

Introduction

Car share is a scheme whereby its fee-paying members can have access to vehicles through a booking system and pay for the usage of vehicles according to how much they have actually travelled by time and by distance. Car share differs from ride-sharing or carpooling in that it is not designed to transport a group of individuals to a common destination at the same time. Car share may be thought of as being closer to car rental, although individuals tend to access the shared vehicle for a short-term period and the shared vehicle tends to be in the users' neighbourhood within walking distance. The organizations, called car share organizations (CSOs), thus provide a *service* of mobility to its members, instead of *car ownership* as in the traditional car market.

Small-scale experiments with sharing cars among people date back many decades. However, it is generally accepted that successful car sharing experiments began in Europe in the mid-1980's (Shaheen *et al.*, 1998). Car sharing programs have now been established in over 100 cities, including recently in some cities in North America, Singapore and Japan.

The application of low-cost sophisticated information and communication technologies and services is the main difference that sets the modern-day car sharing programs apart from their predecessors. It has been suggested that the marriage between the age-old concept of car sharing and advanced information and communication technologies will perhaps present the first opportunity in decades to create a significant new mode of transport, or the first step along a new transportation pathway (Sperling *et al.*, 2000).

Car sharing has a clear benefit in reducing the level of car ownership. With mature large car sharing programs such as StattAuto Berlin and Mobility Car-sharing Switzerland, the ratio of number of persons per shared vehicle can reach 20 (Wagner and Schmeck, 1998). In small start-up programs, the ratio has tended to range between 6-10 persons per shared car (Katzev, 1999).

Car sharing has also appeared to lead to reduction in car usage. For example, a Mobility CarSharing Switzerland study reported that, instead of driving 10,000-15,000 kms per year as previous car owners, the members drove only 5000 kms and used public transportation for their remaining transportation needs (Muheim and Partner, 1996). It has been suggested that because the fixed costs of vehicle ownership are converted into variable costs through car sharing, drivers in CSOs now respond to price signals that more fully reflect the true cost of trip making (Sperling *et al.*, 2000).

As car sharing offers an affordable access to a vehicle for some groups and communities, this represents an improvement in their accessibility, and increased mobility in some cases.

Car sharing has also less tangible but very important benefits such as increasing in community sharing and raising awareness of an alternative transport modes (Cameron *et al.*, 2000). Although car sharing has only an estimated 1-3% of market penetration, it is gaining recognition as an important component of an integrated approach to sustainable transport (Sperling *et al.*, 2000). It has been suggested that car sharing may provide a pathway for a fundamentally new mobility, which focuses on intermodal clustering of

conventional and innovative technologies to create a coordinated transportation system that could substitute for the traditional private vehicle (Salon *et al.*, 1999).

Conceivably, car share programs could also have flow-on effect on road safety as a result of reduction in VKT (less exposure to the risk associated with travel), increased public transport usage, and better serviced vehicles offered by CSOs.

There has been little awareness of car sharing initiatives in Australia. The City of Port Phillip in Melbourne, Victoria, carried out the first study on the feasibility of car sharing in an Australian context. The study involved in-depth interviews with about 10 residents to ascertain their responses to a hypothetical car sharing scheme located in their neighbourhood. The study concluded that “car sharing has to be an integrated part of services that meet a diverse range of mobility needs. As an innovative approach, it will need to be fostered in a community” (Cameron *et al.*, 2000).

To advance this area of research, the City of Melbourne (MCC) funded the Transport Research Centre at RMIT University to undertake a research project to explore the potential of car share programs within the city. This paper presents the major findings from this project. It briefly examines the overall socio-demographic context of the MCC by drawing upon on the data from the Australian Bureau of Statistics (ABS). This overview is then followed by an analysis of car dependency of people living in the MCC, based upon the information gathered in the Victorian Activity and Travel Survey (VATS) over the past five years. Finally, the potential market sector for car share programs is discussed and some thoughts on the future of car share programs as a component of total mobility service are presented.

Social, Political, Environmental Context in Melbourne

The City of Melbourne enjoys an extensive public transport network, as well as many local shopping and entertainment centres. It certainly has fulfilled one requirement for a successful car share program – a good public transport system and many accessible services (LaFord, 1999; Cameron *et al.*, 2000).

In recent years, the City has also enjoyed a boom time. The strong market demand for inner city apartments is just one of the indications. For example, the number of apartments constructed between the financial years 1993 and 1999 just for the CBD and the Southbank area was estimated to be 2865 and 1322 each. These estimates did not include developments of less than 10 units. The projections for the two areas from 1999 to 2003 are still strong, with a total of 2959 apartments for the CBD area and 1492 for Southbank (Zigomanis 2000).

