

Short-term Impacts of Employment Decentralisation in Brisbane, Australia

Matthew BURKE^a, Tiebei LI^b, Jago DODSON^c, Aidan BROTHERTON^d, Murray HENMAN^e

^a *Cities Research Institute, Griffith University, Nathan Campus, QLD 4111, Australia; E-mail: m.burke@griffith.edu.au*

^b *Global, Urban and Social Studies, RMIT University, Melbourne, Australia; E-mail: tiebei.li@rmit.edu.au*

^c *Global, Urban and Social Studies, RMIT University, Melbourne, Australia; E-mail: jago.dodson@rmit.edu.au*

^d *Cities Research Institute, Griffith University, Nathan Campus, QLD 4111, Australia; E-mail: a.brotherton@griffith.edu.au*

^e *Cities Research Institute, Griffith University, Nathan Campus, QLD 4111, Australia; E-mail: m.henman@griffith.edu.au*

Abstract: Australia's largest cities are failing in transport/land use terms. Highly centralised employment structures encourage congestion and lengthy commutes. This paper sought to identify the short-term impacts of employment decentralisation, and contribute to the evidence base for urban policy development. The research surveyed 198 public sector workers who had recently experienced workplace relocation from central Brisbane offices to two suburban locations. A questionnaire captured impacts at an individual and household level, identifying mode changes, trip distances, travel times, changes to schooling, housing, or other activity locations across the household, and changes to travel behaviours of other household members. As might be expected, short-term impacts included increased commute distance, in part due to some workers having to cross from one side of the city to the other on their commute. This resulted in a more modest increase in travel time. There was also a decrease in the use of public transport. However, even in the very short-term there were office-workers who moved house, school and/or the location of a spouse's work to minimize commuting distances. These workers were mostly renters. This suggests that over time a much better equilibrium will emerge where either local workers will start to fill these jobs or a greater proportion of those initially part of a relocation will move closer to their new workplace. As a greater proportion of Australians rent rather than purchasing a dwelling, decentralization may have less onerous short- to medium-term effects. This further establishes the importance of choosing carefully future decentralised employment sites as part of a systematic, coordinated and ongoing transport and land use plan for an over-centralised metropolis.

Keywords: Employment decentralisation; workplace relocation, travel attitudes, Brisbane.

1. INTRODUCTION

Australian state governments have recently commenced a series of small attempts at employment decentralisation. Both *intra-urban* decentralisation, where jobs are moved from central city locations to suburban locations, and *inter-urban* decentralisation, where jobs are moved outside the metropolis to smaller regional towns and cities, have been employed. This is being promoted to reduce leasing costs for expensive downtown office accommodation, to revitalize suburban and regional communities, and to potentially decrease travel costs and improve accessibility to higher-order services employment. But there has been minimal

investigation into the impacts of such decentralisation policies in Australian cities.

The focus of this paper is on intra-urban decentralisation efforts in Brisbane, Australia, in the early 2000s. The Queensland Governments shifted workers to suburban employment centres focused on public transport corridors. The TIEDAC project (exploring *Transport Impacts of Employment Decentralisation in Australian Cities*) explored these issues in an inter-disciplinary manner, drawing on urban studies, travel behaviour, and spatial accessibility modelling. Two interlinked studies were used. First was an examination of the short-term influences of employment decentralisation on affected workers' household travel behaviour, and travel preferences and attitudes, looking for short-term evidence of changes via household adaptation. This is the work investigated in this paper. Second, in-depth modelling of possible mid- to long-term impacts was used to test possible scenarios for employment decentralisation was employed, which we will soon report elsewhere. The project's intent was to provide insights that would be relevant to policy-makers to assist in the design and implementation of improved employment decentralisation policies.

The paper begins with a review of decentralisation studies followed by the approach and methods of the research. Summary results are then outlined. The paper concludes with a discussion highlighting what the prospects for decentralisation might be, the problems that need to be faced, and what future research needs exist to help policy-makers further.

2. BACKGROUND

We define employment decentralisation as a process by which city-regions increase the proportion of jobs that are located outside of their central business district (CBD) and its immediate frame. Various government actions support decentralisation. This includes land-use zoning, taxation and financial incentives, marketing and promotion. But our interest in this paper is in the relocation of state-sector employment, which governments may use to reduce their own office leasing costs but also to encourage private sector co-location and to leverage further suburban office development. The Queensland Government initially proposed to move 20% of its downtown office space, or approximately 5,600 government workers, from the Brisbane CBD to suburban locations by 2017 (Sectorwide, 2008, p. 2). It began with moving workers to locations in the northern suburbs of Brisbane City, and to the central business district of Ipswich, a small regional council on the western edge of the Greater Brisbane area. A 2012 election win saw an incoming conservative government cease the decentralisation program, instead pushing redundancies and shrinking the size of the government workforce. But current Commonwealth Ministers still support decentralisation (albeit urban policy remains particularly weak at the federal level in Australia at present) and local governments in suburban districts remain interested. Other states are continuing with modest programs and Queensland is opening up the possibility for more decentralisation in future. The questions though are about what impacts such policies have for Australian cities.

We undertook a review using TRID (trid.trb.org), Google Scholar and Scopus databases to the year 2016, focusing on published studies that have used quantitative methods, either surveying workers undergoing workplace relocation to decentralised suburban locations, or modelling cities under different decentralisation scenarios. Much of what we found was previously reported in a modelling paper on decentralisation provided to EASTS (see Burke & Li, 2011, pp. 811-812). To summarise and update that information, there tended to be two approaches to this problem, which are rarely inter-linked. The first is to survey workers affected by real-world workplace relocation to a suburban office, to identify short-term impacts. The second is to model and/or analyse travel behaviors at the metropolitan scale, either on real-world data or via scenario testing to predict future outcomes.

