The relationship between transport, economic and spatial development is known to occur in two main directions. Firstly, existing land use and economic developments drive demand for transport in terms of quantity, type, location and mode. Secondly, transport investments and other initiatives guide patterns and locations of economic development and residential growth.

International evidence indicates that the relationship between transport accessibility and land values and productivity is complex. While transport investment can lead to productivity gains, it cannot be assumed that this will occur (Williamson, Philbin and Sanderson, 2012).

This Bulletin has been prepared as part of the Committee for Perth and RAC Get a Move On! project. It analyses the relationship between transport, spatial form and economic growth in Sydney, Melbourne and Perth through the consolidation of information from recently published literature. It aims to identify the impacts of accessibility on the spatial structure of employment and the key strengths and weaknesses resulting from transport and urban form in each metropolis.

Impacts of Accessibility on Economic Activity

In Greater Sydney, Greater Melbourne and Greater Perth, access to employment by car and public transport is highest from and to the central business district (CBD) and inner-suburban locations (see Figure 3, 4 and 5).

This is the result of long-term strategic land use and transport planning combined with development and infrastructure investment patterns which have maximised public transport and road accessibility to and from central locations.

The location of economic activity in all regions does reflect patterns of accessibility. The outcome is that economic activity is centred in CBD and inner locations in all three metropolitan regions (Kelly and Donegan, 2014). Transport infrastructure such as airports or major transport nodes are also associated with economic activity (Kelly and Donegan, 2014; BITRE, 2015b).
Accessibility and Residential Density

In all three major metropolitan regions, CBDs and areas within a five kilometre radius of the CBD have the highest residential densities. However, population weighted densities within five kilometres of the Perth CBD are significantly lower than those in inner Melbourne or Sydney (see Figure 2 – Loader, 2012).

Notwithstanding this, in 2011, a higher proportion of Greater Perth’s population were living within five and 10 kilometres of the CBD than in Melbourne or Sydney (BITRE, 2015b).

The distance that people live from the CBD in all three regions impacts on travel choices. In Greater Sydney, Greater Melbourne and Greater Perth, CBDs and inner areas are associated with higher proportions of non-car journeys by residents and workers (ABS, 2011; NSW Bureau of Transport Statistics, 2016; Loader, 2011).
Spatial Structure – Melbourne and Perth

In Greater Melbourne and Greater Perth, the public transport system and major road systems have a strong radial pattern and maximise accessibility to central locations (see Figure 3 and Figure 4).

In Greater Melbourne and Greater Perth people are able to access more jobs within a 45-minute car journey than they are able to access within a 60-minute public transport journey (see Figure 3 and Figure 4). Car remains the primary mode of transport to work in both of these regions (65.5 and 69.5 respectively) (ABS, 2011).

Accessibility by car is highest to and from central locations and lowest to and from outer locations (see Figure 3). Ease of access to and through inner areas by car has been credited with strengthening the competitiveness of inner areas and delivering agglomeration and productivity benefits in both regions (Kelly and Mares, 2013; SGS, 2012).

In Greater Melbourne, 33% of jobs are located in the CBD, including Docklands and Southbank, which is higher than the proportion of CBD jobs in Greater Perth (23%) (BITRE, 2013). However, Melbourne has a smaller proportion of total employment within 15 kilometres of the CBD (55.9%) when compared to Greater Perth, where 64% of employment is within approximately 15 kilometres of the CBD (BITRE, 2013; BITRE, 2015b; Martinus and Bierman, 2016).

In both Greater Melbourne and Greater Perth, the regional employment and residential centres of gravity are located close to the CBD and the radial structure of the transport system provides relatively even patterns of accessibility from the CBD into residential corridors, particularly by car (see Figure 3 and 4) (PWC, 2015; Kelly and Mares, 2013).

The radial public transport systems of Greater Melbourne and Greater Perth provide access to jobs in central locations but are less effective at providing rapid access to and from outer locations. In Greater Perth, 74% of jobs can be accessed within a 60-minute public transport commute from the CBD compared to 46% in Melbourne and 53% in Sydney.