Population has increased in the urban areas, not because of their lack of economic power, but quite the opposite, as captured succinctly in the following paragraph (Colebatch, 2000):

“In a generation, the socio-economic shape of Melbourne has been transformed. As the city’s professional and middle-class population has multiplied over and over again...inner and inner-middle suburbs, which for decades had housed people too poor to live anywhere else, have been reborn as the homes of the new elite”- The Age, Monday, 10 January 2000.

The re-urbanization of cities through the market process has fitted well with the State Government's urban development strategy. The Urban Village Project, conducted by Energy Victoria, Department of Infrastructure (DOI) and Environment Protection Authority (EPA) in 1996, identified almost 1,000 potential sites for mixed-use, mixed residential density development. Of these sites more than 500 potential sites are in the inner suburbs of Melbourne (Energy Victoria *et al.*, 1996). Urban Villages are mixed use urban centres with medium density housing and environments where people can live, work and meet their everyday shopping, service and lifestyle needs. Calculations indicated that developments of this nature would save up to 40 percent of energy/greenhouse emissions arising from transportation and household uses (Newman and Kenworthy, 1999).

On another front, the State Government Transport Strategy requires private operators to achieve a 50% increase in public transport patronage over the next 15-20 years through improvements to the system, structural reform and service enhancement (DOI, 1996). However, this attempt will not be achieved solely through service enhancement. As clearly recognised by the *Transporting Melbourne* Strategy, travel demand management and integrated planning of transport and land-use must go hand-in-hand to create an urban form that encourages people to live their life using more public transport and other non-motorised travels, and being less dependent on private cars. Therefore, the changing economic, political, environmental and social climate is becoming more conducive for car sharing as a part of an integrated approach to sustainable transport in Australia.

However, against these positive signs, there are also negative forces that need to be recognised.

Firstly, private car ownership in Australia is still relatively inexpensive compared to European countries. The introduction of GST in Australia has led to a reduction in the price for both new and second hand cars, which may discourage people from considering car sharing as an alternative to private ownership.

Secondly, as noted in the Port Phillip study, the Australian Taxation laws favour car use. Company cars, although only about 16% of all new car sales, make up 40% of peak hour traffic and 20% of all traffic (Australian Railway Association, 1999). There would be no incentive to reduce car ownership for those professionals who have company cars, and if so, opportunity to reduce peak traffic volumes through reduction in car ownership among this group would be put at risk. However, Cameron *et al.* (2000) indicated that if annual distances travelled are relatively small, car share may still appear more attractive than tax incentives.

Thirdly, the past 10-15 years have seen an increasing car-dependency in passenger travel in all Australian cities. For example, in Victoria, the percentage of persons using cars as their main method of travel to work has increased from 68.8 percent in 1974 to 84.3 in 1994. There was also a continuing decline in the percentage of persons who walked to work (8.6 percent in 1974 compared to 5.2 percent in 1984 and 3.9 percent in 1994) (ABS, 1994). Similar trends have been observed in Perth (James *et al.*, 1999).

To summarise, there is a potential for car sharing in Melbourne, especially in the inner suburbs. In fact, the prospects over the next 10 years for such programs may be quite bright considering the support for travel demand management articulated in government

policies. However, some existing policies and travel patterns could lead to further dependence on cars unless programs to counter such a trend are fostered and implemented.

Demographic profile in Melbourne

Household Structure

Compared to the rest of the Melbourne Statistical Division (MSD), the residents in the City of Melbourne (i.e. the Melbourne LGA) have a very different composition. According to the 1996 ABS Census, MCC had a significantly lower percentage of households of couples with children (MCC 11.0% vs. MSD 37.2%), but a considerably higher percentage of lone person and group households (MCC 49.5% vs. MSD 26.3%), as shown in Table 1.

Table 1 Household Type (source: ABS, 1996)

Household Type	MCC		MSD	
	No.	Percent	No.	Percent
Couple with children	1772	11.0	422683	37.2
Couple without children	2864	17.8	246534	21.7
One parent family	1110	6.9	109239	9.6
Other one family households	662	4.1	17480	1.5
<i>Total one family</i>	<i>6408</i>		<i>795936</i>	
Two or more families	60	0.4	14801	1.3
Lone households	5572	34.7	250782	22.0
Group households	2375	14.8	48778	4.3
Total non-classifiable	1645	10.2	27039	2.4
Total households	16060	100.0	1137336	100.0

The presence of children in a family tends to be associated with increased travel and increased complexity of travel patterns, contributing to the reliance on the car for day-to-day travel needs (VATS, 1999). Conceivably, the lower percentage of households with children in the MCC may suggest a higher percentage of households with a lesser need to be dependent on cars.

