

Parking and Mode Choice in Sydney: Evidence from the Sydney Household Travel Survey

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Abstract

The management of parking is an important part of the toolkit that transport and land use planners have to influence travel demand, reduce congestion and improve the nature of the urban environment. Parking supply is generally managed at the local government area level, but in NSW a state government parking space levy (PSL) applies to off-street non-residential parking spaces in six business districts in Sydney. Levy funds are spent on public transport infrastructure in outer urban areas to improve public transport access to those travelling to these CBDs.

The Household Travel Survey collects information on a range of trip and other characteristics which can shed light on travel behaviour, parking behaviour and influences, such as mode of travel, trip purpose, trip origin and destination, parking location and costs and whether car costs are subsidised by the employer. This paper reports on analyses of this data from the latest Household Travel Survey and compares driver trips and parking to PSL and non-PSL locations across Sydney.

Introduction

Travel demand is the result of a complex interaction of personal preferences and constraints, the transport options available, the nature of the transport network and the urban form, set in the context of a legacy of past and recent policy. Parking is only one factor which influences travel choices but it is integral to the accessibility afforded by the car given that, at the simplest level, if you drive somewhere you need to park.

One source of information on travel behaviour in Sydney is the continuous Household Travel Survey (HTS), which collects data on personal trip making (mode, purpose, destination, use of parking) plus a range of individual, household and vehicle characteristics that correlate with travel behaviour. The HTS also collects information on parking location and payment as well as employer subsidies for work travel and attitudinal information on mode choice.

This paper presents data from the HTS on the characteristics of driver trips to different locations across Sydney, and how mode use and parking behaviour vary according to the characteristics of the destination, employer support received for vehicle use, and the employees stated reasons for mode choice. The analysis is prefaced by a brief outline of relevant issues raised in the literature on parking policy and travel demand and a description of parking policies in Sydney.

Parking and travel demand management

Overviews of parking policy trends and practices can be found in BAH (2006), Litman (2011), March (2007), Marsden (2006) and TRB (2003). They trace the evolution of parking policy from a 'predict and provide' model, where parking supply was designed to cater for expected demand, to a more tailored approach designed to maximise access for a wide range of users while limiting the negative impacts of on-street parking and increased traffic on road performance. This led to the introduction of minimum parking requirements for new property developments, to cater for the traffic generated.

In some quarters there has been a shift from minimum to maximum parking requirements in response to every increasing traffic demand within CBDs where the historic build-up of parking supply cannot continue. Measures have included incentives to reduce parking supply.

Shoup (1997) has been a long time critic of free parking and high levels of supply which is seen as having entrenching behaviour and land use patterns that have led to sprawl in parts of the USA. He and others (Seigal 2008, Marsden 2006) advocate a market approach to both on and off-street parking.

The discussion has moved away from parking as local traffic issues to the role of parking management as a tool to achieve metropolitan wide strategic goals, requiring a more comprehensive approach (Barter 2010, March 2007, Young and Miles 1997). This is in recognition of the fact that other factors can influence travel choices.

An example is employer subsidies for work travel and taxation policy. Scott et.al. (2012 p7) found that New Zealand fringe benefits tax rules "unintentionally encourage employees to choose larger vehicles, drive more kilometres annually, reduce use of alternative modes and choose more dispersed, automobile-dependent locations than would otherwise occur."

Parking Policy in Sydney

The regulation and management of parking in Sydney has followed a similar evolution. Parking is largely the responsibility of local government. As there are about fifty local councils across the metropolitan areas, this suggests that the supply and management of parking policy is potentially very spatially diverse. In reality however State Government may impose specific constraints or broad guidance to local government on how this should be done. Examples include State Environment Plans and the Guide to Traffic Generating Developments.

