

PLANNED SPATIAL RESTRUCTURING OF AUSTRALIAN CITIES: Are The Transport Benefits Of Employment Decentralisation Policies Greater Than Those Of Transit-Oriented Development?

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ABSTRACT

Perth and Brisbane are both subject to new state government office decentralisation policies. Unlike residential Transit-Oriented Development (TOD), which is proving difficult to achieve in practice, moving workplaces out of Australia's highly centralised city centres is proving easier for governments to enact. Urban restructuring via employment decentralisation is thought to offer specific transport benefits and risks, yet these are mostly unexplored in the contemporary Australian context. This paper explores whether the transport benefits of planned employment decentralisation policies are greater than those of residential TOD, to help gauge whether Australian planners should give support to the decentralisation agenda. The efficacy of residential TOD as a means to change travel behaviour is summarised from a systematic review of previous studies. Modelling of an idealised employment decentralisation scenario for the year 2031 was produced for Brisbane to generate a set of likely travel behaviour changes. Methods for doing a comparative scenario for residential TOD are developed. The results suggest that planned decentralisation can improve transport systems and sustainability, particularly by reducing vehicle travel times, albeit after the short-term dislocations of workplace moves are resolved. The research brings into question the overwhelming and continued focus of much of the planning profession on residential TOD as the main (and sometime only) transport and land use intervention being harnessed to help alleviate traffic congestions and generate sustainable travel behaviour. A broader focus on urban structure in metropolitan transport and land use policy and planning appears warranted.

INTRODUCTION

Transit oriented development (TOD) remains a key focus of planning agencies in Australia towards shifting transport and land use arrangements in cities to support increased public transport patronage and mode shift away from the car. Often framed in terms of residential development, TODs are proving difficult to produce, with resistance in inner- and middle-suburban neighbourhoods to increased residential density. This paper asks whether it is more effective, in terms of transport benefits, to move employment locations in Australian cities, rather than residential locations. We particularly focus on office workers, whose jobs are primarily clustered in the central business districts of our major metropolitan centres. Initiatives to achieve this are already underway in Brisbane and Perth, with state governments moving their own workers to suburban activity centres to reducing leasing costs for their public services. A review of the scientific literature was undertaken to establish known relationships between both residential TOD and employment decentralisation as means to achieve travel behaviour change. Given the paucity of material on employment decentralisation, especially in contemporary Australian cities, summary results of recent strategic transport modelling are presented. This compares an employment decentralisation against a base case for Brisbane in the year 2031, and provides richer detail on likely outcomes of the decentralisation policies currently being pursued in Perth and Brisbane.

The paper commences with a broad introduction to both residential TOD and planned employment decentralisation as travel demand management responses. The broad conceptual underpinnings to the research are provided. Results of the review are provided,

including in table form. Summary detail on the scenarios and the transport model and its calibration are provided, and the results for the employment decentralisation scenario are outlined. Methods for a comparative TOD scenario are advanced and explained. The results raise important questions as to the priorities for transport and land use planning at the metropolitan scale in Australian cities. Limitations of the study are identified, with a number being resolvable via future research.

TRANSIT ORIENTED DEVELOPMENT

The way in which TOD influences travel behaviour in cities is one of the most contested in contemporary transport and land use scholarship. Problems include the range of factors involved, questions over the reliability of past studies due to problems such as residential self-selection bias (see Cao, Mokhtarian and Handy 2009), the difficulties of conducting longitudinal studies tracking change at individual or household level, and the range of confounding factors that plague studies at the regional or metropolitan level. There also arise disputes as to what actually comprises TOD, across cities and cultures. There is often the focus is on residential TOD redevelopment. However, it is difficult to get a precise picture of travel behaviour impacts, though some evidence has emerged.

