

# Women's changing role: implications for the transport task and for modelling personal travel patterns

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## Abstract

This paper explores gender-based differences in travel patterns on weekdays and weekends in metropolitan Melbourne by people of working age, emphasising variations in the purpose and mode of travel made by key socio-demographic groups. The paper also explores implications for transport planning, noting in particular possible refinements to the Melbourne Integrated Transport Model to model travel patterns that are more representative of the present day transport task.

The growing complexity of travel in metropolitan Melbourne is illustrated most explicitly by the changing travel characteristics of women. This paper suggests that there is a strong propensity for women to use public transport to access work; but that outside of work, household pressures and activity needs require more flexible transport modes. These pressures are related to the strong contribution women continue to make to unpaid household work, which increases significantly with the presence of dependent children. A small shift to more sustainable transport modes by selected occupational groups is beginning to emerge, but the private car is still the dominant mode of travel for most people of working-age. This is especially so for women who work part-time, and for men and women engaged in the technical, trade and labouring occupations and in community and personal services.

In large part these findings reflect underlying societal changes in lifestyles and the nature of work, changing expectations and social mores, and structural changes in the economy and the residential character of the city. The findings have implications for understanding travel patterns, forecasting travel demand and for developing transport policies that facilitate participation in the economic and civic opportunities by different groups within a city.

Analysis is based on survey data from the Victorian Integrated Survey of Travel and Activity 2007 (VISTA 07), and comparisons are made with findings from previous studies.

## Section 1. Introduction

In the provision of transport infrastructure and services, and associated modelling tools, a focus is typically made on peak period travel – the movement of large numbers of people primarily for the purpose of work and education. Appreciation of this transport task is based on an understanding of 'aggregates', whereby network performance and efficiency is maximised according to the volume of travel between identified origins and destinations.

There is a risk that this broad approach overlooks the detailed nature of the travel that is occurring, thereby limiting effective policy analyses and development of more refined predictive tools. Understanding who is travelling, by a given mode, at a certain time of day, requires insight into the complex interactions of individual preferences and household

dynamics, and how these may vary over the life course. This growing complexity of travel is perhaps illustrated most explicitly by the changing travel characteristics of women.

Women of working age in contemporary western societies are becoming increasingly important market segments for providers of transport infrastructure and services. As Ironmonger and Norman (2007, p24) have noted, 'the big change in travel behaviour in Melbourne over the past 15 years has been mainly a story of increasing number of trips, travel distance and travel time of women'. While women are travelling more than before, their travel patterns also differ from men in a number of important respects. Earlier work also undertaken for Melbourne (Morris, Richardson and McPherson 1996) has shown differences in men's and women's travel patterns to be closely related to workforce participation and family responsibilities associated with having dependent children. Apart from peak period work journeys, women make more trips than men at most times of the day for all other broad categories of travel. Even in regard to paid work, however, the amount of travel made by women is increasing over time (see Ironmonger 2006). In recent years the continued growth in levels of part-time employment (of both men and women) has been accompanied by strong growth in rates of full-time employment among women, including those in the younger age cohorts of 20-34 years. This growth in full-time employment of younger women reflects their increasing levels of educational attainment and changing expectations and social mores, along with increased employment opportunities arising in part from changing occupational structures and the nature of work. These changes have been accompanied by a number of others, such as increases in the average age at which women first marry and start a family. Such changes are having significant - though perhaps not yet fully appreciated - impacts on the demand for transport and other goods and services, including home ownership.

This paper examines present-day variations in the demand for transport by Melburnians of working age, with particular focus on the differing travel patterns of men and women, relative to their participation in the workforce and family responsibilities. For the purposes of this paper, working age is defined as between 20 and 65 years. Information is drawn from a recent household travel and activity survey undertaken in major Victorian cities, the Victorian Integrated Survey of Travel and Activities 2007 (VISTA 07). Differences in travel and activity patterns are explored across different times of the day and week (including weekdays and weekends); comparisons are drawn with the key findings from other studies on earlier data sets for Melbourne; and some important implications for transport planning and modelling are also outlined.

The balance of this paper is arranged in six sections. Section 2 briefly describes the main source of data employed in this paper, VISTA 07, together with the significance testing undertaken on gender variations in travel patterns. Section 3 describes important contextual information for the analyses, outlining societal changes in workforce participation and contribution to unpaid work, along with some major structural changes that have occurred in Australia in recent decades. Section 4 describes variations in travel and activity patterns for men and women of working age in Melbourne (differentiating between those working full-time or part-time and those who are not employed), based on recent survey information and drawing comparisons with earlier data sets for Melbourne. Section 5 examines differences in travel patterns across the time of day for men and women of working age, again differentiating between those working full-time or part-time and those who are not in the workforce. Section 6 discusses briefly the implications of these findings for modelling and outlines some possible refinements. A brief section (Section 7) concludes the paper.