Vehicle Ownership

Almost one third of the MCC residents did not have any private vehicles (Table 2). The MCC had 4,530 households (28%) without any vehicles, more than doubled the MSD average (11%). On the other hand, the number of households having two or more vehicles (19.6%) was significantly lower than the MSD average (46.7%). This indicates that there was less dependence on private cars for the people living in the Melbourne LGA.

Table 2 Car Ownership by Households (source: ABS, 1996)

No. of vehicles	MCC Household		MSD Household	
	No.	%	No.	%
No vehicle	4,529	28.2	127,941	11.2
One vehicle	6,599	41.1	416,342	36.6
Two vehicle	2,643	16.4	393,437	34.6
Three or more vehicle	516	3.2	137,370	12.1
Not stated	1,773	11.0	62,246	5.5
Total	16,060	100.0	1,137,336	100.0

Income, Education and Occupation Status

The available research findings to date have been limited in relation to the socio-demographic attributes and mobility patterns of participants in car sharing programs. Most surveys have small samples, did not use control groups or travel diaries to collect travel data, and their conclusions tend to be affected by variations in study methodology and in the stage of development of the car sharing organizations (Shaheen *et al.*, 1998). Some of the conclusions are not necessarily consistent with each other. For example, Mobility Carsharing Switzerland foresees a large urban and suburb market, many of them in semirural areas (Muheim and Partner, 1998), while in contrast, Baum and Pesch (1994) (cited in Muheim and Partner, 1996) characterise car sharing as a predominantly urban phenomenon in Germany.

Despite the difficulty in generalising from existing studies, there are some indications about the characteristics of car sharing members. For example, they tend to be well-educated, between 25 to 40 years of age, sensitive to environmental and traffic problems and likely to work in professional jobs (LaFond, 1999; Katzev, 1999). Shaheen (1999) developed an early adopter profile as a result of her study on the carsharing program called CarLink in San Francisco Bay Area. Many of the characteristics are comparable to those of early car sharing adopters in Europe. In addition, the study found that of the participants who expressed interest in the CarLink field test and those who joined the program, 70% were married and 50% belonged to households of two or three members. A significant 80% agreed or strongly agreed that they like to experiment with new ways of doing things – which is consistent with the characteristics of early adopter as defined in Rogers' diffusion theory (1983). The study did not reveal whether the participating households had young children.

According to the 1996 Census, about one fourth of the residents in the Melbourne LGA (25.5%) had qualifications of bachelor degrees or above, which was almost twice the percentage of the MSD average (13.1%). Nearly half of the employed persons in the MCC (46.6%) were in professional, managerial and administrative positions, as compared to the MSD average of 26.9%. Corresponding to these two features, individuals on higher incomes (above \$1,000 per week) comprised 12.1% of the population, significantly higher than the average of 5.9% for the MSD. However, there was also a considerable proportion of individuals (23.7%) who were earning below average income (between \$300-699 a week).

In summary, from the household structure, vehicle ownership, education level and occupation statistics, there appears to be a strong indication of a potential market for car share within the Melbourne LGA.

Travel and activities of people in the MCC - VATS survey

Based on the evidence collected over the years in Switzerland, Katzev (1999) suggested that car sharing would make sense for everyone except those who wish or need to drive to work every day. Economically speaking, car sharing is considered to be less expensive than owning a car for individuals who drive less than about 10,000 miles a year (i.e., 16,000 km per year). Up to this level, owning a car, including a second car, is more expensive than belonging to a car sharing organization. Understandably, this breakeven point is dependent on the cost structure for car sharing.

A survey of the members belonging to two of the four car share organizations operated in Canada, AutoCom in Quebec City and CommunAuto in Montreal, found that 75% of the members sold a previously owned car. Furthermore, 75% of their car trips after joining the CSOs were for entertainment and shopping activities (Katzev, 1999).

Therefore it makes sense to study the travel behaviour of people living in the Melbourne LGA with respect to their mobility patterns for work, shopping and social/recreational, as they are essential components of daily life. Indeed, home-based work, shopping, and social/recreational trips represented 50% of all trips made on a daily basis, according to VATS (1998).

Where MCC People Go for Work, Shopping and Social/Recreational Activities

Ten percent of home-based work trips made by MCC residents ended within the MCC, and another 15% of them in the rest of the inner Melbourne area, which consists of City of Yarra, Port Phillip and Stonnington. However, the majority of the home-based work trips (75%) ended in the other parts of the MSD (Figure 1).

