

Optimising transit networks by moving government workers: the transit impacts of employment decentralization in Brisbane

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Abstract: Australia's office employment is centralized in its major cities. Government decentralization policies in Perth and Brisbane seek to move 20 per cent of each city's state public servants out of their central business districts within ten years. A modeling framework is developed to appraise the likely transit system impacts in Brisbane. Two idealized, hypothetical scenarios are advanced to compare city futures in 2031. One scenario mostly moves workers to middle-suburbia on Brisbane's busways. The other mostly moves jobs to outer-suburban commuter rail nodes. These scenarios are both compared to a base case of continued employment centralization. The results suggest both decentralized models provide contra-flow benefits, improved fare-box recovery, and reduced on-board congestion. But decentralization to outer-suburban rail nodes offers disadvantages by raising total car travel. The implications for planning include the need for strong land use policy to direct decentralization strictly to activity centers to achieve benefits for transit systems.

Key Words: *employment decentralization, urban structure, strategic transport modeling,*

1. INTRODUCTION

Unlike many of their Asian and US counterparts, Australia's five largest cities remain strikingly mono-centric in terms of office employment. This centralization has been linked to significant problems such as the rent spike experienced by the city of Brisbane in 2007, a provincial capital that leapt into the top 50 most expensive cities in the world for commercial office space (CB Richard Ellis, 2007). Being the largest tenants bearing such leasing costs, the Western Australian and Queensland state governments have both sought to move 20% of their public sector employees out of the centers of Perth and Brisbane, respectively, in the next decade (Marmion, 2010; Sectorwide, 2008). Following the lead of Sydney, which has pursued such policies previously (Black et al., 2007) planned employment decentralization is back in vogue and being promoted as offering benefits to transport systems, including reduced congestion across all modes. But there has been little detail provided by government in either Perth or Brisbane as to specifically how many jobs will move where. And there are competing visions for how this could proceed spatially, in creating new suburban landscapes for employment, and changing a city's urban structure. This paper seeks to provide the necessary evidence for decision-makers of the impacts of one key issue: the transit system performance impacts of different decentralization scenarios and urban structures.

2. BACKGROUND

Already strongly focused on the central business district (CBD), current growth in office employment in most of Australia's large cities remains highly centralized. Suburban commercial office developments have been limited by planning systems (with some exceptions) and the commercial strip zoning seen in US cities is uncommon in Australia. Census figures show the Melbourne CBD added 100,000 new jobs between 1996 and 2006 (Mees, 2010:104) with similar growth rates experienced in Brisbane and Perth. Despite this, residential land use is very dispersed in Australian cities, such that there are now large jobs/housing mismatches in the origins and destinations of office workers. These mismatches have been associated with traffic congestion, excessively long commutes, office leasing rent shocks, and distorted housing markets (Badcock, 1997, 2000). But they have also been linked to the weak performance of Australia's line-haul public transport systems, especially in terms of inefficient uni-directional tidal flows, 'dead-running' of non peak flow services, poor cost-recovery, and peak-hour congestion. In 2008 the average Brisbane urban rail passenger trip was subsidized at a cost of A\$8.10 per trip (US\$7.91) representing the majority share of all transit expenditures by the Queensland Government with dead running of services against the peak a major problem. Could it be that carefully planned employment decentralization offers an opportunity to optimize the transit network, and to reduce the subsidy?

There are various decentralization scenarios for Brisbane currently being debated. Brisbane is somewhat unique globally in having an extremely large local government authority, the largest in Australia by population. It is therefore not surprising that Brisbane's Lord Mayor has suggested that the majority of the decentralized jobs should be relocated to middle-suburban locations around 10-15kms from the CBD but within Brisbane City Council's (BCC's) boundaries (Stannard, 2010). Under this scenario, BCC would retain rate revenue and obtain other benefits from the redevelopment of its centers, most of which lie on the extensive busway network being rolled out in the city (see Hoffman, 2008). Yet Brisbane also has one of the world's most extensive commuter rail systems. Indeed, in 1995 the city had the highest ratio of rail km/capita of all those cities surveyed in the *Millenium Cities Database* (Union Internationale des Transports Publics, 2001). And there are questions as to whether locations in outer-suburbia, greater than 15km from the CBD, may deliver better contra-flow travel, and increased rail boardings, with the potential to alleviate the burden of the current CityTrain rail passenger subsidy. Would decentralization to middle-suburbia offer greater or lesser benefits to transit system performance than decentralization to outer-suburbia?

