Analysis and Optimisation Strategy of Employment Decentralisation in Perth through Density and Accessibility Indicators

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Abstract: The spatial structure of urban areas is a critical factor in their efficiency, spatial equity and consequently, sustainability. Monocentric urban structures are often characterised by longer commutes and inner-city congestion, which threaten urban sustainability. The Western Australian government has embarked on an employment decentralisation agenda aimed at bringing jobs closer to the people and improving urban sustainability in the Perth Metropolitan Region. This study employs density and accessibility measures to evaluate this decentralisation (or rather ‘poly-centralisation’) policy. Firstly, it investigates the spatial patterns of labour and job densities and their ability to support suburban activity centres (ACs). Secondly, it investigates potential improvements in the level of job accessibility in and around ACs, which could be delivered by the policy’s employment targets. The results reveal that while the car enables larger catchment areas for ACs, the average densities within these catchments are lower than in those enabled by public transport. Accessibility in AC areas is generally poor, and the current policy targets for jobs at ACs will not change the functional spatial structure, improve accessibility equity or the overall travel patterns within the metropolitan area. Despite having better transport connectivity, there are many other zones within the study area with higher accessibility than the designated AC zones. Results of this work can guide long-term planning by identifying potential/alternative areas to be targeted for densification, as well as those ACs that might require more transport infrastructure investment to compensate for their locational disadvantage.

Key words: urban spatial structure; accessibility; employment decentralisation; spatial equity; labour density

Introduction
While urban populations are continually increasing and pushing suburban expansions, employment opportunities often remain concentrated in central business districts (Weller, 2009; Australian Bureau of Statistics, 2016; Kelobonye, Xia, et al., 2019). This has led many cities around the world to experience rising challenges of excessive commuting and inner-city congestion (Kelobonye, McCarney, et al., 2019). Owing to their threat to the environmental, social and economic sustainability of urban areas, these challenges are increasingly taking the centre stage of planning and development policy. Employment decentralisation is often promoted as a solution to these challenges, through creating a scenario of cross-commuting to multiple work destinations, well connected by public transport (PT). Decentralisation aims to decongest the central core, correct fundamental land use imbalances and bring jobs closer to the people (Frémont, 1993; McCarney & Biermann, 2016).

In Perth, the central subregion hosts 64% of the total metropolitan employment while only about 40% of workers live here. The CBD and its surrounds account for 15% of total jobs in the metropolitan area but is residence to only 2% of workers (Western Australian Planning Commission, 2018). While these numbers may not portray a much-centralised structure, the job-worker imbalances undeniably engender a high level of commuting into the central subregion and the CBD in particular (Kelobonye, Mao, et al., 2019). As with other major Australian cities, such as Sydney and Brisbane (Burke et al., 2010), Perth has developed a major program of encouraging future job growth away from the CBD areas to suburban-based sub-centres. The Western Australian government has identified areas in the suburbs where employment concentration, high-density development and PT coverage will be promoted to minimise commuting – termed as activity centres (Western Australian Planning Commission, 2010).

The activity centre (AC) policy has designated existing and future ACs and their hierarchical levels. The designated centres are in the categories of; capital city, strategic metropolitan centres, secondary centres, district centres, neighbourhood centres and specialised centres. None of the centres, either existing or future, is designated primary centre (yet). A primary centre would be just below the capital
city in the hierarchy. It would be a dominant employment area and would serve a sub-regional catchment much larger than the strategic centres, but self-contained to reduce the number and length of trips. The analysis of this study focuses on the strategic metropolitan centres, from which the policy indicates that a primary centre will be identified and developed. Given the morphology of Perth and its obvious north-south divide, perhaps a minimum of two primary centres would be ideal to enable a greater level of self-containment, (and reduce the need to cross the Swan River with its limited number of crossings). This, however, can start with identifying and prioritising development of one in the short to medium term.