Of the studies surveying workers affected by a workplace relocation, Bell (1991) found that private sector workers moved from a central to a middle-suburban site in Melbourne, Australia, tended to own and use cars more often. Few of the affected workers moved home location. Travel times did not deteriorate though as many workers lived in the eastern suburbs where the new office was sited. Similar results have been found in studies in Oslo, Norway (Hanssen, 1995, pp. 251-252; Naess & Sandberg, 1996). The most recent research of this form has been by Sprumont, Viti, Caruso, and König (2014) who surveyed workers who were to be moved to a suburban university campus in Luxemborg, identifying likely travel behaviour effects. They found workers will tend to use the car more, and that only policy measures to reduce private motor vehicle time/cost, such as new forms of car-sharing, might alleviate that problem. Sprumont and Viti (Forthcoming) have recently followed up with ex-post / ex-ante surveys of 43 employees who moved to the new campus in 2015, identifying a number who changed home address, in part to reduce travel impacts. Despite this their respondents had a modest increase in travel times due to the workplace relocation. However, all these studies tend to be of short-term effects. It is presumed that over time the entire transport-land use system will revert to a new equilibrium as workers retire or change jobs and as new hires will tend to come more from the area more proximate to the suburban office location. Existing workers may also change housing location or make other shifts to reduce travel distances. Transport systems may also be restructured in the longer-term to increase public transport access to denser suburban nodes.

Of the studies modelling travel behaviour at the metropolitan scale, Alexander (1978, 1980a, 1980b) showed that mode shares in Sydney would tend towards more car travel and less public transport use, but that travel times would improve, under decentralisation policies. This prediction was essentially proven true by the work of Parolin (2005, p. 8) who found that real-world outcomes in Sydney from decentralisation policy, including government worker relocations, produced commuting time reductions. The transport mix on offer and the urban structure of the metropolitan region mattered greatly in whether car commuting increases under decentralisation. Research in Seoul, Korea, showed that decentralisation led to no reductions in trip distances, only reductions in commuting times, partly due to workers shifting away from buses and to cars and metros from 1990 to 2005 (Ma & Kang, 2011). The German experience, explored using different methods by Guth, Maciolek, and Holz-Rau (2009, pp. 12-13) suggests poly-centric metropolitan regions, with multiple suburban nodes, are generally more travel-efficient, with lower commuting distances, however they produce more traffic volumes and distances travelled. It is generally assumed that whether a city encourages *laissez-faire* and scattered decentralisation, or whether they promote orderly and clustered decentralisation in corridors or at key business districts supported by public transport, will dramatically impact on what modes workers will use for commuting. *Laissez-faire* decentralisation in San Francisco increased both commute travel times and distances (Cervero & Wu, 1998).

When we look at decentralisation in contemporary Australian cities, it is important to note that they have particular features that make them distinct from North American, European or other Asian cities. Australian cities have highly centralised office employment, with significant growth in central business district office jobs in recent decades. They don't tend to have 'edge cities' of the form found in the US and many Asian metropolises, albeit Parramatta in Western Sydney acts as a large secondary CBD for that city of six million people. At the same time, suburban growth has remained relatively strong, leading to increases in commuting distances in cities such as Sydney (Parolin, 2005:8). Unlike many US cities, Australian cities such as Brisbane have large commuter rail networks, focused on the central business district, where parking supply is curtailed somewhat by local and state

regulation. Despite this car dependence is high. Mode shares for public transport are relatively low with fewer than 10% for Brisbane. Australian cities also differ from Europe and Asia in that a very high proportion (67%) of residents either owned or were in the process of purchasing a home, usually via a mortgage, in the 2011 Census. Despite this, residential mobility is higher than in comparable European cities, with 41.7% of the population moving house between 2006 and 2011 (Australian Bureau of Statistics, 2012).

3. APPROACH AND METHOD

In this paper we report solely on a set of travel surveys, similar to those used by Bell (1991) and Hanssen (1995). However, as a major methodological advance we included a set of questions exploring travel attitudes and preferences, to control for these variables. We surveyed employees who experienced workplace relocation from central Brisbane to two sites: one 16km north of the CBD in Brisbane's Northern Suburbs (hereafter simply referred to as the 'Northern Suburbs' site) or 44km west to Ipswich as part of the Queensland Government's decentralisation program¹. It was hypothesized that the greater distance to Ipswich may lead to different travel behaviour and household changes than at the Northern Suburbs location. The surveys were conducted in two waves over the period 30 February to 10 October 2014. They sought to identify changes in travel behaviour, any residential relocation effects, or changes in household activities. The surveys used conventional travel behaviour survey techniques, using a combination of web and follow-up telephone interviews with the employees to capture current and past travel behaviours, (including trip-chaining and interactions with other household members such as chauffeuring), key demographic information, as well as travel attitudes and preferences. Advance promotion of the survey was used to maximise response. We obtained a total of 198 participants across both sites. Response rates were reasonable, with approximately 25 percent of the total employees who shifted engaging in the survey. The departments surveyed indicated the two samples obtained were a reasonably representative age and gender profile for the employees in the work units that moved. The data was entered into an MS Access database, cleaned and manipulated for reporting and used in the modelling phase. Key variables included gender, age, employment category, car ownership, and a series of travel attitudes and preferences such as 'liking' for public transport and non- motorised modes.

There is a key limitation of our approach. A small number of the government's pooled junior administrative roles were rotated through the decentralisation process such that some persons changed jobs to work at the suburban sites, but did not necessarily shift workplace as part of the relocation process. Such people were excluded by the recruitment process for the surveys, which focused on relocated workers only, which slightly underplays the likely beneficial impacts that may have occurred.

4. SURVEY RESULTS

4.1 Survey Sample

The overall survey sample was 56 percent male / 44 percent female, reflecting in part the workers moved, which included a large IT section from one government department. The average age was 44 years. The Northern Suburbs workplace respondents were disproportionately around 40-55 years of age with a low representation of under 30s; Ipswich

¹ Note that both the departments involved asked not to be named as part of approvals for this research.