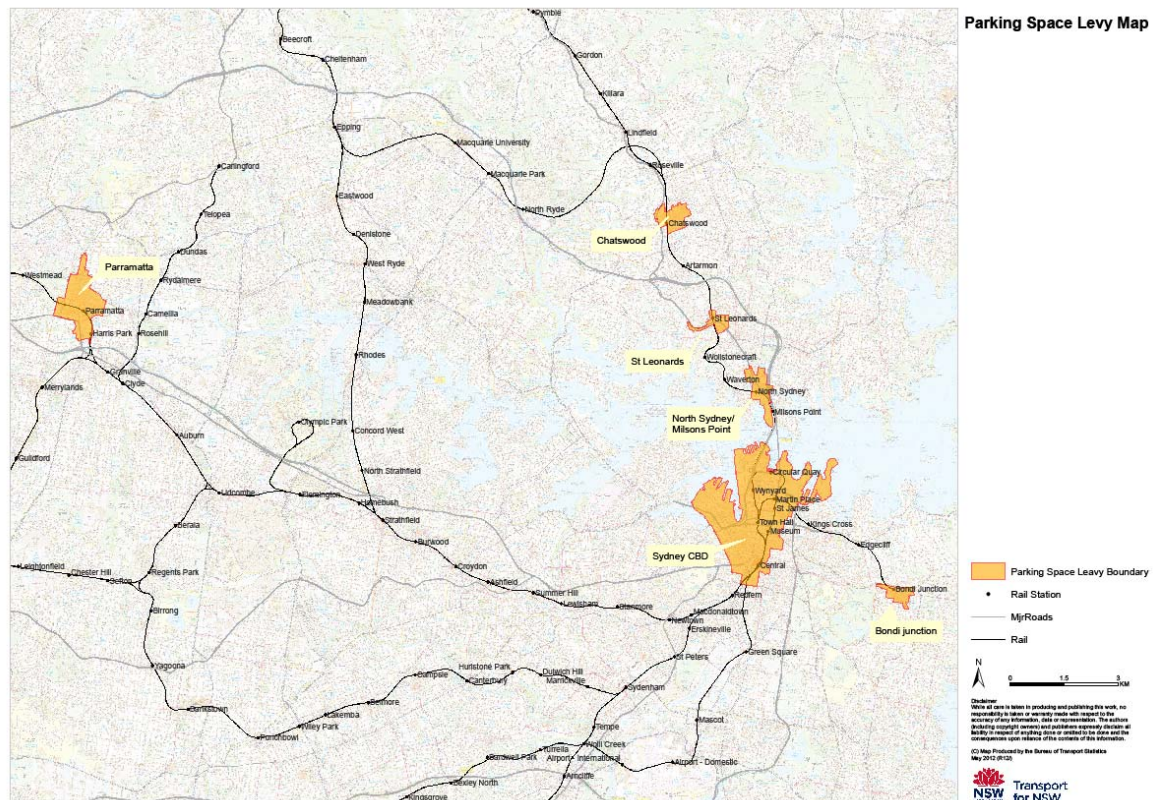
On-road parking needs to be managed, in order to ensure the free flow of traffic, while at the same time allowing parking in such a way as to allow maximum access to shops, businesses and services. The more important a road is in the network hierarchy, the greater the parking restriction, including user categories, time limits and pricing.

Off-street parking covers: residential dwellings, shopping centres, commercial offices, industrial estates, educational institutions, hospitals, commercial parking stations, open air at grade car parks for commuter or shoppers. The control of this parking supply varies by owner, use and across council areas. Local government regulates the nature and supply of off-street parking in new developments through Local Environment Plans (LEPs) and Development Control Plans (DCPs).

While constraints on parking supply have gradually increased in response to the traffic generating nature of different land uses, there is a considerable amount of off-street parking within existing developments. In response to this, the 2011 Draft City of Sydney LEP not only links parking rates to measures of public transport accessibility to across the LGA but also provides incentives to reducing existing parking floor space. (City of Sydney 2011)

The NSW Government introduced a measure to constrain the growth of parking in major commercial centres in 1992. The Parking Space Levy (PSL) applies to off-street non-residential parking spaces in six major commercial centres in the metropolitan area. These are shown in the map below (Figure 1). They are: Category 1 - Sydney CBD and North Sydney/Milsons Point and Category 2 - Bondi Junction, St. Leonards, Chatswood and Parramatta. Rates and exemptions vary between Category 1 and Category 2 PSL areas.

Figure 1: Map of the PSL Areas in Sydney



The legislation specifies that the funds are to be used to improve public transport access to and from these PSL centres from across Sydney. Projects have included the building and upgrading of public transport interchange facilities and commuter car parks which provide access public transport for those travelling to these centres from across the metropolitan area. In 2011/12 the levy raised \$100 million in revenue (OSR 2012). A list of the projects completed since 1998 is at: <http://www.transport.nsw.gov.au/sites/default/files/b2b/aboutus/Completed-Projects-parking-levy.pdf>

Although not a specific transport policy, income tax regulation can indirectly influence travel behaviour to the extent that it allows deductions for work related travel expenses. The Australian Federal Government is phasing out the sliding scale by which greater work car kilometres reduced the tax burden and is replacing it with a flat rate per kilometre.

About the Household Travel Survey

The Bureau of Transport Statistics (BTS) within Transport for NSW (TfNSW) conducts an annual survey of travel by residents of the Sydney Greater Metropolitan Area (GMA). The Household Travel Survey (HTS) allows us to track travel trends and to paint a picture of travel patterns that is reported annually in the HTS Summary Report (BTS 2012). This rich dataset which now comprises 14 waves of data also allows us to investigate in greater depth the relationship between a range of person, household, employment and trip characteristics and how these interact to produce the patterns of travel behaviour of Sydney residents.

The information collected includes trip origin and destinations that are geocoded to a fine spatial level, mode and purpose of trip, time of day, public transport ticket types, car parking location and cost, trip duration and distance, reasons for mode choice, demographic and household characteristics, employment status, employer assistance with travel costs, vehicle ownership and licence holding and reasons for commute mode choice.

As a survey of residents, primarily those in occupied private dwellings, the HTS does not include all travel across Sydney, the main gap being the modes that attract tourists and non-resident business people and their typical trip destinations.