McCarney and Biermann (2016) note that decentralised employment has been a common feature in a series of strategic spatial plans but ACs have not developed at anticipated levels. Decentralisation requires understanding business location decisions, and developing implementable and effective strategies. We employ two indicators which can be considered as both a requirement and objective or yardstick for a successful decentralisation process; density and accessibility. It can be argued that density is a factor of accessibility because it can be a reflection of the increasing value of locations with better accessibility. “As residential areas become denser, more residents experience the local accessibility; as employment areas become denser, more jobs can be accessed through the same road and highway network” (Accessibility Observatory, 2016, p. 13). Therefore, achieving high densities in less accessible areas could disadvantage large numbers of people. On the other hand, high accessibility in low-density areas presents a good opportunity for densification. Moreover, low density can be a hindrance to the attraction of businesses in the sub-centres because it affords businesses a smaller customer base and potential labour pool, and has been linked to lower productivity (Alonso, 1971; Segal, 1976; Marelli, 1981). Thus, we examine worker density around a selection of four ACs, and their respective job accessibility levels. While a few researchers have examined policy targets against implementation progress (in the Perth Metropolitan Region - PMR), the focus of this study is on the targets themselves; are they sufficient? All else being equal, if employment targets for ACs were achieved, what would be the impact on job accessibility and its spatial equity?

Thus, this paper seeks to further contribute to the empirical literature on the decentralisation agenda, by evaluating the sufficiency of the Perth and Peel@ 3.5 million (P&P @3.5mil) employment targets for ACs, through investigating the potential improvements in job accessibility and its spatial equity that could be attained with its implementation. It performs worker density and catchment area analyses to identify, from the existing strategic centres, a potential primary centre for development prioritisation in the short to medium term.

**Study area**

Perth is the State Capital of Western Australia and is the fourth largest city in Australia. It has experienced the fastest population growth in the country in recent years, with the majority of the growth occurring at the fringe areas (Weller, 2009; Australian Bureau of Statistics, 2016; Kelobonye, Xia, et al., 2019). On the other hand, jobs have remained concentrated in the CBD and central subregion, leading to longer commutes and higher spatial inequalities of job accessibility (Kelobonye, McCarney, et al., 2019; Kelobonye et al., 2020).

It is projected that Perth’s population will reach 3.5 million by 2050, adding almost 1.5 million to the current population (Western Australian Planning Commission, 2018). The long-term planning objective is to concentrate employment in ACs to improve job accessibility in the suburbs (Western Australian Planning Commission, 2010). Fig. 1 shows the location of the study area, and the strategic and specialised ACs within the metropolitan region.

**Data**

Base employment and travel time data used in this study were sourced from the Department of Transport (DoT)’s *Strategic Transport Evaluation Model* (Department of Transport, 2011), employment projections came from the P&P @3.5mil report (Western Australian Planning Commission, 2018), and AC data from the *State Planning Policy 4.2* (Western Australian Planning Commission, 2010).
Figure 1: The Perth Metropolitan Region

Source: Map by author. Data from DoT and Perth & Peel @ 3.5mil
Labour density and catchment areas of activity centres

In this section we examine the spatial distributions of job and worker densities across the PMR, and further examine the worker density (measured by place of residence) within the catchment areas of selected ACs.

Higher worker density is found in the inner zones, but it spreads further out than the job density distribution, which is more concentrated in fewer zones (Fig. 2). Farther from the city centre, higher worker density seems to be closer to the passenger train lines. More jobs added in these zones could benefit the firms with a wider labour pool, and improve PT-based job accessibility. Save for the few zones in and around the CBD area (all north of the Swan River), all zones have a worker density of less than 20 workers per hectare. Job density is expectedly very high in the CBD. There are also noticeable spots of high job density, albeit to a lesser extent, in a few other zones which include some notable employment attractions such as the Welshpool, Kewdale and Canning Vale industrial areas, QEII, Curtin University, and the big shopping/activity centres in Cannington, Midland, Morley, Stirling and Joondalup. All these zones have over 20 jobs per hectare. These results reflect the high concentration of jobs in the inner zones and the outspreading low-density population.

