sydney, Melbourne, Brisbane and Perth Statistical Divisions, 2002 to 2010



Note: The HILDA Project was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (MIAESR). The findings and views reported here, however, are those of the authors and should not be attributed to either FaHCSIA or the MIAESR.

Source: BITRE analysis of HILDA customised data, provided by the National Centre for Social and Economic Modelling (NATSEM).

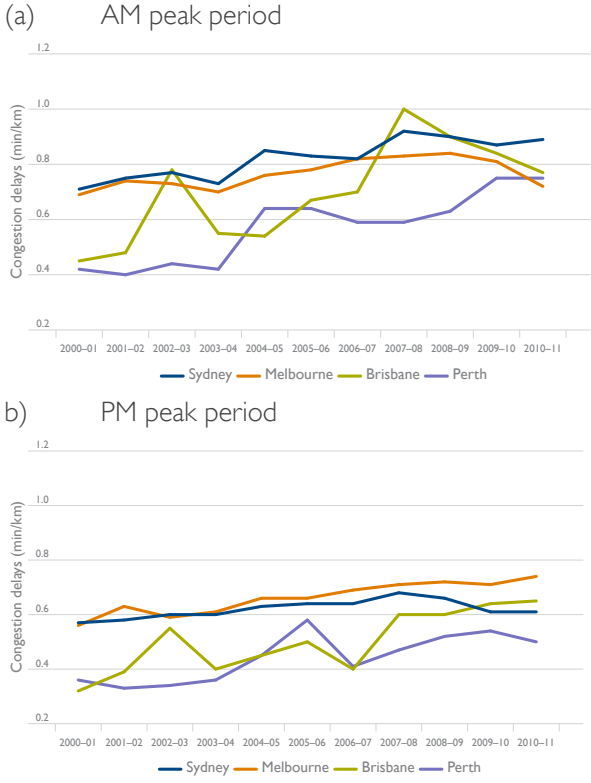
The HILDA survey has the advantage of being comparable across cities, but is not purpose-designed to collect information on travel behaviour. The state government travel surveys provide an alternate source of evidence on recent changes in average commuting times in Sydney, Melbourne and Brisbane, which point to rather more limited changes than are identified by the HILDA survey.

- In Sydney, the average commuting trip duration remained roughly 33 minutes from 2000–01 through to 2006–07, but then rose slightly to reach 35 minutes in 2011–12 (BTS 2013). The rise in the average commuting trip duration since 2006–07 reflects a 1.1km rise in the average commuting distance (ibid).
- BITRE (2011) found that the average commuting time of Melbourne residents was stable at 36 minutes, based on a comparison of the VISTA survey results for 2007–08 and 2009–10.
- BITRE (2013a) analysed SEQ *Household Travel Survey* customised data (provided by Queensland DTMR MDAC) and found that there was no net change in average commuting times for Brisbane residents between the 2004 and 2009 surveys. Average commuting times increased from 33 minutes in 2004 to 35 minutes in 2007, but then fell back to 33 minutes in 2009.

The AustRoads National Performance Indicators (AustRoads 2013) reveal an upward trend in peak period congestion delays over the past decade. Figure 7.7 shows peak period congestion delays, measured in minutes per kilometre, on an annual basis. Although peak period traffic delays have fluctuated, both morning and afternoon peak period delays displayed an underlying upward trend, and were greater in 2010–11 than in 2000–01 in all four cities. The key changes between 2000–01 and 2010–11 are summarised below:

- In Sydney, morning peak traffic delays increased from 0.71 to 0.89 minutes/km, while afternoon peak traffic delays showed little net change.
- In Melbourne, morning peak traffic delays displayed little net change, but afternoon peak traffic delays increased from 0.56 to 0.74 minutes/km.
- In Brisbane, morning peak traffic delays rose from 0.45 to 0.77 minutes/km, while afternoon peak delays doubled (from 0.32 to 0.65 minutes/km). Morning peak traffic delays reached a peak in 2007–08, and have since declined, while afternoon peak traffic delays have only increased slightly since 2007–08.
- In Perth, morning peak traffic delays rose from 0.42 to 0.75 minutes/km, while the increase in afternoon peak traffic delays was less pronounced (from 0.36 to 0.50 minutes/km).

Figure 7.7 Comparison of peak period congestion delays for Sydney, Melbourne, Brisbane and Perth, 2000–01 to 2010–11



Note: Data relates to peak period delays from road traffic conditions that do not permit travel at posted speed. Y-axis of both figures is same scale for comparison purpose.

Source: AustRoads National Performance Indicators (AustRoads 2013).

Strategic planning objectives

This section examines the changes that have occurred since 2001 with respect to two metropolitan planning goals that relate to commuting flows within cities—'increase self-containment' and 'reduce commuting times and distances'.

Increase self-containment

The most recent strategic plans for Sydney and SEQ both contain goals relating to self-containment (i.e. the proportion who live and work in the same area). The *Metropolitan Plan for Sydney 2036* aimed to 'increase employment self-containment' in Western Sydney's subregions (NSW Government 2010, p.148). The *SEQ Regional Plan 2009–2031* aimed to 'support greater levels of trip self-containment within subregions' and required 'local governments to demonstrate employment self-containment in planning decisions' (Queensland Government and COMSEQ 2009, pp. 112, 140). Improved self-containment is specifically discussed in the subregional narratives for the Ipswich, Logan, Redland and Moreton Bay LGAs, but not for the Brisbane City Council (ibid). The current preference for self-containment contrasts with Australia's historical experience, where urban policy has deliberately created residential areas which are set apart from workplaces (O'Connor and Rapson 2003).

As shown earlier (in Table 7.8), the self-containment of employment within subregions increased by 0.6 percentage points (from 39.7 to 40.3 per cent) for the Brisbane SD and by 0.2 percentage points (from 43.7 percent to 43.9 per cent) for the Sydney SD between 2001 and 2006. In each city, there were some subregions which experienced a significant increase in self-containment (e.g. Central Coast of Sydney, Middle West Brisbane) and some subregions which experienced a significant decline (e.g. West Central Sydney, Outer West Brisbane).

The objective for Sydney is focused on Western Sydney[53], which recorded a minor increase of 0.1 percentage points in its subregional self-containment rate between 2001 and 2006 (from 45.9 to 46.0 per cent). This reflects reduced self-containment in the West Central subregion, coupled with improved self-containment in the North West and South West subregions (Table 7.8).

In the Brisbane SD, the changes in self-containment rates were mixed for the targeted outer suburban subregions. The Outer North subregion (i.e. the Moreton Bay LGA) and the Outer East subregion (i.e. the Redland LGA) had significant increases in self-containment, while the Outer West subregion (i.e. the Ipswich LGA) had a significant decline, and the Outer South subregion (which includes the Logan LGA) had a more modest decline (see Table 7.8).

In summary, the census-based evidence shows that self-containment rates increased marginally between 2001 and 2006 in both the Sydney and Brisbane SDs. This reflects mixed results across the targeted subregions, some of which increased their self-containment rate (e.g. Redland, North West Sydney), while others experienced a significant decline (e.g. Ipswich, West Central Sydney).

53 Western Sydney comprises three planning subregions—West Central, North West and South West.

Reduce commuting times and distances

Reducing commuting times and distances is a key objective for all four cities. The *Metropolitan Plan for Sydney 2036* aimed to ensure 'more jobs are located closer to home' (NSW Government 2010, pp. 6), while one of the high-level goals of the *NSW 2021* state plan is to 'reduce travel times' (NSW Government 2011, p.18). *Melbourne @ 5 million* aims to ensure Melbournians can work closer to where they live and spend less time commuting to and from work (Victorian Department of Planning and Community Development 2008, pp. 7, 9). The *SEQ Regional Plan 2009–2031* focuses on reducing travel times and distances as a means of cutting greenhouse gas emissions and responding to oil supply vulnerability (Queensland Government and COMSEQ 2009, pp. 12, 46, 145). For Perth, 'one of the key objectives of Directions 2031 is to improve the relationship between where people live and where they work, to reduce commuting time and cost' (Western Australian Planning Commission 2010, p.30).

There are two principal data sources that provide evidence about changes in average commuting times/distances and can be compared across the four cities:

- BITRE estimates of average commuting distances, derived from ABS *Census of Population and Housing* data for 2001 and 2006 (see Table 7.11)
- HILDA-based estimates of the average commuting times of full-time workers from 2002 to 2010 (see Figure 7.6).

State government travel surveys also provide evidence relevant to this objective, although Sydney's *Household Travel Survey* is the only one to cover the complete 2001 to 2011 study period. For the remaining cities, where the travel survey data is less comprehensive, BITRE has drawn upon additional indicators (e.g. AustRoads (2013), ABS (2006, 2012c)) to inform its assessment.

Table 7.12 provides an overview of the data that BITRE used to assess trends since 2001 for this planning objective. The key messages from Table 7.12 are summarised below.

- Average commuting distances remained essentially unchanged for Sydney, Melbourne, Brisbane and Perth between 2001 and 2006. Between 2006 and 2012, average commuting distances rose by about 1km for Sydney, and there are also some indications of an increase for Melbourne. Post-2006 evidence for Brisbane is mixed, and for Perth it suggests minimal change.
- Since 2001, all four cities have recorded an increase in average commuting times. Average commuting times have risen moderately for Sydney over the past decade, irrespective of which data source is relied upon. Average commuting times also showed a moderate net increase for Melbourne during the decade (just not between 2007–08 and 2009–10). The limited data available for Perth shows a more substantial 6 minute increase in average commuting times. However, between 2002 and 2010, Brisbane saw the largest net increase in average commuting times of 7 minutes—this reflected a substantial increase in peak period congestion delays, and was concentrated prior to 2007–08.

These recent trends are not consistent with the objective of reducing commuting times and distance. Instead, the evidence suggests that Sydney and Melbourne residents have experienced increases in both commuting times and distances since 2001. While there appears to have been minimal change in commuting distances for Perth, and the direction of change in commuting distances is unclear for Brisbane, the net increase in average commuting times was comparatively large for these two cities.

Table 7.12 Observed changes with respect to changes in average commuting times and distances since 2001

City	National data sources	State-specific data sources
Sydney	Based on census data, average commuting distances showed minimal change for Sydney SD residents from 2001 to 2006. The HILDA survey identifies a 4 minute net increase in average commuting times for Sydney from 2002 to 2010.	*Household Travel Survey* data from 2000–01 to 2011–12 shows a 0.9km net rise in the average commuting distance and a 2 minute net rise in the average commuting trip duration. The increases in commuting times and distances were concentrated after 2006–07.
Melbourne	Based on census data, average commuting distances showed minimal change for Melbourne residents from 2001 to 2006. ABS survey data points to a potential increase in commuting distances from 2006 to 2012, reflecting a shift towards longer distance commutes. The HILDA survey identifies a 3 minute net increase in average commuting times for Melbourne from 2002 to 2010. However, average commuting times fluctuated around the 34 minute mark between 2007 and 2010, with little net change. The AustRoads indicators show a significant net rise in afternoon peak traffic delays (of 0.2 minutes per km) from 2000–01 to 2010–11, but little net change in morning peak delays.	BITRE analysis of data from Ironmonger (2006) suggests the average commuting time rose by 3 minutes for Melbourne between 2001 and 2006. Based on the VISTA survey, average commuting times remained unchanged at 36 minutes for a one-way commute from 2007–08 to 2009–10.
Brisbane	Based on census data, average commuting distances showed minimal change for Brisbane residents from 2001 to 2006. ABS survey data points to a potential increase in commuting distances from 2006 to 2012, reflecting a decline in the proportion of commutes of 5km or less. The HILDA survey identifies a 7 minute net increase in average commuting times for Brisbane from 2002 to 2010, most of which occurred prior to 2007. The AustRoads indicators show a significant net rise in peak period traffic delays (of 0.3 minutes per km) from 2000–01 to 2010–11, which was concentrated prior to 2007–08.	Based on the SEQ *Household Travel Survey*, average commuting distances of Brisbane residents fell by 1km from 2007 to 2009, while average commuting times fell by 2 minutes.
Perth	Based on census data, average commuting distances showed minimal change for Perth residents from 2001 to 2006. ABS survey data suggests there has been limited change in commuting distances from 2006 to 2012. The HILDA survey identifies a 6 minute net increase in average commuting times for Perth from 2002 to 2010, with the increase occurring after 2005. The AustRoads indicators show a significant net rise in morning peak traffic delays (of 0.3 minutes per km) from 2000–01 to 2010–11. The increase occurred after 2003–04.	None available

Note: Further details of assessment process and contributing data are in the individual city reports (BITRE 2010, 2011, 2012a, 2013a). The HILDA Project was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (MIAESR). The findings and views reported here, however, are those of the authors and should not be attributed to either FaHCSIA or the MIAESR.

Sources: BITRE analysis of ABS *Census of Population and Housing* data for 2001 and 2006, BTS JTW 2001 (table 2) and 2006 (table 7) data and Strategic Travel Model distance outputs, corrected 2001 commuting matrix provided by Western Australian DPI, ABS-VicRoads road distance data, VISTA survey tabulations, Queensland DTMR road network distance dataset and SEQ *Household Travel Survey* customised data, HILDA customised data (provided by NATSEM), AustRoads National Performance Indicators (AustRoads 2013), ABS (2006, 2012c), Ironmonger (2006) and BTS (2013).

Overview of progress against strategic planning goals

Table 7.13 summarises BITRE's assessment of recent changes with regard to the strategic planning goals that relate to commuting flows. The objective of increased self-containment was specified in the Sydney and SEQ (including Brisbane) strategic plans. Both Sydney and Brisbane recorded a marginal improvement in self-containment at the SD scale and mixed results across the targeted subregions. All four cities aimed to reduce commuting times and distances. However, progress since 2001 has generally not been in the desired direction, particularly with respect to commuting times, which increased in all four cities.

Table 7.13 Observed changes since 2001 with respect to strategic planning goals that relate to commuting flows

Strategic planning goal	Time period to which evidence relates	Extent of progress			
		Sydney	Melbourne	Brisbane	Perth
Increase self-containment	2001 to 2006	Mixed	-	Mixed	-
Reduce commuting distances	2001 to 2012	Negative	Negative	Mixed	No change
Reduce commuting times	2002 to 2010	Negative^	Negative	Negative	Negative

Notes: The overall assessment for the commuting distance and time objectives differs from that in BITRE (2010, 2011, 2012a, 2013a), due to the inclusion of more recent data points, and the division into two objectives.

- Not in the strategic plan.

^ Sydney assessment is partly based on Household Travel Survey data covering the 2000–01 to 2011–12 period.

Sources: BITRE analysis—details of assessment and sources provided earlier in this chapter (e.g. Table 7.12) and in individual city reports (BITRE 2010, 2011, 2012a, 2013a).