## **Section 2. Brief description of VISTA 07**

VISTA 07 is an activity-based travel survey, conducted with approximately 11,000 households in Melbourne and a further 6000 households across Geelong, Ballarat, Bendigo,

Shepparton and Latrobe.<sup>1</sup> The focus of this paper is on travel of those residents living in the Melbourne Statistical Division (MSD).

Within responding VISTA 07 households, a completed travel diary is supplied for each person aged over five years of age for a single specified day<sup>2</sup>. The sampling of households was spread across the full 2007/08 financial year.

The bulk of the survey, a travel diary, is structured around the time, location and purpose of every out of home activity. Methods of travel used are collected as the links between these activities. Demographic information is also collected for each of the household members, including age, gender, employment status, study status, other activities and the relationship to others in the household.

VISTA 07 captures information about each individual 'trip-stage' made by respondents. For instance, a person's travel involving a drive to the station, a train to the city and a walk to work is recorded as three individual trip-stages. While the detailed travel chain remains available for analysis, the data is typically aggregated and analysed by 'trips' - the travel between main activities by a single (prioritised) mode. Using the above example, there would be one work trip, made by train. All analyses in this paper are conducted using the trip data, unless otherwise stated.

VISTA 07 thus allows complex dynamics of household travel and activities to be analysed in detail. Individuals' travel can be monitored across the day, and information analysed from the broader interpersonal and household contexts. As the survey covers all transport modes, travel by private transport can be compared directly with public transport and non-motorised trips.

Data collection is stratified and subsequently expanded according to the local government area of each household. Population estimates used in the data expansion process are obtained from the 2006 Census of Population and Housing. The survey is also administered in a similar way to the Census, with personal drop off and collection of forms wherever possible. Data is all self-reported.

VISTA 07 was conducted primarily to allow recalibration of the Melbourne Integrated Transport Model (MITM), the Department of Transport's in-house strategic demand model. The MITM is a multi-modal analysis tool which allows various transport infrastructure and land-use planning scenarios to be tested. Detailed information about VISTA 07, including summary results and the questionnaire used, is available online at [www.transport.vic.gov.au/vista](http://www.transport.vic.gov.au/vista). A second wave of VISTA data has recently been collected and will be released as VISTA 09 over the coming months.

The VISTA information is similar in many respects to the Victorian Activity and Travel Survey (VATS) previously conducted in Victoria (see RMIT University Transport Research Centre 1996). This paper makes some comparisons with the results based on the earlier data for Melbourne as presented in Morris *et al.* (1996). However, the significance testing reported in this paper is confined to cross-sectional variations in travel patterns in 2007, with a primary focus on the effects of gender and employment status.

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<sup>1</sup> In total, responses from 17,115 households were obtained in VISTA 07, yielding an overall response rate of 47%.

<sup>2</sup> Diary information includes cross-references to travel involving other individuals from within the household. Travel for children aged less than five years is therefore imputed from the diaries of other household members.

### Section 3. Contextual changes

Increased labour force participation by women has been linked to many highly significant economic and social changes; and, has in turn, far reaching consequences for many areas of society. Along with the increased participation of women in the workplace, changes have also occurred in the nature of work due to a major economic transformation of Australian cities which began in the 1970s, accompanying the shift to a post-industrial economy. Major changes in the structure of employment in Melbourne include: a decline and redistribution of manufacturing activity, with manufacturing jobs moving overseas or out to the city's edge; an increased office sector, with particularly strong increases in levels of employment in CBD-based financial and business services; and increases in community and personal services and construction activities (see O'Hanlon and Hamnett 2009; Victoria: Department of Planning and Community Development 2010).

Accompanying these significant changes in macro-factors, the character of many of Melbourne's residential areas has also been transformed. The central and inner areas have attracted increasing numbers of professional and middle class populations, at least since the 1970s (Colebatch 2000), or even earlier (Howe 2009). Many inner suburbs have been transformed 'from rundown working class neighbourhoods into popular and ...expensive' areas through the process commonly known as gentrification (Vedelago 2010). As the *Melbourne Atlas* attests, Melbourne's house and unit prices are highest in the inner and eastern suburbs; and the strongest price growth over the last thirty years has been recorded in inner and bayside suburbs (Victoria: Department of Sustainability and Environment 2007, Part 3.15).