Figure 2: Worker and job density spatial distribution

Selection of activity centres

We focus on four strategic metropolitan centres for catchment area analysis and further appraisal to identify a potential primary centre, which is currently missing in the existing centres and undesignated in the future plan. The four centres are Joondalup, Midland, Rockingham and Armadale; selected for a number of reasons which mainly centre on their location. Starting with what they have in common: 1) they are outside the central subregion which hosts the majority of jobs and is a major importer of labour – thus their growth could alleviate pressure on the central subregion; 2) they are reasonably distant from the city centre which gives them greater potential to change the overall travel patterns within the metropolitan area, particularly reducing traffic on the city-bound network routes; and 3) they are connected to the existing rail network which is a significant factor in promoting PT access. These locational characteristics make the selected centres good candidates for development into a primary centre. The four centres were also selected for their variety in locational characteristics: 1) two of them
are along the main corridor of the city’s north-south expansion (Joondalup and Rockingham) while the other two are on the eastern edge, beyond which not much of the city’s expansion will occur; 2) two are on the northern side of the CBD (and the Swan river) (Joondalup and Midland) whereas the other two are on the south. The even spatial distribution of these centres provides a good opportunity to improve the spatial equity of access to amenities across the metropolitan region.

**Worker density within the catchment areas of selected activity centres**

Catchment areas of the four selected strategic ACs were determined based on car and PT travel times. A catchment area is defined by all zones from which the AC zone can be reached within the threshold time i.e. AC is the destination. The spatial patterns of worker density within the catchment areas are also indicated (Figs. 3 and 4 for car and PT respectively). The car-based threshold time used was 30mins while the PT-based one was 45mins. The main reason for this is that the PT catchment areas covered a very small area/number of zones in 30mins. A longer travel time for PT could also be justified by the utility value of a PT trip i.e. passengers may be able to use the time spent on the bus/train for other things such as on the phone or laptop.

**Figure 3: Worker density of zones within 30 min of strategic centre by car**

Source: Map by author. Data by DoT.
The car enables a fairly balanced catchment area from all directions (Fig. 3). The ACs are largely surrounded by zones of low density, while higher-density zones are farther from the ACs. Midland and Armadale have most of the labour force located mainly on one side of the AC, with far fewer people living on the side closer to the fringes of the city’s built-up area. Thus, even though the car enables access from these areas, the ACs effectively only have ‘half catchments’ of labour pool. Moreover, the city’s eastward expansion is curtailed, so it is not expected that worker density will improve evenly across the catchment areas. In contrast, Joondalup and Rockingham lie on the main corridor along which population growth is projected stretching north and south.

Figure 4: Worker density of zones within 45 min of strategic centre by PT

Source: map by author. Data by DoT.
Despite the PT threshold being set at a longer 45 min travel time, the PT catchment areas (Fig. 4) are much smaller than those based on car travel time. While this is a general testament to the inferiority of PT versus private car in Perth’s accessibility maps, it also evidences, in particular, the low accessibility provided by PT in the outer areas relative to the CBD. A strikingly obvious pattern about these catchment areas is their alignment with the train lines, which highlights the value of the train in providing PT-based accessibility to ACs. The Armadale AC catchment area even ends only a short distance beyond the railway terminal. The upcoming 8km extension of the Armadale Line to Byford under the METRONET Project (Australian Government, 2018) could therefore play a critical role of widening the catchment area of the Armadale AC and improving its accessibility. The low density around this area, however, is a challenge that should be taken note of. In fact, for all four ACs, the PT catchment area leaves out many higher-density zones that are covered by the car catchment area. This might indicate a possible discrepancy between the location of ACs and the desired residential locations, which in turn could reinforce car reliance at the expense of sustainable modes like walking, cycling and PT. Meanwhile, the low density in PT catchment areas could hinder the attainment of sufficient patronage levels, thus posing a challenge to the sustenance of PT services in the medium to long term.