CHAPTER 8

Drivers of change in commuting patterns

Key points

- Gravity model regression analysis is used to explore the drivers of origin-destination commuting flows, and describe how commuting behavior has responded to recent spatial patterns of residential and job growth within each city.
- For Sydney, Melbourne, Brisbane and Perth, the gravity model analysis is capable of explaining between 67 and 85 per cent of the variation in origin-destination commuting flows in 2006.
- The number of people commuting between an origin and destination location tends to increase with the number of employed residents of the origin location and the number of jobs in the destination location, but declines as the distance between the two locations widens. The distance between the two locations serves as a proxy for the time and cost of commuting between them.
- Other significant drivers include:
  - Transport infrastructure—distance is less of an impediment for travel between origin-destination pairs that have a direct rail connection or a direct freeway connection
  - Industry and skills—the greater the alignment between the skills available in the origin location and the skills demanded in the destination location, the greater the commuting flows between those two locations.
- For Melbourne and Brisbane, distance was a greater impediment to commuter travel in 2006 than it was in 2001, reflecting a 55 per cent national increase in automotive fuel prices over the period.
- The study also identifies the drivers of *change* between 2001 and 2006. The key drivers of growth in commuting flows for an origin-destination pair include the rate of growth in employed residents in the origin location, the rate of growth in jobs at the destination location, distance (reflecting the impact of rising fuel prices over the period) and very large scale expansions of transport infrastructure.

Background

BITRE's study sets out to explore the drivers of commuting flows, and how commuting behaviour has responded to recent changes in population and employment. In the series of individual city reports (BITRE 2010, 2011, 2012a, 2013a), BITRE uses regression analysis to describe how the recent changes in commuting flows relate to the observed spatial patterns of residential and job growth within each city. The role of other potential drivers of commuting flows— such as distance, transport infrastructure and skills—are also investigated.

The chapter commences with a description of the relationship between commuting flows and these potential drivers. In the second part of the chapter, gravity models are used to explain variation in origin-destination commuter flows in each of the four cities, and the drivers of recent changes in these commuter flows. This chapter presents only a broad overview of the regression results—details of methodology and results are contained in the individual city reports (BITRE 2010, 2011, 2012a, 2013a).

Key drivers of origin-destination commuting flows

Gravity models are often used to explain spatial variation in commuter flows. Gravity models relate passenger flows between origin and destination zones to the relevant population total in the origin and destination zones and to distance. The gravity model is traditionally estimated in logarithmic form using ordinary least squares (OLS) estimation, as shown below.

$$\ln C_{ijt} = \alpha + \beta \ln R_{it} + \gamma \ln W_{jt} - \delta \ln D_{ijt}$$

C_{ijt} = commuting flow from zone i to zone j in time period t

R_{it} = the number of employed residents of zone i in period t

W_{jt} = the number of people working in zone j in period t

D_{ijt} = the travel cost between zones i and j as of period t (typically proxied by measures of either distance or travel time)

α, β, γ and δ are the model parameters to be estimated.

This simple gravity model provides a useful introduction to the principal drivers of spatial commuter flows within a city—the spatial distribution of employed residents and jobs, and travel costs. This simple gravity model can be extended to explore the influence of other potential drivers of spatial commuter flows—such as transport infrastructure and skills.

Spatial distribution of employed residents and jobs

It is expected that the number of people commuting between an origin location and a destination location will depend on the number of employed residents living in the origin location and the number of jobs available at the destination location. Similarly, *changes* in commuting flows will depend on spatial patterns of growth in employed residents and jobs.

Overall patterns of residential and job growth are shaped by planning policy. Within this context, spatial patterns of growth are determined by individual's choices about where to live and work as well as by the location decisions of employers. Job access is one of several key

factors—alongside proximity to family and friends, lifestyle and housing cost—that underpin people's choice of where to live (ABS 2009a). For employed people in Sydney, better work access and prospects was the equal most important consideration (at 21 per cent) in the choice of where to live, alongside lifestyle factors (Hay 2009). The distance from home to work is a particularly important factor behind the home and job moves of employed people who walk/cycle to work or live within 5 kilometres of where they work. However, housing cost was the key consideration for movers commuting over 10 kilometres to work, suggesting that different groups make the trade-off between housing affordability and commuting time in different ways (ibid).

These results highlight the interconnected relationship between residential/jobs growth and changes in commuting behavior. While spatial patterns of residential and job growth are a key driver of commuting flows, commuting considerations also affect the spatial distribution of growth.

Travel costs

The cost of travel between any two locations is another important driver of commuting flows. The cost of travel between two areas depends on the opportunity cost of the time spent undertaking the journey as well as direct costs such as petrol, tolls, public transport fares and parking fees. The journey time depends on the distance between the two areas and average speed, which in turn depends on transport infrastructure and the level of congestion.

Direct measures of the generalised travel cost or travel time between each origin-destination pair were generally not available. However, BITRE was able to experiment with road network distance, straight line distance and travel time measures for Sydney, and the road network distance was found to be the most appropriate representation of generalised travel cost amongst these alternatives (BITRE 2012a).

The regression results presented later in this chapter are based upon a straight line distance measure [54], which provides a common basis for comparison across all four cities. The expected relationship is that a greater distance between any origin-destination pair will generally be associated with a greater travel cost and a greater impediment to travel between those two locations. Model results based on the road network distance measure (and for Sydney, the travel time measure) are available from BITRE (2011, 2012a, 2013a). The conclusions drawn from the gravity model regression analysis were largely robust to the use of either straight line or road network based distance measures (ibid).

Other drivers

Transport infrastructure

The extent to which distance acts as an impediment to travel is likely to depend on the mode of travel and the capacity of the transport network. For example, in peak period, commuting times by rail can be substantially quicker than commuting between the same origin-destination

54 The straight line distance estimate for an origin-destination pair was derived by BITRE as the distance between the population weighted centroid of the origin SLA (calculated using CCD data) and the job weighted centroid of the destination SLA (calculated using DZ data), with those who reported working at home assigned a distance of zero.

pair by car (Haynes 2012, WAPC 2009). Peak period travel speeds can also be quicker on freeways than on arterial roads (VicRoads 2010). Consequently, the impact of distance may be less pronounced for origin-destination pairs that are connected by the freeway network or the rail network, than for those that are not. There is also some evidence that travel time savings may be available on Brisbane's dedicated busways (Parsons Brinckerhoff 2010). These relationships have been explored through the gravity model, with results presented later in the chapter.

Changes in commuting patterns will be shaped, to some extent, by development of new transport infrastructure, which changes the relative costs of commuting to different areas. For example, Rasmussen (2010) highlights the role of Melbourne's Western Ring Road in reducing travel times and expanding the spatial labour markets of the West Industrial Node and the North Industrial Node. BITRE's regression analysis investigates whether the major expansions of transport infrastructure that occurred between 2001 and 2006 significantly changed spatial commuting patterns within each city. For some cities, there were very large scale transport infrastructure projects that were completed prior to the 2001 census, which also had the potential to influence commuting patterns between 2001 and 2006. Table 8.1 lists the major road and public transport infrastructure projects that have been included in the regression analysis for each city.

New transport infrastructure can also shape patterns of population and job growth within a city. For Sydney, BITRE (2012a, p.296) finds that 'new motorway infrastructure appears to have been a strong determinant of employment growth patterns, particularly in the wholesale trade and logistics industries', while Thakur (2009, p.2) concludes that the 'Western Ring Road and CityLink, have managed to redress what several planning strategies over the last 3 decades could not, that is to redirect growth to west and north west Melbourne'.

Table 8.1 Major transport infrastructure projects included in regression analysis of changes in commuting flows between 2001 and 2006

City	Projects completed between 2001 and 2006	Projects completed prior to 2001 census
Sydney	M5 East Motorway between Beverley Hills and Sydney Airport (opened in 2001) Cross City Tunnel, connecting the Inner West with the Eastern Distributor (2005) Westlink M7, a 40km motorway between Liverpool and Baulkham Hills (2005)	None
Melbourne	Electrification of rail line between St Albans and Sydenham (2002) Extension of Mont Albert tram line to Box Hill (2003) Extension of Burwood Highway tram service to Vermont South (2005) Geelong Road (Princes Freeway) upgrade (2002) Craigieburn Bypass, which extended the Hume Freeway to the Metropolitan Ring Road (2005)	CityLink (first opened in December 2000, but closed for repairs to Burnley Tunnel between 19 February and 16 June 2001) Western Ring Road (1999)
Brisbane	Inner Northern Busway to Kelvin Grove (2004) and Herston (2005) Port of Brisbane Motorway stage one (2002) Inner City Bypass (2002)	South East Busway (opened in stages between October 2000 and April 2001) Airtrain (May 2001) Pacific Highway upgrade to motorway status between Logan Motorway and Worongary (October 2000)
Perth	Extension of northern rail line to Clarkson (2004) Opening of Thornlie spur line (2005) Kwinana Freeway extension to Safety Bay Road, including bus transitway (2002) Roe Highway stage six and seven extensions (2004, and early 2006, respectively) Tonkin Highway extension to Thomas Road (2005)	None

Notes: Major transport infrastructure investments were selected based on their potential to have significantly altered spatial commuting flows and their total cost. A threshold of $150 million was used to identify major road infrastructure projects, while a lower threshold of $25 million was used to identify major public transport projects. Projects that were finalised after the 2006 census were excluded. Where available evidence suggested projects had their major impact after the 2006 census, the projects were also excluded (e.g. Liverpool to Parramatta Tway, Regional Fast Rail).

Sources: BITRE (2010, 2011, 2012a, 2013a)

Skills

The basic gravity model formulation assumes that employees are homogenous (Trendle and Siu 2005). In practice, employees have different skills and educational attainment and vary in their suitability for employment in different industries. Consequently, skill and industry-related factors play a role in shaping commuting flows between different parts of the city and how they change over time. In the context of the Sunshine Coast, Trendle and Siu (2005) show that distance has less of a deterrent effect in the commuting decision for more educated workers. BITRE (2012a) finds that the deterrent effect of distance varies across Sydney's industries, being weaker for spatially concentrated industries (such as Information, media and telecommunications and Finance and insurance) and greater for spatially dispersed industries (such as Retail trade and Health care and social assistance).

Other things equal, commuting flows are likely to be greater for origin-destination pairs which have good alignment between the skill (industry) mix of employed residents in the origin location and the skill (industry) mix of jobs available in the destination location. To investigate the influence of skills and industry on commuting flows, BITRE developed measures of skill mismatch and industry mismatch, which identify the proportion of employed residents of the origin SLA who would need to change skill categories (industries) to match the skill (industry) mix of the destination SLA. For all four cities, the skill mismatch index proved to be more closely linked to commuting patterns than the industry mismatch index, and so the regression results presented later in this chapter are based on BITRE's skill mismatch index.[55]

Explaining origin-destination commuter flows

The preceding discussion has identified several factors which are likely to be important drivers of spatial commuting flows. A wide range of other factors are also likely to have an influence, such as age, occupation, home ownership, income and gender (Trendle and Siu 2005).

This section summarises BITRE's estimated gravity models for origin-destination commuting flows within the four capital city statistical divisions (SDs).8 More comprehensive results, and methodological details, are available from the individual city reports (BITRE 2010, 2011, 2012a, 2013a). The regression analysis is not intended to be comprehensive.[56] The purpose is to:

- quantify the influence that residential growth, job growth and distance have on spatial patterns of commuting in each of the cities
- explore the effects of transport infrastructure and skills on spatial patterns of commuting
- enable comparisons to be made across cities through adoption of a common model specification.

Table 8.2 compares the results of a common gravity model specification for 2006. To ensure comparability, a straight line measure of distance is used for all cities. The Perth model had a higher explanatory power (84 per cent) than the Sydney and Melbourne models (78 and 77 per cent, respectively), which in turn had better explanatory power than the Brisbane model (68 per cent).

55 The skill mismatch index was calculated using 2001 and 2006 census data, and can theoretically take values between 0 and 1. It was based on three qualifications categories: no post school qualification, certificate level qualification, and higher qualification. Constraints on data availability meant a slightly different classification was used to construct the 2001 index: no post school qualifications above Certificate Level II; Certificate III or IV; higher qualification.

56 The state transport departments have typically developed far more sophisticated models of spatial commuting flows (e.g. the SEQ Strategic Transport Multi-Modal Model or the NSW Government's Strategic Travel Model), which reflect more disaggregated flow data and more detailed information on transport infrastructure and mode usage. Such models have been progressively improved over many years and have the capability of addressing a much broader set of questions (see, for example Victorian Department of Transport 2009b).

Table 8.2 Comparison of gravity model of origin-destination commuter flows between Sydney, Melbourne, Brisbane and Perth, 2006

	Sydney Statistical Division	Melbourne Statistical Division	Brisbane Statistical Division	Perth Statistical Division
Sample	3788	5152	18 531	1289
Adjusted R-squared (per cent)	77.8	76.8	67.8	84.1
Parameter estimates				
Constant	–14.14	–6.56	–7.91	–11.74
Log of number of employed residents in origin SLA	1.14	0.58	0.81	1.05
Log of number of jobs in destination SLA	1.13	0.96	0.77	1.01
Log of straight line distance between origin and destination SLA	–1.37	–1.34	–0.89	–1.06
Direct rail connection X Log of straight line distance	0.14	0.20	0.17	0.12
Direct freeway connection X Log of straight line distance	0.21	0.06	0.05	–0.02
Skills mismatch index for origin-destination pair	–1.71	–2.01	–1.48	–1.15
Robust t-value				
Constant	–45.4	–17.4	–80.6	–39.9
Log of number of employed residents in origin SLA	45.5	19.3	91.3	46.9
Log of number of jobs in destination SLA	62.9	59.9	130.2	48.2
Log of straight line distance between origin and destination SLA	–78.6	–59.8	–125.9	–29.6
Direct rail connection X Log of straight line distance	13.4	16.0	20.8	5.8
Direct freeway connection X Log of straight line distance	10.4	6.8	9.8	–1.0
Skills mismatch index for origin-destination pair	–12.3	–19.9	–30.5	–6.3

Notes: The dependent variable is the log of the number of persons commuting from the origin SLA to the destination SLA in the given year. Origin-destination pairs with less than 4 commutes were excluded. The original model specification for Perth presented in BITRE (2010) was based on the Perth working zone and excluded the freeway variable—the models were re-estimated so all cities could be presented on a comparable basis. The Sydney model was also re-estimated using alternate variable derivations so results would be on a more comparable basis, and so results differ from those presented in BITRE (2012a). The Brisbane sample is much larger than that for the other cities, due to the greater disaggregation of SLAs within the Brisbane SD.

Sources: Estimated by BITRE using SAS OLS estimation and robust standard errors. Based on ABS Census of Population and Housing 2001 and 2006 commuting matrices and qualifications data, as detailed in BITRE (2010, 2011, 2012a, 2013a).

The core gravity model explanatory variables are all highly significant[57] and have the expected signs. The number of people commuting between an origin and destination location tends to increase with the number of employed residents of the origin area and the number of jobs in the destination area. Greater distance between an origin-destination pair is associated with smaller commuting flows. These three factors together explained between 65 per cent (for Brisbane) and 83 per cent (for Perth) of all variation in spatial commuting flows.