The analysis reported in this paper is based on five waves of HTS data (2006/07 to 2010/11) pooled weighted to represent the estimated resident population at June 30 2010. It reports on the travel and other characteristics of residents of the whole GMA, with a focus on car trips to the six PSL areas compared with other destinations.



Figure 2: Sydney GMA

In the HTS, all trip legs within a journey are captured and the data can be reported as linked or unlinked trips. Unlinked trips are reported here in order to capture all driver trips, although trip purpose is reported as linked trip purpose in order not to obscure the true reason for travel where there is a change of mode. Unless otherwise stated, driver trips are reported as all trips with a destination in a location, including internal trips.

Parking location, payment and cost are only collected with respect to vehicle driver trips not passengers. In cases where the driver used a non-household vehicle or a vehicle not garaged at the residence over night, vehicle characteristics are not available. Employer assistance with travel costs is a person question, asked of all workers regardless of whether they made a trip to work on their travel day or what mode they may have used. Due to question sequencing, reasons for mode choice is only collected from employed persons with a fixed place of work who travelled to that place on their travel day and the person was home before leaving for work. This narrows the sample of workers for whom we have this information. Trip destinations and main work place address have been coded to PSL areas on a best fit travel zone basis.

Overview of parking behaviour

About 20 million journeys are made by residents of the GMA on an average weekday, and by far the majority of these trips are undertaken by private vehicle; 47% as a vehicle driver and a further 20% as a vehicle passenger (BTS 2012a). Not all vehicle trips resulted in an episode of parking, for example a driver may stop briefly without parking, to drop off or pick up someone, or a passenger may take over the vehicle and drive away. For 7% of vehicle trips the driver did not park and 82% of these had the purpose of 'drop off or pick up someone' and 12% were for shopping.

Parking location

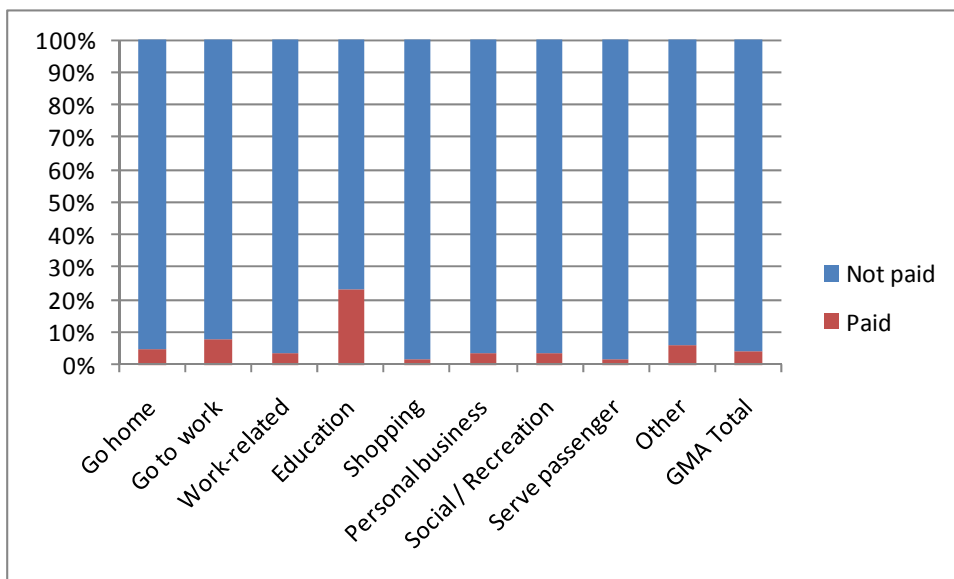
Of those who did park, 35% did so at a residential property. Most of these were trips to return home trips and a small proportion was for social visits. A further 36% parked off-street and 22% parked on-street. Excluding driver trips that parked at a residence, the split of parking locations becomes 38% on-street and 62% off-street, suggesting that the provision of off-street parking affords drivers considerable mobility that would not otherwise be available. Off-street parking therefore accounts for a larger share of the parking task and factors that influence the supply, availability and use of off-street parking could be expected to influence travel behaviour.

Parking payment

One means of controlling parking supply is through charging. Parking may be free to all or to selected users or someone else may pay the cost. In the HTS, questions about parking costs are not asked where the vehicle was parked at a residence. Only 4% of vehicle driver trips that parked away from home incurred a fee. This is a small proportion but still amounts to a quarter of a million driver trips across the metropolitan area on an average weekday. Off-street parking is more likely to be charged. When the variable 'was parking paid' is broken down by parking location, 25% of those who did pay parked on-street and 75% parked off street, while 31% of those who did not pay park on-street and 69% off-street.

There was little difference by trip purpose except that a surprising 23% of driver trips to education involving a parking payment, and 8% of trips to work.