Trip from home to social/recreational activities exhibits a similar trend, showing most of the destinations (69%) were outside of the inner suburbs with 14% within the Melbourne LGA and the balance within the three inner Melbourne LGAs.

However, MCC residents were more likely shopping within the LGA itself (54%), and only 30% of the shopping trips were outside of the inner suburb LGAs.

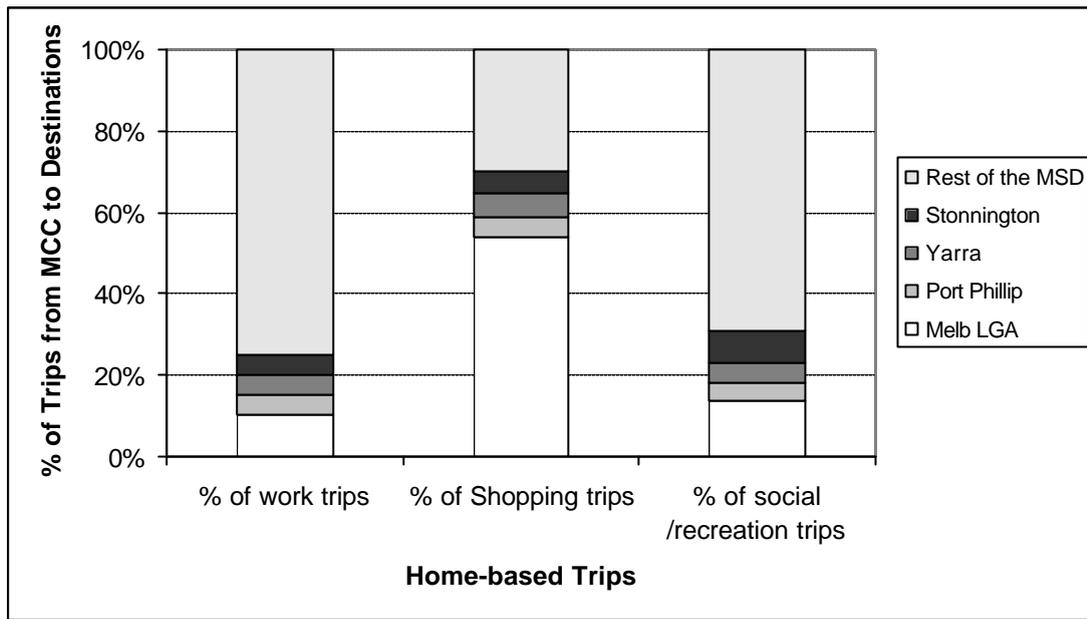


Figure 1 Distribution of Trip Destination by Major Trip Purposes (source: VATS, 1998)

Travel to Work

Of the total home-based work trips made by the MCC residents, about 65% of them were more than 10 km. Only 18.3% of them were less than 5 km for the MCC residents, according to the 1998 VATS. This further illustrates the distribution of work destinations shown in Figure 1.

For the MCC residents, as the distance to work increased, the shares of tram and train increased considerably (Table 3). Train was favoured over tram for longer distances (over 10 km), while tram was used substantially between 3–10 km distances. The very high use of the public transport by the MCC residents can be attributed to the radial nature of the Melbourne’s public transport network that allows people in the centre to travel on public transport with ease. Walking and cycling also played important roles for work trips of shorter distance. For example, home-based work trips of less than 1 km were dominated by walking (77%). On the other hand, cycling was very popular for work trips between 2-3 and 3-4 km, representing 19% and 35% of such trips.

Table 3 Mode Use for home-based work trip (source: VATS, 1998)

Mode	% Mode Use for Home-Based Work Trip (MCC)								Total
	0-1 km	1-2 km	2-3 km	3-4 km	4-5 km	5-10 km	10-15 km	>15 km	
Walking	77	25	28	6	4	1	1	1	5
Bicycling	0	0	19	35	0	4	1	0	3
Taxi	0	0	4	2	0	4	1	0	1
Car driver	19	35	29	18	53	35	52	43	41
Car passenger	4	23	10	3	11	8	1	6	6
Train	0	0	0	3	15	20	31	45	31
Tram	0	17	9	32	18	25	11	4	11
Other	0	0	0	0	0	3	1	1	1

Total	100								
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Overall, of all persons who made trips to their work (i.e. excluding people who did not go to work or worked at home), 8% used non-motorised mode, i.e. walk and cycle, and 42% used public transport. In another words, half of the MCC employed persons who needed to travel to work did not rely on private motor vehicles for their home-based work trips. Since car share would make more sense to people who do not need to drive to work, the presence of large proportion of such individuals, as in the case for people living in the MCC, suggests a potential for car share programs.