The magnitude of the parameter estimate on the straight line distance variable is largest for Sydney and Melbourne. This implies that distance is more of an impediment to commuter

57 Throughout this chapter, the assessment of whether a variable is statistically significant or not is based on a 5 per cent probability level. If the variable is significant at the 10 per cent probability level, but not at the 5 per cent level, it is referred to as borderline significant.

travel in Sydney and Melbourne than it is for either Perth or Brisbane—this result is consistent with the greater density and congestion of Sydney and Melbourne. The parameter estimates also imply that distance is less of an impediment to commuter travel in Brisbane than it is in Perth. This is reasonably consistent with the AustRoads National Performance Indicators for 2005–06 which report that average morning peak travel speeds were a little faster on Brisbane's arterial roads and freeways than on Perth's (40 vs 39 kilometres per hour), while afternoon peak speeds were considerably faster on Brisbane's roads (45 vs 41 kilometres per hour) (AustRoads 2013).

The additional variables—capturing rail connections, freeway connections and skill mismatch—proved to be generally significant predictors of origin-destination commuting flows:

- The skill mismatch variable is a significant addition to the gravity model of commuter flows. When an origin-destination pair has a large degree of skill mismatch, commuter flows are predicted to be significantly lower than if the supply and demand for skills is well aligned between the two SLAs. The skill mismatch variable has a less pronounced effect in the Perth model, compared to the other cities.
- The direct rail connection variable also proved to be a significant predictor of commuter flows. The existence of a direct rail connection between an origin-destination pair has the effect of offsetting the distance penalty and boosting commuter flows. The magnitude of this effect is greatest for Melbourne.
- The direct freeway connection variable proved to be a significant predictor of commuting flows for Sydney, Melbourne and Brisbane, but not for Perth. For Sydney, Melbourne and Brisbane, the existence of a freeway connection between an origin-destination pair had the effect of reducing the distance penalty and boosting commuter flows, reflecting the greater average travel speeds available on the freeway network. The magnitude of this effect was greatest for Sydney.

The question of whether distance was a lesser impediment to travel for origin-destination pairs that are directly connected by one of Brisbane's dedicated busways was investigated in BITRE (2013a). The busway variable was not statistically significant in the preferred model specification.[58] The lack of significance may reflect the fairly limited busway system in operation at the time of the 2006 census, with Brisbane's busway network undergoing multiple extensions since that time.

For each city, the gravity models were estimated for both 2001 and 2006. The 2001 model typically had lower explanatory power than the 2006 model, perhaps relating to boundary changes or greater data quality problems in 2001. However, the parameter estimates generally remained fairly stable between 2001 and 2006. The notable exception was that the parameter estimate for the distance variable became increasingly negative between 2001 and 2006 in all four cities, although the change was not statistically significant for Sydney or Perth. For Melbourne and Brisbane, the regression results provide evidence of an increase in the extent to which distance impedes travel, a result which presumably reflects the sharp increase of 55 per cent nationally in nominal automotive fuel prices between the September quarters of 2001 and 2006 (ABS 2009b).

58 The variable was statistically significant and negatively signed in some alternate model specifications. The parameter estimates for this variable proved to be very sensitive to changes in model specification.

Explaining changes in origin-destination commuter flows

This study also uses regression analysis to understand the drivers of change in commuter flows between 2001 and 2006. The following key drivers of growth in origin-destination commuter flows were investigated:

- the rate of growth of employed residents in the origin location
- the rate of growth in jobs at the destination location
- travel costs, proxied by distance (reflecting the potential impact of rising fuel prices over the period)
- skill alignment between the origin and destination locations
- major expansions of transport infrastructure (see Table 8.1 for details of the projects investigated).

Table 8.3 compares the results of a common model specification which attempts to explain changes in origin-destination commuter flows for each city between 2001 and 2006. For all four cities, the analysis is focused on origin-destination pairs with at least 100 commuters in both years.[59] The Melbourne change model had higher explanatory power (69 per cent) than the Brisbane and Perth models (60 and 52 per cent, respectively), which in turn had considerably better explanatory power than the Sydney model (37 per cent).

Most of the explanatory power of these models is attributable to the employed resident growth and job growth variables. The parameters on these two variables are positively signed and highly statistically significant for all four cities. The higher the growth rate of employed residents in the origin location and the higher the growth rate of jobs in the destination locations, the greater is the predicted rate of growth in commuter flows between those two locations.

59 The dependent variable tends to take very extreme values for origin-destination pairs which have zero or low commuter flows in one of the two periods. Such observations were highly influential in the regression analysis and detracted from its usefulness. BITRE dealt with this issue by focusing the analysis on those origin-destination pairs which had non-trivial commuter flows in both periods. Table 8.3 adopts a cutoff of 100 commuters, while the individual city reports discuss results of sensitivity analysis based on alternate cutoff points.

Table 8.3 Comparison of gravity model of change in origin-destination commuter flows between 2001 and 2006 for Sydney, Melbourne, Brisbane and Perth

	Sydney Statistical Division	Melbourne Statistical Division	Brisbane Statistical Division	Perth Statistical Division
Sample	1733	1790	1142	606
Adjusted R-squared (per cent)	37.4	69.0	59.9	51.7
Parameter estimates				
Constant	0.03	–0.03	–0.08	–0.03
Growth rate of employed residents in origin SLA	0.52	0.88	0.84	0.54
Growth rate of jobs in destination SLA	1.03	0.90	0.64	1.04
Log of straight line distance between origin and destination SLA	–0.02	–0.01	–0.01	–0.01
Skills mismatch index for origin-destination pair	–0.06	–0.12	–0.01	–0.09
Transport infrastructure investment between 2001 and 2006	0.04	–0.01	0.03	0.00
Transport infrastructure investment completed before 2001 census	na	0.00	0.04	na
Robust t-value				
Constant	3.3	–4.2	–7.0	–2.5
Growth rate of employed residents in origin SLA	12.3	19.5	17.0	7.5
Growth rate of jobs in destination SLA	24.1	20.0	14.5	22.9
Log of straight line distance between origin and destination SLA	–3.5	–1.7	–2.4	–1.4
Skills mismatch index for origin-destination pair	–1.4	–3.2	–0.3	–1.5
Transport infrastructure investment between 2001 and 2006	2.3	–0.7	1.7	–0.2
Transport infrastructure investment completed before 2001 census	na	0.6	2.3	na

Notes: The dependent variable approximates the percentage change in the number of persons commuting from the origin SLA to the destination SLA between 2001 and 2006. Based on origin-destination pairs that have a commuter flow of at least 100 persons in both 2001 and 2006. Details of included transport infrastructure projects are provided in Table 8.1.

The models were re-estimated so all cities could be presented on a comparable basis. For example, the original model specification for Perth presented in BITRE (2010) was based on the Perth working zone and excluded the distance variable. The Sydney change regression results differ from those presented in BITRE (2012a), as the calculation of the employed residents growth variable was revised to be consistent with the approach adopted for the other cities.

Sources: Estimated by BITRE using SAS OLS estimation and robust standard errors. Based on ABS Census of Population and Housing 2001 and 2006 commuting matrices and qualifications data, as detailed in BITRE (2010, 2011, 2012a, 2013a).

In recognition of the previously mentioned result that the deterrent effect of distance on commuting flows tended to be larger in 2006 than in 2001, a distance term was included to specifically test for its impact on the observed change in commuting flows. The variable was negatively signed for all four cities, and was statistically significant for Sydney and Brisbane (and borderline significant for Melbourne). In these cities, more distant origin-destination pairs tended to experience lesser growth in commuter flows between 2001 and 2006 (controlling for other influences), reflecting rising travel costs (specifically, fuel costs) over the period.

A skill mismatch variable was incorporated in the model to test for whether origin-destination pairs with a high degree of skill mismatch tend to experience lesser growth in commuting flows. This variable was only statistically significant for Melbourne. In Melbourne, origin-destination

pairs with a high degree of skill mismatch tended to experience lesser growth in commuting flows between 2001 and 2006 (controlling for other influences).

A variable capturing major transport infrastructure investments between 2001 and 2006 was included in the change regression for all four cities. A lagged transport infrastructure investment variable was included only for Brisbane and Melbourne, as in these cities some particularly large-scale projects were completed just prior to the period of interest (see Table 8.1). The transport infrastructure variable(s) proved statistically insignificant in the Melbourne and Perth regressions. However, the transport infrastructure variable was statistically significant and positively signed in the Sydney change regression, suggesting that commuting flows between locations connected by the new motorways increased more than would otherwise have been expected given residential and job growth in those locations. For Brisbane, the transport infrastructure investment variables were also positively signed, with the lagged variable statistically significant and the contemporaneous variable borderline significant.[60]

The cross-city differences in the significance of the infrastructure investment variable as a driver of changes in commuting flows between 2001 and 2006 will relate to the scale of projects that were completed in each city during the time period, not just in terms of project cost, but also in terms of the project's potential to transform the overall pattern of commuting within the city. The projects that were completed in Perth, Melbourne and Brisbane between 2001 and 2006 were of relatively small scale, although some had greater potential to reshape city-wide commuting patterns than others. The major transport infrastructure investments captured for Sydney (i.e. the Westlink M7, the M5 East Freeway and the Cross City Tunnel) were much larger in scale, costing around $3 billion altogether, and the completion of the orbital motorway network represented a fairly fundamental transformation to the freeway network that supports commuter flows in Sydney.

This set of regression results indicates that some major transport infrastructure investments—such as the series of freeway and tunnel investments that occurred in Sydney between 2001 and 2006 or the series of motorway and public transport investments that were completed in Brisbane between 2000 and 2006—can significantly reshape commuting flows within a city.

60 The assessment of whether a variable is statistically significant or not is based on the 5 per cent probability level. When the variable is significant at the 10 per cent probability level, but not at the 5 per cent level, it is referred to as borderline significant.

Summary

This chapter uses gravity models to explain origin-destination commuter flows within Australia's four largest cities, and to identify some of the key drivers of recent change in these commuter flows.

For Sydney, Melbourne, Brisbane and Perth, between 67 and 85 per cent of the spatial variation in commuting flows can be explained by reference to just a few key factors:

- the number of employed residents in the origin location
- the number of jobs in the destination location
- the distance between the two locations
- whether there is a direct rail or freeway connection between them
- the degree of alignment between the skills available in the origin location and the skills demanded in the destination location.

Growth in employed residents and jobs also played an important role in explaining changes in origin-destination commuting flows in these four cities between 2001 and 2006. Factors such as the distance between an origin-destination pair and transport infrastructure investments also made a contribution to explaining the rate of growth in commuting flows for some cities.

CHAPTER 9
Outlook

Key points

- State government population projections suggest that Sydney, Melbourne, Brisbane and Perth Statistical Divisions (SDs) will grow at average annual rates of 1.4, 1.6, 1.8 and 1.9 per cent, respectively, from 2006 to 2031. These projections anticipate that the Outer sector of each city will contribute the *largest share of population growth*—from 65 per cent in Melbourne to 76 per cent in Perth—and be the *fastest growing*—from 1.6 per cent average annual growth in Sydney to 2.6 per cent in Brisbane and Perth.
- Sydney's South West and North West subregions, Melbourne's Outer South and Outer West, and Brisbane's Outer West are each projected to add more than 300 000 residents between 2006 and 2031.
- Employment projections suggest that Sydney, Melbourne, Brisbane and Perth SDs will grow at average annual rates of 1.4, 1.3, 2.2 and 1.7 per cent, respectively, from 2006 to 2031. The Outer sector is also projected to be the *fastest growing* in terms of employment and to contribute a *larger share* of job growth than the Inner and Middle sectors. Perth's Outer sector is projected to attain the largest share of city-wide job growth (55 per cent), followed by Sydney (48 per cent), Melbourne (41 per cent) and Brisbane (34 per cent).
- The Central Business Districts (CBDs) are projected to add many additional jobs in Sydney (147 000), Melbourne (142 000) and Brisbane (73 000) between 2006 and 2031. However, the share of jobs located in the CBD is projected to fall in Sydney, Brisbane and Perth, and remain stable for Melbourne. Outside the CBDs, Sydney's North West and Melbourne's Outer South are expected to add 150 000 and 141 000 jobs, respectively.
- Should these spatial projections of population and employment growth be realised, BITRE's exploration of future commuting patterns suggests that the relative importance of same-subregion commutes will increase significantly in all four cities, with same-subregion commutes contributing about half of the increased commuter flows in each city from 2006 to 2031. It also suggests that the relative importance of inward commutes is likely to decline.
- Declines in the relative importance of inward commutes (and the projections of rapid outer suburban job growth) will potentially pose a challenge to achieving growth in the public transport mode share. However, the increased importance of close-to-home commutes will open an opportunity to increase the active transport mode share.

Context

This chapter explores possible future population, employment and commuting patterns in the four largest capital cities.

The chapter begins with comparison of population projections from ABS (2008), which enable overall population growth in the four largest capital city Statistical Divisions (SDs) to be compared on a consistent basis. Small area population projections from the Australian Government Department of Health and Ageing (2009) are then used to compare population growth at the sectoral scale. Each state government also produces its own population projections, which differ in their underpinning methods and assumptions. State government population projections were used in our previous cities reports (BITRE 2010, 2011, 2012a, 2013a), but this chapter incorporates updated state government population projections for Sydney, Melbourne and Perth.

BITRE's individual city reports for Sydney, Melbourne, Brisbane and Perth (BITRE 2010, 2011, 2012a, 2013a) used small area employment forecasts/projections that were either produced or commissioned by the state government. This chapter incorporates updated employment forecasts for Sydney only. The small area employment forecasts and projections differ considerably across the cities in their underpinning methods and assumptions.

Some of these small area population and employment projections extend beyond 2031 or end just before then. For consistency we have used the same projection period (2006 to 2031) for Sydney, Melbourne, Brisbane and Perth.[61]

Projected population growth

> 'Projected population figures are not forecasts. If migration patterns, life expectancy or fertility differ from what has been assumed, the future population will vary from these projected figures. Projections should be used with caution, but are an essential input when planning for infrastructure and services at a range of geographical levels' (Office of Economic and Statistical Research (OESR) 2011).

Because long term population projections are mostly based on assumptions about the key predictors of population (i.e. fertility, mortality and migration), it is implicit that the population projections do not reflect policy positions and hence are likely to differ from policy targets.

Based on Projection Series B[62] from ABS (2008), Brisbane and Perth are projected to grow at 1.9 per cent per annum, on average, between 2006 and 2031 (see Table 9.1). The projected average annual rate of growth is lower for Melbourne (1.4 per cent) and Sydney (1.2 per cent). Melbourne is expected to increase its population the most (by 1.6 million people by 2031), followed by Sydney (1.4 million), Brisbane (1.1 million) and Perth (0.9 million). These projections also indicate that in 2031, the four capital cities will continue to retain their current population

61 The Perth population projections (Western Australian Government 2012) and the Brisbane employment projections (National Institute of Economic and Industry Research (NIEIR) 2007) both end in 2026. BITRE extrapolated these projections to 2031, by applying the 2021–2026 growth rate to the 2026–2031 period.

62 Projection Series B 'largely reflects current trends in fertility, life expectancy at birth, net overseas migration and net interstate migration' (ABS 2008 p.3). The three elements of the projection—births, deaths and migration—are assumed to be relatively stable over the longer term.

rankings, with Sydney having the largest population, followed by Melbourne, Brisbane and Perth.