At the same time, Melbourne's socio-demographics have been changing. As in other Australian cities, significant trends include: the ageing of the population; increasing levels of educational attainment (especially among women); a trend towards delaying child bearing; decreasing average household size; and significant increases in the proportion of single-person households. The presence of women in the workforce varies with occupational categories, but has been particularly strong in professional occupations and in clerical, sales and service occupations (Richardson, Morris and Loeis 1996).

By international standards, Australia has quite high levels of workforce participation. *The Intergenerational Report 2010* indicates that the total labour force participation for people aged 15 years and over in Australia grew strongly from 60.7 per cent in 1978-79 to 65.5 per cent in 2008-09, with particularly strong growth in women's labour force participation by older women aged between 55 and 64 years. In line with most OECD countries, the *prime age* participation rates for Australian women aged 15-54 years have also risen strongly, reaching 75 per cent in 2008 (some 4 percentage points higher than the OECD average of 71 per cent). By comparison, Australia's workforce participation rate for *all* people of traditional working age (aged from 15 to 64 years) was the tenth highest in the OECD in 2008, at 76.5 per cent (Commonwealth of Australia 2010).

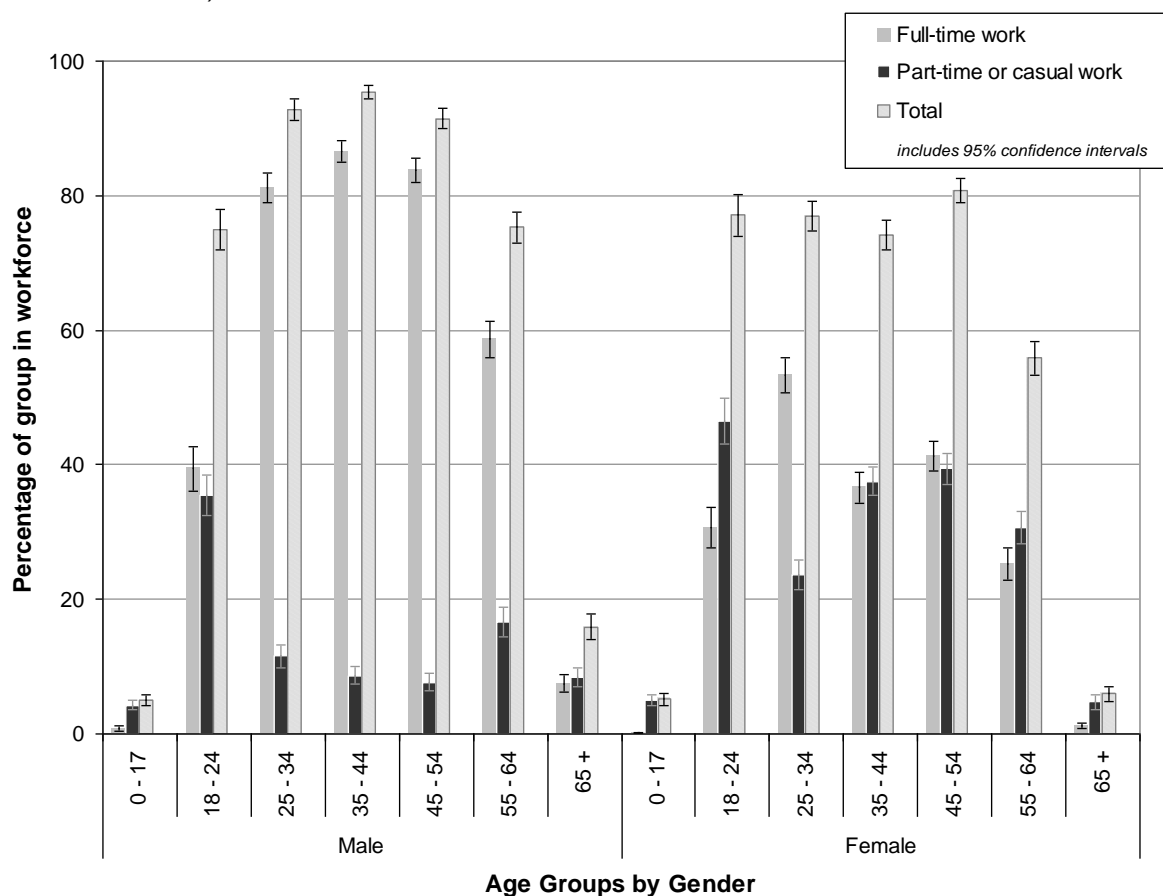
A summary of VISTA 07 data illustrates that these high workforce participation rates hold locally (Figure 1). Also visible is the shift in working arrangements once women reach 35 years of age, when flexibility sought around child and household responsibilities results in similar numbers of women working part-time as full-time. These work arrangements reflect the significant contribution that women continue to make to unpaid household work and the increased responsibilities associated with raising children.