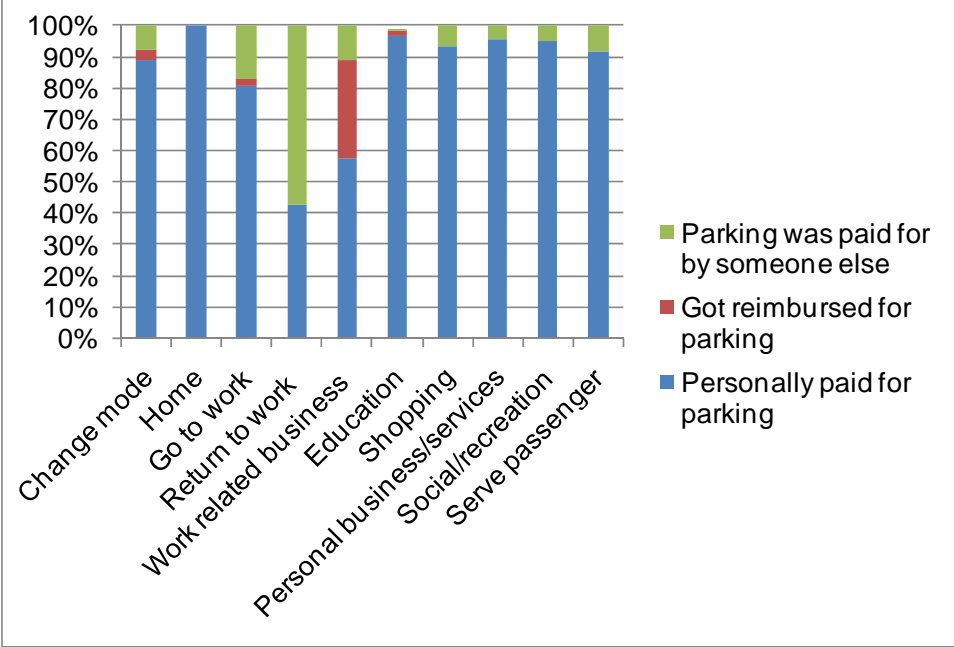
Figure 3: Trip purpose by whether parking was paid



Who paid for parking?

Whether the driver pays themselves will influence the decision to travel by car. For those trips where there was a parking payment made, in 84% of cases (213,400) it was the driver themselves who paid, for 11% (27,500) the payment was either made by someone else or the driver was reimbursed (5%) for the charge (13,000).

Figure 4: Trip purpose by who paid



Payment frequency

Parking frequency gives some indication of whether drivers are making a series of adhoc trips or making regular trips to locations where they have access to a dedicated parking space. For 60% of trips the parking payment was a one-off, 17% made an annual payment and the remainder paid weekly, fortnightly or monthly.

Employer assistance with travel

In the HTS all workers are asked if their employer helps with the costs of travel to and from work. Respondents nominate all types of assistance provided in a multiple choice format so the percentages will add to more than 100. The figures reported here refer to the percent of respondents rather than responses. Half of all workers have no assistance and the rest reported receiving one or more of: free parking, fuel costs, vehicle costs, company car, parking costs, public transport fares or a car pooling scheme. Other types of assistance reported include taxi fares, travel allowance or shuttle bus. The most common form of assistance was the provision of free parking, followed by the payment of fuel costs, other vehicle costs and the provision of a company car.

Nearly 1.5 million workers (49%) reported receiving at least one type of assistance and over one million workers received free parking. This was 69% of those receiving some kind of assistance. A third of workers had their fuel costs paid, a third had other vehicle costs paid, 26% received a company car and 10% had parking costs paid. A very small proportion had the use of a car pool for travel to work or their public transport costs paid. This shows the significant level of subsidy available to drivers compared to public transport users for the journey to work.

Who receives this assistance?

Free parking was the most commonly provided assistance across all occupation groups, but the amount and type of assistance varied considerably. Managers, technicians/trades workers and machinery operators/drivers were most likely to report that they received any assistance. They received the most types of assistance and were also most likely to be provided with a company car. Very few clerical/administrative workers, labourers or professionals reported receiving any other forms of assistance other than free parking.

How does assistance influence travel behaviour?

About 90% of those who said they received travel assistance and who made a trip to work at their main job address (at a fixed location other than home) on their travel day, used private vehicle (as a driver or passenger) for the trip, compared with 56% of those with no assistance. A further 11% of those with no assistance used public transport and private vehicle for the trip and 24% use public transport only.

Reported reasons for mode choice for trip to work

The reasons for commute mode choice is asked of those who made a trip to their main job address, at a fixed location other than home, and they were at home prior to leaving for work on their travel day. This is a multiple response variable.

Those using bus or train alone or together with car as part of the journey are asked their reasons for public transport use. For the 540,000 public transport users, 'Avoiding parking problems' was reported by 50% of respondents. Separating public transport users into those who used public transport alone and those who used car and public transport shows that avoiding parking was a more important reason for those using car as well as public transport, being nominated by 60% of respondents compared with 46% of those who used bus and/or train only. So those who drove to interchange with public transport were more conscious of parking as a reason to use public transport.

Some public transport users are 'captive public transport users' in that they don't drive or own a car or someone else uses the car, but only one third of 'public transport only' commuters reported not owning a car as a reason for using public transport. Cost was an important reason for 31% of 'public transport only' users and 38% who used car as well as public transport to travel to work. 'Public transport is faster' was an important reason for 25% of all public transport users and 36% who used car and public transport. The proximity to public transport at either the home or destination end was nominated by 22% of those who used PT only and 9% of those who used public transport and car. This reflects the importance of public transport interchanges in providing access to public transport to those who do not live close to those parts of the network that connect with places they want to go to.