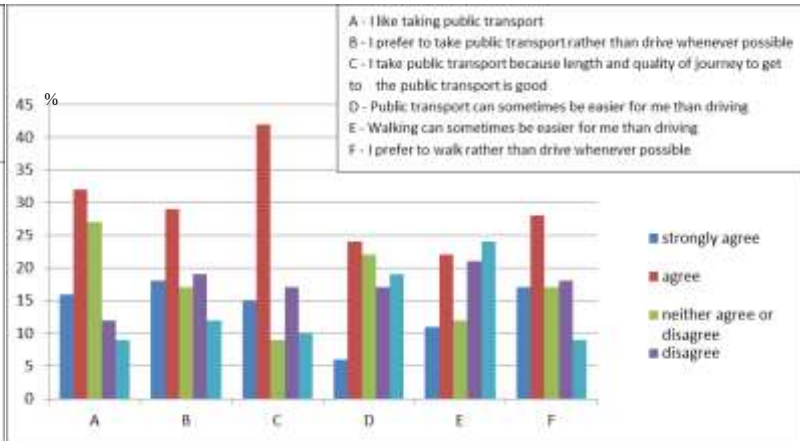
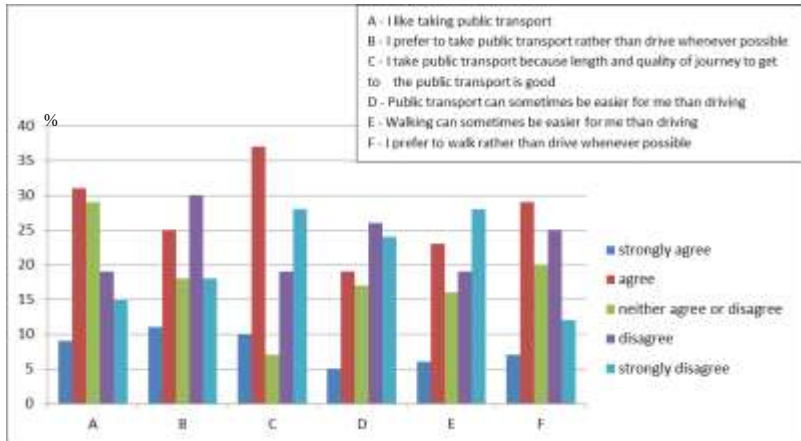
workplace respondents had a relatively even distribution between the ages of 25 and 50. Across both sites just over 80 percent of respondents owned their own home or had a mortgage, with around 20 percent renting properties. Most respondents reported having two registered motor vehicles per household, reflecting Brisbane’s general car dependence.

Table 1: Demographics of the survey sample

		Moved to Northern Suburbs	Moved to Ipswich
Number of respondents		104	94
Male		60%	52%
Age	Under 40	27%	44%
	40-55	56%	44%
	Over 55	16%	12%
Housing tenure	Owning or purchasing own home	85%	80%
	Renting	15%	20%
Household size	1 person	15%	20%
	2 persons	26%	28%
	3 persons	19%	21%
	4 persons	21%	24%
	5 persons	15%	6%
	6 persons	2%	1%
No. of children in household	0	51%	56%
	1	13%	18%
	2	25%	19%
	3	10%	6%
	4	1%	0%

4.2 Travel Preferences

Travel preferences for the two sites are shown in Figure 1. In summary, there are few differences between the two groups across the many variables though there is some subtle variation. For instance, respondents moved to the Northern Suburbs were somewhat less likely to agree that a “... trip to/from work is a useful transition between home and work” than those moved to the Ipswich site. But there is nothing to suggest that travel preferences, per se, might influence one group to behave markedly different to the other. Both groups reported emphatically that “Getting to work without a car is a hassle” and that they “... need a car to do many of the things I like to do”.



'strongly agree' = 1 to 'strongly disagree' = 5

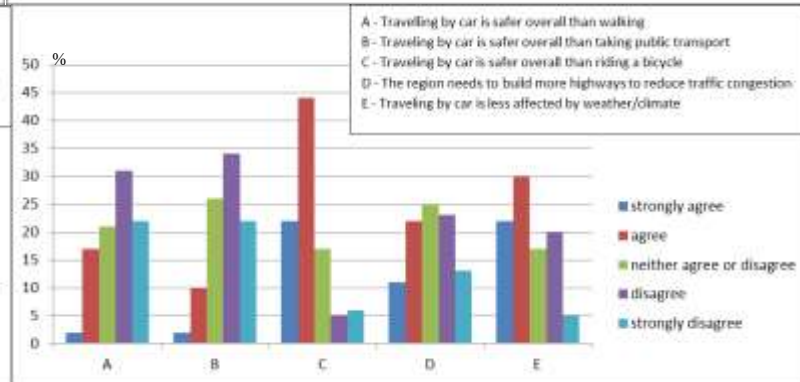
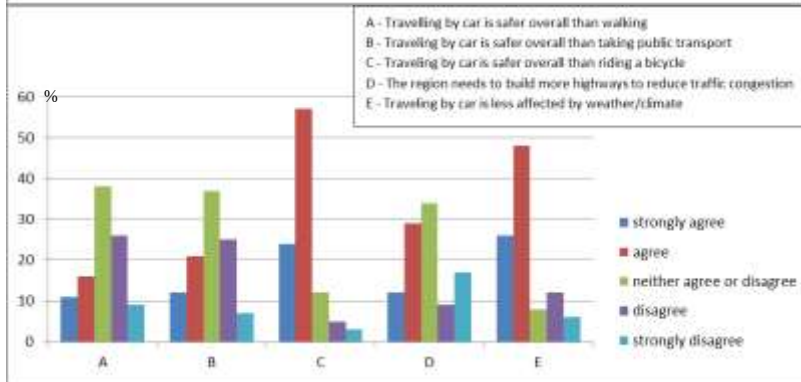
Statistically significant differences between means for Ipswich and Northern Suburbs sites were items:

A
 Mann Whitney $U = 4129.0$
 Sig. (2-tailed) = 0.038

B
 Mann Whitney $U = 3972.5$
 Sig. (2-tailed) = 0.024

C
 Mann Whitney $U = 3676$
 Sig. (2-tailed) = 0.01

F
 Mann Whitney $U = 3459.5$
 Sig. (2-tailed) = 0.05

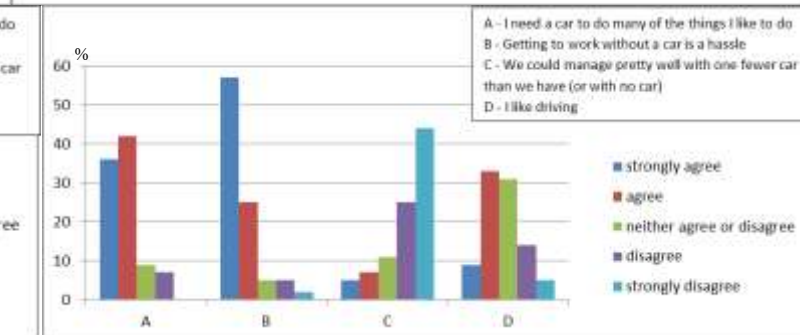
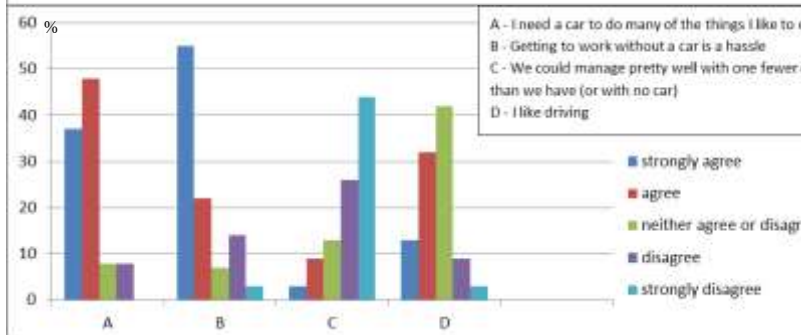