However, less than 10% of jobs can be accessed within a 60-minute commute from outer/fringe locations in all three metropolitan regions (see Figure 3, Figure 4 and Figure 5). The outcome is that public transport use is significantly higher for journeys to work in CBD locations than in non-CBD and outer locations.

Figure 3: Employment Accessibility by Car, Melbourne and Perth
Public transport accessibility within a 60-minute public transport commute is higher in Greater Perth than in Greater Melbourne. This is associated with Greater Perth’s smaller population and geographical footprint; the quality and speed of rail infrastructure; and the relatively centralised structure of employment (BITRE, 2015d; Martinus and Bierman, 2016).

However, total journey to work public transport mode share to the Perth CBD and in Greater Perth more widely, at 41% and 12% respectively, is significantly lower than in either Greater Melbourne at 45% CBD and 16% total or Sydney with 55% CBD and 23% total (ABS, 2011; BITRE, 2015c).

Perth’s Urban and Spatial Form

The spatial form of metropolitan Perth and Peel is linear, stretching 150 kilometres north and south along the WA coast. This, combined with an over-concentration of employment in the CBD and surrounds, places substantial congestion pressure on the region’s north-south transport infrastructure, especially the Kwinana and Mitchell Freeways (BITRE, 2015d).

These key freeways are already operating at capacity in peak periods, especially on the approaches to Perth’s CBD and at Swan River crossings such as the Narrows Bridge and the Causeway (BITRE, 2015d).

It is predicted that population growth, without a commensurate increase in Perth’s transport network capacity, will spread peak period loadings throughout the day and significantly increase congestion costs (BITRE, 2015d). It is also predicted to place considerable additional pressure on the Mandurah and Butler passenger rail services (BITRE, 2015d).

This has been identified as a productivity inhibitor in the Sydney metropolitan region (PWC, 2015). Reduced car accessibility in Greater Sydney is associated with a combination of factors that include: large population and geographical footprint; higher density urban form; congestion; topographical constraints; and infrastructure. Congestion has been found to specifically impede access to Sydney’s CBD (SGS, 2012).

Accessibility and Employment Structure – Sydney

The proportion of the total geographical area within Greater Sydney from which residents are able to access more than 50% of available jobs within a 45-minute car commute is lower than the total proportion of Greater Melbourne or Greater Perth (see Figure 5). The share of the population that can access CBD-based firms within a 45-minute car commute is also significantly lower in Greater Sydney (23%) than in Greater Melbourne (45%) or Greater Perth (93%) (Davis, 2016, p. 7).
A comparison of Figures 4 and 5 indicate that patterns of accessibility by public transport in the Greater Sydney region are more dispersed than in Greater Melbourne and Greater Perth (Kelly and Mares, 2013b).

The proportion of employment that can be accessed within a 60-minute public transport commute from the CBD is also slightly higher in Sydney (53%) than in Melbourne (46%) (Kelly and Mares 2013a; Kelly and Mares 2013b; Davis 2016). This reflects the Sydney region’s more inter-connected heavy rail system, which provides access to a number of key employment nodes (see Figure 5 - Kelly and Mares, 2013b).

The development of this system has been the result of long-term policy consistency and investment that has directly supported the establishment of strategic decentralised activity centres, primarily located in the region’s inner to middle west and north-west, that is within approximately 20 kilometres of the Sydney CBD (SGS, 2012).
The outcome is that metropolitan Sydney is the only Australian capital in which residential, employment and economic centres of gravity, the point in the city where the residential, employment and economic pull of all the locations in the region are evenly balanced, are shifting away from the CBD (PWC, 2015).

Metropolitan Sydney’s shifting centre of gravity has been recognised as providing opportunities to strengthen key polycentric nodes of economic activity. Simultaneously however, this has also raised substantial challenges associated with the need for rapid infrastructure/transport connections between economic nodes in order to enable these centres to achieve the economic agglomeration benefits associated with CBD locations (PWC, 2015).