Table 9.1 Australian Government population projections for Sydney, Melbourne, Brisbane and Perth, 2006 to 2031

	2006	2011	2016	2021	2026	2031	Change	Average annual growth 2006–2031
Statistical Division				'000				per cent
Sydney	4 282	4 553	4 840	5 133	5 368	5 711	1 429	1.2
Melbourne	3 743	4 062	4 386	4 712	4 973	5 355	1 612	1.4
Brisbane	1 820	2 023	2 239	2 459	2 637	2 902	1 082	1.9
Perth	1 519	1 698	1 885	2 076	2 229	2 457	938	1.9

Note: Figure for 2006 is final estimated resident population, the rest of the years are projections.

Source: ABS Cat. 3222.0 Population Projections Australia, 2006 to 2101 (Series B projections) (ABS 2008).

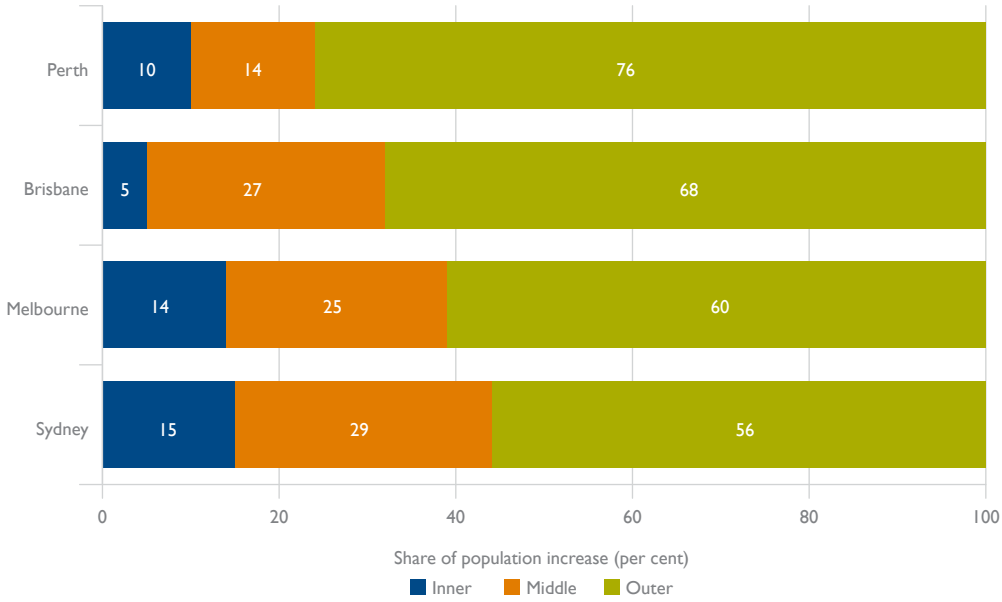
Figure 9.1 shows how the population increase between 2006 and 2031 is expected to be allocated across the Inner, Middle and Outer sectors of the four largest cities, based on small area population projections from the Australian Government Department of Health and Ageing (2009).[63]

The Outer sector of each city is expected to experience a larger increase in population than the Inner and Middle sectors. The anticipated contribution of the Outer sector to total growth ranges from a low of 56 per cent for the Sydney SD to a high of 76 per cent for the Perth SD. Melbourne's Outer sector is expected to add 1.03 million people (representing 60 per cent of Melbourne's total increase), while Sydney and Brisbane's Outer sectors are expected to add 0.81 and 0.75 million respectively. Sydney's Inner and Middle sectors are projected to contribute 15 and 29 per cent, respectively, of the city's total increase in population—which is more than the anticipated growth shares of the Inner and Middle sectors of Melbourne, Brisbane and Perth through to 2031.

In terms of the sectoral rates of growth, Perth's Outer sector is predicted to increase at the fastest average annual rate (2.7 per cent), followed by Brisbane's Outer sector (2.6 per cent). In contrast, slow growth is anticipated for Melbourne's Middle sector (0.9 per cent) and Perth's Middle sector (1.0 per cent).

63 ABS produced these population projections for Statistical Local Areas (SLAs) on a consultancy basis for the Department of Health and Ageing. The projections are based on ABS (2008) series B projections, and cover the period to 2027. BITRE has extrapolated the SLA projections to 2031, by applying the 2022–2027 growth rates to the 2027–2031 period.

Figure 9.1 Australian Government projections of population growth for Sydney, Melbourne, Brisbane and Perth Statistical Divisions by sector, 2006 to 2031



Note: Figure for 2006 is final estimated resident population. Figure for 2031 is a projection. Map 1.2 shows sectoral boundaries.

Source: BITRE analysis of Australian Government Department of Health and Ageing (2009).

Table 9.2 shows the respective state government population projections for Sydney, Melbourne, Brisbane and Perth between 2006 and 2031 by sector, including the expected growth shares and average annual growth rates. The projections are drawn from the Bureau of Transport Statistics (BTS 2012a) for Sydney,[64],[65] Victorian Department of Planning and Community Development (2012) for Melbourne, OESR (2011d) for Brisbane, and Western Australian Government (2012) for Perth.[66] These projections were available at the Statistical Local Area (SLA) scale for Sydney, Melbourne and Brisbane, and at the Local Government Area (LGA) scale for Perth.

Bearing in mind that different sets of assumptions underlie each city's population projections, the state government population projections suggest that Sydney and Melbourne will both experience a population increase of around 1.7 million people between 2006 and 2031, with a 1.0 million increase projected for Brisbane and a 0.9 million increase for Perth. Perth and Brisbane are expected to experience a relatively fast rate of growth (at 1.9 and 1.8 per cent per annum, respectively), while slower growth is anticipated in Melbourne (1.6 per cent) and Sydney (1.4 per cent).

64 BTS (2012a) provided the most current population projections/forecasts available at the time this analysis was undertaken. Subsequently, in August 2013, the NSW Department of Planning and Infrastructure released a new set of preliminary population projections which provided less spatial detail (i.e. the projections related to LGAs, not SLAs).

65 In BTS (2012a) they are referred to as population forecasts, but it is also noted that the forecasts are based on the Department of Planning & Infrastructure's (DPI) 2010 Interim Population Projections, and allowing for minor rounding differences, are consistent with DPI totals for Estimated Resident Population at the SLA level.

66 The *WA Tomorrow* projections for Perth end in 2026. BITRE has extrapolated these projections to 2031, by applying the 2021–2026 growth rate to the 2026–2031 period.

This is similar to the previous cross-city growth pattern from the ABS population projections (Table 9.1). The main difference is that the more recent NSW Government projections (BTS 2012a) anticipate higher population growth for Sydney than did ABS (2008)—an increase of 1.7 million, rather than 1.4 million.

For each of the four cities, Table 9.2 shows that the clear majority of population growth (64–76 per cent) between 2006 and 2031 is projected to occur in the Outer sector. The Outer sector also has the highest projected average annual growth rate in all four cities. Particularly rapid growth is projected for Outer Brisbane and Outer Perth, averaging 2.6 per cent per annum. Sydney's Outer sector is expected to grow more slowly than the other cities (at 1.6 per cent per annum). Relatively slow average annual growth is expected for the Middle sectors of Melbourne (0.8 per cent), Brisbane (0.9 per cent) and Perth (0.9 per cent).

Table 9.2 State government population projections for Sydney, Melbourne, Brisbane and Perth by sector, 2006 to 2031

	2006	2031	Change	Share of growth	Average annual growth rate
Statistical Division	'000			per cent	
Sydney[a]					
Inner	737	950	213	12	1.0
Middle	1 223	1 605	383	22	1.1
Outer	2 322	3 462	1 140	66	1.6
Total Sydney	4 282	6 017	1 735	100	1.4
Melbourne[b]					
Inner	280	477	197	11	2.1
Middle	1 818	2 229	411	24	0.8
Outer	1 582	2 706	1 124	65	2.2
Total Melbourne	3 681	5 412	1 731	100	1.6
Brisbane[c]					
Inner	88	155	67	7	2.3
Middle	903	1 117	214	21	0.9
Outer	829	1 562	733	72	2.6
Total Brisbane	1 820	2 834	1 014	100	1.8
Perth[d]					
Inner	238	348	110	12	1.5
Middle	472	591	119	13	0.9
Outer	812	1 528	716	76	2.6
Total Perth	1 522	2 467	944	100	1.9

Notes: Population projections based on medium series projection by state governments. Projections for each city differ in the underpinning methods and assumptions used for Total Fertility Rate (TFR), life expectancy and net overseas migration. SLA projections were used for Sydney, Melbourne and Brisbane, while for Perth, LGA projections were used. For Brisbane, BITRE uses the 2011 version of the OESR population projections, concorded to 2006 ASGC. Map 1.2 shows sectoral boundaries.

Sources: BITRE analysis of: a) BTS (2012a), b) Victorian Department of Planning and Community Development (2012), c) OESR (2011d), d) Western Australian Government (2012).

The two sets of sectoral projections shown in Figure 9.1 and Table 9.2 bear some similarities in terms of the spatial patterns of growth, although they differ in magnitude. Both projections converge in that the majority of population growth in each city is expected to occur in the Outer sector. The Middle sector of each city is anticipated to contribute moderately to population growth between 2006 and 2031, whilst the Inner sector is expected to contribute the smallest share of growth in each city.

At the subregion scale, the state government projections suggest that the largest increases in population between 2006 and 2031 will occur in:

- Sydney—the South West subregion (an extra 422 000 residents), the North West subregion (404 000) and the West Central subregion (237 000)
- Melbourne—the Outer South subregion (an extra 390 000 residents) and the Outer West subregion (381 000)
- Brisbane—the Outer West subregion (an extra 321 000 residents) and the Outer North subregion (200 000)
- Perth—the North West subregion (and extra 244 000 residents) and the South West subregion (212 000).

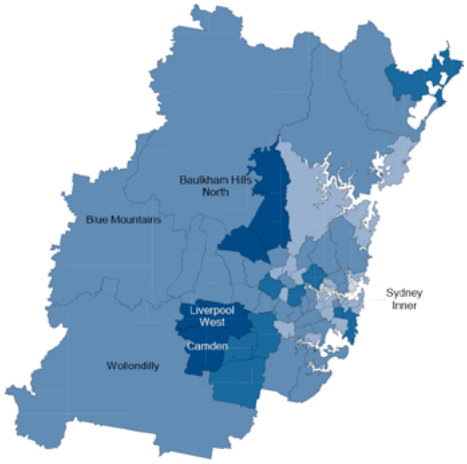
To explore the spatial pattern of this population increase, Map 9.1 illustrates the expected change in the population count at the small area scale from 2006 to 2031.[67] The areas that are expected to add the most population are all located in the Outer sector. In Sydney, for example, the Camden SLA in the South West subregion and the Blacktown North SLA in the North West subregion have the largest anticipated population increase (178 000 and 151 000, respectively). In Melbourne, the Whittlesea North SLA is projected to gain 139 000 new residents, with significant gains also anticipated for Wyndham North (110 000) and Cranbourne (106 000). In Brisbane, the Ipswich Central and Ipswich East SLAs in the Outer West subregion are projected to add the largest number of people (141 000 and 124 000, respectively). In Perth, the largest gains are projected for the Wanneroo (207 000), Rockingham (110 000) and Swan (100 000) LGAs.

The state governments also produce projections of the number of dwellings that will be required to accommodate this future population growth. For example, OESR (2012) projects that 471 100 additional dwellings will be required in Brisbane between 2006 and 2031, with 122 400 of those projected to be located in the Ipswich LGA (i.e. the Outer Western subregion). Further details of dwelling projections are presented in the individual city reports for Sydney, Melbourne and Brisbane (BITRE 2011, 2012a, 2013a).

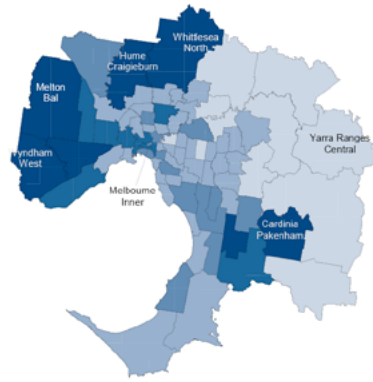
67 SLA projections are presented for Sydney, Melbourne and Brisbane, while LGA projections are presented for Perth.

Map 9.1 State Government projected population increase at small area scale for Sydney, Melbourne, Brisbane and Perth, 2006 to 2031

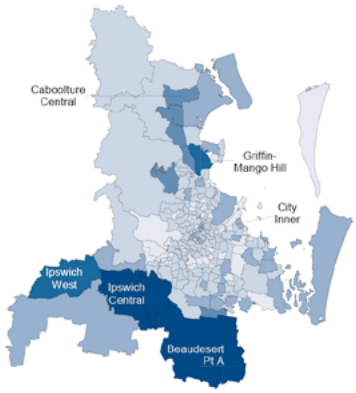
Sydney SD



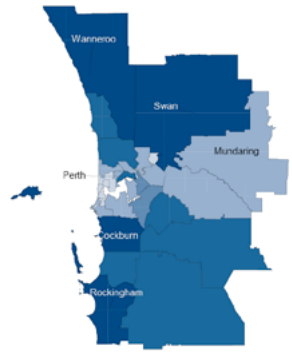
Melbourne SD



Brisbane SD



Perth SD



Projected population change by SLA of residence
(Number of persons)

- Gain more than 60 000
- Gain 30 000 to 60 000
- Gain 15 000 to 30 000
- Gain 5 000 to 15 000
- Gain 500 to 5 000
- No significant change, gain up to 500

Notes: Population projections based on medium series projection by state governments. Projections for each city differ in their underpinning methods and the assumptions used for Total Fertility Rate (TFR), life expectancy and net overseas migration. For Brisbane, BITRE uses 2011 version of the OESR population projections, concorded to 2006 ASGC. SLA projections were used for Sydney, Melbourne and Brisbane, while for Perth, LGA projections were used. All four city maps are presented on a common scale.

Sources: BITRE analysis of: a) BTS (2012a), b) Victorian Department of Planning and Community Development (2012), c) OESR (2011d), d) Western Australian Government (2012).

Projected growth in employment

Small area employment projections[68] that were either produced or commissioned by state governments were used to explore the employment outlook in the individual city reports (BITRE 2010, 2011, 2012a, 2013a).[69] Projections were available at the SLA scale for Sydney, Brisbane and Perth and at the LGA scale for Melbourne. This section incorporates updated employment projections for Sydney only, drawn from BTS (2012b). The employment projections for Melbourne are drawn from Victorian Department of Transport (2008) and those for Brisbane are drawn from NIEIR (2007).[70] The Perth projections are based on the *Directions 2031* employment projections for subregions (Western Australian Planning Commission 2010), allocated to SLAs using unpublished Western Australian Department of Planning and Infrastructure (DPI) employment projections (prepared in 2006).

Because the long term employment projections tend to be based on assumptions about population growth, labour force participation, industry trends and land use trends, they are likely to differ from policy targets. Each set of projections employs different methods and assumptions, so care needs to be exercised when looking at the results of the four cities together. Despite this constraint, it is still useful to explore emerging patterns within each city, and to see if there is a common pattern across the cities.