Travel to Shopping

Residents in the MCC tend to shop locally, as 53% of home-based shopping trips were between less than 1 km to 2 km. The same tendency was shown with the average MSD people, with 49% of the shopping trips being made locally (VATS, 1998).

As shown in Table 4, for shopping trips of less than 1 km, 87% of the trips were undertaken by walking. For up to 2 km trips, walking was still the primary mode. Car was the second popular mode used, perhaps as a part of linked trip.

For shopping trips over 2 km to 10 km, tram became the most used mode to shopping, followed by car as driver. In these trips, the percentage of people who walked to shopping decreased considerably.

Table 4 Mode use for shopping trip by MCC residents (source:VATS, 1998)

	% of mode use for home-based shopping trips								
MODE	0-1 km	1-2 km	2-3 km	3-4 km	4-5 km	5-10 km	10-15 km	>15 km	Total
Walking	87	60	23	0	0	2	11*	0	44
Car driver	13	6	36	13	22	24	25	42	20
Car passenger	0	22	11	23	0	10	33	32	12
Train	0	0	0	0	12	12	14	21	7
Tram	0	12	31	63	47	30	16	5	14
Other modes**	0	0	0	0	19	21	0	0	3
Total	100	100	100	100	100	100	100	100	100

*Data aberration caused by small sample counts.

** Other modes include buses, bicycles and others

Overall, the chances of walk or using trams or trains for shopping activities were high (65%) across all distance ranges. Thus, this again is a positive sign that almost two thirds of the MCC residents on average did not need to rely on private vehicles for shopping activities.

Travel to Social and Recreational Activity

Social and recreational activities include eat/drink, exercise, watching or participating in sports, concerts, etc. Such a wide variety of activities made up 20% of all daily trips and was the highest of all home-based trips (VATS, 1998).

For such trips, MCC residents appeared to travel longer distances. Seventy-five percent of these trips were more than 5 km, including 45% of them more than 10 km (VATS, 1998).

As shown in Table 5, for trips up to 2 km, walking was the dominant mode. For trips over 2 km, car trips (as driver or passenger) became the most often used modes. The proportions of trips by car as passenger were also close to that by car as driver, indicating that social/recreational trips of longer distance (>5km) were less likely to be single person (i.e. driver only) trips.

Overall, “person in car” trips made up 64% of all trips for social/recreational purposes. Compared to home-based work and shopping trips, MCC residents relied more on private vehicles for social/recreational activities than for work and shopping purposes. This is plausible, as social/recreational activities tend to be varied in their destinations, which can be better managed with private cars.

Table 5 Mode Use for Social/recreational Trips by Distance (VATS, 1998)

	% Mode use for home-based social/recreational trips							
	0-1 km	1-2 km	2-3 km	3-4 km	4-5 km	5-10 km	>10 km	Total
Walking	88	44	23	5	0	3	2	11
Bicycling	0	21	8	0	4	0	0	2
Taxi	0	0	0	0	11	4	3	3
Car driver	12	5	51	28	32	32	38	32
Car passenger	0	28	15	31	25	38	36	32
Train	0	0	0	5	0	8	15	9
Tram	0	3	3	31	23	12	5	8
Other Bus	0	0	0	0	4	2	1	1
Total	100	100	100	100	100	100	100	100

In summary, the above analyses have shown that for home-based work and shopping trips, about 50% to 65% of the trips were made without private vehicles, but with walking, cycling, and public transport modes. This indicates a good potential for car share for these kinds of MCC residents. For social/recreational activities, the use of cars increased to 64% of all trips. As European car share members’ most frequent need for accessing shared vehicles were for social/recreational purposes, people who join car share programs in the MCC would probably most frequently require their shared vehicles for these trips as well.

Individual mobility patterns

To further investigate the total picture of individual travel, the next section will be based on the combined VATS data over the five years from 1994 to 1998. As each year’s sample was drawn randomly, they would still be a random sample of the MCC residents when combined. Time effects on the data are not considered to be significant in this case, as it is reasonable to assume that the implication of income, occupation and other socio-demographic factors on travel patterns would be more significant than that of the elapse of time.

There were 324 household respondents from the five years’ VATS surveys, and a total of 652 person respondents from these households. In general, there were significant

numbers of respondents in all the categories of gender by employment, or by income level or by their occupations, thus providing a statistically valid basis for further investigating the travel patterns of these demographic groups (Wang, 2000).