In addition, despite the success of the Sydney metropolitan region in developing a more polycentric spatial structure, patterns of economic activity and productivity suggest that non-CBD employment nodes remain somewhat dependent on the Sydney CBD in the sense that they tend to be located within 20 kilometres of the CBD and have strong public transport networks that stem from the CBD. Other factors include proximity to university precincts and large numbers of tertiary educated residents; and key transport infrastructure assets such as the airport.

CBD Expansion and Local Authority Boundaries

In Melbourne, the redevelopment of Southbank and Docklands, the expansion of the boundaries of the City of Melbourne and investment in road and public transport infrastructure have been credited with strengthening the economic pull of the CBD (PWC, 2015). This expansion has also been associated with lower rents in inner locations, the expansion of agglomeration and productivity benefits and delivering increased potential for affordable housing in inner locations (PWC, 2015).

Employment Decentralisation and Levels of Self-Containment

Employment self-containment refers to the proportion of people who live and work within a specified geographical area. High levels of employment self-containment in an area indicate a strong correlation between employment opportunities and the skills of the local population (Martinus, 2016). Higher levels of self-containment also mean that a smaller proportion of the resident population of a geographical area travels outside the area for work.

Increasing employment self-sufficiency, job to population parity, and employment self-containment have been long-term planning and transport policy objectives for metropolitan Sydney, Melbourne and Perth and underlie policies promoting employment decentralisation (Martinus, 2016; Davis and Harford-Mills, 2016).

However, despite differing spatial structures of employment and economic activity in Greater Sydney, Greater Melbourne and Greater Perth, employment self-containment in non-central sub-regions within all major cities, with the exception of the Peel region, remain lower than 50% (BITRE, 2013).

Conclusions

The spatial distribution of economic activity, employment and productivity in the Australian metropolitan regions of Perth, Sydney and Melbourne appears to be strongly associated with transport infrastructure and accessibility.

In overall terms, the Perth and Peel region is a predominantly monocentric city in the sense that a majority of businesses and services and hence jobs are located within approximately 15 kilometres of the CBD. Perth’s urban form, plus its public transport and road network reinforce the accessibility, attractiveness and economic agglomeration benefits of the CBD and inner-suburban locations.

This over-concentration of employment in the CBD brings both benefits and costs.
Benefits:
• Ease of access to Perth’s CBD and inner areas is a current economic strength and contributes to economic activity and productivity benefits associated with central locations.
• Centralised employment structure and a radial transport network provides relatively even patterns of accessibility from the CBD into residential corridors.
• The Perth CBD is located close to regional, residential, economic and employment centres of gravity and this heightens the ‘pull’ of the CBD and inner locations.
• The Perth region’s centralised employment structure heightens the potential for accessibility benefits provided by higher density residential development in inner locations.
• Centralised employment structure provides potential for public transport efficiencies.

Costs:
• Greater Perth’s employment is centralised yet dispersed, within an approximate 15 kilometre radius of the CBD. Outside the central CBD, the majority of centralised employment areas are car dependent, increasing pressure on road infrastructure.
• Majority of residents in outer sub-regions, with the exception of Peel, travel outside their home sub-region for work.
• The linear urban form of the Perth and Peel regions, coupled with its centralised, dispersed employment structure is placing pressure on north-south infrastructure links – increasing the potential for congestion costs.
• Additional ‘linear’ residential growth patterns in the Perth metropolitan region, particularly further expansion of the north-western and south-western corridors will impact negatively on employment accessibility by car and public transport.

Strategies for Successful Decentralisation
The development of an effective polycentric land use and employment structure is dependent on consistent long-term policy objectives, supported by investment in transport infrastructure to heighten accessibility of strategic locations.

However Sydney’s example indicates that even with long-term investment, non-CBD activity centres are only likely to be successful if: they are within 20 kilometres of the CBD; are supported by rapid public transport connections to the CBD; are accessible by public transport and road; and have access to a large and appropriately skilled population.