'strongly agree' = 1 to 'strongly disagree' = 5

Statistically significant differences between means for Ipswich and Northern Suburbs sites were items:

A
 Mann Whitney $U = 3481.0$
 Sig. (2-tailed) = 0.00

B
 Mann Whitney $U = 3040.0$
 Sig. (2-tailed) = 0.00



'strongly agree' = 1 to 'strongly disagree' = 5

There are no statistically significant differences between means for Ipswich and Northern Suburbs sites.

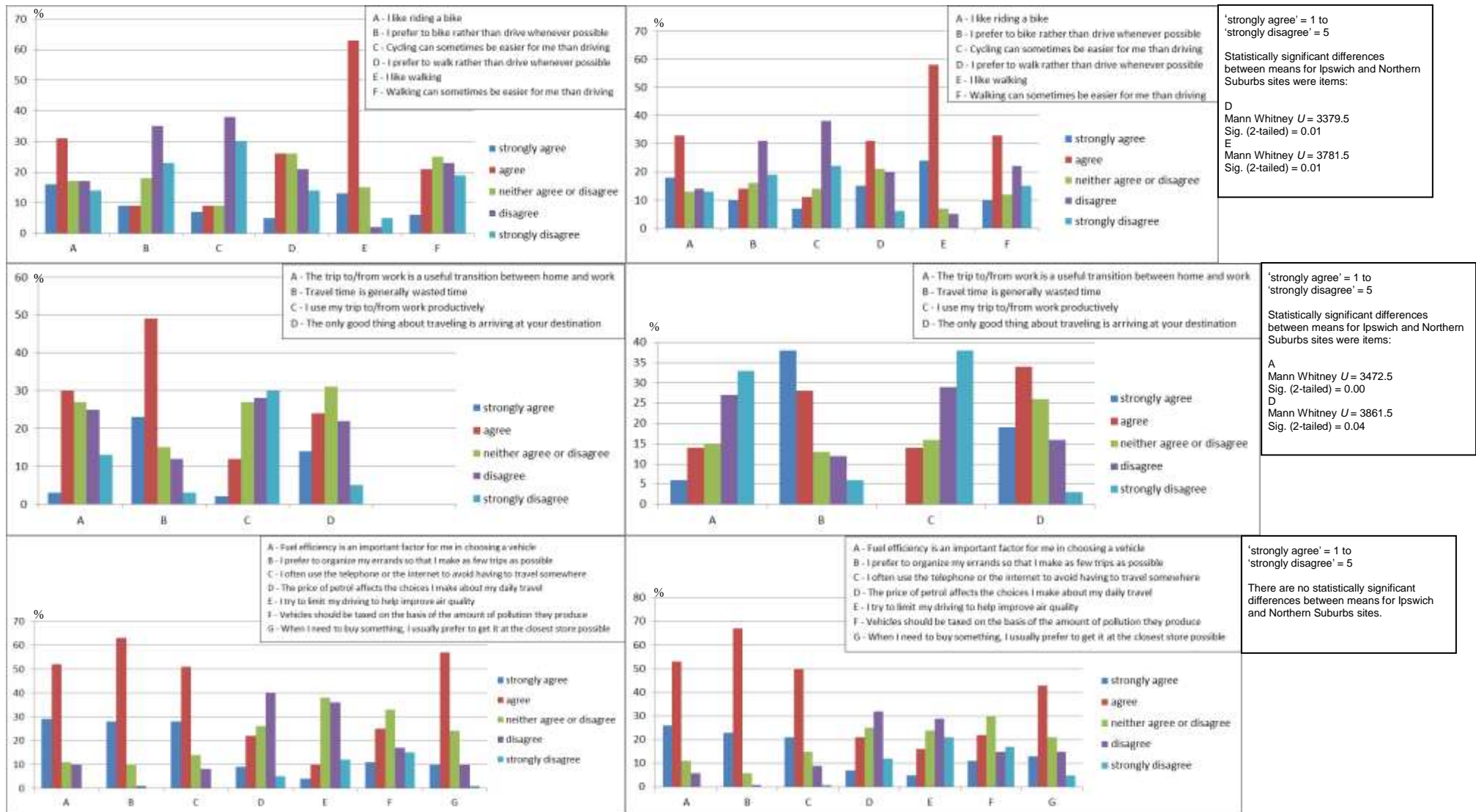


Figure 1: Travel preferences for those moved to the Northern Suburbs (left) and Ipswich (right) in percentages

4.2 Travel Behaviour Changes

Before and after commute distances for those moved to the Northern Suburbs and to Ipswich are presented in Figure 2. Before and after commute times are shown in Figure 3. Whilst the changes in mean commute distances across both sites (20.1km to 28.45km at the Northern Suburbs; 17.7km to 45.2km for Ipswich) were statistically significant, only the change in the mean commute time at Ipswich was.