We have also computed and compared average worker densities within the four ACs’ catchment areas (Fig. 5). The CBD is also provided as a benchmark, (based on the results for zone 171, one of the 34 zones making up the CBD and selected due to its central location in the CBD). An interesting result here is that the average densities around the four centres are higher in the PT catchments than in the car catchment areas (except for Rockingham). This is because even though the car catchments cover more higher-density zones, they are larger, and so also include zones with very low worker density. The highest average density among the four centres is in the Joondalup catchment area, followed by Midland, both by PT and car. For Midland and Armadale, the car provides access over a much larger catchment, but the eastern parts of these catchments are under-populated areas (as seen in Fig. 3). Thus, the average densities in car catchment areas for these two centres are much lower than those in PT catchment areas i.e. there is greatest discrepancy in their average densities (Fig. 5). Note that these two centres are served by terminal train stations, hence it could be argued that they have half catchments by PT (since the train clearly has great influence in shaping the PT maps). In terms of total populations, all car-based catchments have at least twice as many workers as the PT catchment areas, with Joondalup topping the list under both travel modes (see Table 1). Interestingly, this is an opposite trend to that exhibited by the CBD, where the PT catchment area has more people than the car catchment area. In fact, the CBD falls behind Joondalup and Midland in terms of the number of workers within its car catchment area. This could indicate that although the car is a popular mode of travel for work commute in Perth, it may not be as effective as PT in accessing CBD-based jobs. The low density in the AC catchment areas indicates that there is potential for adding more houses/workers.

Figure 5: Average worker density in AC catchment areas (workers/hectare)
Table 1: Total number of workers living in activity centre catchment areas

<table>
<thead>
<tr>
<th>Activity Centre</th>
<th>Number of workers within catchment area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Car (30min)</td>
</tr>
<tr>
<td>Joondalup</td>
<td>333,897</td>
</tr>
<tr>
<td>Midland</td>
<td>266,901</td>
</tr>
<tr>
<td>Armadale</td>
<td>225,723</td>
</tr>
<tr>
<td>Rockingham</td>
<td>113,963</td>
</tr>
<tr>
<td>CBD</td>
<td>248,547</td>
</tr>
</tbody>
</table>

Source: Created by author using DoT resident worker data

Potential job accessibility improvement from the employment targets

Measurement of accessibility

While accessibility can have many definitions and methods of measurement, it is defined here as “the number of job opportunities that can be reached from a zone within a given travel time threshold”. Thus, the more job opportunities that can be reached from a zone the better accessibility that zone is deemed to have (Accessibility Observatory, 2016; Sun et al., 2017; Kelobonye, McCarney, et al., 2019). Thus, accessibility (A) here is calculated as (Equation 1):

\[ A_i = \begin{cases} \sum_j a_j & \text{if } t_{ij} \leq k, \\ 0 & \text{if } t_{ij} > k, \end{cases} \]

where \( a \) is the number of job opportunities in zone \( j \), \( t_{ij} \) is the travel time from home zone \( i \) to zone \( j \), and \( k \) is the travel time threshold within which jobs are deemed to be accessible.

Changes in job accessibility

The spatial distribution of job accessibility across the metropolitan area shows clear spatial inequity between the city centre and outer suburbs (Fig. 6). Decentralising employment from the city centre and concentrating more jobs in ACs is expected to improve job accessibility for residents of the outer suburbs, creating a more even spatial distribution, and hence, spatial equity of job accessibility. This in turn should reduce excess commuting particularly to the CBD, contributing to better travel efficiency overall. We present in Fig. 6(a), the spatial pattern of job accessibility throughout the metropolitan region as it was in 2011. In Fig. 6(b), the target numbers of jobs for all ACs by 2050 (based on the P&P @3.5mil) were added to determine the level of improvements in job accessibility for the outer sub-regions.
Figure 6: Potential impact of the P&P @3.5mil employment targets on job accessibility

Accessibility of job opportunities within 30 minutes by car...