In cities where there really are 'transit-oriented' sites and others that are more car-oriented, like Taipei and California, there is evidence for residential TOD influencing a range of travel behaviours, including improved transit ridership, at the metropolitan scale (Cervero 2007; Lin and Shin 2008). At the scale of individual development projects, studies of behavioural impacts have shown incoming residents report increased transit use for both commute and non-commute trips (i.e. Dill 2008). Some evidence of the efficacy of contemporary residential TOD in the Australian settlement is finally emerging, noticeably in recent research from Western Australia (Curtis and Olaru 2010). As with all studies of the built environment and travel behaviour, the data is mainly associative, not causal, the magnitude of effects is not clear, and there are no certainties as to the exact mechanisms by which specific travel behaviours are influenced.

There have been surprisingly few residential TODs actually built in Australian cities thus far, despite over a decade of prominent promotion by the planning fraternity, a major international conference on TOD held in Perth, and state government policy vehicles such as Queensland's previous 'TOD Taskforce'. The barriers to implementing TOD as a policy option are many, and include:

- community resistance to increased density, exemplified by the 'save our suburbs' movements;
- constrained capacities within the urban fabric to accommodate increasing densities, in many locations;
- land rents, which make apartments a poor investment in many middle- and outer-suburban areas;
- heritage legislation, such as the character housing controls around inner-city rail and bus stations; and,
- other regulatory hurdles for inner-city and brownfield development, with suburban greenfields expansion perceived as 'easier' to achieve by developers (Flint 2005; Searle 2003).

EMPLOYMENT DECENTRALISATION

By contrast, planned employment decentralisation has received very little scholarly attention in recent decades, despite its obvious potential for reshaping urban structure and transport/land use patterns. Most attention has been given to moving residents nearer to transport (TOD) and to New Urbanism instead. This is despite a very strong period of concentration of employment within central business districts (CBDs). Suburban commercial offices and business parks are often limited by planning controls and US-style commercial strip zoning policies are rare in Australia. Mees (2010:104) reported the Melbourne CBD as adding 100,000 new jobs between 1996 and 2006, alone. Though Sydney has a longer history with such policies, only recently have the Western Australian and Queensland

Governments taken up planned employment decentralisation, each announcing that they will move 20% of their own public sector employees out of the central business districts of Perth and Brisbane, over the next ten years (Marmion 2010; Sectorwide 2008) primarily as a response to increased commercial office rents in CBD locations.

Past research on the travel behaviour impacts of employment decentralisation is of two types: modelling and analysis of city travel behaviours at the metropolitan scale; and, analysis of firms and their workers actually subject to a move. In Australia the key research at the metropolitan scale effects of planned decentralisation included the modelling work of Alexander (Alexander 1978, 1980) who demonstrated, using conventional four-step transport modelling, significant benefits to travel times, but not mode shares, for decentralisation in Sydney. Parolin (2005:8) showed that Sydney's policies to support outer-suburban centre development, including planned government employment decentralisation to those centres, have produced gains in reducing what otherwise would have been increased commute journeys. However, Cheung and Black (2007) have shown that Canberra, a city with strong clustered employment decentralization policies, has generated little jobs-housing co-location, in that few workers in the sub-centers (i.e. Woden, Belconnen) choose local housing, or vice versa, and the city has low mode shares for public transport, even by Australian standards. At the level of the firm or institution, Bell (1991) conducted pre- and post- move travel surveys of workers in Coles Myer's head office which moved from the Melbourne CBD to Tooronga in the late 1980s. Workers moved to middle-suburbia in Melbourne tended to own and use private motor vehicles more after the move, and few staff relocated their homes, albeit that the new office was located closer to many of their places of residence than before (Bell 1991).

Internationally, the evidence suggests that suburban workers affected by a move are more likely to use cars, particularly in the short-term (Hanssen 1995:251-252; Naess and Sandberg 1996). At the metropolitan scale these impacts are worst under laissez-faire employment decentralisation of the type found in North America. Planned employment decentralisation to transit nodes can mitigate against these impacts, and has been extremely successful in producing more efficient 'reverse-commuting' patterns and high public transport mode shares in cities such as Stockholm, Singapore and Tokyo (Bernick and Cervero 1997; Malone-Lee, Loo and Chin 2001).

A summary of the transport benefits of TOD and employment decentralisation policies, and their barriers to implementation, are shown in Table 1.