Non-CBD activity centres are more likely to generate substantial economic activity and productivity when associated with: high levels of connectivity to the CBD; strategic transport infrastructure, such as airports or ports; or specialised nodes such as technology, science or innovation clusters. It is further noted that, even with the development of successful non-CBD employment nodes, levels of employment self-containment above 50% appear to be difficult to achieve in non-central locations.
Appendix A: Melbourne, Sydney and Perth – Comparison of Spatial Form and Public Transport Structure

<table>
<thead>
<tr>
<th>Melbourne</th>
<th>Sydney</th>
<th>Perth</th>
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<tbody>
<tr>
<td><strong>City of Melbourne:</strong></td>
<td><strong>City of Sydney:</strong></td>
<td><strong>City of Perth:</strong></td>
</tr>
<tr>
<td>• Population: 93,597</td>
<td>• Population: 205,339</td>
<td>• Population: 24,244</td>
</tr>
<tr>
<td>• Population Density: 28.86 people per hectare</td>
<td>• Density: 76.84 people per hectare</td>
<td>• Density: 17.65 people per hectare</td>
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<tr>
<td>• Size: 32km² (Profile i.d., 2016a)</td>
<td>• Size: 27km² (Profile i.d., 2016b)</td>
<td>• Size: 14 km² (Profile i.d., 2016c)</td>
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<tr>
<td>• Boundary amendments: The boundaries of the City of Melbourne have been expanded in recent decades, incorporating Southbank in 1993 and Docklands in 2007.</td>
<td>• Boundary amendments: The City of Sydney has undergone multiple boundary changes over its history. Most recent was a boundary change in 2003 which amalgamated the City of Sydney and City of South Sydney.</td>
<td>• Boundary amendments: A boundary change to the City of Perth came into effect in July 2016 with parts of the City of Subiaco being amalgamated with the City of Perth. The areas amalgamated into the City include The University of Western Australia, QEII Medical Centre and Kings Park. The amalgamation will increase the number of residents living in the City of Perth by approximately 1,250.</td>
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**Employment structure:**