3. PREVIOUS RESEARCH

We can gain a glimpse of the probable answers to these research questions by exploring the experiences of cities and decentralization programs elsewhere, including the extensive research conducted by EASTS collaborators in recent years (summarised in Alpkokin et al., 2007a). Asian cities feature heavily in the literature. Decentralization to rail-based locations in both Singapore and Japan has had some success in reducing congestion and improving transit system performance (Bernick and Cervero, 1997; Malone-Lee, Loo and Chin, 2001). Singapore's 'Regional Centre' employment nodes, fixed mainly on mass rapid transit (MRT) nodes, provide the city with strong public transport mode shares and significant bi-directional flow on its transport networks (Malone-Lee et al. 2001). However, in Tokyo employment has been focused to multiple nodes within the urban core or inner-city, and not so much to middle- or outer-suburban locations, such that performance is more mixed (see Alpkokin et

al., 2007b). In Istanbul decentralization of employment led to decreased commuting times, despite growth in traffic volumes over time, placing jobs within reach of suburban residents (Alpkokin et al., 2005). Cities elsewhere have also had successes, with Paris experiencing a rise in 'reverse commuting' following the redistribution of jobs, including to outer-suburban new towns on rail lines, such as Marla-Vallée (20km east of the city) and Massey-Saclay (20km to the south-west) (Searle, 1996:43; Tuppen, 1979:56). London also used planned decentralization policies in the face of agglomeration from 1963 to the mid-1980s. This led to a decline in central London employment, with concurrent reductions of travel movements into the central city, and reduced over-crowding on transit (Hall, 1972:385-386). However, except under the strong guidance of land use planning controls such as those used in Singapore, decentralization of employment to suburban locations tends towards increased trip distances, and greater car use (Aguiléra, Wenglenski and Proulhac, 2009). Market-based decentralization to sites away from transit nodes is generally to be avoided.

In Australia planned decentralization has had its successes in influencing travel behavior. Sydney has pursued a range of policies, including government office relocations, to support outer-suburban centers. However, Sydney's average journey-to-work distance to a set of selected employment centers increased from 17.93km in 1981 to 20.66km in 2001 – a 15.2% increase over the 20 year time period (Parolin, 2005:8). Yet in Canberra, the nation's pre-eminent example of a city planned on a poly-nucleated model, the city struggles to achieve transport gains. Despite the potential for jobs-housing co-location, few workers in the sub-centers choose locally available housing, or vice versa, and Canberra has low public transport mode shares (Cheung and Black, 2007).

But what of research that has actually followed workers who have experienced relocation from a central to a suburban location? One such study in Stockholm found that after moving there were immediate increases in the average commute distances of affected workers, which were not reversed by subsequent staff turnover in the next few years (Naess and Sandberg, 1996). Research in Melbourne found that workers moved to middle-suburbia in Melbourne tended to own and use private motor vehicles more after their move, and that very few staff relocated their homes (though the particular site studied was actually closer to most employee's places of residence) (Bell, 1991). And in Oslo in the short- to medium-term next to no staff moved their homes, instead suffering increases in travel time/cost, with the share of employees in an affected workplace with a public transport season pass falling markedly (Hanssen 1995:251-252). Such studies suggest short-term dislocations are a certain feature of decentralization programs, but these research methods don't explore much longer term effects (i.e. over 15 years) when job and housing location choices are more likely to redistribute workers, bringing the urban system into equilibrium.

There are outstanding research gaps that need resolution to be confident in understanding which urban structure would best suit a city such as Brisbane. In particular, few of the previous studies relate to Australia's specific urban forms and structures and there is little evidence from cities with extensive busway systems of the form that Brisbane has pursued. Further, scant comparative research has been done on whether planned decentralization to middle- as opposed to outer-suburban locations in Western, dispersed cities is preferable, including in terms of supporting transit systems.

4. METHOD

Given employment decentralization policies have only recently emerged in Brisbane, conventional strategic transport modeling offers the clearest path for comparing the transport impacts of various decentralization scenarios. Such modeling was undertaken using the Brisbane Strategic Transport Model - Multi-Modal (BSTM_MM). This is the main transport model used by the Queensland Government's Department of Transport and Main Roads (TMR) for Brisbane. The model was previously calibrated and validated by TMR for 2006 by comparison with observed road, rail and bus patronage data and with ABS journey-to-work data. The planning horizon was set at the year 2031, for which full transport and land use scenarios were provided by TMR. The base case model includes many changes to the transport and land use system of Brisbane, reflecting a re-conceptualisation of both the city's rail system and its bus networks in the *Draft Connecting SEQ 2031* integrated regional transport plan (Transport and Main Roads, 2010). Important to this research, the bus networks in the base case include a much greater density of cross-suburban links, including high-frequency routes focused on suburban activity centers, of a form that would support employment decentralization were it to occur.

Two hypothetical, idealized employment decentralization scenarios were developed for the city, for comparison against each other and the base case. Each scenario was in part drawn from the information publicly release on the decentralization program (Sectorwide, 2008) and the planning policy pertaining to employment and activity centers in the South East Queensland Regional Plan (Department of Infrastructure and Planning, 2009). A total of 15,630 jobs (representing approximately 20% of workers in the Brisbane CBD, and only part of the predicted future employment growth there) were relocated to suburban activity centers. The first scenario follows the Brisbane Lord Mayor's suggestions of moving the majority (75%) of the jobs to middle-suburban locations, with the remainder to outer-suburban locations. The second scenario reverses this approach, instead locating 75% of the jobs to outer-suburban centers, with the remainder to middle-suburban sites. Many of the outer-suburban centers are more than 30km from the Brisbane CBD, nearer to or on the edge of Greater Brisbane's urban footprint. In both scenarios, the jobs are placed strictly into activity centers that are directly on key transit links (either busway or rail nodes) consistent with the government's decentralization policy. The differences in job numbers at key centers for the base case and the two idealized decentralization scenarios, as modified within the trip generation sub-model, are shown in Table 1.