Use of Cars by Employment

For people living in the MCC who were on full-time jobs, about 27% of them (males and females) did not use cars on an average day for all of their trips. Within this group, 40% of males and 30% of females relied on cars for every trip they made (Figure 2). For people who were on part-time jobs, 56% of males and 36% of females did not use cars on an average day for all their trips, respectively. Within this group of part-time employed people, about 15% of males and 36% of females made all their trips using the car.

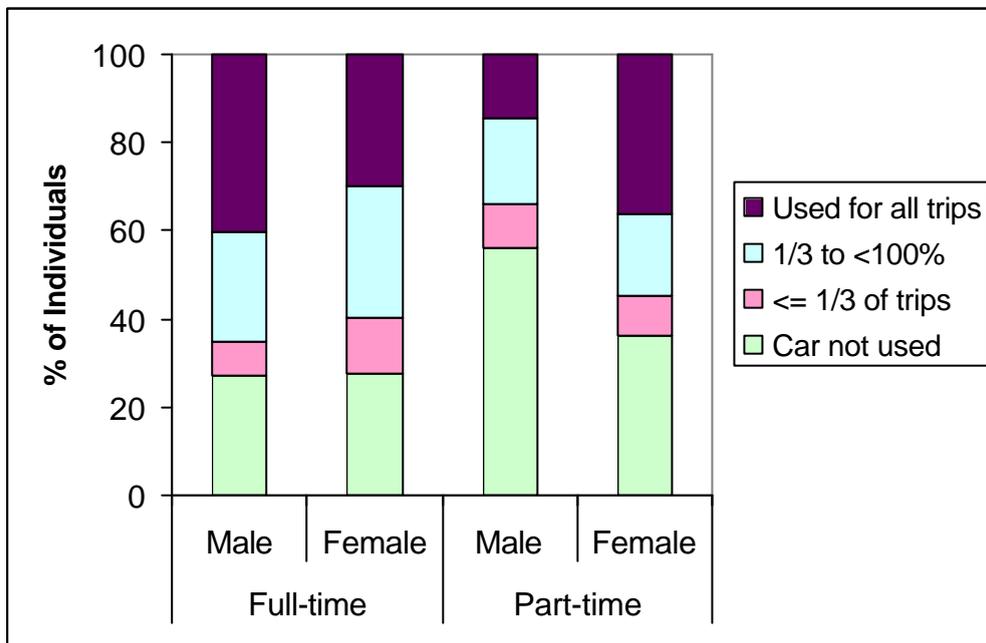


Figure 2 Individual's car use by employment status (source: VATS 1994-98)

Interestingly, the percentage of females who relied on cars totally was quite similar no matter whether they were in full-time (30%) or part-time employment (36%). On the other hand, females on part-time jobs made twice as many all-car trips (36%) than their male counterparts (15%).

The difference in the use of private cars between women and men who were on part-time jobs may have been contributed by a number of factors. Traditionally, females play more roles in serving household needs such as grocery shopping and pick-up/drop-off children. Some women choose to work part-time in order to balance their family and work commitment. Apart from this possible factor, it has also been noted that females tend to have a greater concern for security and safety in travel, whether they are travelling alone or with their children. Understandably, private cars are more favoured than any other modes of transport because they provide the kind of flexibility, security

and safety desired. However, the real cause for the difference would require further analysis.

According to VATS (1998), about 8 percent of MCC residents in full-time employment and 9% MCC residents in part-time employment reported that they did not make any trips on an average day. Therefore, based on the above indication that 27% of people living in the MCC with full-time jobs did not use cars for any of their trips on an average day, car share programs may be potentially attractive to 25% (i.e.=92%*27%) of this group of people. Similarly, about 33% of females (=91%*36%) and 50% of males (=91%*56%) in part-time employment, who did not make any car-based travel on an average day, may find car sharing suitable for their lifestyles.

Use of Cars by Occupation

On an average day, individuals who were employed in the clerical, sales and service industries were less likely to use their cars. Of the total 97 individuals in these occupations, 88 made trips (91%) (VATS, 1998). Of those people, 43% did not use cars at all, and only 28% relied on cars for each of their trips.

Managers and professionals were quite alike in terms of using cars for their trips (Figure 3), with 25% of professionals and 22% of managers not using cars on an average day.