Table 9.3 presents the employment projections for Sydney, Melbourne, Brisbane and Perth between 2006 and 2031 by sector. Bearing in mind the different assumptions attached, relatively rapid job growth is predicted for Brisbane, averaging 2.2 per cent per annum. Sydney and Melbourne are expected to have job growth of 1.3–1.4 per cent per annum, while Perth is expected to grow employment by an average of 1.7 per cent per annum through to 2031.

Employment is expected to grow fastest in the Outer sector of each city, and the Outer sector is projected to contribute the largest share of job growth for each city between 2006 and 2031. Perth's Outer sector is projected to contribute 55 per cent of jobs growth, compared to 48 per cent for Outer Sydney, 41 per cent for Outer Melbourne and 34 per cent for Outer Brisbane. In Brisbane, each sector is expected to contribute a similar share of the total employment increase. Employment growth is expected to be relatively slow in Inner and Middle Sydney, Inner and Middle Perth, and Middle Melbourne, averaging 1.0–1.3 per cent growth per annum. However, Inner Brisbane is expected to grow quite rapidly, with average annual growth of 2.5 per cent (similar to that of Outer Brisbane).

68 The Sydney figures are described as employment forecasts (BTS 2012b), while the figures for the remaining cities are described as employment projections (Victorian Department of Transport 2008, NIEIR 2007) or an anticipated scenario (Western Australian Planning Commission 2010). In the remainder of this chapter, the term "projections" will be used to encompass all of these sources.

69 The employment projections for Sydney, Melbourne and Brisbane are disaggregated by industry. BITRE (2011, 2012a and 2013a) include some analysis of projected job growth by industry.

70 The NIEIR (2007) employment projections for Brisbane end in 2026. BITRE has extrapolated these projections to 2031, by applying the 2021–2026 growth rate to the 2026–2031 period.

Table 9.3 Employment projections for Sydney, Melbourne, Brisbane and Perth by sector, 2006 to 2031

Statistical Division	2006	2031	Change	Share of growth	Average annual growth
	'000			per cent	
Sydney[a]					
Inner	726	961	235	28	1.1
Middle	576	785	208	25	1.2
Outer	789	1 193	404	48	1.7
Total Sydney	2 092	2 940	847	100	1.4
Melbourne[b]					
Inner	532	753	221	30	1.4
Middle	732	944	212	29	1.0
Outer	590	891	301	41	1.7
Total Melbourne	1 854	2 588	734	100	1.3
Brisbane[c]					
Inner	217	406	189	33	2.5
Middle	360	545	186	32	1.7
Outer	213	408	195	34	2.6
Total Brisbane	789	1 359	570	100	2.2
Perth[d]					
Inner	241	326	85	26	1.2
Middle	182	244	62	19	1.2
Outer	196	379	183	55	2.7
Total Perth	619	949	330	100	1.7

Notes: Employment estimates are often higher than Journey to Work employment counts for the 2006 census year, to adjust for census undercount of workers. For Brisbane, the NIEIR projections appear to have been produced before the release of 2006 census employment totals. For Melbourne, since the sector classification is SLA-based, but only LGA projections were available, BITRE has apportioned the Stonnington LGA projections between the Inner and Middle sectors, based on 2006 census employment shares.

Sources: BITRE analysis of: a) BTS (2012b), b) Victorian Department of Transport (2008), c) NIEIR (2007), d) *Directions 2031* employment projections for subregions (WAPC 2010) and unpublished Western Australian DPI employment projections for SLAs (prepared in 2006).

At the subregion scale, these projections suggest that the largest increases in employment between 2006 and 2031 will occur in:

- Sydney—the North West (an extra 150 000 jobs), the City of Sydney (147 000), the South West (120 000) and West Central (114 000)
- Melbourne—Inner Melbourne (221 000, including about 142 000 jobs added in the City of Melbourne LGA) and the Outer South subregion (141 000)
- Brisbane—Inner Brisbane (189 000, including about 73 000 jobs added in the CBD[71]), and the Outer West (94 000) and Middle North (87 000) subregions
- Perth—Inner Perth (85 000, including about 35 000 jobs added in the City of Perth LGA) and the North West subregion (69 000).

71 Defined (as in Chapter 5) as the combination of the City Inner and City Remainder SLAs.

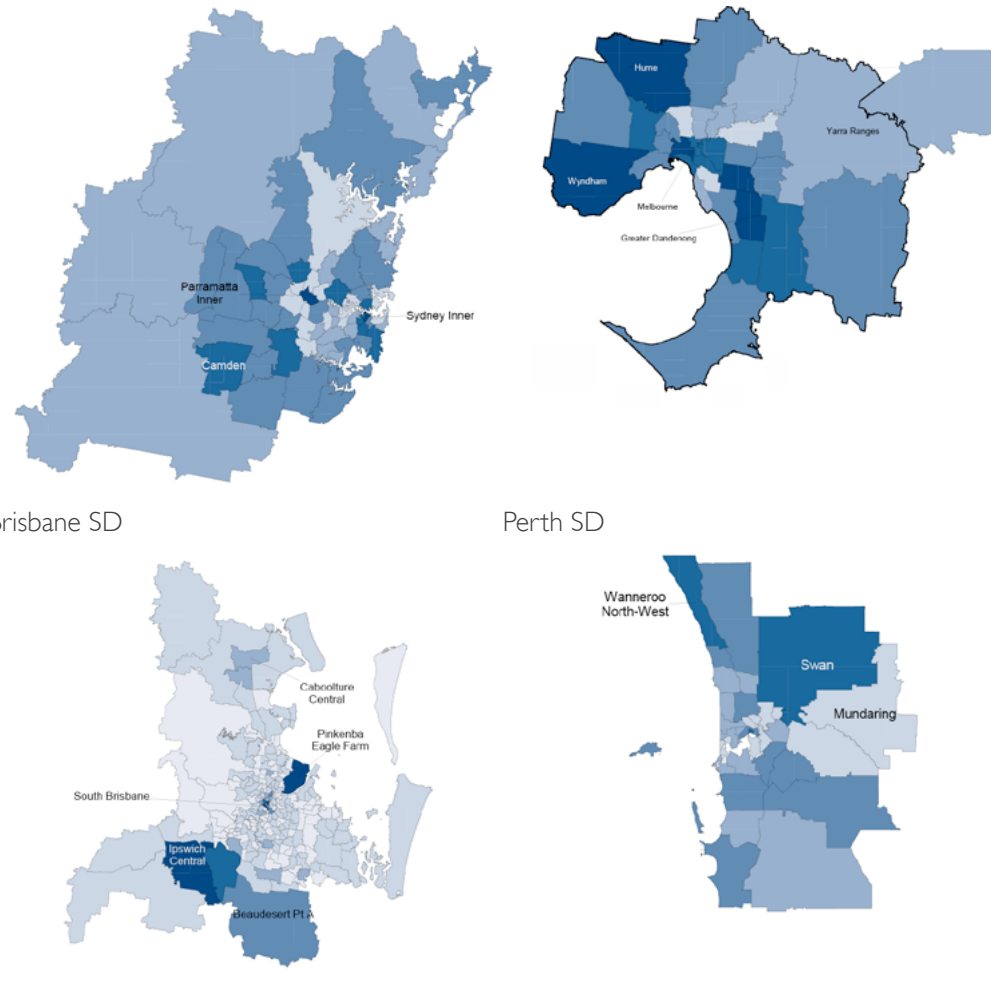
Despite this growth in CBD jobs, the share of jobs located in the CBD is projected to fall in Sydney, Brisbane and Perth, and remain stable for Melbourne.

Map 9.2 presents projected job growth at the small area scale from 2006 to 2031. The SLAs with the largest projected job increases are Sydney Inner (88 000), Ipswich Central (70 000), South Brisbane (48 000), Brisbane City Inner (45 000), Pinkenba-Eagle Farm (home to Brisbane Airport—45 000) and Parramatta Inner (40 000). In Melbourne, the City of Melbourne and Greater Dandenong LGAs are expected to add the most jobs (142 000 and 54 000 jobs, respectively).

Map 9.2 Change in projected employment at small area scale in Sydney, Melbourne, Brisbane and Perth, 2006 to 2031

Sydney SD

Melbourne SD



Brisbane SD

Perth SD

Notes: SLA projections were used for Sydney, Brisbane and Perth, while LGA projections were used for Melbourne, and the Yarra Ranges LGA extends beyond the SD boundary. Otherwise, based on capital city SDs. For Brisbane, the NIEIR projections appear to have been produced prior to the release of 2006 census employment totals.

Sources: BITRE analysis of: a) BTS (2012b), b) Victorian Department of Transport (2008), c) NIEIR (2007), d) *Directions 2031* employment projections for subregions (WAPC 2010) and unpublished Western Australian DPI employment projections for SLAs (prepared in 2006).

Commuting implications of population and employment growth

The spatial projections of population and employment growth presented in this chapter have implications for spatial patterns of commuting through to 2031. This section explores the potential spatial composition of the expected increase in commuter travel in the Sydney, Melbourne, Brisbane and Perth SDs.

Methodology

Chapter 8 discusses the drivers of changes in commuting flows over the 2001 to 2006 period, and shows that the key drivers of growth in commuting flows are the rate of growth in employed residents in the origin location and the rate of growth in jobs at the destination location. In this section, a simplified version of the regression in Table 8.3—incorporating only these two explanatory variables (i.e. growth of population and jobs)—is used as a device for translating the available population and employment projections into the potential impacts on commuter flows in each city. Details of this simple model of commuting change are provided in the reports for each individual city (BITRE 2010, 2011, 2012a, 2013a).[72]

In this report, to keep things relatively straightforward only a single growth scenario is considered for each city, based on the state government's small area projections of population (as described in Table 9.2 and Map 9.1) and the available small area projections of employment (as described in Table 9.3 and Map 9.2). Projections of growth in the working age population[73] and projections of employment growth between 2006 and 2031[74] are inputted into the commuting change model for each city to elicit likely outcomes in spatial commuter flows *if the population and employment growth projections are realised*. BITRE's change model is at the SLA scale, and SLA-based population and employment projections are used.[75]

This approach produces an estimate of the potential spatial distribution of commuter flows in each city in 2031, assuming a particular spatial allocation of population and job growth through to 2031.[76] This potential future commuting pattern is then compared to the 2006 baseline for each city. This exercise is undertaken for exploratory purposes only and is not intended to be predictive.

The adopted approach only investigates the influence of spatial projections of population and job growth on commuting patterns, and the impacts of other drivers (such as changes to the transport network) are not explored. It should also be noted that while the change model was estimated for a short time horizon (2001 to 2006), it is being applied to a much longer time

72 Table 8.12 of BITRE (2013a) summarises the results of this simplified version of the change regression model for Sydney, Melbourne, Brisbane and Perth. The model explanatory power is much lower for Sydney (40 per cent) than for the other cities (51 to 69 per cent).

73 The future growth rate of employed residents for each SLA is assumed to equal the future growth rate of its working age population (15 to 64 year olds).

74 BITRE extended the Perth population projections and the Brisbane employment projections to 2031, which enabled the modelling for all four cities to be based on a common time period (2006 to 2031). The scenario modelling results in the individual city reports used a range of different time periods.

75 For Perth, where only LGA projections of population were available, the SLAs within each LGA were assumed to have the same rate of population growth. The same applies to Melbourne with respect to the employment projections.

76 The individual city reports for Sydney, Brisbane and Perth consider the commuting implications of a range of different population and job growth scenarios (BITRE 2010, 2012a, 2013a).

period (2006 to 2031), over which fundamental changes in the nature of the relationship are likely. The results in the following section should be interpreted with these caveats in mind. [77]

Results

Figure 9.2 explores the potential spatial pattern of future commuting flows in Sydney, Melbourne, Brisbane and Perth in 2031, and compares them with actual commuting patterns in the base year (2006). A number of changes are apparent.

- There is a significant decline in the proportion of inward commutes in Sydney, Brisbane and Perth (of 3.0, 1.5 and 6.4 percentage points, respectively), with a small decline for Melbourne (0.2 percentage points) between 2006 and 2031.
- There are also small reductions in outward commutes as a proportion of total commutes for all four cities (of up to 0.5 percentage points).
- There is a significant increase in the proportion of commutes within the home SLA for Brisbane, Perth and Sydney (by 4.9, 4.5 and 1.2 percentage points, respectively), with a small increase in Melbourne (0.4 percentage points).
- The proportion of commutes to a different SLA within the home subregion increases for Sydney, Melbourne and Perth (by between 0.7 to 2.2 percentage points), but declines for Brisbane (by 1.4 percentage points).
- There are mixed changes in the proportion of cross-suburban commutes, with a significant increase for Perth (1.3 percentage points) and a significant decline for Brisbane (of 1.8 percentage points) between 2006 and 2031.

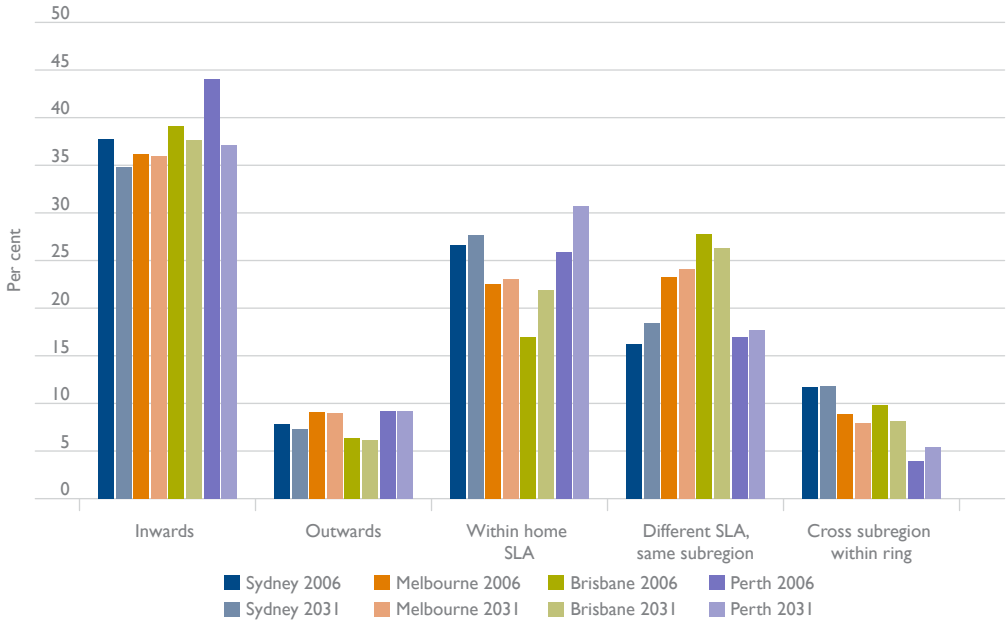
A key pattern emerging from this spatial exploration of future commuting flows is the increase in the relative importance of same-subregion commutes (i.e. commutes within the home SLA and commutes to a different SLA in the home subregion and ring). Based on Figure 9.2, all four cities show a significant increase in the relative importance of same-subregion commutes—ranging from 1.2 percentage points for Melbourne to 5.3 percentage points for Perth. Commutes within the home subregion contribute around half of the modelled increase in commuter flows in each city (ranging from 48 per cent for Perth to 55 per cent for Melbourne) between 2006 and 2031. The increase in the relative importance of same-subregion flows is largely occurring at the expense of inward flows and (in Melbourne and Brisbane, only) cross-subregion flows.