Source: Map by author. Data from DoT and P&P @3.5mil.

It should be noted that, due to data restrictions, the model’s 2011 travel time estimates were used for modelling future accessibility. While this does not account for the planned road network improvements, it can reveal the expected employment distribution and provides a good basis for assessing potential accessibility changes resulting from the new job spatial distribution. We should expect to see visible hotspots develop around ACs in 2050, reflecting the concentration of jobs in those areas, and consequent improvement in job accessibility. Given that there is no growth target for the CBD, we also expect to see a reduction in the CBD dominance, and accessibility levels evening out to ACs. Note that job accessibility here is based on car travel times, which is the most efficient travel mode in Perth (Kelobonye, McCarney, et al., 2019; Kelobonye et al., 2020) and is used in the majority (almost 80%) of trips to work (Australian Bureau of Statistics, 2017).

The 2011 results show that some zones located in the central subregion could provide access to almost 80% of total metropolitan jobs within 30 minutes drive time. Only two of the 10 strategic centres had an accessibility of more than 50% (Morley, 53.4% and Stirling 52.6%), and both are in the central subregion and on the northern side of the river. Job accessibility from ACs is important for the anticipated growing number of people living there, as they are to host high-density residences (Western Australian Planning Commission, 2010).

After adding employment targets for all existing strategic, specialised and secondary centres, car-based job accessibility in 30 minutes was recalculated. Assuming other factors remain the same, this shows the spatial pattern of accessibility and its equity, or lack thereof, that would be attained in 2050. It should be noted that this is a simplified approach that could be improved by future travel time estimates which will differ from current ones due to population growth, transport investments and changing traffic conditions. Although preliminary, the results of this task can provide a good indicator of future accessibility for these centres and guide planning and spatial distribution of jobs and workers.

Interestingly, the improvement from 2011 is almost unnoticeable (Figs. 6(a) and (b)). The most obvious improvement is on the immediate south of the Swan River, west of the Mandurah line. Slight decline in
the central-area dominance and improvement along the Armadale line are also visible. Of the four selected ACs, Joondalup and Rockingham experience a slight improvement, while Midland and Armadale see a decline in their levels of job accessibility (as a proportion of total jobs in the metropolitan region) (See Table 2). Therefore, the current AC employment targets, while they may seem radical to some, are actually not that different from business-as-usual and will have little impact overall. Given that the employment base in the metropolitan region is projected to almost double by 2050, and numbers in other areas will also inevitably increase, including in the CBD itself, ACs can, and need to, add significantly more than double their current employment sizes to become competitive sub-centres that can improve accessibility in the outer subregions and impact on Perth’s monocentric and dispersed spatial structure.

Table 2: Job accessibility comparison for strategic activity centres between 2011 and 2050

<table>
<thead>
<tr>
<th>Activity centre</th>
<th>Accessibility in 2011 (%)</th>
<th>Accessibility in 2050 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stirling</td>
<td>52.6</td>
<td>48.94</td>
</tr>
<tr>
<td>Morley</td>
<td>53.36</td>
<td>48.36</td>
</tr>
<tr>
<td>Cannington</td>
<td>42.21</td>
<td>42.42</td>
</tr>
<tr>
<td>Fremantle</td>
<td>23.08</td>
<td>26.71</td>
</tr>
<tr>
<td>Midland</td>
<td>26.87</td>
<td>25.46</td>
</tr>
<tr>
<td>Joondalup</td>
<td>13.78</td>
<td>14.92</td>
</tr>
<tr>
<td>Armadale</td>
<td>13.26</td>
<td>12.1</td>
</tr>
<tr>
<td>Rockingham</td>
<td>8.22</td>
<td>8.37</td>
</tr>
<tr>
<td>Mandurah</td>
<td>5.46</td>
<td>5.89</td>
</tr>
<tr>
<td>Yanchep</td>
<td>2.43</td>
<td>3.15</td>
</tr>
</tbody>
</table>