Table 1: Transport Benefits of and Barriers to Implementing Residential TOD and Planned Employment Decentralisation policies

Policy	Residential Transit Oriented Development	Planned Employment Decentralisation
Transport benefits	Increased public transport use Decreased journey lengths	Decreased traffic congestion Decreased journey times
Barriers to implementation	Community resistance Market demand Regulatory barriers Long lead times	Public sector union resistance

MODELLING THESE SCENARIOS

Modelling residential TOD and employment decentralisation scenarios in Australian cities is not an easy task. As noted, there is a level of uncertainty about what TOD actually is, its efficacy, and the likely spatial patterns for residential TOD at the metropolitan scale in Australian cities are not clear. Similarly, it is not certain how the employment decentralisation policies will eventuate in practice. Conventional strategic transport and land use models are capable of providing some indication of possible responses, but many have limitations when it comes to exploring transport and land use scenarios (Kaneko and Fukuda 2004; Loudon and Parker 2008). Most models used in Australia's state capital cities, though multi-modal, do not have iterative feedback loops that allow forecast transport settings, such as congestion and

travel speeds, to change probable land development patterns for a future city via an integrated land use model. They thereby omit one of the key drivers of transport and land use change. The models also tend to not recognise that trips are inter-related (omitting trip-chaining) and other factors that may limit their capacity to adequately model residential TOD and other 'Smart Growth' scenarios (Loudon and Parker 2008). But it is still possible to run conventional models of this type, albeit recognising these limitations, and there are few other research approaches available for testing such scenarios and their transport impacts.

The conventional transport modelling approach has been used by the authors to test employment decentralisation scenarios for Brisbane. The full results are published elsewhere (see Burke and Li 2011; Burke, Li and Dodson 2011) but some summary detail is required here. The modelling used the Brisbane Strategic Transport Model - Multi-Modal (BSTM_MM), as used by the Queensland Government Department of Transport and Main Roads (TMR). The planning horizon was set at the year 2031, for which transport and land use scenarios were provided by TMR, based on the transport and land use arrangements planned for in the *Draft Connecting SEQ 2031* integrated regional transport plan (Transport and Main Roads 2010). The scenario was developed and scaled according to government announcements and planning policy (Department of Infrastructure and Planning 2009; Sectorwide 2008). The changes made to the city's urban structure were modest. 15,636 jobs were moved out of the CBD, reflecting not only government workers but some small 'multiplier' effects as other firms are likely to co-locate to service government offices. 75% of jobs were moved to middle-suburban centres, 25% to outer suburban centres, with jobs tightly clustered around key rail and busway nodes, as per the government policy. Few changes were made to the BSTM_MM beyond the redistribution of employment. Total trip attractions for the entire study area were checked to balance out total trip productions, ensuring each scenario was solely about employment decentralization, and not changes in job numbers for the city as a whole. The BSTM_MM procedures were applied in *EMME/3*, and outputs include mode shares and total traffic volumes, vehicle travel distances and vehicle travel time on links, nodes and intersections, as well as for the network as a whole. For an accurate comparison, the total trips in the decentralization scenario was re-adjusted to equate with those in the base case, thus allowing more accurate comparison.

RESULTS OF EMPLOYMENT DECENTRALISATION MODELLING

The results for the planned employment decentralisation scenario were very promising about these policy's likely transport impacts. Looking at the AM peak hour period, and unlike what was initially hypothesised, mode shares for the car did not escalate dramatically, as jobs were moved strictly to key activity centers with good transit access, supported by new cross-suburban bus routes planned for Brisbane and included in the model. Full mode share results are provided in Table 2. Car passenger trips fell by 3.7%, which makes sense given that with a greater variety of employment locations, less households would have two or more adults working in the same location, and be in a position to carpool.

Table 2: Comparison of mode shares for the base case and the idealized decentralization scenario – AM Peak Hour trips only - 2031

Travel Mode	Base case scenario	Decentralization scenario
Car driver trips	52.5%	52.1%
Car passenger trips	20.4%	19.7%
Transit trips	19.0%	20.3%
Bicycle trips	1.3%	1.4%
Walk only trips	6.7%	6.5%
TOTAL	100%	100%

The main changes, however, are in reduced trip lengths, significantly reduced trip travel times, and in resulting decongestion on the road network. Changes in overall travel distances by car (vehicle kilometers travelled) and travel times (vehicle hours travelled) are shown in Table 3.