Table 1 Changes in total employment between the base case and the two idealized decentralization scenarios, Brisbane, 2031

Scenario 1			
Total no. of jobs moved to middle suburban locations (75% of relocated jobs)		Total no. of jobs moved to outer suburban locations (25% of relocated jobs)	
Chermside	2,408	Ipswich	488
Garden City	2,408	Cleveland	488
Carindale	2,408	Beenleigh	488
Indooroopilly	2,408	Caboolture	488
		Logan Central	488
Buranda/ Bowen Hills	2,100	Springwood	488
		Springfield	488
		Strathpine	488
<i>TOTAL</i>	<i>11,732</i>	<i>TOTAL</i>	<i>3,904</i>
Scenario 2			
Total no. of jobs moved to middle suburban locations (25% of relocated jobs)		Total no. of jobs moved to outer suburban locations (75% of relocated jobs)	
Chermside	845	Ipswich	1,466
Garden City	845	Cleveland	1,466
Carindale	845	Beenleigh	1,466
Indooroopilly	845	Caboolture	1,466
		Logan Central	1,466
Buranda/ Bowen Hills	528	Springwood	1,466
		Springfield	1,466
		Strathpine	1,466
<i>TOTAL</i>	<i>3908</i>	<i>TOTAL</i>	<i>11,728</i>

The locations of key sites are shown in Figure 1.

Few changes were made to the BSTM_MM beyond the redistribution of employment. There was no change made to the parking cost sub-model for the suburban centers so as not to underplay the likelihood of more available parking in these locations. Very modest ‘multiplier effects’ were assumed in both the decentralization scenarios, in that though significant numbers of government workers are moved out to suburban centers, this attracts few additional private-sector firms to also join them at these locations. The number of jobs by employment category was changed in the zones representing the key activity centers, reflecting the rise in white-collar employment, and employment densities were recalculated for each of these zones in the model. Tight clustering of employment meant higher employment densities in the key centers, which influences the mode share sub-model of the BSTM_MM but these were tested to ensure no dramatic effects on the mode split sub-model. Total trip attractions for the entire study area were also 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.