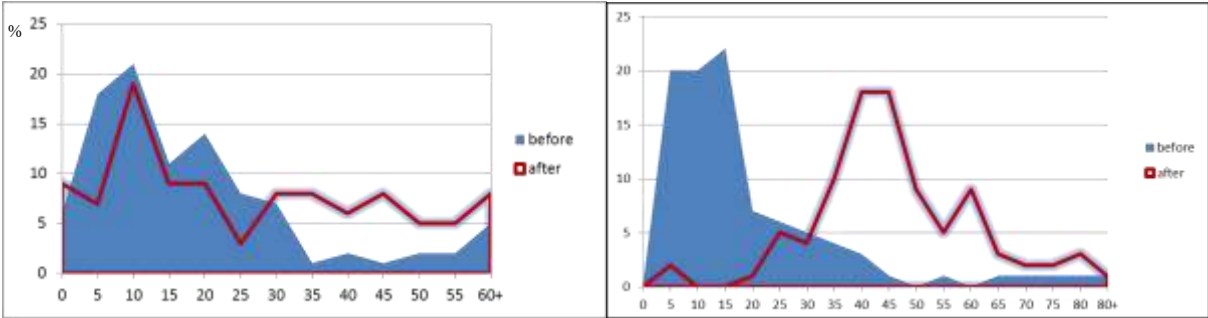


Figure 2: Commute distances in km, before and after, for those moved to the Northern Suburbs (left) and Ipswich (right)

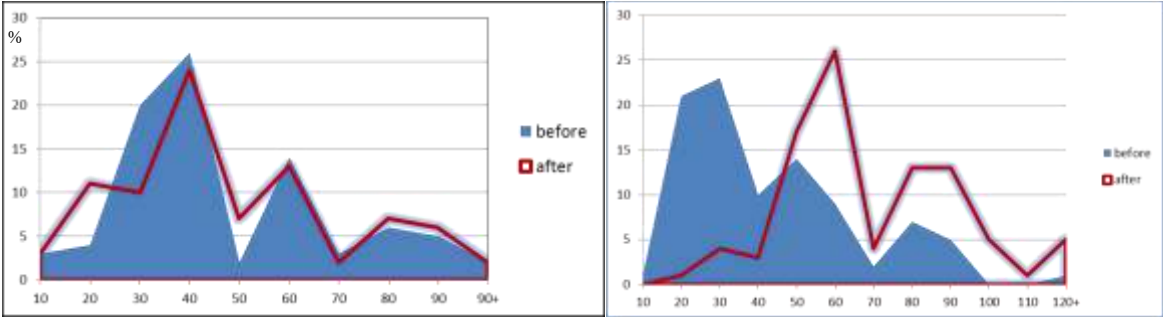


Figure 3: Commute times in minutes, before and after, for those moved to the Northern Suburbs (left) and Ipswich (right)

Figures 2 and 3 show a marked difference between the two groups. As hypothesized, the longer distance to Ipswich, some 44km from the Brisbane CBD, appears to have had a much greater impact on commute times and commute distances than for those moved only 16km to the Northern Suburbs site. At the Northern Suburbs there were a significant number of respondents who reported commutes of 35km or more, when previously there were very few, due to some having to now travel from the southern Brisbane. However, in total this group’s commute times barely changed overall. This is as car mode shares increased significantly.

Respondents were asked to identify their commutes and inform “... what transport method do you use for commuting?” with the potential to select more than one mode. They were then asked to repeat this to report modes they previously used, prior to the workplace relocation. This data is reported in Figure 4. Bus, train and ferry commute travel all declined significantly for both the Northern Suburbs and Ipswich groups after the move to a decentralised location. There was little self-reported walking or cycling at the previous central

location for those moved to the Northern Suburbs, but strong walking (47%) and cycling (12%) mode shares fell markedly for those moved to Ipswich.

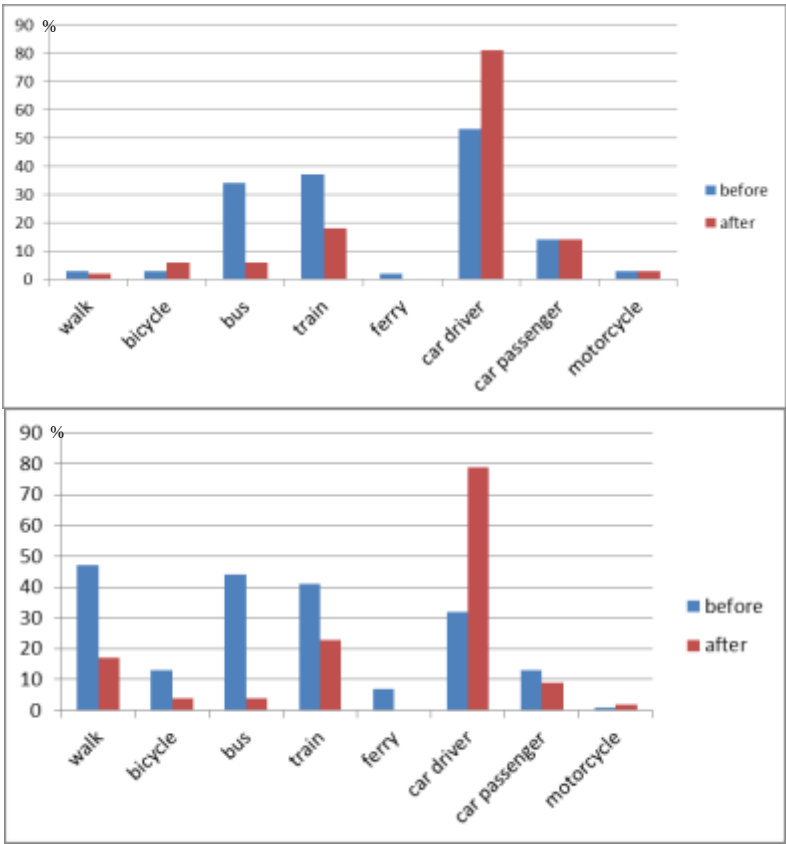


Figure 4: Commute modes used by respondents, in percentages, before and after, for those moved to the Northern Suburbs (top) and Ipswich (below).

At both sites the respondents suggested the main barrier to using public transport was that it took too long in comparison to the car. It was uncompetitive in travel times offered. Less than 10% of respondents suggested there were problems with either stops being too far away, or that routes didn't travel where they wanted to go, which was surprising given Brisbane's excessively radial public transport network. Other suggestions they provided were that there were no or too few express services, low frequencies or services, poor transfers, and unwanted exposure to the weather. Lower fares, more frequent services (especially to/from Ipswich) and restrictions on car parking were reported as the main ways to increase public transport commuting. Also noted were increasing the reliability of connecting services, improving safety, and running evening services.

The respondents were asked to report their strategies for coping with the transport problems they experienced. They were also asked what aids would have helped them. The results are shown in Figures 5 and 6, respectively. Respondents mostly reported leaving home earlier and later, or doing nothing at all, in response to any new challenges they faced after workplace relocation. Other strategies mentioned included moving house (which we will discuss at length, below), getting to work later, buying a second car, and compressing the working week into four days. Flexible working hours and the flexibility to work more from home were reported as the major aids that would have assisted workers, though around 27% at the Northern Suburbs site reported nothing would have helped them more. Other notable

aids mentioned included monetary assistance, more parking options, flexible work locations and new public transport services.