Table 3: Comparison of transport performance between the base case and the idealized decentralization scenario– AM Peak Hour trips only – 2031

	Base Case Scenario	Decentralization Scenario	Percentage Change
Total Private Vehicle Kilometers Travelled (VKT)	14,055,000	13,636,708	-3.0%
Total Private Vehicle Hours Travelled (VHT)	402,000	362,811	-9.7%

A 9% reduction in total travel time result for the road network, suggested by this the modelling, suggests some significant improvements to congestion within Brisbane may be possible if employment decentralisation policies. However, these results were only achieved if decentralisation was tightly controlled solely to transit nodes, especially in the middle-ring suburbs. The policy produces significant decongestion and improved vehicle levels of service on links right across the city. Further, it appeared to produce some benefits in improved contra-flow travel volumes against the strong tidal-flows of peak direction travel in Brisbane, which may assist with improving cost-recovery on the public transport network. Some caution should be used in considering the size of this travel time reduction though. There is significant likelihood that the model is not accounting for possible countervailing effects. Workers may well react to these changed conditions and give up individual travel time savings to instead travel further to a wider range of job locations. Behavioural assumptions within the model, in that commuters will seek to minimise travel costs, may not be accurate for explaining the full set of likely travel behaviour changes, at this scale. Research in the 1980s and 1990s on real-world US cities suggests that urban structure is less influential in minimising commuting than might be expected (Giuliano and Small 1993; Hamilton 1982). This has been hypothesised as relating to constant travel budgets across populations (see Marchetti 1984; Metz 2008). What is more useful is comparing across scenarios, under the same assumptions.

TOD MODELLING

We have now sought to operationalize a TOD development scenario that includes significantly more TOD than the modest amount currently included in the BSTM_MM base case for 2031. In essence, we are seeking to move the same, modest number of workers, and their households, to TOD sites, as we moved workers in the employment decentralisation scenario. In this way, we can compare the transport impacts of both policy measures, scaled at an equivalent level, using the same model and the same key parameters.

The TOD scenario was drawn from the publicly released transit orientated development guide available from the local governments and the TOD policy contained in the South East Queensland Regional Plan, extrapolated out to the year 2031. A total of 17 TOD zones were selected from the BSTM traffic zones based on the land use characteristics, local socio-economic profile and the level of transit links provided in that zone in the 2031 scenario. As illustrated in Figure 1, most TOD zones are situated at major suburban residential areas that lie on a major commuter rail line where also offer high-frequency bus services to and from the Brisbane CBD.