Scenario modelling results presented in the individual city reports for Sydney, Brisbane and Perth show that this increase in the relative importance of same-subregion commutes and the decline in the relative importance of inward commutes are also observed for each city under each of the alternate scenarios, which are based on different spatial projections of population and job growth (BITRE 2010, 2012a, 2013a).[78]

77 Note that updated employment forecasts, such as those currently being prepared for Brisbane, would also be expected to impact on the results of this modelling exercise.

78 Only a single scenario was considered for Melbourne.

Figure 9.2 Proportion of commuters by type of flow in Sydney, Melbourne, Brisbane and Perth Statistical Divisions, 2006 and 2031



Note: The spatial distribution of commuting flows in 2031 assumes that population and employment projections to 2031 (as detailed in sources) are realised. The spatial distribution of commuting flows in 2006 is based on ABS Census of Population and Housing data for 2006. Flow type categorisation based on commutes that have an origin and destination within SD. Inward commutes include commutes to workplaces in the CBD from elsewhere in SD, from outer suburban residences to Middle or Inner sector workplaces and from Middle sector residences to Inner workplaces. The opposing flows are categorised as outward commutes (e.g. from Middle to Outer). Cross-suburban commutes involve travel to a different subregion in the home ring (e.g. from Melbourne's Outer North to its Outer West). Appendix A provides details of subregion boundaries. More detail on the underlying modelling approach is available from BITRE (2010, 2011, 2012a, 2013a).

Source: BITRE analysis of ABS *Census of Population and Housing* 2006 (unpublished data), BTS (2012a, 2012b), Victorian Department of Planning and Community Development (2012), Victorian Department of Transport (2008), OESR (2011d), NIEIR (2007), Western Australian Government (2012), WAPC (2010), and unpublished Western Australian DPI employment projections (prepared in 2006).

The results of this modelling exercise suggest that commuting flows within the Outer sector will account for the largest proportion of increased commutes in Perth, Sydney, Brisbane and Melbourne (51, 47, 40 and 34 per cent share, respectively). This reflects the large projected increases in the number of Outer sector residents and jobs in each city through to 2031 (Tables 9.2 and 9.3). While commuting flows within the Outer sector tend to dominate growth for each city, strong increases are also anticipated in commuting flows within the Inner and Middle sectors and in cross-sectoral inward commutes (i.e. Outer to Middle, Middle to Inner, Outer to Inner). For example, in Melbourne, increased commutes within the Middle sector account for 16 per cent of the modelled growth in commuter flows from 2006 to 2031, with increased flows from the Outer sector to the Middle sector and from the Middle sector to the Inner sector also making a significant contribution (13 and 12 per cent, respectively).

The remaining spatial exploration of commuting growth between 2006 and 2031 focuses on the key changes in subregional flows for each city, assuming the spatial population and employment projections are realised.

The origin-destination subregion pairs which are anticipated to generate the largest share of city-wide growth in commuting flows between 2006 and 2031 all involve the same subregion of residence and work, and are as follows:

- Sydney—South West (15.4 per cent share of city-wide growth) and North West (14.8 per cent)
- Melbourne—Outer South (15.0 per cent) and Inner (8.6 per cent)
- Brisbane—Outer West (21.9 per cent) and Outer North (7.9 per cent)
- Perth—North West (19.1 per cent) and South West (10.7 per cent).

The listed same-subregion pairs align closely to the subregions with the highest projected population growth in each city between 2006 and 2031. That is, a particularly large projected increase in the population of a subregion tends to translate into a substantial increase in predicted commuter flows within that subregion (should sufficient local job growth occur).

For each city, the largest anticipated increases in commuting *between different subregions* from 2006 to 2031 are:

- Sydney—from the North West subregion to West Central (which contributes 4.1 per cent of the city-wide increase in commuter flows)
- Melbourne—to Inner Melbourne from either the Middle North or Outer West subregion (which both contribute 3.5 per cent of growth in commuter flows)
- Brisbane—from the Middle North to Inner Brisbane (4.9 per cent) and from the Outer North to the Middle North (3.8 per cent)
- Perth—from Middle Perth to Inner Perth (6.0 per cent), from the North West to Inner Perth (4.1 per cent) and from the North West to Middle Perth (3.8 per cent).

The individual city reports contain more detailed information about the implications of the spatial projections of population and jobs for growth in commuter numbers at the SLA scale (BITRE 2010, 2011, 2012a, 2013a).

The spatial projections also have implications for commuting distances. Detailed results regarding the effects on average commuting distances are available from the individual city reports (ibid). They point to a similar basic outcome in that the average commuting distance is expected to slightly increase for the Sydney, Melbourne, Brisbane and Perth SDs between 2006 and 2031.

These spatial projections are expected to influence transport mode shares for commuter travel in several ways. The projected increase in the relative importance of same-subregion commutes, which tend to involve relatively short distances, may create an opportunity to increase active transport mode shares. Any significant shift away from inward commutes is likely to be unfavourable for public transport mode shares, because about three-quarters of commuter use of public transport is due to inward commuting (BITRE 2011, 2012a and 2013a). The forecasts of rapid outer suburban job growth (in Table 9.3) also pose a challenge for increasing the public transport mode share, as the existing public transport systems are rarely used to access outer suburban workplaces.[79] A reorientation of the public transport

79 In 2006, the public transport mode share to access Outer sector jobs was 5.1 per cent for Outer Sydney, 2.6 per cent for Outer Melbourne, 2.7 per cent for Outer Brisbane, and 2.1 per cent for Outer Perth (BITRE 2010, 2011, 2012a, 2013a).

system—to better service those making trips within outer suburban subregions—may be needed in order to encourage a significant shift towards public transport.

Summary

This chapter summarises the outlook for Sydney, Melbourne, Brisbane and Perth in terms of spatial projections of population, employment and commuting growth through to 2031.

The population of Sydney, Melbourne, Brisbane and Perth is projected to grow at average annual rates of 1.4, 1.6, 1.8 and 1.9 per cent, respectively, between 2006 and 2031. The total number of jobs located in Sydney, Melbourne, Brisbane and Perth is projected to grow at average annual rates of 1.4, 1.3, 2.2 and 1.7 per cent, respectively. These projections of population and jobs were either produced or commissioned by state governments and each set of projections employs different methods and assumptions.

The modelling suggests that realisation of these spatial projections of population and employment is likely to result in a significant shift towards same-subregion commutes in all four cities between 2006 and 2031, as well as a reduction in the relative importance of inward commutes. Due to the large projected increases in the number of outer suburban residents and jobs, flows *within* the Outer sector of each city are likely to represent a large proportion of the total increase in commutes (34–51 per cent).

CHAPTER 10
Discussion

This report compares patterns of population growth, job growth and commuting in Australia's four largest cities. It brings together the findings of four recent BITRE Reports covering Perth (BITRE 2010), Melbourne (BITRE 2011), Sydney (BITRE 2012a) and South East Queensland (BITRE 2013a). This series of reports has aimed to build an evidence base on the spatial dimensions of recent changes in population, jobs and commuting flows in our largest cities, and how commuting behaviour has responded to these changes. A secondary aim has been to investigate the extent to which there has been progress in reshaping each city's spatial development and commuting patterns in the direction envisaged by recent metropolitan plans.

These in-depth case studies of Australia's four largest cities provide the basis of this final comparative report, which presents an overview of relevant statistics across the four cities and extracts some common themes and differences that emerge from the individual city studies. Some implications of these changes in spatial development patterns for infrastructure and strategic metropolitan planning are also discussed.

Some common themes (and differences)

Spatial patterns of population growth[80]

Australia's largest cities are all highly suburbanised and low density by world standards (Forster 2006). Recent capital city strategic plans adopt urban consolidation policies, which aim to limit the rate of suburban expansion by encouraging new dwelling construction in existing built-up areas (i.e. infill development) and encouraging higher density residential development.

Over the past decade, rates of infill development in Perth have been well below the strategic plan targets, but Sydney, Melbourne and Brisbane have been tracking above their long-term infill targets. All four cities experienced a significant reduction in the typical size of newly produced lots. Sydney, Melbourne, Brisbane and Perth all recorded density gains in their established inner and middle suburbs between 2001 and 2011. All four cities similarly recorded an increase in the residential density of activity centres between 2001 and 2006, although the magnitude of change was limited for Melbourne.

While there was relatively little change in Perth's dwelling mix between 2001 and 2011, Sydney, Melbourne and Brisbane each experienced a clear shift towards higher density forms of housing—with a significant increase in the proportion of high-rise flats, units and apartments

80 The material in this section is drawn from Chapters 3 and 4 of this report, except where otherwise noted. Data sources and methods are outlined in Chapters 3 and 4.

and a significant decline in the proportion of separate houses. The shift towards higher density forms of housing was most pronounced in Sydney, where 54 400 new high-rise flats, units and apartments were added, compared to 47 100 separate houses, 41 800 semi-detached dwellings and 20 000 low-rise flats, units and apartments.

Perth and Brisbane had average population growth of 2.3 per cent per annum between 2001 and 2011, compared to 1.7 per cent for Melbourne and 1.1 per cent for Sydney. However, the Melbourne Statistical Division (SD) gained the most new residents (636 300). This compares to a gain of 477 600 persons for the Sydney SD, 408 900 persons for the Brisbane SD and 351 500 persons for the Perth SD.

The Central Business Districts (CBDs)[81] of all four cities had very rapid population growth from 2001 to 2011, due to redevelopment with higher density housing. The Middle sector of each city recorded average population growth of 0.9–1.8 per cent per annum. The Outer sector of Melbourne, Brisbane and Perth grew more rapidly, with 2.4–2.9 per cent average annual growth. This pattern was not repeated in Sydney's Outer sector, which averaged 0.9 per cent per annum growth. Nevertheless, the outer suburbs accommodated much of the population growth in all four cities, contributing 46 per cent of Sydney's growth, compared to 53 per cent for Brisbane, 62 per cent for Melbourne and 68 per cent for Perth.

All Australian Statistical Local Areas (SLAs) that added over 25 000 new residents from 2001 to 2011 were located in the outer suburbs of the four largest capital cities. The SLAs with population increases of more than 25 000 were mainly located in Melbourne (e.g. Melton East, Whittlesea North, Cranbourne, Wyndham North, Craigieburn), and to a lesser extent, Perth (e.g. Rockingham, Wanneroo North West, Swan). Sydney and Brisbane each had a single SLA which added more than 25 000 residents—Blacktown North for Sydney and Ipswich East for Brisbane.

There were a few SLAs in each city with population losses from 2001 to 2011. These were typically rather established outer suburban SLAs (e.g. Broadmeadows in Melbourne, Joondalup South in Perth), where the fall in population reflects the transition of households through their life cycle and into the empty nest stage.

Spatial patterns of job growth[82]

Jobs tend to be concentrated in and around the CBDs of Australian cities, while population is distributed more widely throughout the middle and outer suburbs. For example, Melbourne's Inner sector contained 30 per cent of the city's employment in 2011, but only 8 per cent of its population. The Middle sector accounted for 38 per cent of jobs and 47 per cent of population, while the Outer sector contained 32 per cent of jobs and 45 per cent of population. Similar patterns are evident for Sydney, Brisbane and Perth. In all four cities, there is a significant shortfall of outer suburban jobs compared to employed residents, but particularly in Perth's outer suburbs which provided only 53 jobs for every 100 employed residents in 2011.

In Sydney, Melbourne, Brisbane and Perth, between 25 and 34 per cent of jobs were located within 5 kilometres (km) of the CBD in 2006. The CBD-based activity centres were the

81 The CBD has been defined as the central LGA for Sydney, Melbourne and Perth, and as the combination of the City Inner and City Remainder SLAs for Brisbane.

82 The material in this section is drawn from Chapters 5 and 6 of this report, except where otherwise noted. Data sources and methods are outlined in Chapter 5 and 6.

dominant job location in each city, ranging in size from 108 700 jobs in Perth to 300 100 jobs in Sydney. Sydney contains several other centres with over 25 000 jobs (e.g. St Leonards, Parramatta, Macquarie Park, Sydney Airport-Mascot), but there are no non-CBD activity centres of this size in the other three cities. The most substantial employment clusters in Melbourne, Brisbane and Perth's middle and outer suburbs are typically industrial areas or transport-specialised centres (e.g. Melbourne Airport, Australia's TradeCoast area in Brisbane, Kewdale-Welshpool and Osborne Park in Perth).

Over the 2001 to 2011 period, Melbourne added 302 300 jobs, compared to 223 300 jobs added in Brisbane, 184 600 in Sydney and 174 400 in Perth. The Health and community services industry was the main source of job growth in Sydney, Melbourne and Brisbane (and the second largest source in Perth). The Property and business services industry added the most jobs in Perth, and was also a significant contributor to Brisbane's growth.

In the 1970s and 1980s, jobs dispersed to suburban locations and the employment share of the CBDs declined (NSW Government 2005, O'Connor 2006, Stimson and Taylor 1999). From 2001 to 2011, the Inner sector—and particularly the CBD—of all four cities experienced substantial job growth. Inner Melbourne added about 92 000 jobs (80 000 in the CBD), while between 52 000 and 61 000 jobs were added to each of Inner Sydney, Inner Brisbane and Inner Perth. This job growth was sufficient for the inner cores of the four largest Australian cities to maintain a relatively steady share of metropolitan employment from 2001 to 2011,[83] reflecting strong growth in Property and business services, Finance and insurance and Government administration jobs (and in Mining jobs in Inner Perth). Due to the specialised nature of this job growth, these inner cores are increasingly becoming economically distinct from the rest of the city (O'Connor and Rapson 2003, Forster 2006).

Outer suburban job growth is being driven by the consumption demands of the growing population and by the decentralisation of warehousing, logistics and manufacturing jobs (NSW Government 2005). Between 2001 and 2011, the Outer sector recorded the most rapid job growth in all four cities, with Outer Perth growing particularly rapidly (by 3.9 per cent per annum, on average). The Outer sector added more jobs than the other sectors in Sydney (67 000), Melbourne (107 000) and Perth (76 000), while the Middle sector added the most jobs in Brisbane (82 000).

Beyond the inner city, the key job growth areas were Ryde in Sydney; Craigieburn and Wyndham North in Melbourne; Pinkenba-Eagle Farm in Brisbane; and Swan, Belmont and Cockburn in Perth. Job growth at airports was an important factor for the Belmont, Craigieburn and Pinkenba-Eagle Farm SLAs (BITRE 2013c). The Wyndham North, Swan and Cockburn SLAs contain large and rapidly growing commercial and industrial zones, while Ryde is home to the Macquarie Park specialised centre. A common feature of job growth in all four cities is the rapid job growth of specialised centres, which include airports, business parks, hospitals and universities.