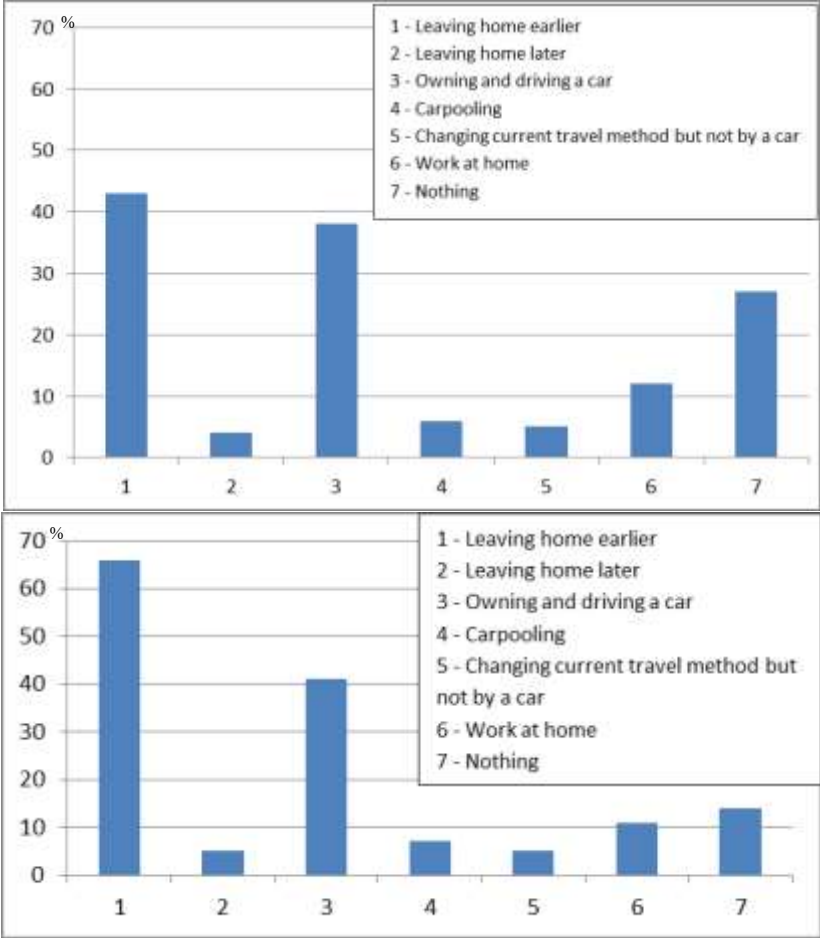
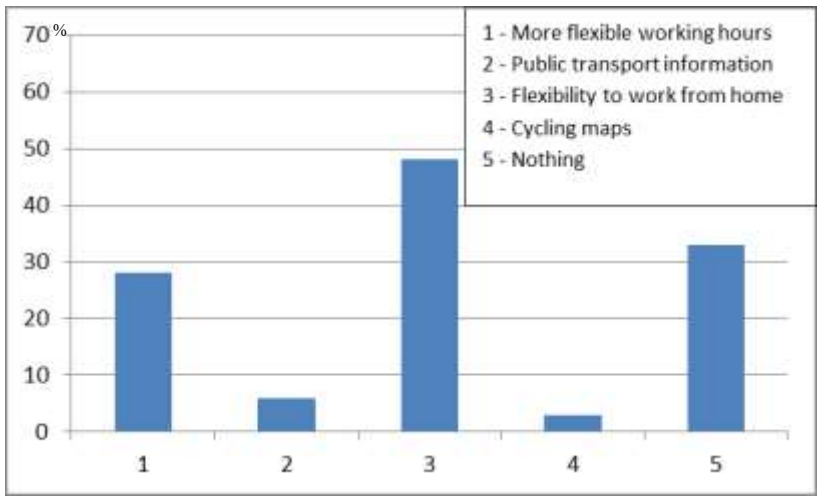


Figure 5: Coping strategies in percentages for those moved to the Northern Suburbs (top) and Ipswich (bottom).



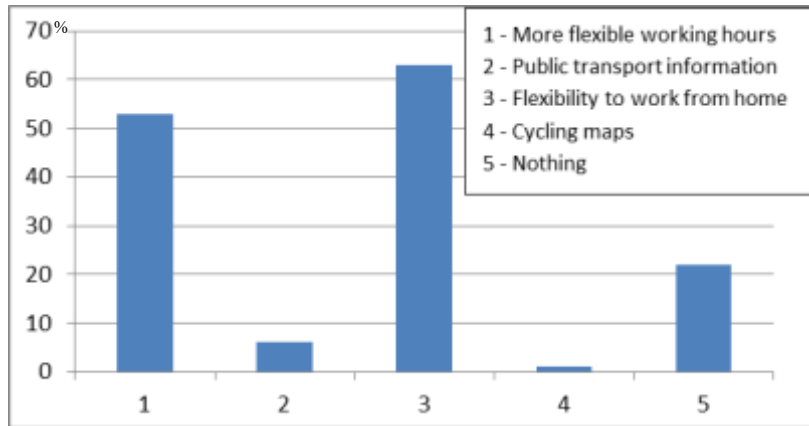


Figure 6: Aids that would have helped alleviate transport problems for those moved to the Northern Suburbs (top) and Ipswich (bottom).

Unlike the very major changes in modes used for commuting, the respondents reported no major changes in their travel to other activities, with only very minor increases (~5%) in car driving to education and shops generally reported across the two sites, after workplace relocation. But perhaps what was most interesting was that though the workplaces had only moved less than 18 months previously, there were already a small but significant number of respondents, around 6%, who had already made significant changes to their household location. Those who moved were plotted and information on their travel patterns identified, including any changes in their time of leaving home for work, their travel distances to work before and after, and any changes in transport mode. A summary of this information is provided graphically in Figure 7 for the Northern Suburbs site. Notably, a number of employees who were renting moved to be very proximate to the Northern Suburbs workplace, either in the same suburb or nearby. Another worker moved house to Carina from the far southern suburbs of Brisbane to reduce their commute to the Northern Suburbs workplace considerably. As such, a series of adjustments were already being made by a group of employees to reduce travel impacts.