For those who used private vehicle only (as a driver or passengers) most stated that they did so because of the convenience and independence afforded by car. Only 14% of the 92,000 car commuters reported that their employer provides or subsidises their vehicle or parking as a reason for driving. This is despite the fact that over one million people receive free parking or other employer travel assistance. Due to question sequencing, not everyone with employment subsidy is asked about their reasons for mode choice – it depends on their workplace location (fixed work location, not at home) and whether they made a trip that day and their trips started from home. However, the difference suggests many drivers don't perceive the availability of parking as a factor in their mode choice, although clearly it is a factor in the options available.

A number of response categories refer to the limitations of public transport including indirect services, having to interchange, travel time, the timetable or services not being available at the origin or the destination. It is difficult to ascertain the extent to which these responses reflect

negative perception of services or users, lack of familiarity with public transport or the reality of the options available. Journey to work (JTW) data shows that about 42% of CBD workers who drove to work on Census day 2006, lived in Inner Sydney, Eastern Suburbs, Lower North, all areas that are well served by public transport. Habit, attitudes and the subsidies provided for car travel may play a role in the mode choice of these drivers where other options are available.

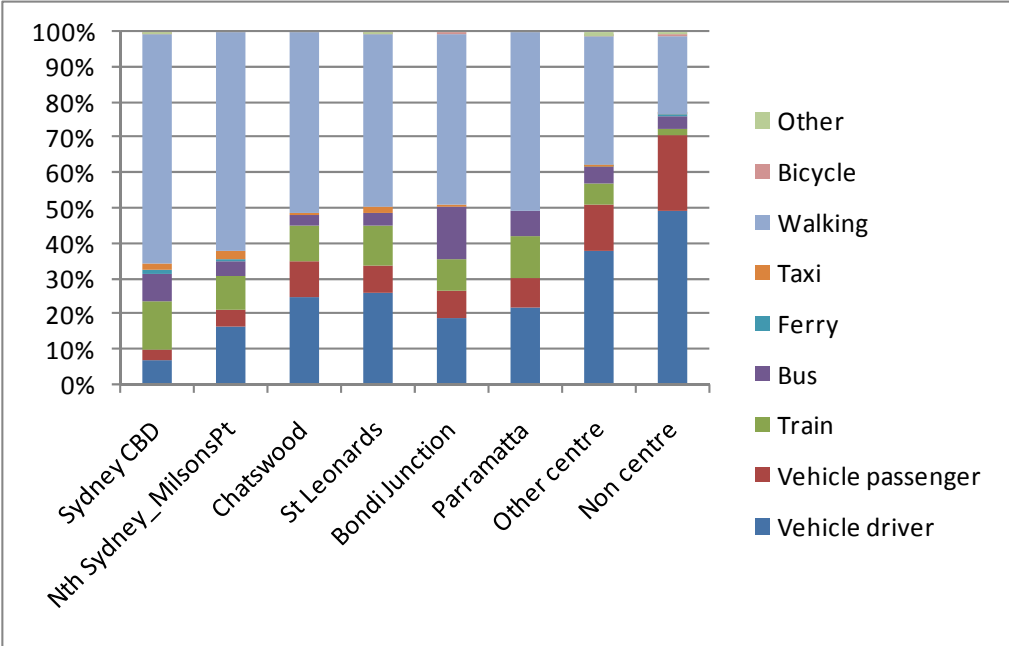
Only 12% reported needing the car for other work related travel or to carry tools. A further 10% said they needed the car for other non-work trips, possibly to do something on the way to or after work, such as pick up children.

Destination of driver trips

The remainder of the analysis will compare travel to the designated Parking Space Levy (PSL) areas with the rest of Sydney.

Mode choice is influenced by trip purpose and destination, as well as traveller characteristics, with public transport use generally understood to be higher for commuting to work and education, for travel to higher density centres and for travellers on lower incomes (BTS 2012b, BTS 2008). The figure below shows mode share of trips to PSL centres compared with other destinations. Trips to the PSL centres exclude those that start within the centre. In total 60% of trips by GMA residents are by car. Sydney CBD had the lowest share of trips by car, followed by North Sydney/Milsons Point and then Bondi Junction.