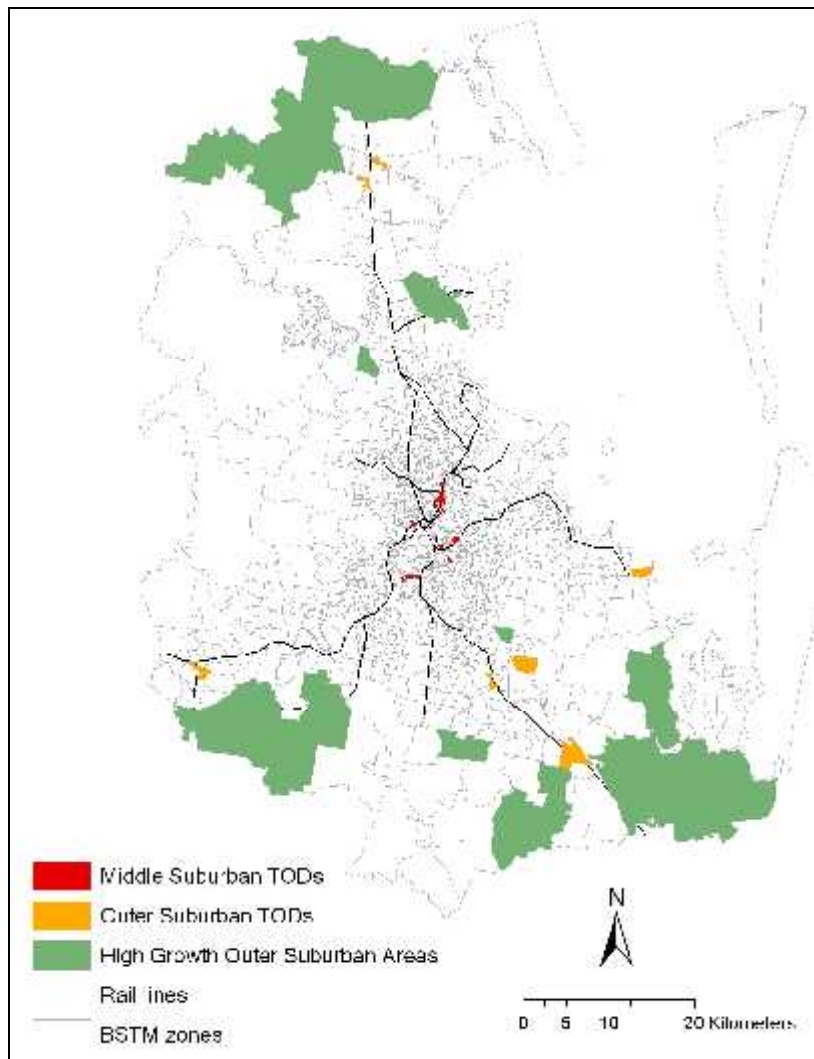


Figure 1: Distribution of TOD zones and high growth outer suburbs

The TOD scenario shifts a total of 15,636 employed residents (same number as the job decentralization scenario) from the projected high growth outer suburbs (e.g. Springfield, Griffin) to the TOD zones, reflecting less growth (sprawl) at urban fringe and more compact growth (through infill and redevelopment) at existing urban areas in the future. The scenario moves the majority (80%) of the new residents to middle-suburban TOD locations, with the remainder (20%) to outer-suburban TOD locations. This is on the basis of that land rents are primarily precluding much TOD development outside of the inner-city areas. Many of the outer-suburban TODs are more than 30km from the Brisbane CBD, nearer to or on the edge of Greater Brisbane’s urban footprint. The differences in the number of residents at TOD zones and high growth outer suburbs for the base case and the TOD scenario as modified within BSTM, are shown in Table 4. These represent very modest changes for most sites.

Table 4: Changes in total residents between the base case and the TOD scenario, Brisbane, 2031

Total no. of residents removed from high growth outer suburbs		Total no. of residents moved to inner-suburban TOD zones (80% of relocated residents)		Total no. of residents moved to outer-suburban TOD zones (20% of relocated residents)	
Caboolture-West	-1,954	Yeerongpilly	1,251	Springwood	447
Griffin	-2,931	Bowen Hills	1,251	Ipswich	448

Central Pine West	-977	Fortitude Valley	1,251	Cleveland	447
Rochedale	-977	Herston	1,251	Morayfield	448
Ipswich-East	-1,954	Hamilton	1,251	Calboolture-Central	448
Ipswich-Central	-1,954	Albion	1,251	Beenleigh	447
Logan	-977	Milton	1,251	Woodridge	447
Beaudesert	-977	Coorparoo	1,251		
Wolffdene-Bahrs Scrub	-977	Woolloongabba	1,251		
Jacobs Well-Alberton	-977	Greenslopes	1,251		
Redland Bay	-977				
TOTAL	-15,636	TOTAL	12,510	TOTAL	3,126

The development of TOD scenario was undertaken within the 'residential household segmentation model' of BSTM. The number of working residents at TOD zones and outer suburbs were modified in order to re-calculate the number of household in each of the ten demographic categories for each of the traffic zones in the model. The adjusted input variables include '*total number of population*', '*total number of employed residents*', and '*total number of white collar employed residents*'. The variables '*average local income*' and '*total number of full time students*' were not included in the analysis because the change in these two variables at specific traffic zones are hard to predict under the TOD scenario.