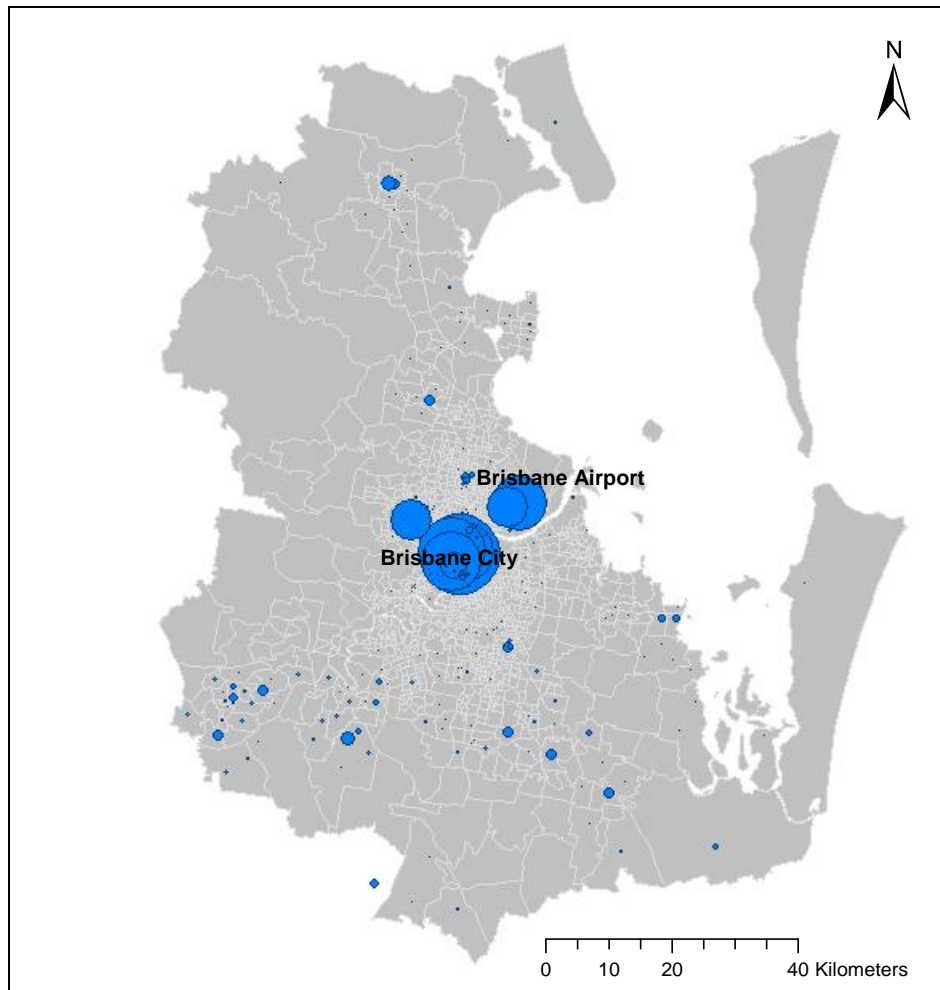


Figure 1a Base case showing centralized government office employment

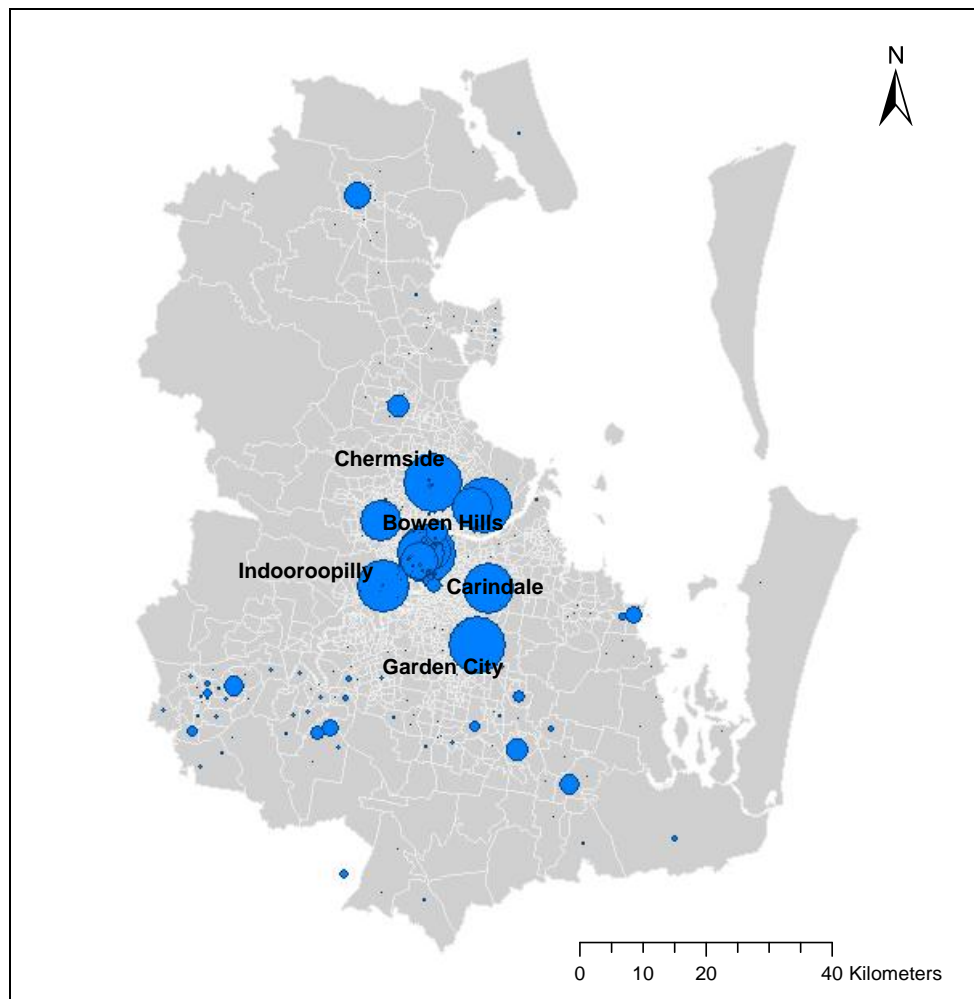


Figure 1b Scenario 1 – employment decentralization mainly to middle-suburbia

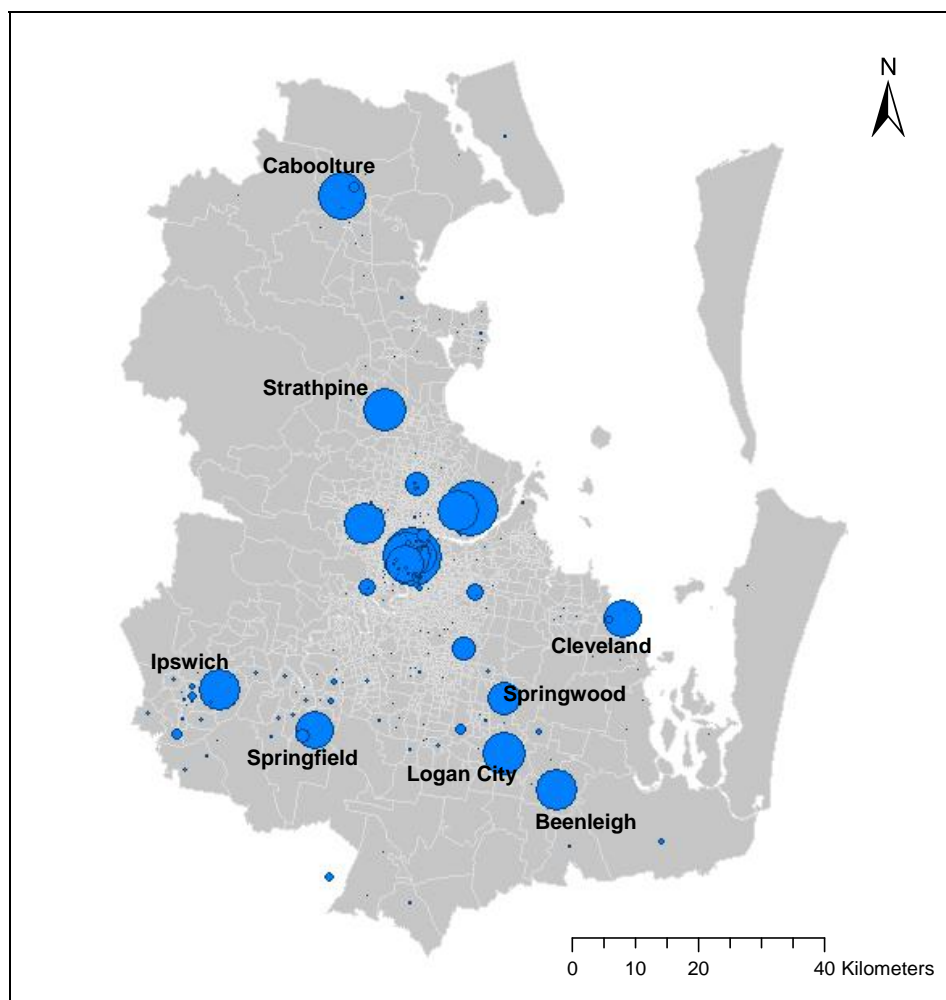


Figure 1c Scenario 2 – employment decentralization mainly to outer-suburbia

There are many limitations to the decentralization scenarios, including that they are unlikely to be achieved without strong planning controls and the addition of limited multiplier effects. They are in no way government policy. And they represent a future state of equilibrium after the short term dislocating effects of workplace relocation have been resolved. What the two scenarios are useful for is in indicating what might occur on the transport system, and in terms of transit system performance, under these theoretical and idealized urban structures.

The BSTM_MM procedures (including trip generation, trip distribution, mode choice and trip assignment) were applied using EMME/3 software. For the decentralization scenarios the number of trips between the adjusted trip productions (origins) and attractions (destinations) were re-calculated within the gravity based trip distribution sub-model. The destination choice of each trip was determined by the newly estimated total travel cost between the origin and destination including the number of job opportunities, travel distance, toll charges 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. Final outputs include total traffic volumes, vehicle travel distance and vehicle travel time on links, nodes and intersections, as well as for the

network as a whole. The model produced a slightly greater number of final trips for the decentralization scenario (+0.07% for Scenario 1; +0.18% for Scenario 2). For an accurate comparison, the total trips in the decentralization scenarios were re-adjusted to equate with those in the base case, thus allowing more accurate comparison.

5. RESULTS

Before looking at transit system performance, it is best to look at total network performance under the idealized decentralization scenarios. Our focus here is on AM peak hour travel, for which the commuter task is particularly important and where congestion on road, rail and bus networks is greatest.

Total trips by mode

Table 2 provides a comparison of total trips by mode for the three model runs.

Table 2 Comparison of trips by mode between the base case and the idealized decentralization scenarios – AM Peak Hour trips only – 2031