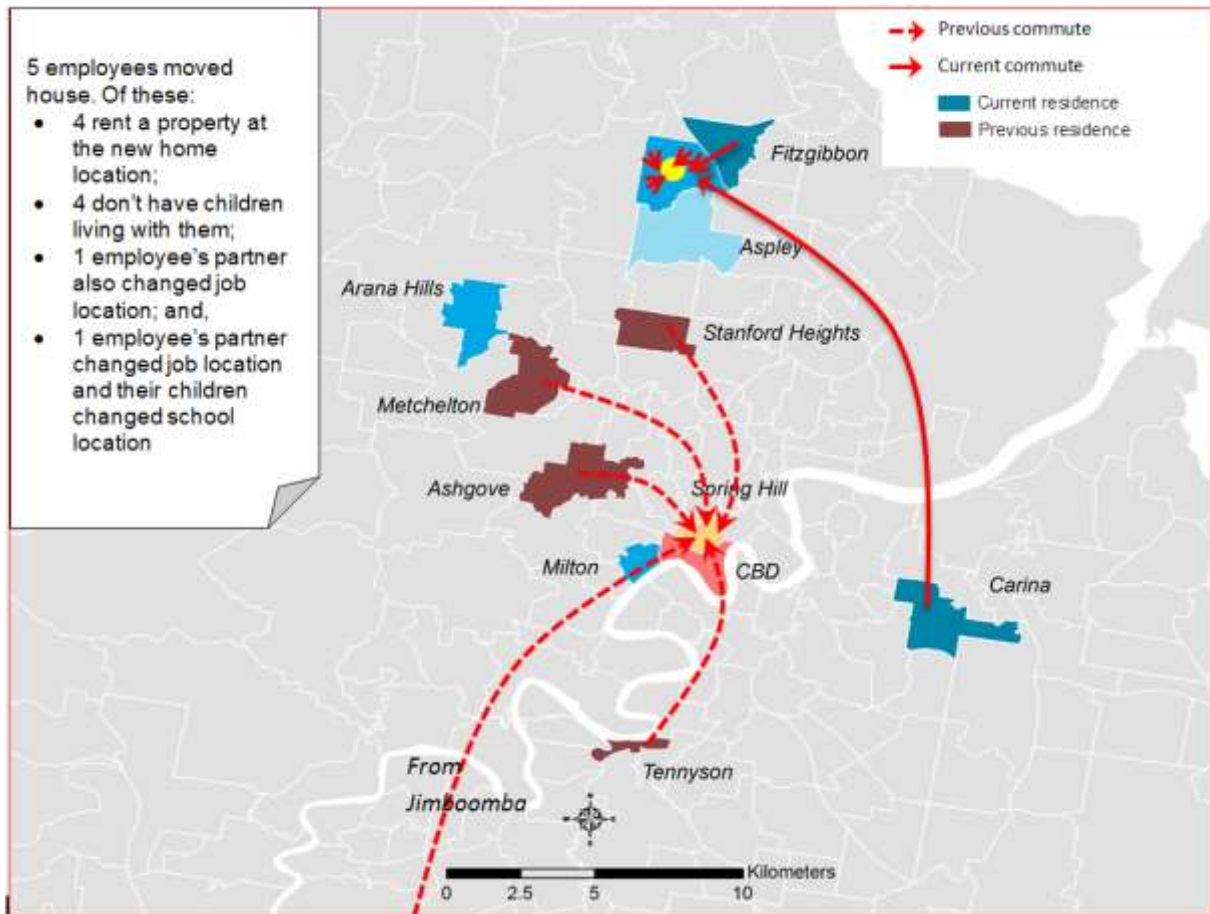


Figure 7: Home relocations and changes in commutes for those moved to the Northern Suburbs

Figure 8 reports similar information in a slightly different way. Rather than showing commutes, it shows the sites from which specific individuals moved to new housing locations to access the Ipswich workplace. Two of the employees went so far as to make purchase decisions, buying houses proximate to the new workplace, shifting from Sandgate and Clayfield to be near Ipswich (as shown in red in Figure 8). Others who rented (arrows shown in orange) shifted home location to new sites that were either more central or west of the Brisbane CBD, including to sites on the Ipswich rail line allowing a contra-flow outbound rail commute in peak hours.