While the shortfall of outer suburban jobs (relative to employed residents) became more pronounced in specific outer suburban subregions,[84] there was no general tendency for the outer suburban job gap to widen between 2001 and 2011. In Outer Sydney and Outer Brisbane, job growth kept pace with residential growth, with employment self-sufficiency

83 The employment share of Inner Sydney, Inner Melbourne and Inner Brisbane changed by less than 1 percentage point from 2001 to 2011, while Inner Perth's share fell by 1.5 percentage points.

84 Particularly Outer Western Brisbane and Outer Western Melbourne.

remaining relatively stable[85]. Strong job growth resulted in Outer Perth becoming a little more self-sufficient with respect to employment (and its Eastern subregion becoming a lot more self-sufficient). However, Outer Melbourne recorded a significant decline in self-sufficiency, which was largely due to job growth not keeping pace with the very rapid residential growth occurring in Outer Western Melbourne.

About 4 per cent of each city's workforce reported working from home on census day 2011, and the proportion who worked from home declined for all four cities between 2001 and 2011. Working from home tends to be highest in more affluent suburbs with large professional populations (e.g. Woollahra, Cottesloe) and on the rural fringes of the cities (e.g. Cardinia North, Pine Rivers Balance).

Spatial patterns of commuter travel[86]

The overall spatial structure of commuting flows is broadly similar across the four cities. In 2006, 36–45 per cent of commuting flows within each of the four capital city SDs occurred in an inward direction and 6–10 per cent in an outward direction. The remaining 46–55 per cent of flows occurred within the home ring, and typically within the home subregion. Commutes within the home subregion (and ring) are the single most prominent type of commuter flow in Sydney (43 per cent), Melbourne (46 per cent) and Brisbane (45 per cent), and the second most prominent category for Perth (43 per cent, against 44 per cent for inward flows).

Inward commutes constitute about three-quarters of total public transport use by commuters and most commonly involve commuting to a place of work in the CBD. Between 25 and 42 per cent of Inner sector residents of each city commuted to a CBD workplace in 2006, compared to 15–21 per cent of Middle sector residents and 6–11 per cent of Outer sector residents. In each city, outer suburban residents are most likely to commute to an Outer sector workplace, and are more likely to commute to a place of work in the Middle sector than the Inner sector.

Forster (2006) argued that the preponderance of journeys to work between dispersed suburban origins and destinations has led to very high levels of automobile dependence in Australian cities. There are, however, signs that the level of automobile dependence has stopped rising. From 2001 to 2011, the private vehicle mode share of commuter travel declined in all four cities, with the decline ranging from 0.8 percentage points for Sydney to 4.0 percentage points for Melbourne. The public transport mode share rose in each city, but the increase was relatively modest for Sydney (0.8 percentage points).

Reflecting the concentration of population and jobs growth in the outer suburbs, from 2001 to 2006 the largest increases in commuter flows were for flows *within* outer suburban subregions—such as the 21 230 extra people who commuted within Melbourne's Outer Southern subregion or the 13 880 extra people who commuted within Outer Northern Brisbane. There were also substantial increases in the number of people commuting *within* the innermost subregions—such as the extra 12 640 people who commuted within Inner

85 Changes of less than 1 job for every 100 employed residents. Despite this overall stability, there were specific outer suburban subregions in each city which recorded significant declines in self-sufficiency, offset by others that recorded improvements.

86 The material in this subsection and the following subsection is drawn from Chapters 6 and 7 of this report, except where otherwise noted. Data sources and methods are outlined in Chapters 6 and 7.

Melbourne. Active transport mode shares are highest in these innermost subregions, and these increases in inner city commutes contributed to the increase in active transport in each city.

The largest increases in commuter flows between different subregions were typically inward flows, such as the extra 6750 commuters from Middle Perth to Inner Perth. Despite this, there was a small decline in the probability that an employed resident of each city would commute to an Inner sector workplace (of 0.5–1.8 percentage points). In all four cities, inward flows had a below-average rate of growth, so the proportion of inward commutes declined (by 0.7–1.1 percentage points). This decline in the relative importance of inward commutes, coupled with increases in the relative importance of outward commutes and cross-suburban commutes (off a low base), is consistent with the observation of Forster (2006) that spatial commuting patterns within Australian cities continue to grow in complexity.

Commuting distances and times

Average commuting distances were similar for residents of Sydney, Melbourne and Brisbane in 2006, and a little lower for Perth. In each city, average commuting distances were lowest for Inner sector residents (5–7km), higher for Middle sector residents (8–10km), and highest for Outer sector residents (13–15km).[87] Average commuting distances remained essentially unchanged for all four cities between 2001 and 2006. However, the Sydney *Household Travel Survey* reports a 1.1km net rise in average commuting distances between 2005–06 and 2011–12.

In 2006, Sydney full-time workers took 37 minutes on average to commute to work, compared to 33 minutes for Melbourne and Brisbane, and 28 minutes for Perth. The longer commuting distances of Outer sector residents do not fully translate into longer trip durations (due to the greater speed of travel), with average commuting times tending to be 4–7 minutes longer for Outer sector residents than for Inner sector residents.

All four cities recorded an increase in average commuting times over the study period. Between 2002 and 2010, the HILDA survey identifies substantial net increases in the average commuting times of full-time workers in Brisbane (7 minutes) and Perth (6 minutes), with moderate increases for Sydney (4 minutes) and Melbourne (3 minutes). The Sydney *Household Travel Survey* reports a 2 minute net rise in the average commuting trip duration between 2000–01 and 2011–12.

Some implications of the research

Commuting flows are driven by the spatial distribution of the residential population and jobs within the city. The current spatial distribution of population and jobs reflects the accumulated pattern of development over many decades, but continues to be shaped and influenced by demographic trends, cultural preferences, economic forces and government interventions. There are a range of mechanisms through which governments attempt to influence the spatial allocation of population, jobs and commuting within our cities. Two of the key mechanisms are considered in this section—capital city strategic plans and transport infrastructure.

87 These are straight line commuting distances. Average road network commuting distances are presented in the Sydney, Melbourne and SEQ reports (BITRE 2011, 2012a, 2013a)

Strategic planning

While the primary focus of this study has been identifying spatial changes in population, employment and commuting, a secondary focus has been providing contextual information about urban policy directions for each city and investigating the extent to which the recent spatial changes have been in line with the stated strategic planning goals. This evidence about the reality of recent trends in population, employment and commuting flows can then be used to inform future planning initiatives.

Sydney, Melbourne, Perth and South East Queensland (SEQ) each had several different strategic plans in operation during the 2001 to 2011 period. This report focuses on the *Metropolitan Plan for Sydney 2036, Melbourne 2030* and its *Melbourne @ 5 million* update, the *SEQ Regional Plan 2009–2031,* and the Perth and Peel plan—*Directions 2031 and beyond*.[88] The strategic plans for the four cities specify a range of common long-term goals that are relevant to the scope of this study. These relate to limiting urban sprawl, increasing residential densities around centres, locating employment in centres, achieving job growth in particular suburban locations, achieving greater use of public transport and active transport, concentrating development around public transport, and reducing commuting times and distances. To operationalise strategic planning into development control instruments and infrastructure design and construction can involve 10 to 15 year processes, and so the observed changes in population, jobs and commuting patterns since 2001 will partly reflect policy initiatives from earlier decades.

The available evidence suggests that there has been some movement in the desired direction for most of the population-related planning goals since 2001. Progress has been particularly significant with respect to the objectives of increasing residential densities in centres (for Sydney and Brisbane), shifting the focus of population growth within the city (in Melbourne and Brisbane), and consolidating rural population growth in existing settlements (in Melbourne).[89] This is consistent with the beliefs of state and territory governments that the population-related strategic planning objectives—such as managing greenfield development and transitioning to higher densities—are most able to be influenced by planning (Productivity Commission 2011).

Recent progress against the employment-related planning goals has been weaker than progress against the population-related goals. While there was a significant increase in the centred employment share in Sydney and Brisbane, there was rather limited progress in growing employment in the targeted suburban areas of Sydney, Brisbane and Melbourne, and in concentrating employment growth within Melbourne and Perth's centres.[90]

Due to mixed evidence, the underlying direction of change was difficult to determine for some of the transport and commuting related planning goals (e.g. concentrating development around public transport nodes, increasing self-containment). However, the 2001 to 2011 period saw generally positive progress towards achieving greater use of both public transport and active transport in each city. For the strategic planning goal of reducing commuting times and distances, the observed changes have generally not been in the desired direction, particularly with respect to commuting times, which increased in all f+our cities.[91]

88 Following changes in government, new strategic plans are currently being prepared for Sydney and SEQ. The Victorian Government released its new *Plan Melbourne* metropolitan strategy in October 2013.
89 Supporting analysis provided in the 'Strategic planning objectives' section of Chapter 4.
90 Supporting analysis provided in the 'Strategic planning objectives' section of Chapter 5.
91 Supporting analysis provided in the 'Strategic planning objectives' sections of Chapters 6 and 7.

Some of the long-term strategic planning goals are reasonably well-aligned with recent trends in Australia's four largest cities, including the goals of increasing residential densities in centres, shifting the focus of population growth within the city, and increasing active transport and public transport use. The recent increases in public transport use appear to result largely from an environment conducive to growth in public transport patronage (e.g. rising petrol prices, immigration-led population growth),[92] rather than from specific state government interventions.

Forster (2006) previously identified a mismatch between the planners' view of a desirable future urban structure and the complex realities of the evolving urban structures. Based on BITRE's analysis, there are two main areas where the strategic planning goals do not match up well to recent trends. Firstly, the 'on the ground' changes that have been occurring with respect to the employment-related planning goals have generally not been progressing at the required pace (or breadth) of change. Secondly, over the past decade, movements in commuting times have been in the opposite direction to that envisaged by planning authorities. These two issues are discussed, in turn, below.

Forster (2006, p.173) concludes that the 'metropolitan strategies do not come to terms with the dispersed, suburbanised nature of much economic activity and employment'. In recent years, suburban job growth has been occurring in a mix of dispersed locations and specialised centres, more than in the non-specialised activity centres. Of the four cities, only Brisbane saw an increase in the employment share of its non-specialised activity centres between 2001 and 2006. The challenges of attempting to focus job growth in centres have been widely noted in the literature,[93] including the quality of infrastructure in established suburban centres, the commercial imperatives faced by developers, and the concern that activity centre policy is out of step with the real world priorities of employers and their employees (O'Connor and Rapson 2003).

The capital city strategic plans aim to direct employment growth to particular suburban locations, and from 2001 to 2011, all four cities had a significant increase in the number of jobs in the targeted locations.[94] However—with the exception of Perth—this job growth did not keep pace with local residential growth, resulting in a decline in self-sufficiency. In Outer Western Melbourne and Outer Western Brisbane in particular, the shortfall of jobs (relative to employed residents) became much more pronounced between 2001 and 2011. These subregions are expected to accommodate a large proportion of their respective city's future residential growth. Unless this recent trend is reversed and matching job growth is achieved, the existing imbalances will widen, with implications for commuting patterns, travel times and infrastructure.[95]

Even if a balance between the number of jobs and workers in a suburban region is achieved, this is no guarantee that people will find a job close to home (Forster 2006). The 'on the ground' changes in commuting patterns between 2001 and 2006 did actually involve a small shift towards people finding work in their home subregion, with all four cities increasing the proportion of same-subregion commutes (by 0.3–0.6 percentage points) and reducing the proportion of inward commutes (by 0.7–1.1 percentage points). However, these recent

92 For further discussion of drivers, see Gaymer (2010) and BITRE (2013b).

93 See, for example, Birrel et al (2005), State Planning Commission (1987), Hill (2005), WAPC (2003), NSW Government (2005), Charter Keck Cramer (2006), Fagan and Dowling (2005) and O'Neill (2010).

94 The locations targeted for job growth were Western Sydney, Brisbane's Western Corridor, Outer Perth, and all locations outside Central Melbourne.

95 See, for example, Figure 5.3 and related text.

incremental shifts in urban structure and commuting patterns left average commuting distances unchanged, and were not sufficient to stop commuting times from rising. The recent increases in average commuting times have largely reflected reduced commuting speeds (due to rising levels of congestion and mode shifts), rather than increased commuting distances.

There are wide-ranging interconnections, and in some cases tensions, between the different strategic planning goals. For example, in line with the planning objective that an 'increased proportion of the region's future population will be accommodated in the Western Corridor' (Queensland Government and COMSEQ 2009, p.11), Brisbane's Western Corridor recorded rapid residential growth from 2001 to 2011, averaging 3.2 per cent growth per annum. However, job growth in the Western Corridor has not kept pace with local population growth, resulting in a decline in self-sufficiency, reduced self-containment of employment, and increased commuting distances for local residents.

Progress against strategic planning goals can also have implications for broader economic, social or environmental policy goals, which need to be taken into account. For example, while recent progress in 'limiting urban sprawl' in Sydney has exceeded expectations, the COAG Reform Council (2012, p.98) notes that the 'goal of a more compact city is a delicate balancing act. Infill development will help Sydney meet sustainability and economic competitiveness goals but may have negative effects on affordability and growth'.

Transport infrastructure

Through regression analysis, Chapter 8 highlighted the ways in which transport infrastructure influences commuting patterns within our largest cities. In all four cities, origin-destination pairs that were directly connected by the rail network tended to have significantly larger commuting flows than pairs that had no such connection. Similarly, the existence of a direct freeway connection between two locations tended to significantly boost commuter flows in Sydney, Melbourne and Brisbane (but not for Perth). The magnitude of this effect was greatest for Sydney.

New transport infrastructure can help shape patterns of population and job growth within a city. For Sydney, BITRE (2012a, p.296) finds that 'new motorway infrastructure appears to have been a strong determinant of employment growth patterns, particularly in the wholesale trade and logistics industries'. Changes in commuting patterns will also be shaped, to some extent, by the development of new transport infrastructure, which changes the relative costs of commuting to different areas. For example, Rasmussen (2010) highlights the role of Melbourne's Western Ring Road in reducing travel times and expanding the spatial labour markets of the West Industrial Node and the North Industrial Node. Similarly, BITRE's regression results show that *some* transport infrastructure investments—such as the series of freeway and tunnel investments that occurred in Sydney between 2001 and 2006—can significantly reshape commuting flows within a city.

The relationship between transport infrastructure and spatial development patterns is bi-directional. While new transport infrastructure can help shape spatial development patterns within a city, spatial development trends are the fundamental driver of changes in spatial commuting patterns and thereby contribute to changes in commuter use of the different transport modes. For example, Gaymer (2010) identifies the substantial jobs growth in Melbourne's CBD as one of the principal drivers of the increase in public transport patronage

in Melbourne between 2002 and 2007. The higher residential and job densities in the inner city—which led to substantial growth in commutes *within* the innermost subregion of the four largest cities—were also an important contributor to the recent increases in the active transport mode share.