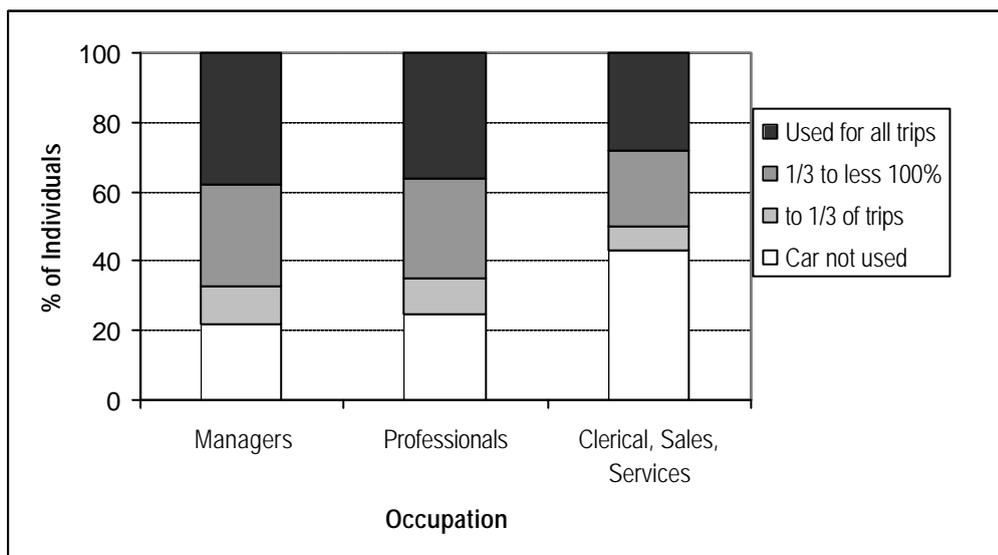


Figure 3 Individual car use profile by occupation (source: VATS 1994-98)

Therefore, because of their greater tendency of not using cars on an average day, people in the clerical, sales and service industries would be more likely to respond positively to car share programs.

Use of Cars by Income

On an average day, about 35% of individuals who earned between \$300 - \$699/week did not use cars for any of their trips, as compared with 18% of individuals earning more than \$1500 a week.

Table 6 Use of Cars for Trips by Individual Income (source: VATS 1994-98)

	Person Income (\$/week)					
	Nil	\$1-\$299	\$300-\$699	\$700-\$999	\$1000-\$1499	>= \$1500
Car not used	42	59	35	26	24	18
to 1/3 of trips	3	7	10	6	13	14
1/3 to <100% of trips	14	16	18	36	37	29
Used for all trips	41	18	37	32	26	39
Total	100	100	100	100	100	100

It appeared that as people's income increased, the likelihood of not using cars at all decreased. This is probably related to their work demand and that high-income earners are most likely to have ready access to private cars. Furthermore, for high-income earners, cars are more likely part of salary packages (some even including a secured parking spot paid by their employers). Australia's current and proposed fringe benefits tax system gives more tax incentives for the use of vehicles than for public transport. If there is no other compelling reason for companies to encourage reduction in vehicle trips, it is unlikely that individuals who benefit from company cars would reduce their car travels.

Therefore, car share schemes need to be promoted with other environmental programs, such as greenhouse gas reduction targets, to win support of companies in reducing vehicle usages. Based on the above figure, about 20% of people earning \$700/wk and above may still potentially be attracted to car share programs, as they do not need to use cars for any of their travel on an average day.

Use of Cars by Mode to Work

For individuals who used public transport for travel to work, 73% of them did not use cars at all. For people who walked or cycled to work, 66% of them did not use cars at all. For those who used car to go to work, 59% of them made all of their trips in cars, while only 10% of them used their cars for less than one third of the total trips, as shown in Table 7.

Table 7 Percentage of car use by mode to work (source: 1994-98)

Percent of Car Use	Mode used for home-based work trip		
	Car	Public transport	Walk/cycle
Car not used	0%	73.5%	66.1%
to 1/3 of trips	9.6%	12.2%	15.3%
1/3 to <100% trips	31.7%	14.3%	18.6%
Used for all trips	58.7%	0%	0%
Total	100%	100%	100%

It is therefore highly likely that those who used alternative transport modes other than private vehicles for travelling to work would find car share suitable to their lifestyles.

A future market strategy for car share program would need to consider these people as the most essential demographic group.

Conclusions

The conclusion from the above findings is that the MCC has a significant potential market that is suitable for car share schemes.

This market has been examined from

1. the socio-demographic composition of the MCC residents based on overseas programs' observations,
2. the travel and activity patterns obtained from VATS98 dataset, and
3. most importantly, the dependence on cars of various demographic groups within the MCC for their day-to-day activities, which was obtained from the five-year accumulation of the MCC data within the VATS datasets.