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<tr>
<th>Melbourne</th>
<th>Sydney</th>
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<tr>
<td>• High employment densities are focused in CBD and immediate surrounds.</td>
<td>• Highest job densities are within the CBD; however, employment has also shifted into a small number of key activity centres which are located within approximately 20km of the Sydney CBD.</td>
<td>• Employment is focused in the Perth CBD and dispersed locations within approximately 20km of the CBD.</td>
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<td>• In recent decades, the physical size of the CBD (City of Melbourne boundaries) have increased.</td>
<td>• Spatial structure which more closely resembles a polycentric ‘urban village’ than other regions but which retains an imbalance of employment in eastern locations.</td>
<td>• Highest employment densities are found in the CBD and centrally located activity centres, such as Subiaco.</td>
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<td>• Outside the CBD, employment is relatively dispersed with higher employment densities in inner eastern locations (PWC, 2015).</td>
<td>• Employment has historically been focused in eastern locations, however growth of activity centres such as Macquarie Park in the north-west has shifted Sydney’s employment ‘centre of gravity’ towards its residential centre of gravity 9km from the CBD towards the region’s inner west (PWC, 2015).</td>
<td>• The employment and residential ‘centre of gravity’ for Perth and Peel sits south of the CBD and has been shifting towards the CBD (PWC, 2015).</td>
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<td>• The employment ‘centre of gravity’ sits to the southeast of the CBD but has been moving towards the CBD in recent years.</td>
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<td>Melbourne</td>
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<td><strong>Residential development patterns:</strong></td>
<td><strong>Residential development patterns:</strong></td>
<td><strong>Residential development patterns:</strong></td>
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<tr>
<td>• Residential development has occurred in a radial corridor pattern out</td>
<td>• Sydney is Australia’s most compact, high density, urban region.</td>
<td>• Residential growth in Perth and Peel</td>
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<td>from the CBD. As a result, CBD jobs are accessible to a high proportion</td>
<td>• Residential development has been focused in western locations, with additional strong</td>
<td>has occurred in a radial corridor pattern which also exhibits a strong linear form. The</td>
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<td>of the population from all angles (PWC, 2015).</td>
<td>corridor growth along the north-eastern coast.</td>
<td>result of linear growth is an urban footprint which extends more than 150 km along the</td>
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<td>• High density residential development has been focused within inner</td>
<td>• Distance from the Sydney CBD to the region’s most significant outer activity centre,</td>
<td>coast.</td>
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<td>and middle locations, increasing accessibility to CBD/inner/middle</td>
<td>Penrith in Sydney’s west is 55km.</td>
<td>• Perth’s linear growth has been the result of focused residential development in coastal</td>
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<td>employment areas and to existing public transport infrastructure.</td>
<td>• Higher residential densities are more dispersed through the metropolitan region (i.e.</td>
<td>corridors to the north-west and south-west of the CBD. It has also been influenced by</td>
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<td>• There is some evidence of higher densities along public transport</td>
<td>higher average densities throughout) but are primarily focused in eastern locations.</td>
<td>climatic conditions as well as by the Darling Scarp, which has formed a natural barrier to</td>
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<td>routes, particularly in inner locations (Loader, 2012).</td>
<td>There is evidence of higher densities along rail routes (Loader, 2012).</td>
<td>eastern growth.</td>
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<td>• Residential densities in inner locations are significantly lower than those in either</td>
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<td>Melbourne or Sydney and areas of higher density residential development are more dispersed,</td>
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<td>with nodes of density occurring in central and middle locations such as East Perth,</td>
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<td>Subiaco, Vincent and Stirling Central (BITRE, 2015c). There are also notable areas of</td>
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<td>higher density development in fringe locations, 35km and 45km from the Perth CBD (Loader,</td>
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<td>2012).</td>
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<td>• There is no clear evidence of significant higher density development occurring along key</td>
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<td>public transport corridors (Loader, 2012).</td>
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<td>Melbourne</td>
<td>Sydney</td>
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<tr>