Despite participating in the workplace in increased numbers, women overall have not compensated by reducing their work around the home. According to the Australian Bureau of Statistics (2009), women spent around the same amount of time on household work in 2006 as they had in 1992, with an average of 33 hours and 45 minutes per week devoted to unpaid work (such as cooking, cleaning, shopping and caring for children). While men are

doing slightly more household work than in the past, women still did around 1.8 times as much as men in 2006 (compared with twice as much in 1992). Moreover, the presence of children under the age of 15 years within households is shown to increase the amount of household work for both men and women, but most of the additional work continues to be taken up by women.

Changes in these macro- and micro- factors have important implications for travel behaviour and for infrastructure planning, including the evaluation and provision of transport (see Cavagnoli 2009; Cavagnoli and Norman 2008).

**Figure 1: Variations in workforce participation in Melbourne, by gender and age**  
(Source: VISTA 07)



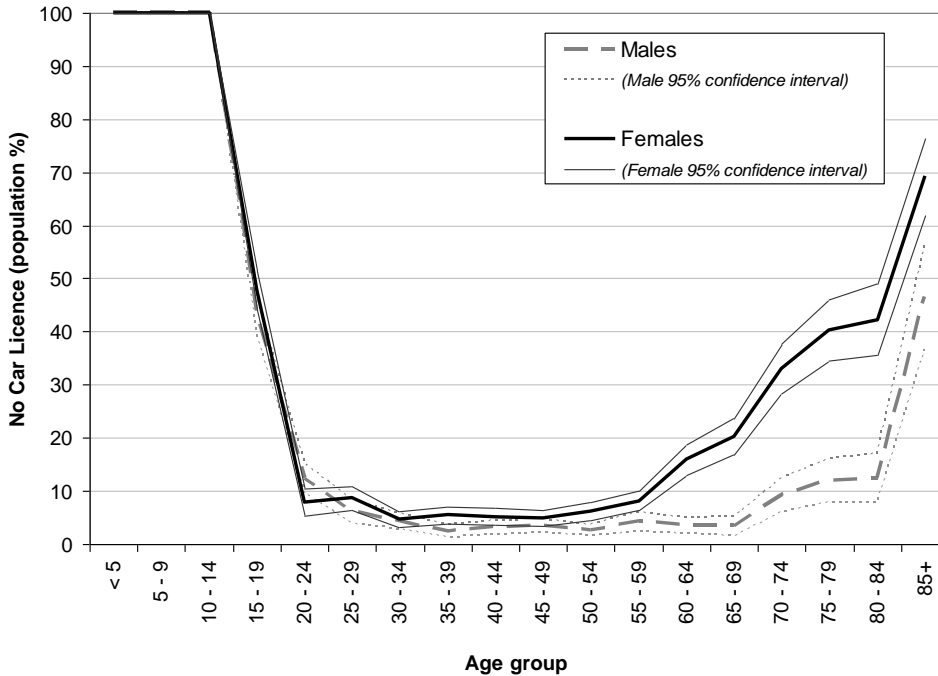
## Section 4. Travel patterns of working age men and women in Melbourne

Today's women of working age in Melbourne are highly mobile. Most women of working age hold a driver's licence, and, as Figure 2 shows, the levels of licence holding among men and women at comparable ages are almost identical within the age range of 20-60 years. In the current population, substantial differences in licence holding only emerge once people pass the age of 60 years, when the proportion of women without a licence is both higher and increasing at a faster rate than men. The reduced level of licence holding among older women is consistent with findings in other studies, both in Australia and overseas; and this reflects the fact that there is a significant proportion of women in older cohorts who never

learnt to drive (Rosenbloom and Morris 1998), as well as a tendency for older women to stop driving at an earlier age than men (Rosenbloom and Herbel 2009; Unsworth, Wells, Browning, Thomas and Kendig 2007).