Consequently, the available spatial projections of population and job growth to 2031 have implications for future use of the different transport modes and for future infrastructure requirements. Some of the key messages emerging from these projections are summarised below:

- The Outer sector of each city is projected to contribute the *largest share of population growth*—from 65 per cent in Melbourne to 76 per cent in Perth—and be the *fastest growing*—from 1.6 per cent average annual growth in Sydney to 2.6 per cent in Brisbane and Perth.
- Sydney's South West and North West subregions, Melbourne's Outer South and Outer West, and Brisbane's Outer West, are each projected to add more than 300 000 new residents between 2006 and 2031.
- The Outer sector is also projected to be the *fastest growing* in terms of employment and to contribute a *larger share* of job growth than the Inner and Middle sectors. Perth's Outer sector is projected to attain the largest share of city-wide job growth (55 per cent), followed by Sydney (48 per cent), Melbourne (41 per cent) and Brisbane (34 per cent).
- The CBDs are projected to add many additional jobs in Sydney (147 000), Melbourne (142 000) and Brisbane (73 000). However, the share of jobs located in the CBD is projected to fall in Sydney, Brisbane and Perth, and remain stable for Melbourne. Sydney's North West and Melbourne's Outer South subregions are expected to add 150 000 and 141 000 jobs, respectively.

BITRE's exploration of future commuting patterns suggests that realisation of these spatial projections of population and job growth is likely to result in a significant shift towards same-subregion commutes and a reduction in the relative importance of inward commutes in all four cities. Due to the large projected increases in the number of outer suburban residents and jobs, commutes *within* the Outer sector of each city are likely to represent a large proportion of the total increase in commutes (34–51 per cent). Ongoing greenfield residential development is expected to lead to a continuation of the recent trend towards increased commuter flows *within* urban fringe SLAs.

Such increases in the importance of close-to-home commutes may open an opportunity to increase the active transport mode share. However, declines in the relative importance of inward commutes (and the projections of rapid outer suburban job growth) will pose a challenge to achieving ongoing growth in the public transport mode share, since three-quarters of commuter use of public transport is due to inward commuting, and public transport is rarely used to access outer suburban workplaces. A reorientation of the public transport system—to better service those making trips within outer suburban subregions—may be needed in order to encourage a significant shift towards public transport.

Future directions

Over the course of this research project, a detailed evidence base has been built about the reality of recent spatial trends in population, employment, commuting and transport use in Australia's four largest cities. This evidence base has proven to be a valuable resource for infrastructure planning within the Department (including, for example, as an input to policy development regarding aviation capacity in the Sydney region and in formulating urban network strategies for key cities). However, the current evidence base is by no means comprehensive, and could be improved upon in a range of ways, as is discussed below.

In its review of capital city strategic planning systems, COAG Reform Council (2012) found that while many governments had some form of performance measurement in place, the performance measures were not always clearly linked to strategic planning outcomes or supported by public reporting. Through the course of this study, BITRE encountered a number of data gaps with respect to strategic planning goals. For example, there was limited data on the number of jobs and dwellings located in centres, and how this was changing over time (which led to BITRE producing its own estimates). Also, the significant differences across jurisdictions in the definitions and reporting systems underlying the greenfield/infill targets meant that cross-city comparisons were not particularly meaningful. COAG Reform Council (2012) has recommended that clear frameworks be developed for measuring progress and monitoring implementation of strategic planning in cities, and this is currently being progressed through the Standing Council on Transport and Infrastructure (SCOTI 2013).

BITRE's analysis of spatial changes in employment and commuting flows in Australia's four largest cities has been focused on changes between 2001 and 2006.[96] This is a very limited period over which to assess change, and further analysis of the changes that occurred between the 2006 and 2011 censuses would provide a more solid understanding of recent trends, and help determine whether the observed changes are transitory or ongoing.

The Australian Bureau of Statistics' (ABS) shift to a completely new statistical geography will create some challenges for analysing job growth (and commuting growth) at a small area scale between 2006 and 2011, as the outputs from the two census years have not been made publicly available on a common set of geographic boundaries.[97] The marked increase in the number of employed persons coded to an undefined capital city (or state) location in the 2011 census also makes it difficult to quantify where job growth is occurring.[98] For example, about 22 per cent of the increase in Sydney's place of work count between 2006 and 2011 is attributed to the 'Sydney undefined' category.

Despite these issues with comparing place of work data over time, some high-level results from the 2011 census have been incorporated within this comparative report (see Chapter 3 and Boxes 4.1, 5.1, 5.2, 6.1 and 6.2). BITRE also sees a need for further analysis of 2011 census data to shed light on recent patterns of growth in Australia's major cities (particularly with respect to employment and industry growth) and for updated estimates and projections of congestion costs in Australia's capital cities.

96 Note that the analysis of population covered the 2001 to 2011 period, as it was primarily based on Estimated Resident Population (ERP) data rather than census data.

97 The 2011 census place of work data (Working Population Profile) is readily available at the GCCSA, SA4, SA3, SA2 and LGA scales. The 2006 census place of work data is readily available at the SD, SSD, SLA and LGA scales. Where LGA boundaries remained stable between 2006 and 2011, a change comparison can be made at the LGA scale (see, for example, O'Neill (2013)). Otherwise, ABS can produce customised tabulations that support analysis of employment change on a place of work basis.

98 A more detailed discussion of this issue is contained in .id (2012)

APPENDIX A
Subregion boundaries

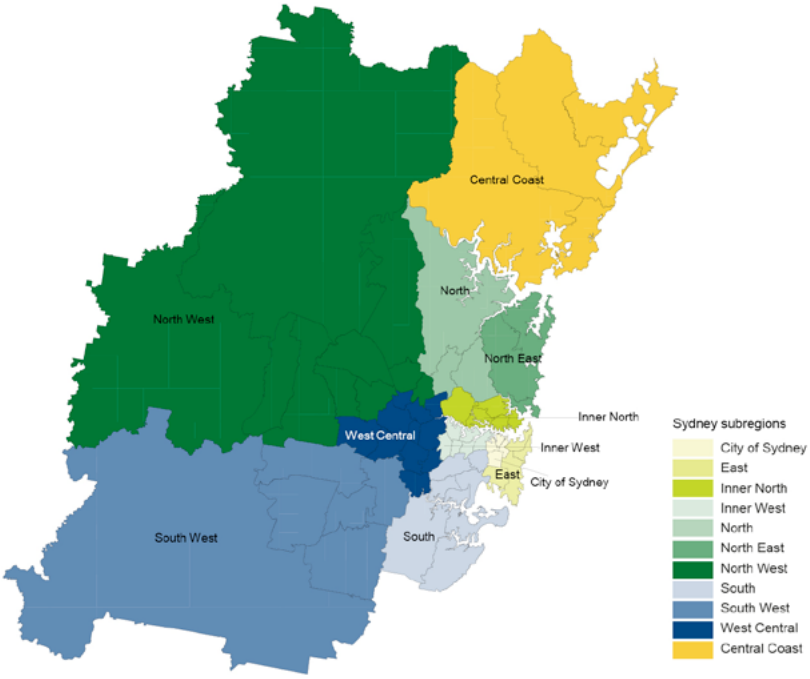
In this study, BITRE has disaggregated the capital city statistical divisions in several ways, including by sector (Inner, Middle and Outer), subregion and Statistical Local Area (SLA). Sectoral boundaries were shown in Map 1.2. This appendix contains maps displaying the subregional boundaries for Sydney, Melbourne, Brisbane and Perth.[99]

- Sydney's subregions are based on the eleven planning subregions that formed the basis of City of Cities and the *Metropolitan Plan for Sydney 2036*. The planning subregions are based on LGA boundaries, and sometimes cut across BITRE's Inner, Middle and Outer sector boundaries. Note that the new draft Metropolitan Strategy for Sydney has introduced a different set of subregional boundaries.
- BITRE has defined Melbourne and Brisbane's subregions, based on ABS' ASGC boundaries. Melbourne's subregions are based on Statistical Subdivision (SSD) boundaries, while Brisbane's subregions are based on ABS Statistical Region Sectors. There is a total of 9 subregions in each city, with the Inner sector constituting one of the subregions, and the Middle and Outer sector each being divided into four separate subregions.
- Perth's subregions are based on the planning subregions adopted in the *Network City* strategic plan. There are six subregions, with the Inner and Middle sectors each constituting a single subregion, and the Outer sector being divided into four separate subregions. In the more recent *Directions 2031* strategic plan, the Inner and Middle subregions are combined to form the Central planning subregion, while the Eastern subregion has been relabeled as the North East subregion. Note that the scope of this study is restricted to the Perth Statistical Division (SD), and so excludes the Peel planning subregion.

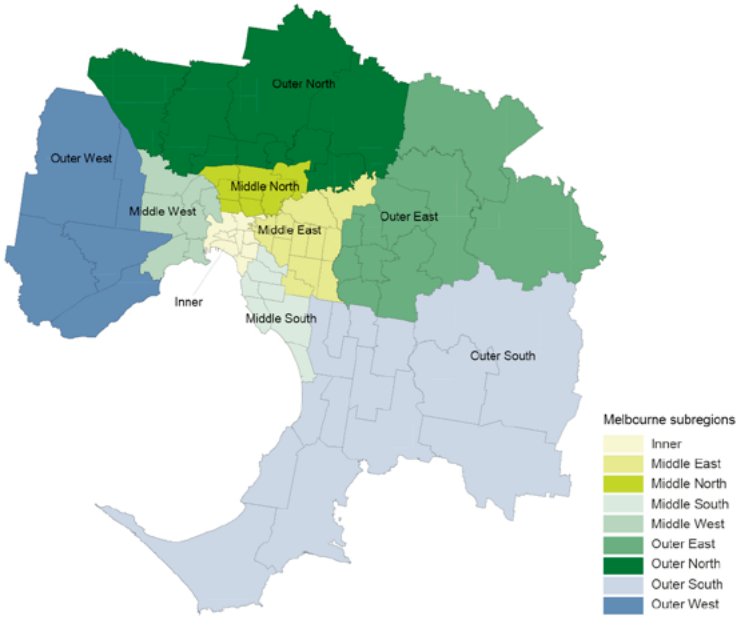
The subregions can all be built up from SLAs, and were defined based on 2006 Australian Standard Geographic Classification (ASGC) boundaries. A detailed listing of the SLAs which comprise each subregion is contained in the individual city reports (BITRE 2010, 2011, 2012a, 2013a).

99 Note that the maps do not adopt a common scale.

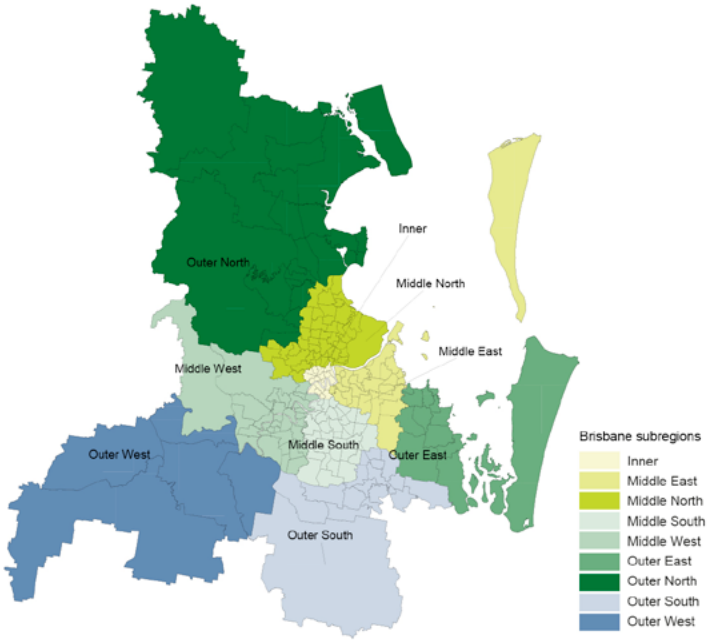
Map A.1 Subregional boundaries for Sydney Statistical Division



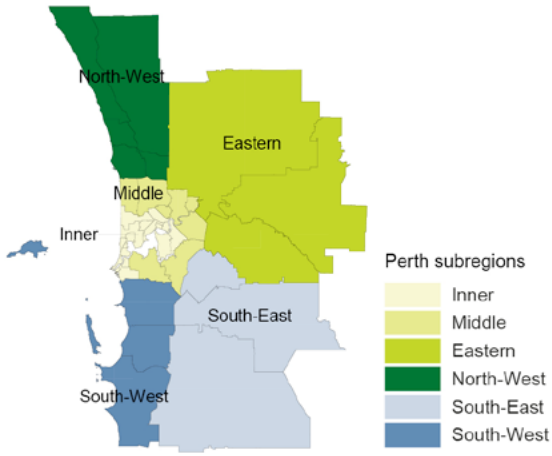
Map A.2 Subregional boundaries for Melbourne Statistical Division



Map A.3 Subregional boundaries for Brisbane Statistical Division



Map A.4 Subregional boundaries for Perth Statistical Division



APPENDIX B
List of tables, figures and maps

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Acronyms and abbreviations

ABS	Australian Bureau of Statistics
ACELG	Australian Centre for Excellence in Local Government
AHURI	Australian Housing and Urban Research Institute
ANZSIC	Australian and New Zealand Standard Industry Classification
ASGC	Australian Standard Geographical Classification
ASGS	Australian Statistical Geography Standard
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BTS	Bureau of Transport Statistics (previously known as TDC)
Cat.	Catalogue
CBD	Central Business District
CCD	Census Collection District
CD	Collection District
COAG	Council of Australian Governments
COMSEQ	Council of Mayors South East Queensland
DHA	Australian Government Department of Health and Ageing
DI	Victorian Department of Infrastructure
DPCD	Victorian Department of Planning and Community Development
DPI	Department of Planning and Infrastructure
DSDIP	Queensland Department of State Development, Infrastructure and Planning
DTMR	Queensland Department of Transport and Main Roads
DZ	Destination Zone
e.g.	Latin, short for exempli gratia, meaning 'for example'
ERP	Estimated Resident Population
et al.	Latin, short for et alia, meaning 'and others'
FaHCSIA	Australian Government Department of Families, Housing, Community Services and Indigenous Affairs
GAMUT	Australasian Centre for the Governance and Management of Urban Transport
GCCSA	Greater Capital City Statistical Area
GMA	Greater Metropolitan Area
GPO	General Post Office
HILDA	Household Income and Labour Dynamics in Australia

HTS	Household Travel Survey
i.e.	Latin, short for id est, meaning 'that is'
ibid.	Latin, short for ibidem, meaning 'in the same place'
JTW	Journey to Work
km	Kilometre
km/hour	Kilometre per hour
Km^2	Square kilometre
LGA	Local Government Area
MDAC	Modelling Data and Analysis Centre (of DTMR)
MDP	Metropolitan Development Program
MIAESR	Melbourne Institute of Applied Economic and Social Research
n/a	not applicable
NATSEM	National Centre for Social and Economic Modelling
NIEIR	National Institute of Economic and Industry Research
No.	Number
NSW	New South Wales
OESR	Office of Economic and Statistical Research
OLS	Ordinary Least Squares
RFGM	Regional Framework for Growth Management
SCOTI	Standing Council on Transport and Infrastructure
SD	Statistical Division
SEQ	South East Queensland
SEQROC	South East Queensland Regional Organisation of Councils
SLA	Statistical Local Area
SSD	Statistical Subdivision
STM	Strategic Travel Model
TDC	Transport Data Centre
UPT	Urban Public Transport
VISTA	Victorian Integrated Survey of Travel and Activity
Vol.	Volume
WAPC	Western Australian Planning Commission

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