Then the new estimates of number of households by category will be used as new input to the vehicle availability model and the trip production model in BSTM. As with the TOD scenario, the number of trips between the adjusted trip productions (origins) and attractions (destinations) will be then re-calculated within the gravity based trip distribution sub-model. The route choice of each trip is determined by the newly estimated total travel cost between origin and destination including the number of job opportunities, access to the local transit services, travel distance, toll charge and parking cost, etc. The outputs from the trip distribution model of the BSTM_MM are a trip matrix by trip purpose that is combined using time period factors to give separate AM peak, day off peak, PM peak and night period matrices. After the mode choice model and trip assignment sub-models, the BSTM_MM produces trip matrices for the various transport modes, simultaneously on the transport networks.

Unfortunately, at the time of writing, a key methodological issue is preventing the computation of final results, comparable to the earlier employment decentralization scenario. The major reason for this is that the 'residential household segmentation model' in BSTM_MM has been developed and calibrated using 2001 ABS census data. During that period the urban development in Brisbane was relatively dispersed with little residential development around the TOD sites. Moving large numbers of household into the TOD zones creates very high local residential densities that are presently causing problems with the household prediction process within the BSTM_MM. At the time of writing we are unable to run the model in exactly the same manner as we did with the base case and employment decentralization scenarios, and as such are reticent to provide results until such time as a reliable 'like for like' comparison can be made, using exactly the same model procedures. Our present research is concentrated solely on resolving these issues to allow for true comparative results for the two scenarios to be produced. A number of possible solutions to overcome the problems with the TOD modeling are being pursued, including modification of the TOD approach and re-calibration of prediction parameters using newly released ABS census data or travel survey data.

Discussion

Though the study has significant limitations, not least in looking at only one city, and only using one model (albeit as good as is available for the purpose), and in not yet having produced comparable results for the TOD scenario. And there are many limitations with the approach used, including the uncertainty of both TOD and planned employment

decentralisation futures for Australian cities. However, the implications of this research, deriving from the reviews and modelling of planned employment decentralisation scenarios are, we believe, significant.

Mostly silent in terms of the decentralisation agenda, we believe it is time for planning researchers and advocates to embrace employment decentralisation as a policy priority, for the betterment of Australian cities. We are not arguing for the demise of CBDs, far from it, but carefully scaled and located employment decentralisation appears to offer too many benefits to ignore, whilst actually saving state governments money in office leasing costs. These benefits may come without creating significant political turmoil, unlike building more infrastructure, or travel demand management activities such as road pricing. Other than public sector union resistance, which can be managed, and the short-term dislocation effects there may be few disbenefits to planned employment decentralisation.

A renewed focus on employment decentralisation, even just that presently committed to in WA and Queensland, creates pressing needs for research, given the major gaps in knowledge on the topic for contemporary Australian cities. Research is needed quickly into the impacts on affected workers, given the paucity of information available and the potential for significant deleterious short-term impacts. A focus should be on interventions and means to reduce the worst effects, and maximise the benefits of decentralisation programs. State and local government agencies will need to identify how centres policies should be amended to factor in potentially significant growth in suburban employment nodes. Transport agencies, including local authorities who manage road networks surrounding suburban activity centres, are going to need to understand just what employment decentralisation may mean to plan for appropriate transport infrastructure and services, including suburban public transport networks. Large private sector developers with activity centres are going to need to understand how to work with and deliver better outcomes to meet the needs of relocated workers and the agencies involved.

The transport benefits of planned employment decentralisation vs. TOD need resolution, which we hope success with out TOD modelling will help resolve. Further, the effects of these policies on peak-spreading, the phenomena whereby people travel more outside of peak-hour, deserve attention. Research is needed on the socio-demographic impacts of the two policies, in terms of helping specific population groups and their transport and employment accessibility needs, and in reducing the long commute for certain groups. Without understanding the full effects, those planning the future of Australia's cities may be choosing the wrong set of policy approaches, or not harnessing their full potential. The authors hope to make a significant contribution to this research agenda.

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