Figure 5: Mode share of trips into PSL centres

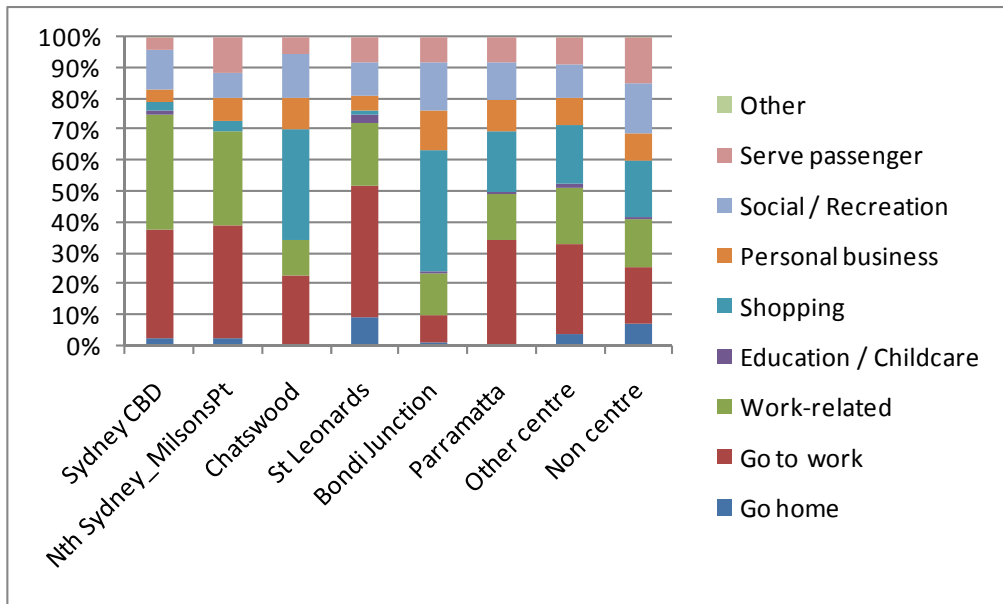


Purpose of driver trips to PSL areas

The purpose of trips to each centre explains the likelihood of paying. Two thirds of trips to Sydney CBD, North Sydney/Milsons Point and St Leonards were work related, either commuting, business or return to work trips. Many of the shopping and recreational trips undertaken within commercial centres are made by workers and are likely to be short and undertaken on foot or by public transport. Over a third of trips to Chatswood and to Bondi Junction were for shopping and another quarter were for personal business or social/recreation.

Parramatta has a similar pattern to 'Other (non PSL) centres' with a more even distribution of trip purposes.

Figure 6: Purpose of driver trips by destination

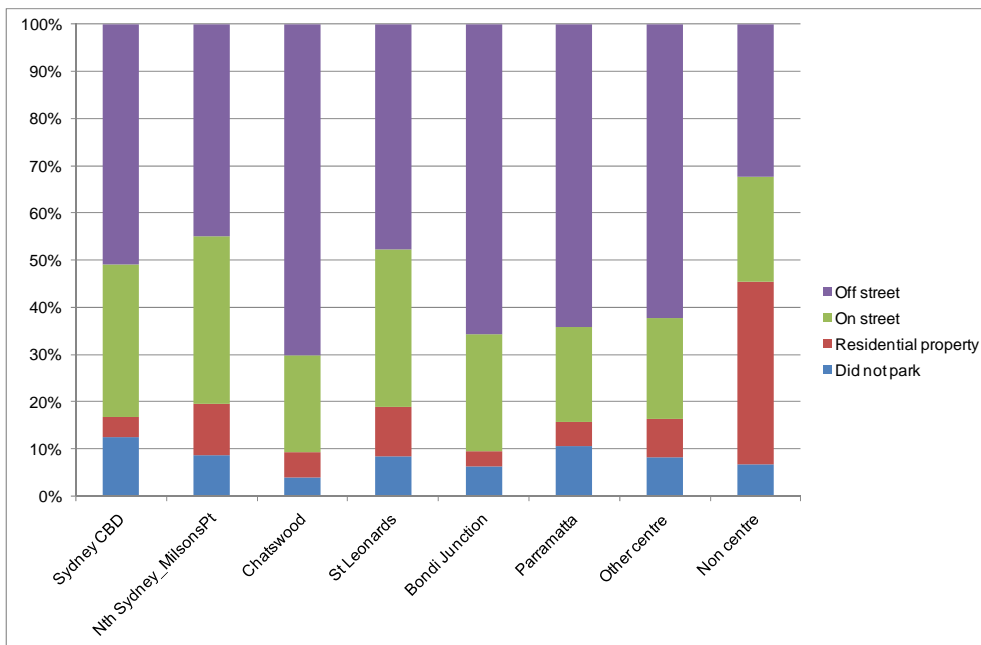


Purpose is linked trip purpose. Work-related includes return to work.