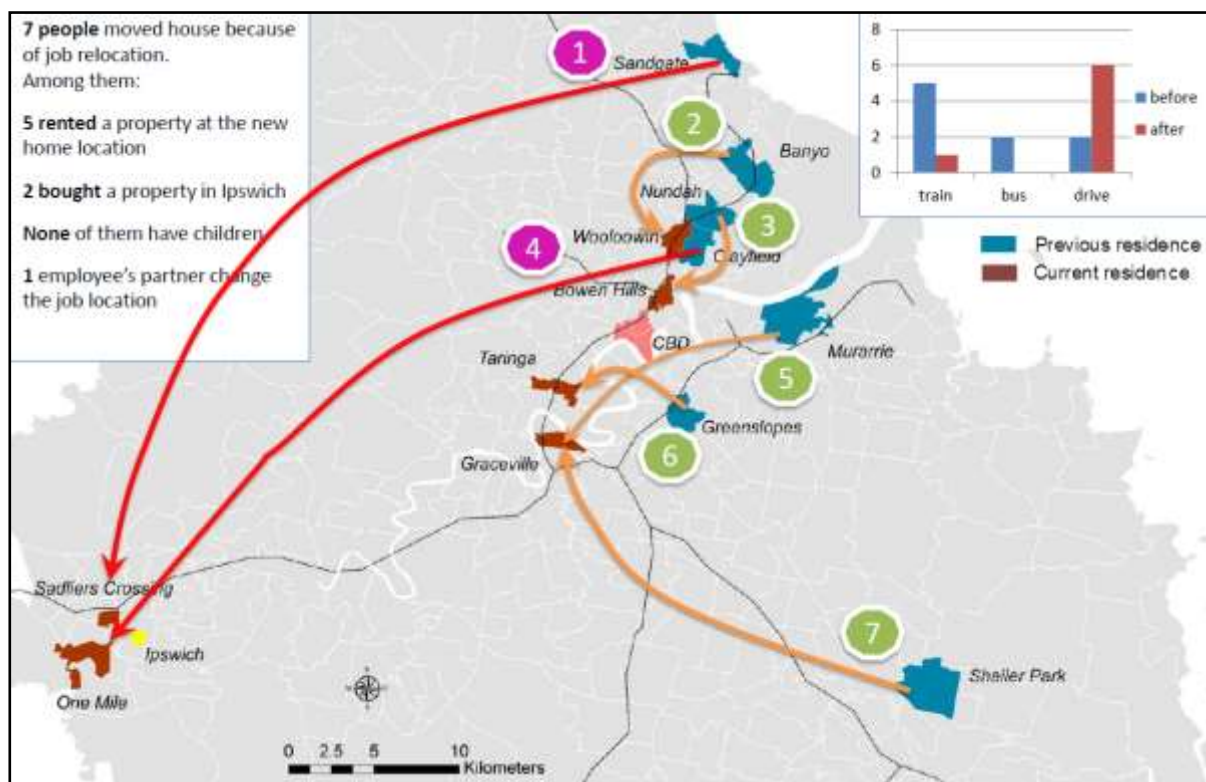


Figure 8: Home relocations for those moved to the Ipswich workplace

DISCUSSION

Our findings mirror somewhat those of Sprumont and Viti (Forthcoming) in Luxemborg, in that we also find a series of short-term adaptations being made as households quite quickly adapt to a workplace relocation if it is easy for them to do so. One key contribution of the research sample is that those renting houses, and without children, were clearly more likely than others to change home location, and potentially make other changes such as the location of a partner's workplace. This suggests that a key policy implication for workplace relocations may be to more carefully consider which work units of an agency or business are moved. Those with a greater proportion who rent and not have children, may have less problematic short-term transport impacts. This does not appear to be a factor in Queensland Government decisions about workplace relocation, and we are not aware of this being considered in programs elsewhere in Australia. However, including this as a consideration appears a way forward to minimise the adverse impacts and maximise the benefits of decentralisation in a shorter time-scale.

The study does bear out that there are likely benefits from workplace relocation for suburban locations even in the short-term, including for land-developers and landlords as workers start to move house to be near work. What is less clear, however, is the timeline by which a new equilibrium will emerge as slowly workers shift jobs and new employees are drawn to the suburban site from a very different catchment.

There are some limitations in transferring these findings beyond Australia. Decentralisation is still an embryonic concept in Greater Brisbane, with no mature secondary CBDs in the region. Relocations to a more mature node with a greater density of employment and better supported by public transport and cycling infrastructure (such as Parramatta in Sydney) would likely produce better outcomes. Other limitations of the study include that we

did not explore the full set of travel activities undertaken by respondents during the day in an intensive manner, such as those performed by Sprumont and Viti (Forthcoming). The exact routes taken by commuters were not captured, such that we are unable to determine what impacts were likely to be on the traffic network. Presumably much of the increased car travel was contra-flow to peak hour travel, especially to Ipswich, and therefore not responsible for significant congestion effects, though we cannot be certain. It would also assist to add additional respondents to the survey sample by adding another site to increase statistical power for further analysis.

Future research needs include understanding the timescale by which a new equilibrium in the labour catchment of a relocated workplace is reached, and in better understanding mid- and long-term impacts. Trialing and evaluating travel demand management (TDM) approaches with affected workers to minimise negative impacts should be a priority. Broader research approaches that tie surveys of workers relocated to modelling and scenario testing are also needed to improve the modelling being conducted on such issues. This will be a focus of future work reported from the TIEDAC project.

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REFERENCES

- Alexander, I. (1978). Office Decentralisation in Sydney. *The Town Planning Review*, 49(3), 402-416.
- Alexander, I. (1980a). Office dispersal in metropolitan areas 1: a review and framework for analysis. *Geoforum*, 11(3), 225-247.
- Alexander, I. (1980b). Office dispersal in metropolitan areas II: Case study results and conclusions. *Geoforum*, 11(3), 249-275.
- Australian Bureau of Statistics. (2012). 2011.0 - Reflecting a Nation: Stories from the 2011 Census, 2012–2013. Canberra: Australian Bureau of Statistics.
- Bell, D. A. (1991). Office location — city or suburbs? *Transportation*, 18(3), 239-259.
- Burke, M., & Li, T. (2011). Optimising transit networks by moving government workers: the transit impacts of employment decentralization in Brisbane. *Journal of the Eastern Asia Society for Transportation Studies*, 9, 810-825. doi:10.11175/easts.9.810
- Cervero, R., & Wu, K.-L. (1998). Sub-Centring and Commuting: evidence from the San Francisco Bay Area, 1980-90. *Urban Studies*, 35(7), 1059-1076.
- Guth, D., Maciolek, M., & Holz-Rau, C. (2009). Suburbanisation of Jobs and Commuter

Traffic: Does Employment Decentralisation Lead to Travel-reducing Commuting Patterns? Empirical Evidence from Germany, 1987-2007. Paper presented at the European Transport Conference.

Hanssen, J. U. (1995). Transportation Impacts of Office Relocation: a case study from Oslo. *Journal of Transport Geography*, 3(4), 247-256.

Ma, K.-R., & Kang, E.-T. (2011). Time-space convergence and urban decentralisation. *Journal of Transport Geography*, 19(4), 606-614.

doi:<http://dx.doi.org/10.1016/j.jtrangeo.2010.06.016>

Naess, P., & Sandberg, S. L. (1996). Workplace Location, Modal Split and Energy Use for Commuting Trips. *Urban Studies*, 33(3), 557-580.

Parolin, B. (2005, 30 Nov - 2 Dec 2005). Employment Centres and the Journey to Work in Sydney: 1981-2001. Paper presented at the 2nd State of Australian Cities Conference, Brisbane, Queensland.

Sectorwide. (2008, September 2008). Spreading the Jobs Around. Sectorwide - monthly magazine for the Queensland public sector, 14, 2.

Sprumont, F., & Viti, F. (Forthcoming). The effect of workplace relocation on individuals' activity travel behavior. Submitted manuscript - under review.

Sprumont, F., Viti, F., Caruso, G., & König, A. (2014). Workplace Relocation and Mobility Changes in a Transnational Metropolitan Area: The Case of the University of Luxembourg. *Transportation Research Procedia*, 4, 286-299.

doi:<http://dx.doi.org/10.1016/j.trpro.2014.11.022>