<td><strong>Public transport system:</strong></td>
<td><strong>Public transport system:</strong></td>
<td><strong>Public transport system:</strong></td>
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<tr>
<td>• Radial heavy rail system primarily providing access from outer residential origin locations to CBD and inner destinations.</td>
<td>• Interconnected multi-modal public transport system primarily incorporating heavy rail and bus. The system provides access to key activity centres including the CBD, North Sydney, Macquarie Park, Mascot Airport, Parramatta, Penrith and Liverpool (i.e. serves numerous destination locations).</td>
<td>• Integrated heavy rail and bus system which connects outer residential locations and activity centres with the Perth CBD. The rail system includes 175km of dedicated metropolitan passenger rail lines. Stations are 2.5km apart on average, the result of the development of new rail lines designed to provide higher speed services.</td>
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<tr>
<td>• Melbourne has 232km of dedicated metropolitan passenger rail lines and a total network length of 403km (BITRE, Australasian Railway Association, 2014). The rail system incorporates the ‘City Loop’, an underground heavy rail loop under the city centre which provides heavy rail accessibility to multiple CBD destinations and has been credited with substantially increasing accessibility in the CBD (BITRE, 2015d).</td>
<td>• Sydney has 178km of dedicated rail lines and a total route length of 334km. Average distance between stations is 1.9km (BITRE, Australasian Railway Association, 2014).</td>
<td>• Perth’s passenger rail service delivers the most consistent frequencies in Australia. The Mandurah line achieves the highest train speeds, for all-stops services, of all metropolitan rail lines in Australia, with an average speed of 84km/h (BITRE, Australasian Railway Association, 2014 p. 41).</td>
</tr>
<tr>
<td>• Melbourne’s rail system caters for 226 million patrons per annum and has a journey to work mode share of 11.7% (BITRE, Australasian Railway Association, 2014 p. 41).</td>
<td>• The system caters for 306 million passenger trips per annum and heavy rail has a journey to work mode share of 16% (BITRE, Australasian Railway Association, 2014 p. 41).</td>
<td>• Annual heavy rail patronage in Perth is 83 million passenger trips per annum (PTA, 2016) and heavy rail has a journey to work mode share of 4% – substantially fewer than either Sydney or Melbourne (BITRE, Australasian Railway Association, 2014 p. 41; ABS, 2011).</td>
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<tr>
<td>• Melbourne also has a 250km interconnected tram system servicing the CBD and inner areas, within approx. 15km of CBD. The system caters to 183 million passengers per annum and has a journey to work mode share of 3.6% (BITRE, Australasian Railway Association, 2014 p. 41). Overall public transport journey to work mode share is approximately 16%.</td>
<td>• Trips to work on Sydney’s public transport network is dominated by trips to the Sydney CBD. Sydney CBD has a public transport mode share of 71.5% while 21.5% of journeys to work in the wider metropolitan region are via public transport. Overall public transport journey to work mode share in Sydney is approximately 23%.</td>
<td>• The bus system in Perth and Peel attracts more total boardings per annum than rail, in excess of 84 million boardings in 2014-2015 (PTA, 2016) but has a similar journey to work mode share of 4% (ABS, 2011). Overall, journey to work mode share by public transport in Greater Perth is approximately 12% (ABS, 2011).</td>
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<tr>
<td>• Economic activity and professional service sector employment is strongly focused in the CBD. There are also higher densities of employment, although much less significant than in the CBD, within inner eastern locations.</td>
<td>• The Sydney CBD, including Haymarket and the Rocks, produces more economic activity than any other small area in Greater Sydney. In 2011-12, it produced $64.1 billion of economic activity – 23% of the metropolitan area’s economy (Kelly and Donegan, 2015).</td>
<td>• A higher proportion of journey to work train and bus trips are to the City of Perth than to any other single destination (ABS, 2011).</td>
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<tr>
<td>• Melbourne’s CBD produced $39.2 billion in 2011-12. The figure is $53.9 billion if Docklands ($8.2 billion) and Southbank ($6.5 billion) are incorporated into an extended CBD, reflecting urban renewal and the expansion of CBD businesses into these areas.</td>
<td>• North Sydney is the second most significant centre, producing $10.2 billion. As with the CBD, North Sydney is dominated by professional and financial services.</td>
<td>• Clustering of economic activity around the CBD has been found to be less intense in Perth than in other large Australian cities, however other productive areas are primarily within 15km of the CBD and include Subiaco ($4.2 billion); the Osborne Park industrial area ($4.0 billion); Canning Vale ($2.8 billion); and Fremantle ($2.5 billion) (Kelly and Donegan, 2015).</td>
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<td></td>
<td>• Sydney’s “global arc”, extending from areas directly south of the CBD, including Sydney Airport, through to the North Shore then west to Macquarie Park, encompasses a number of areas with higher levels of economic activity.</td>
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</tbody>
</table>
Melbourne