Travel Mode (AM)	Base case Scenario trips	Scenario 1 trips	Total change in trips	% Change	Scenario 2 Trips	Total change in trips	% Change
Car driver trips	895,159	888,346	-6,813	-0.8	896,997	+1,838	+0.2
Car passenger trips	347,962	335,211	-12,751	-3.7	345,530	-2,432	-0.7
Transit trips (total)	348,059	372,270	+24,211	+7.0	352,451	+4,392	+1.3
Kiss'n'ride transit trips	64,276	68,800	+4,523	+7.0	65,269	+993	+1.5
Park'n'ride transit trips	38,144	45,540	+7,396	+19.4	41,070	+2,926	+7.7
Walk to transit trips	222,110	232,606	+10,196	+4.6	221,977	-133	-0.1
Bicycle trips	22,639	23,446	+807	+3.6	22,362	-277	-1.2
Walk only trips	114,714	111,354	-3,360	-2.9	111,796	-2,918	-2.5
TOTAL	1,705,004	1,705,004	0	0	1,705,004	0	0

Immediately we can see that not all forms of decentralization will have equivalent travel behavior impacts. The modeling suggests quite significant changes between the base case and the two decentralization scenarios, and between the middle- and outer-suburban scenarios.

For Scenario 1, which shifted jobs mainly to middle-suburban locations, the model predicts a slight fall in car driver trips (-0.8%) and a much greater fall in car passenger trips (-3.7%). Walk only trips fall significantly (-2.9%) which is traded off partly by a rise in bicycle trips (+3.6% but off a lower base). Transit trips grow by 7.0%, helped by particularly large increases in park'n'ride transit trips (+19.4%, off a low base).

For Scenario 2, where jobs are moved mainly to outer-suburban locations, the model predicts a very small rise in car driver trips (+0.2%) and a much smaller fall in car passenger trips than in Scenario 1 (only -0.7%). Walk only trips and bicycle trips both suffer falls (-1.2% and -2.5% respectively). Transit trips do increase (+1.3%) but to nowhere near the extent of Scenario 1.

The results are reasonably intuitive. Car passenger trips fall further than car driver trips in each decentralization scenario, which may be explained by two factors. Firstly, with jobs decentralized to multiple centers, less households will have two or more adults working in the

same location, and able to share a vehicle. Secondly, there is predicted to be less on street traffic congestion in the inner-city, providing less incentive for drivers to use high-occupancy vehicle lanes and achieve travel time savings. Walk only trips decline under both decentralization scenarios, which relates to the large numbers of persons living and working in Brisbane's CBD, who walk to work. Less of these trips are possible under decentralization. Yet bicycle trips rise, perhaps as more jobs are within easy cycling distance (<5km) of more households.