Based on the suggestion that people who join car share schemes are those who do not need (or depend on) cars for their regular activities such as work or shopping and, the travel and activities patterns of people living in the Melbourne LGA that have been examined in this study, the following attributes may characterise the person who is more likely to opt for car share as a way to obtain access to cars on an as-needed basis:

- a. On below average income (less than \$699 a week);
- b. Employed in clerical, sales and service industries;
- c. Used public transport or non-motorised modes for going to work.

As high as 35% of individuals on below average income did not use cars for any of their trips on an average day (Table 6); about 43% of individuals who worked in clerical, sales and service industries did not travel by the car (Figure 3); among those who travelled by public transport or non-motorised modes for going to work up to 73% of individuals did not use cars on an average day (Table 7). It may be suggested that a lower bound estimation of 35% of these individuals may be likely to respond to earlier market promotion of car sharing.

About 20% of the individuals, who were on higher income, or worked as managers and professionals, might still find car share programs work for them. The main barrier is, perhaps, that cars are often offered to them as part of salary packages that attract better tax incentive from the employers' point of view. Therefore, car share initiatives should be promoted with other environmental goals (e.g. greenhouse gas reduction target) of companies in order to realise its potential benefits.

The findings about the travel and activity patterns of the MCC residents present a unique opportunity that has not existed for other overseas programs when initiating car share programs. This unique opportunity is that the attributes for its potential market sector are known to some extent. It would be much more meaningful to target such potential market sectors to determine the details such as the type of vehicle fleet, price structure and management of a car share program.

One limitation of this project is that the travel and activity patterns from the individuals were extrapolated based on their one-day's travel and activity profile. It is known that travels in weekdays vary from weekends for most of people. Anecdotal evidence also suggests that some MCC residents did not use cars for their home-based work or shopping activities on weekdays, but they see cars as "indispensable" for weekend trips. Future research needs to take this into consideration.

Lateral-thinking on car share

The attractiveness of mobility and other personal benefits offered by the private vehicle is demonstrated by its increasingly dominant share of all personal travel in developed countries. In almost all OECD countries, private vehicles now account for around 80% of all motorised passenger travel (ECMT/OECD, 1995). All major Australian cities are comparable to the OECD countries in this regard (ABS, 1996; James *et al.*, 1997).

This highly individualised form of mobility choice has significant adverse impacts on the society as a whole. Congestion (hence reduced efficiency), air and noise pollution, severance of the natural landscape caused by road networks, high consumption of energy per capita, decreasing levels of fitness among the population, higher accident risks, decreasing sense of community and so on are just some of the negative impacts that are widely recognised.

Some of the negatives of auto use also stem from the level of ownership, e.g. on-street and off-street parking demand, under-utilised resources and careless travel decisions, and so on. Many strategies aimed at reducing the impact of car use (e.g. through fuel efficiency programs and alternative fuels) and the use of car (e.g. through urban consolidation and road pricing) have been proposed. However, there has been a shortage of achievable solutions in transport planning and policy frameworks to deal with the increasing number of cars in urban areas.

Car sharing seems to offer an achievable solution to curtail the growing number of private cars. Car share programs should therefore not be seen only as programs belonging to green transport initiatives. Indeed, car share should be considered seriously by public transport providers. Car share can offer services that could not be met by traditional public transport system. Morris and Richardson (1996) pointed out that for public transport services to provide a genuine alternative for travel in contemporary urban situations, they should attempt to emulate many of the characteristics of the car. Their suggestion was based on the recognition of the new set of transport needs – the need for more flexible transport services as a result of the marked social and demographic changes, in particular, those changes reflected in the increased participation in the workforce by women, especially those with children.

Public transport planners should therefore recognise that there are synergies to be drawn from car share programs to meet this new-age transport challenge. Car share cannot exist on its own. Its viability depends on whether people who join car share programs would have their mobility needs fulfilled by public transport or other non-motorised modes in times other than when using shared vehicles becomes necessary. Some overseas car share programs have been reported to offer discounted public transport tickets, or free bicycle accessories to encourage the members to use non-car alternative modes. In some cases, car rental companies and taxi companies have also been brought in as a part of total mobility service to car share members. Clearly those car share programs have developed to the stage where they recognised the importance to work with other mobility providers. Perhaps, to the same extent, other traditional mobility providers, in particular the public transport sector, need to be alert to the fact that for them to have truly successful businesses in the new transport era, they should work with car share programs as well.

Car share programs would also be able to mitigate the negative impacts of cars through working with the traditional car market. For example, although most family cars are purchased for use by the entire families, they might be used mostly in driver-only trips. There would be enormous savings in terms of energy and material resources if smaller cars are used for driver-only situations and when the occasions do rise, bigger cars are used for family. This can be facilitated through car share.

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