Productivity:
• Productivity strongly reflects patterns of economic activity and infrastructure and is heavily focused in CBD/eastern locations and around key infrastructure assets like the airport.

Economic activity per working hour 2011-12 Melbourne:
(Kelly and Donegan, 2014)

Relationship between employment centres:
• Melbourne’s key employment centres, such as the Docklands and Southbank are within close proximity to the CBD and are highly connected to the CBD via public tram links.
• Outside the CBD, employment is relatively dispersed and more car dependent.
• The Monash Technology Precinct - university, science, technology and innovation, in Clayton, which is approximately 19km south east of the CBD, has been identified as having the highest employment densities outside the CBD and is located on a heavy rail line (Loader, 2013).

Sydney

Productivity:
• Highly productive areas are centred in the CBD, North Sydney and Macquarie Park and are also evident in Homebush Bay and surrounding the airport. It is noted that the Homebush Bay area is highly accessible by public transport.

Economic activity per working hour 2011-12 Sydney:
(Kelly and Donegan, 2014)

Relationship between employment centres:
• Key employment centres including North Sydney; Macquarie Park; Parramatta; and Mascot Airport are within 25km of the CBD.
• However western activity centres - Parramatta, Penrith and Liverpool, have not attracted significant proportions of professional/value added employment and travel time between centres has been identified as limiting potential for agglomeration benefits in these centres.
• Activity centres have the potential to form a single economic agglomeration even when they are spatially separate but only if served by rapid transport links with a 15-minute travel time, enabling the benefits of agglomeration to occur (PWC, 2015).

Perth

Productivity:
• In 2011-12, productivity in Perth, economic activity generated per hour, was primarily focused in central locations including the Perth CBD and inner locations such as South Perth, Como, Melville, Subiaco, Perth Airport and surrounds.

Economic activity per working hour 2011-12 Perth:
(Kelly and Donegan, 2014)

Relationship between employment centres:
• Employment areas in Perth are centralised yet relatively dispersed. Outside the Perth CBD, areas that support significant economic activity include Subiaco (3km from CBD); Osborne Park industrial area (9km); Canning Vale (18km); Perth Airport (17km); and Fremantle CBD (20km). Economic activity in Canning Vale, Perth Airport and Fremantle is associated with road, airport and port infrastructure. A significant proportion of employment within these locations is dispersed rather than within defined higher density nodes.
• Professional service sector employment is focused in the CBD and inner locations. A professional services corridor stretches from Perth City westward through West Perth, Leederville and Subiaco, accommodating firms in mining, energy, and financials. There is a manufacturing corridor stretching from Kwinana, tied to Fremantle Port, the Jandakot Airport, the Kewdale freight terminal, and the Perth Airport (Martinus et al., 2016).
• There are existing heavy rail and bus connections between the Perth CBD, Subiaco and Fremantle. A heavy rail connection to Perth Airport is due for completion in 2020.
### Melbourne

**Relationship between types of employment density and population qualifications:**
- Residents with tertiary qualifications primarily live in central locations with slightly higher densities in north-eastern locations (Kelly and Mares, 2013a).
- Employment self-containment is highest in central sub-regions.

**Proportion residents tertiary qualifications:**
(Kelly and Mares, 2013a)

**Employment accessibility:**
- Accessibility to employment within a 45-minute car journey in Melbourne is relatively high in comparison to Sydney. The CityLink toll road, constructed in 2000 is thought to have improved access to high value employment in the CBD, delivering $9 billion of value to the regional economy (BITRE, 2015).
- Employment accessibility within a 60-minute public transport commute is limited to inner and middle locations in Melbourne. This is likely to be associated with the employment dispersal outside the CBD, the extent of the system; and speed and connectivity, that is the need to travel into the inner-city and change mode or service in order to access employment that is not within the central CBD. There are areas in outer residential locations where employment accessibility within a 45-minute drive or 60-minute public transport trip is less than 1%.

**Employment self-containment:**
- Employment self-containment is highest in inner city locations and sits between 30-50% in other locations. The lowest self-containment is in the inner east and highest levels in the south-east. (BITRE, 2013).

### Sydney

**Relationship between types of employment density and population qualifications:**
- In Sydney, higher densities of residents with professional qualifications are concentrated in northern and eastern locations within proximity of the CBD, along the harbour and northern rail routes, and aligned with the ‘global economic arc’ (Kelly and Mares, 2013b).

**Proportion residents tertiary qualifications:**
(Kelly and Mares, 2013b)

**Employment accessibility:**
- Sydney exhibits more dispersed patterns of accessibility by public transport than Melbourne. In addition, the proportion of jobs accessible within a 45-minute car journey or 60-minute public transport journey is relatively balanced. However, large areas within the region remain relatively inaccessible within a 60-minute public transport or 45-minute car journey, with accessibility highest in central eastern locations and lowest in northern, southern and western sub-regions.