Vehicle Kilometers Travelled and Vehicle Hours Travelled

The trip rates, above, translate into notable changes in both the distances and hours that are travelled on the network. Of most interest are reductions in private vehicle kilometers travelled (VKT) and private vehicle hours travelled (VHT) in the AM Peak Hour for the year 2031. The modeling suggests that Scenario 1 provides a significant decrease of -3.0% in VKT and an even greater decrease of -9.7% in VHT, when compared to the base case. Scenario 2, however, provides for a rise in VKT of 2.5% and a disconcerting increase of 5.1% in VHT compared to the base case.

On street transit operating conditions

On street bus operations are given little priority on most Brisbane arterial roads, though the city's busway network has greatly increased travel speeds and reliability for many routes operating to and from the CBD. Total vehicle traffic volumes on the arterial road network will be a significant factor in the likely performance of on street buses. Much of inner-city Brisbane's road network is already congested in the AM peak, and volumes are predicted to rise in the Brisbane 2031 base case. The BSTM_MM allows one to view changes in traffic volumes between scenarios.

Figure 2 compares the total numbers of vehicles forecast per link on the road network under both the base case and Scenario 1, for the whole network, in the AM peak. There are significant decreases in traffic flows (displayed as links with green bars) across most of the road network. There are particularly strong decreases on radial links leading into the city. A number of outer-suburban arterials experience a modest increase in vehicular traffic, as do out-bound links in the inner-city where there are small increases in contraflow travel. However, the links experiencing more traffic are generally where there is currently excess capacity in the AM peak. This suggests superior operating conditions for on street buses across the network if employment is decentralized to middle-suburban centers.

Figure 3 compares the base case with Scenario 2 under the same conditions. There is a much more mixed performance, with no clear network benefits. Many links suffer increases in traffic volumes, suggesting little likely improvement in on street bus operating conditions if the employment is moved to outer-suburban locations.

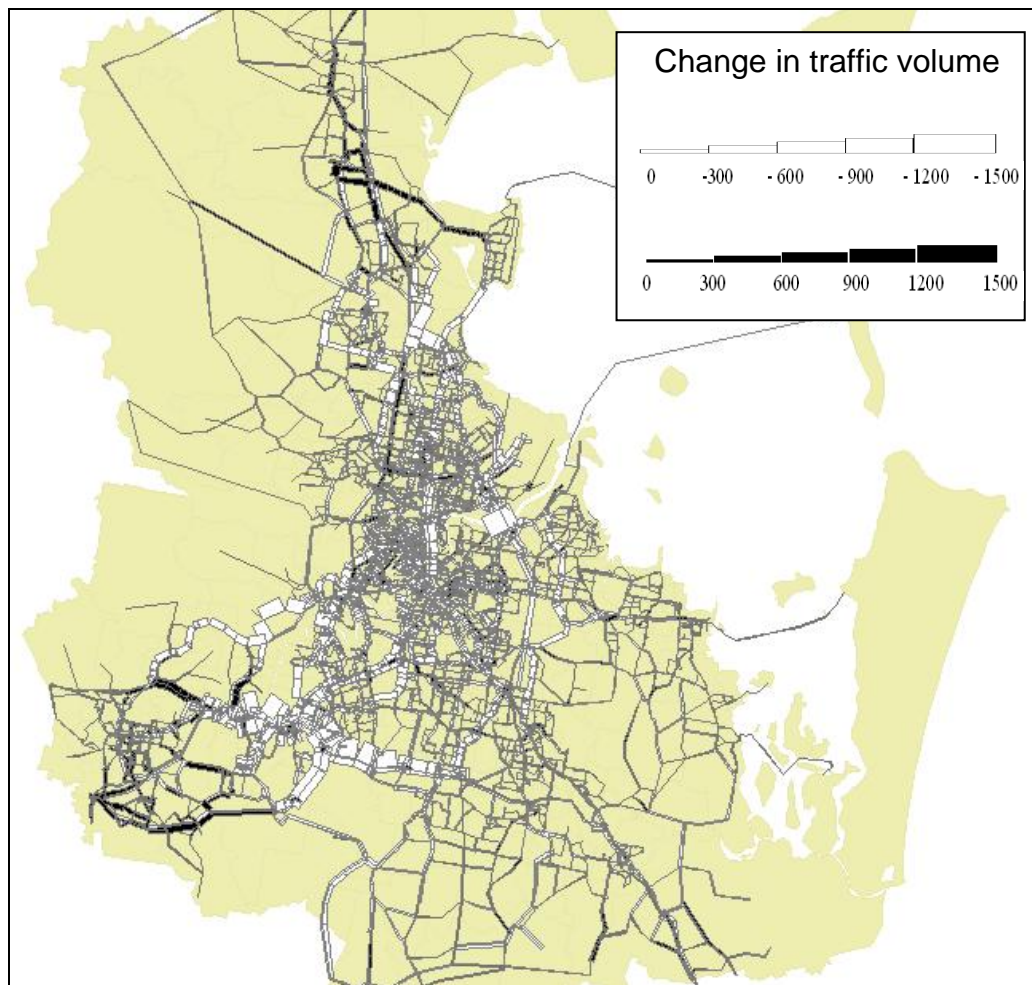


Figure 2 Changes in traffic volume on road links,
base case scenario Scenario 1 – AM Peak Hour only – 2031