Source: Created by author
*Table sorted by this column

A critical review of policy employment projections and targets: the space behind the numbers

The metropolitan region is projected to double its employment base to 1.7 million jobs by 2050, from an estimated 0.85 million in 2011 (Western Australian Planning Commission, 2018). The P&P @3.5mil makes projections for employment growth according to four major subregions; South Metropolitan Peel (consisting of South West, South East and Peel), North West, North East and Central sub-regions (Fig. 1). It further makes specific employment targets for ACs, where jobs are aimed to be concentrated. Comparing these targets to the wider subregional projections, however, suggests that jobs will actually not be concentrated in ACs. For instance, the North-West subregion is projected to have an additional 143,560 jobs by 2050 (Table 3), but only about 17% of these will be in strategic centres (Joondalup and Yanchep) while 18% will be shared between the six secondary centres (Fig. 7). This leaves 65% of additional jobs in the sub-region to be potentially located outside the areas planned for intensive densification and high accessibility.

In the North-East sub-region, only about 9% of additional jobs will be in the only strategic centre in the sub-region (Midland). The secondary centres will share about 4%, meaning that about 87% will not be in a major AC. The South Metropolitan Peel sub-region will grow the most with 293,750 new jobs, a 204% change from 2011. However, the three strategic centres in this sub-region (Armadale, Rockingham and Mandurah) will share just about 5% (14,460) of the new jobs. The six secondary centres will share 4%. Thus, 91% of additional jobs in South Metropolitan Peel will be in neither a strategic nor secondary centre.

The Central sub-region, while it is projected to add more jobs than North-East and North-West (285,840), will have the least growth with a total change of only 52%. This is a welcome projection as the central dominance is sought to be reduced. However, as with the other sub-regions, major centres will host only a small share of the additional jobs. The four strategic centres will take a combined 6% of additional jobs. The eight secondary centres will share 7% of the subregion’s job growth between them. This sub-region also has five Specialised centres, targeted to host a combined 19% of the additional jobs. Thus, about 32% of additional jobs in the Central sub-region will be in a strategic, secondary or specialised centre. There are also 10 industrial centres which together are projected to contribute 33% of the new jobs in this sub-region. It is a notable observation that the strategic planning document makes no specific projections for the CBD, which will undoubtedly take a sizeable portion of job growth in this
sub-region. It is therefore unclear how the remaining 36% (103,041) will be distributed across the sub-region. However, the more these jobs are spread to other centres (than the CBD), the better for the spatial equity of employment opportunities, as well as their accessibility (assuming ACs will get increasingly better access while CBD congestion increases). It is noted that the CBD has the best level of PT access at a regional level and putting these additional jobs in other locations may well reduce PT access – but may improve car access. A decentralisation agenda that strengthens concentration in ACs could minimise this effect and give PT the best chance of competing with the car.

The 2050 vision entailed in the P&P @3.5mil presents a good opportunity to decongest the inner city and drive towards a polycentric urban structure and spatially equitable accessibility, but this opportunity will be lost if more effort is not directed towards growing the job share of ACs. While the ACs are not (currently) in the most accessible zones, they are anticipated to be anchors of future growth and their accessibility is expected to improve significantly as transport infrastructure and services will be added or improved specifically to service them. Thus, by not adding a larger share of jobs to these areas, the opportunity to harness the benefits of these investments, and to improve accessibility in the sub-regions, will also be lost.