**Employment self-containment:**
- Employment self-containment is highest in inner city locations and sits between 20-50% in other locations. The lowest self-containment is in the inner west and highest levels are in the northern beaches. (BITRE, 2015).

### Perth

**Relationship between types of employment density and population qualifications:**
- In Perth and Peel, residents with tertiary qualifications are concentrated in central, inner southern and inner, western and north-western locations (Kelly and Mares, 2013c).

**Proportion residents tertiary qualifications:**
(Kelly and Mares, 2013c)

**Employment accessibility:**
- Perth and Peel currently have higher levels of accessibility to employment within a 45-minute car journey and 60-minute public transport journey than either Sydney or Melbourne. This is likely to be associated with the smaller population of Perth in comparison to Sydney and Melbourne, lower levels of traffic congestion, as well as with the quality of transport infrastructure, such as the speed of heavy rail connections from Butler and Mandurah to the Perth CBD.
- Accessibility to employment by public transport and car is lowest for residents living in outer suburban locations in all areas, particularly within the southern corridors. This reflects the length of the south western corridor, which stretches more than 85km from the Perth CBD to the south, as well as the spatial dispersal of employment, that is the imbalance of employment in northern locations, and the radial nature of the public transport system, which requires multiple transfers particularly to access employment outside the Perth CBD.

**Employment self-containment:**
- Employment is highest in the Central sub-region (85%); followed by the Peel region (66%) and is lowest in the South-east (32%) and North-west (41%) sub-regions (Martinus and Bierman, 2016).
### Congestion:

**Melbourne**
- Avoidable costs of congestion are lower in Melbourne than in Sydney, with congestion estimated to cost the economy $4.6 billion in 2015 (BITRE, 2015b).
- The 2016 TomTom Congestion Index rates Melbourne as the 52nd most congested city in the world with congestion delays in peak periods increasing travel time by 52% compared to free-flowing conditions (TomTom, 2016).

**Sydney**
- Avoidable costs of congestion are estimated to be higher in Sydney than in any other Australian capital. In 2015, congestion delays were estimated to cost the regional economy $6.1 billion (BITRE, 2015b).
- The 2016 TomTom Congestion Index rates Sydney as the 30th most congested city in the world with congestion delays in peak periods increasing travel time by 65% compared to free-flowing conditions (TomTom, 2016).

**Perth**
- Costs of congestion in Perth are lower than in Sydney or Melbourne.
- The 2016 TomTom Congestion Index rated Perth 72nd in its Global Traffic Index in regard to congestion delays in peak periods. Congestion increases travel time by 44-45% compared to free-flowing conditions (TomTom, 2016).
- Avoidable costs of congestion in Perth are predicted to rise from $2 billion (2015) to $5.7 billion (2030 estimate) (BITRE, 2015b).
- The Mitchell and Kwinana Freeways have been identified as key congestion ‘hotspots’ in the Perth region (BITRE, 2015d).
References


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Bureau of Infrastructure, Transport and Regional Economics, 2014, Trainline 2 Statistical Report, Department of Infrastructure and Regional Development, Canberra, Australia


About FACTBase

FACTBase is a collaborative research project between the Committee for Perth and The University of Western Australia to benchmark the liveability of Perth and its global connectedness through an examination of Perth’s economic, social, demographic and political character.

The FACTBase team of academics and researchers condense a plethora of existing information and databases on the major themes, map what is happening in Perth in pictures as well as words, and examine how Perth compares with, and connects to, other cities around the world.

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About the author

Gemma Davis is Manager of Research and Strategy for the Committee for Perth and is an Honorary Research Fellow with The University of Western Australia. She is a policy and strategic planning professional with 19 years’ experience and has worked as a consultant in Australia and New Zealand for public and private organisations. She holds an Honours Degree in Urban and Regional Planning from Curtin University and has undertaken studies in Arts and Psychology at The University of Western Australia and Aboriginal Studies at Curtin University.

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