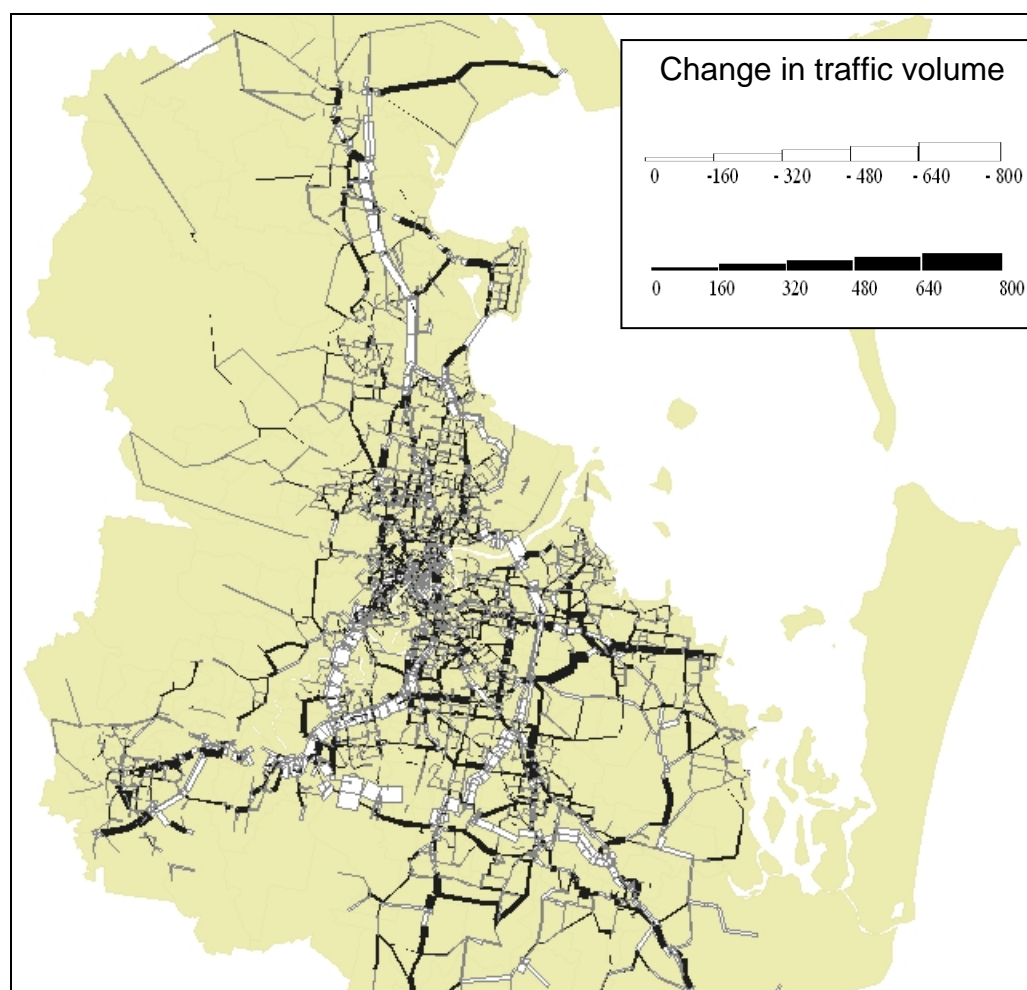


Figure 3 Changes in traffic volume on road links,
base case scenario Scenario 2 – AM Peak Hour only – 2031

Transit network optimization

Commensurate with the mode shares, shown earlier, the model predicts significant changes in total boardings by mode across the scenarios, as shown in Table 3.

Table 3 Comparison of passenger boardings by mode for the base case and the idealized decentralization scenarios – AM Peak Hour trips only – 2031

Travel Mode (AM)	Base case scenario	Scenario 1		Scenario 2	
	Passengers	Passengers	% difference to base case	Passengers	% difference to base case
Rail	243,436	272,838	12.1	252,213	3.6
Bus	264,938	286,581	8.2	268,405	1.3
Ferry	4,640	4,447	-4.2	4,640	0.0
TOTAL	513,014	563,866	9.9	525,258	2.4

There is less use of ferries, which do not service any of the suburban employment nodes, in Scenario 1. But there is generally more use of the same rail and bus services under both employment decentralization scenarios, and greater transit vehicle occupancy, given we did not add or subtract from any of the bus, rail or ferry services.

However, a key factor in network optimization is the proportion of travel that is contra-flow to the AM peak direction on the rail and bus networks. Unfortunately the BSTM_MM operationalises most rail lines as pendulum lines, such as the Ipswich-City-Caboolture line, which does not terminate in the city center. The model does not disaggregate passenger boardings on pendulum routes to inbound (i.e. Ipswich-City) or outbound (City-Caboolture) travel flows. It is therefore impossible to calculate the exact level of contra-flow travel predicted. What is possible is to look at the small set of discrete rail and bus routes that are solely in-bound, such as many peak hour express train services, to compare flows across the scenarios and see if there are passenger reductions. And to do a similar inspection of routes that are solely out-bound, and see if there are increases in passenger boardings.