Table 3: Jobs by sub-region 2011-2050 and respective share of strategic centres

<table>
<thead>
<tr>
<th>Sub-region</th>
<th>Jobs 2011</th>
<th>Jobs 2050</th>
<th>Total change</th>
<th>Total % change</th>
<th>Jobs added in ACs</th>
<th>Growth share in ACs*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>546,120</td>
<td>831,960</td>
<td>285,840</td>
<td>52%</td>
<td>103,041</td>
<td>63.95%</td>
</tr>
<tr>
<td>North-East</td>
<td>82,380</td>
<td>192,950</td>
<td>110,570</td>
<td>134%</td>
<td>14,440</td>
<td>13.06%</td>
</tr>
<tr>
<td>North-West</td>
<td>80,570</td>
<td>224,130</td>
<td>143,560</td>
<td>178.2%</td>
<td>50,200</td>
<td>34.97%</td>
</tr>
<tr>
<td>South Metropolitan Peel</td>
<td>143,970</td>
<td>437,730</td>
<td>293,750</td>
<td>204%</td>
<td>25,810</td>
<td>8.79%</td>
</tr>
</tbody>
</table>

Source: Adapted from PnP @3.5 million.

*This column shows the proportion of new jobs located in ACs (strategic, specialised and secondary centres).

Fig. 7 illustrates that the projected job shares of ACs will be quite low among all the four subregional frameworks. Given the large proportions of jobs expected to be in the subregions but not in ACs, it can be predicted that the plan would deliver a dispersed structure rather than a polycentric one. This will bring a serious challenge to the accessibility of those jobs, particularly by PT whose coverage is quite limited in the suburbs. Therefore, this growth pattern is likely to reinforce reliance on the undesired private car as the only viable travel option outside of ACs.
Summary and conclusions

The paper evaluated the urban spatial structure of the Perth Metropolitan Region with respect to its transformation into a polycentric structure. This was done through an investigation of the city’s employment decentralisation agenda, using density and accessibility indicators. Using these indicators, strategic centres were scored and ranked to aid the process of identifying the best suited for development into a primary centre. We investigated the ability of the suburban areas to support the ACs by identifying the catchment areas of selected strategic centres and determining their labour densities. We also critically evaluated the sufficiency of the policy employment targets for ACs through predictive accessibility assessment.

The results show that the catchment areas based on PT travel times were significantly smaller than those of private car, despite having a threshold of 45 min as opposed to the 30 min for car. However, the average labour density was higher within the PT catchment areas in three of the four selected ACs (except Rockingham). Labour density is higher closer to the train lines, and the PT catchment areas are also closely aligned to the railway, which explains their higher average densities when compared to car-based catchment area densities. Joondalup strategic centre had the highest labour density in both PT and car catchment areas, and highest potential improvement in job accessibility compared to
the other three selected strategic centres. Midland had the highest accessibility (both current and projected) among the four ACs, and this is mainly due to its proximity to the job-rich central subregion. Midland and Armadale have limited growth potential on their eastern side, and are therefore not best suited for primary centre development. Thus, Joondalup is recommended as having the best potential and being most suited for prioritisation and development into a primary centre in the short to medium term.

The results of this work further suggest that the employment targets for ACs from the projections of P&P @3.5mil will have little impact on job accessibility in the outer subregions. The central subregion will retain its dominance of the job share and overwhelming accessibility advantage. For many of the ACs, the projections indicate a lower growth rate than the overall growth in their respective subregions, and indeed in the entire metropolitan region. This trend more likely reflects ‘scatteration’ rather than employment concentration in ACs. This might exacerbate rather than alleviate challenges of poor accessibility in the outer subregions (accessibility inequity), particularly by PT. Employment targets for ACs need to be higher and more radical in order to create competitive employment hubs, maximise PT accessibility and transform the city to a multi-destination, polycentric urban spatial structure.

It is worth noting that while decentralising jobs can improve opportunities near suburban residents, it could also reduce accessibility by PT due to limited coverage in the suburbs compared to the CBD. This is because PT accessibility in Perth is highest in the CBD. In the suburbs, ACs are/will be relatively well connected to the PT network and should host the majority of suburban jobs to maintain good PT accessibility. Failure to adopt appropriate employment targets and residential densities for ACs will create, at best, low-density, dispersed commercial districts that can only be accessed by car. A notable limitation of this study is in the use of current travel time estimates in the projected job accessibility maps, which do not account for future improvements to road and PT infrastructure and services.

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