Parking location of driver trips to PSL areas

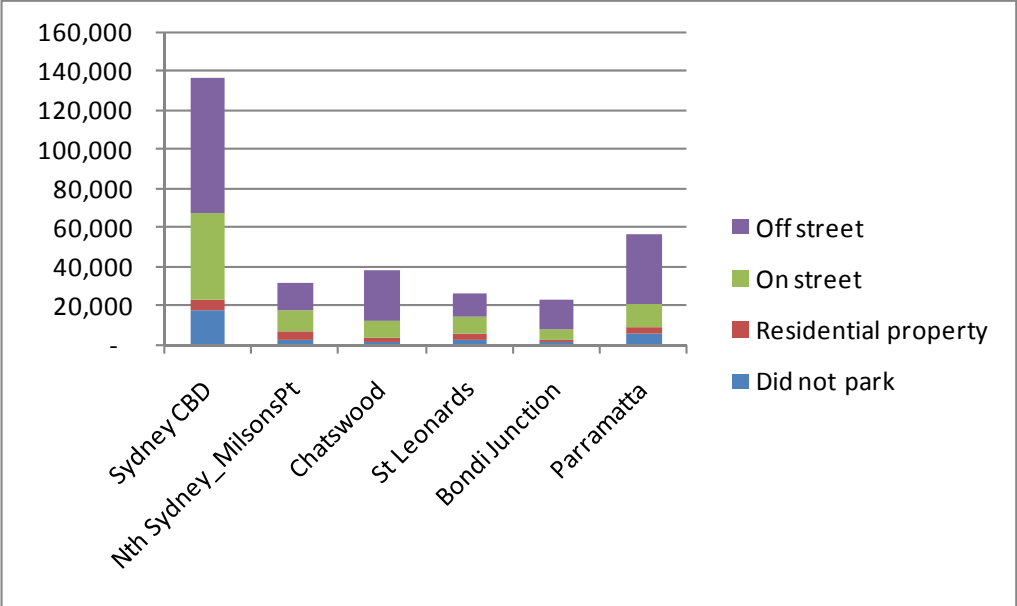
The location and cost of parking are inextricably linked. Where parking is in higher demand, supply is usually constrained, prices are higher and off-street parking generally plays a more important role than on-street parking. Off-street parking was the most common location for all of the PSL areas, but the mix varied by centre (Figure 7). Chatswood had the lowest level of use of on-street parking (20%) and 70% off-street. Parramatta and Bondi Junction had a similar pattern, as did 'other (non-PSL) centres' as a group. North Sydney/Milsons Point had a more even split of 45% off-street and 35% on-street followed by St. Leonards and then Sydney CBD.

Figure 7: Parking location by destination



The actual trip estimates in Figure 8 show the sheer level of vehicle demand within Sydney CBD -- 70,000 average weekday trips parking off-street and over 40,000 on street. A further 17,000 driver trips to Sydney CBD did not park but were probably making a drop off or pick up trip.

Figure 8: Number of driver trips to each area by parking location



Parking payment in PSL areas

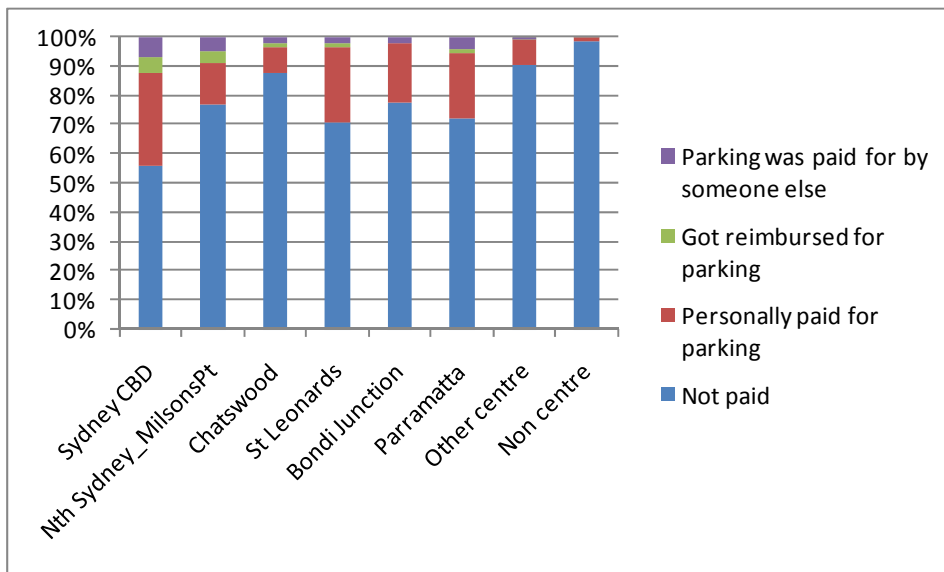
The very low rate of parking payment metropolitan wide is not the case in the PSL areas although even here non-payment predominates. More parking was paid for in PSL areas but there was also a higher share that were reimbursed or paid for by someone else.

Sydney CBD had the lowest proportion of unpaid parking, 55%, followed by St Leonards and Parramatta both 70%. Chatswood had the highest level of parking for free and a similar share to the 'Other centres' group. This probably reflects the nature of the parking supply in these areas. Most of the PSL areas are quite small in physical area apart from Sydney CBD.

The higher rate of reimbursement for work trips in PSL centres reflects the parking market in these high density commercial centres, levels of employer subsidy for vehicle travel and the concentration of occupations that attract fringe benefits when compared to the rest of the metropolitan area.

Trips for non-work related purposes were more likely than work related trips to be paid for by the driver themselves. For 31% of work related business trips, the driver was reimbursed for the parking payment and for 11% the parking was paid for by someone else. In 57% of cases the driver paid themselves.