For inbound AM peak rail services there are observable differences, but these are mainly increases in boardings. For instance, the inbound Beenleigh-City Express services (of which there are 9 in the AM peak period) serve a total of 9,506 passengers in the base case, 10,580 passengers in Scenario 1 (+11.3%) and 9,715 passengers in Scenario 2 (+2.2%). For outbound services similar results are obtained. The outbound City-Beenleigh train services (of which there are 5 in the AM peak period) carry a total of 2,599 passengers in the base case, 2,964 passengers in Scenario 1 (+14%) and 2,745 passengers in Scenario 2 (+5.6%). This suggests a rise in contra-flow traffic on the rail network, but not reductions of inbound passenger boardings.

On buses, the modeling error for individual bus routes with low volumes is likely to be significant across modeling runs. Busway services also often run as pendulum routes for which disaggregation is not possible. This makes calculation of contra-flow traffic similarly problematic. On higher volume routes that start or end in the city center, there are observable differences. The 140 route from Browns Plains-City is a good example. It runs through a similar corridor to the Beenleigh line from the south of Brisbane, entering a busway a few kilometers north of Garden City and travelling past Buranda. The 11 inbound services in the AM peak period carry 2,283 passengers in the base case, 2,451 passengers in Scenario 1 (+7.4%) and 2,403 passengers in Scenario 2 (+5.3%). The 6 outbound services carry 1,707 passengers in the base case, 1,948 passengers in Scenario 1 (+14.1%) and 1,773 passengers in Scenario 2 (+3.9%). This is a similar pattern to that observed for rail, above. Results for key cross-suburban routes differ slightly. The main orbital route in Brisbane is the 'Great Circle Line', which circumnavigates the city on a radius approximately 10-15km from the city center. The activity centers of Indooroopilly, Chermside, Carindale and Garden City (receiving the majority of decentralized jobs in Scenario 1) are all located on this route. There are 12 clockwise and 14 anti-clockwise services in the AM peak. Combined these services are predicted to carry 4,059 passengers in the base case, 4,415 passengers in Scenario 1 (+8.8%) and 4,056 passengers in Scenario 2 (-0.1%).

In summary, there is a similar pattern across bus and rail services, with more contra-flow traffic, but also small increases in inbound radial travel under employment decentralization. Ridership is up, as are vehicle loadings. What cannot be determined from this form of analysis, however, is the length of these transit journeys, where they start and end on the network, or how many are transfer trips, which requires further analysis and is beyond the scope of this paper.

6. DISCUSSION

The results should be viewed with caution, remembering these are idealized scenarios. There are likely to be some minor modeling errors. And the decentralization scenarios may be difficult to replicate in the real world, particularly in terms of how they tightly cluster employment in activity centers on the busway and rail lines. Further, these results refer only to a future state of equilibrium after the dislocating impacts of short-term workplace relocations have been resolved over time. Despite this, there is clearly some suggestion that the policies being pursued by the Queensland Government could have significant effects on travel patterns, and on transit systems, within Brisbane.

The results suggest that planned decentralization could offer increased mode shares for transit, as has cities such as Singapore where similar policies have been pursued with vigor (Malone-Lee, Loo and Chin, 2001). In line with the literature, the modeling predicts reduced congestion on key links in the inner-city, especially under Scenario 1, potentially improving operating conditions for on street buses. The congestion benefits predicted here are considerable. This is predicated, however, on our model accurately predicting travel behavior responses to decongestion, including all possible induced travel effects (Parry, 2002).

The differences in the results for the decentralization scenarios suggest that there may be more to be gained in terms of transit mode share by moving jobs to middle-suburban employment centers, as opposed to sites on the edge of the urban area. There were no dramatic contra-flow benefits to be obtained on the rail network from moving this small number of jobs to outer-suburban rail nodes. However, this effect warrants further investigation, as it may well be that a larger decentralization program might have greater impact. Further, sites well outside the current urban envelope, such as Caboolture are likely to be those that are most problematic for travel patterns, as opposed to more established centers closer to existing populations such as Ipswich. Indeed, Caboolture sits between Brisbane and the city of the Sunshine Coast, population 250,000 persons, further to the north and would be better modeled using a regional, rather than city transport model, which is not available at the present time (one is presently being developed by the Queensland Government).

There are many other avenues for inquiry. Can one interrogate the modeling outputs to gain a richer sense on the nature of the bus and rail movements, particularly through the central city? What are the effects of decentralization on peak-spreading, in alleviating crush loads on congested bus and rail systems in peak hour? Do workers moved to suburban activity centers leave later from home, spreading out the peak on road and transit networks? What are the socio-demographic impacts of decentralization, in making office jobs accessible via transit to more of the population? Can decentralization alleviate the long commute for specific household types? Can decentralization defray state investment in road and transit systems, or make these investments perform better? And are there ways to incorporate travel behavior change programs into government employment relocation policies, to reduce the dislocating effects of relocations in the short-term, and encourage modal shift earlier? Without filling in these evidence gaps and understanding the likely effects, we may not produce optimal outcomes from the decentralization policies being employed in Australian cities and elsewhere.

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