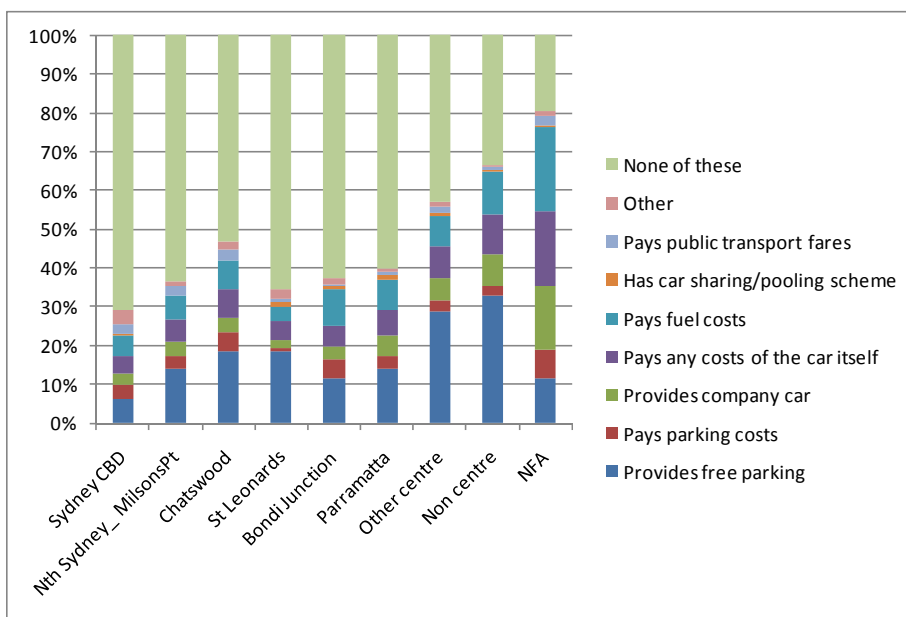
Figure 9: Parking payment by destination



Employer assistance for PSL area workers

Workers employed in the PSL centres were less likely than average to have any travel assistance compared with those who work in other locations (Figure 10). Although Sydney CBD had the lowest rates of employer assistance, because of the size of the city and concentration of jobs, the actual number of workers who receive employer assistance (68,600) is greater there than for all of the other PSL areas combined. Chatswood had the highest rate of employer assistance of the PSL areas. Workers with no fixed work address reported receiving fuel costs (22%), vehicle costs (19%) a company car (16%) and free parking (12%). This category of workers includes occupations such as plumbers who might travel to various locations each day to provide services to different residences or businesses.

Figure 10: Workers' main job location by employer assistance



Discussion

Analysis of the HTS shows that the majority of trips undertaken by residents of the GMA are by private vehicle and most car travel does not incur a parking cost. Drivers pay personally for most parking, although in a proportion of these cases, the cost is reimbursed. Significantly, the majority of driver trips involving subsidised parking (paid for by someone else or reimbursed) are work related – 50% for travel to work and 35% for business travel. Only 12% of those who commute by car report needing their car for work related reasons.

Parking constraint policies are particularly effective when applied in concentrated centres where the need for congestion relief is greatest and where strong parking restraint can be balanced by high level public transport services. The HTS shows that parking in PSL centres was much more likely to incur a cost than other locations and travel to PSL centres is more likely to be undertaken by public transport than for other locations.

Although trips to education have not been analysed spatially here, the high level of paid parking for trips for the purpose of education suggests that the tertiary institutions have also introduced similar charging regimes to manage travel demand. These precincts also tend to have complementary parking restrictions in the surrounding streets imposed by the local council.

Many of the reasons that commuters gave for driving relate to the limitations of public transport including indirect services, having to interchange, travel time, the timetable or services not being available at the origin or the destination. It is difficult to ascertain the extent to which this is simply negative perception, lack of knowledge of public transport or reflects the reality of their mode choices. Journey to Work (JTW) data suggests that commute trips to centres are made from nearby locations that are well served by public transport services.

The annual HTS results have consistently shown that parking availability and cost is the main reason for the decision to travel to work by public transport (BTS 2012, TDC various years). Those who use interchanges for travel to work cite parking issues as a reason for using public transport more than those who used public transport only. Strong community support for commuter car parking at train stations is also revealed in customer satisfaction surveys and community consultations conducted by Transport for NSW (BTS 2011).

It is apparent that many commuters do not bear the full cost of their car use. A more level playing field may be introduced through workplace travel programs which have been shown to reduce the subsidy to drive and increase support for public transport, resulting in reduced car travel and increased public transport use and cycling (PCAL 2010). These programs can reduce development costs by avoiding the cost of excessive parking provision.

Further investigation of the HTS would shed light on vehicle occupancy, parking duration, and the extent to which people park in locations adjoining PSL areas. It would also be useful to know how many unique drivers are responsible for driver trips and parking activity to get an indication of how many trips could be shifted to public transport.

If data on the spatial distribution of parking across Sydney were available it could be compared with the HTS results. In addition, information on parking usage and the extent of compliance with on-street and off-street parking regulation would give a picture of the extent to which available supply exceeds official supply.

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