**Figure 2: Proportion of males and females without a driver’s licence**

(Source: VISTA 07; MSD residents only; ‘Licence’ includes learner permit)



On weekdays, women of working age make more trips than men of comparable work status. As Table 1 shows, this holds true for women working full-time or part-time, and for those who are not employed (including those not in the labour force and those who are unemployed). Women working part-time make more weekday trips on average and have the highest trip rates overall (with 4.2 trips per weekday). Women working full-time have the next highest weekday trip rates (with 3.8 trips per weekday). By comparison, men who work full-time make 3.4 trips on average per weekday. Women who are not employed make fewer trips (with 3.2 trips per weekday) than other groups of women of working age, but they nonetheless travel more than men engaged in part-time or casual work and than their male counterparts not in the workforce.

**Table 1: Weekday Trip Rate**

(Source: VISTA 07; Weekday Trips; MSD residents aged 20-65)

Gender	Work Status			Total
	Full-time work	Part-time or casual work	Not employed	
Male	3.4	3.1	2.7	3.2
Female	3.8	4.2	3.2	3.8

All gender differences are significant at the  $\alpha=.05$  level; Cell relative standard errors are less than 25%.

Women who work part-time have quite different travel patterns from men or women who work full-time or who are not working. Women employed part-time or in casual jobs not only make more trips, but their weekday travel patterns are also more strongly oriented towards car travel than other population groups of working age (Table 2). Almost three-quarters of all trips made by women working part-time are made as car drivers, and close to 10 percent of

trips are made as car passengers. The share of travel undertaken by public transport is highest among men who work part-time or casually, but public transport usage is also relatively higher among people working full-time, especially women. Walking trip rates are substantially higher for males and females who are not employed, while for those in paid work, women appear more inclined to walk than men. Cycling is more likely to be undertaken by males than females, irrespective of employment status.

**Table 2: Mode use by gender and employment status (% of average weekday trips)**  
(Source: VISTA 07; Weekday trips; MSD residents aged 20-65)

Mode	Work Status					
	Full-time work		Part-time or casual work		Not employed	
	Male	Female	Male	Female	Male	Female
Vehicle Driver	<b>72</b>	<b>66</b>	<b>67</b>	<b>73</b>	58	64
Vehicle Passenger	<b>5</b>	<b>9</b>	8	9	<b>9</b>	<b>13</b>
Public transport	<b>9</b>	<b>11</b>	12	6	10	6
Walking	<b>9</b>	<b>13</b>	<b>9</b>	<b>10</b>	<b>20</b>	<b>16</b>
Bicycle	<b>3</b>	<b>1</b>	<b>2*</b>	<b>1*</b>	<b>3*</b>	<b>1*</b>
Other	1	1	<b>2*</b>	<b>0*</b>	1*	0*

Significant gender differences at the  $\alpha=.10$  level are displayed in bold.

\* Estimate has a relative standard error of 25% to 50% and should be used with caution

The comparatively higher levels of car driving on weekdays by women engaged in part-time or casual employment is consistent with earlier results obtained for Melbourne (Morris *et al.*1996). The explanation for this may well lie in the complexity of travel and activity patterns characterising the daily lives of women in paid employment, many of whom have significant responsibilities on the home front. For many women, increased participation in the workforce effectively places demands on their time over and above the many other roles that they assume over the life course. Such other roles have traditionally included rearing and raising a family and caring for older parents. Studying and assisting with the care of grandchildren are examples of other supplementary roles that may be assumed by working-age men and women.

On weekends, women of working age appear more inclined to assume the role of car passenger for a larger proportion of their travel when compared with weekdays (Table 3). This is reflected in higher vehicle occupancies for private travel on weekends, owing to a larger share of trips being made for social, recreational or shopping purposes, with friends, couples or families doing things together more often (Victoria: Department of Transport 2009). Public transport usage on weekends is comparatively lower for men and women than on weekdays, irrespective of employment status. The relative importance of walking as a travel mode appears to be similar on weekends and weekdays for most groups, except for men and women who are not employed (who walk less often on weekends than they do on weekdays).

Among those engaged in full-time work, the broad differences in travel patterns based on gender and employment status disguise some important variations between occupational groups (Table 4). For all occupational groups, car driving is clearly the dominant mode of travel. The highest levels of car driving are found among those working full-time as technicians, trades people, drivers and labourers, and this is especially true for men. Workers engaged full-time in community and personal services also demonstrate higher than average car usage (and at levels comparable with women working in part-time jobs across all occupations). The more dispersed pattern of workplaces and variability in place of work and in the timing of work shifts in the service sector are relevant factors that would appear likely to account for some of these differences.

**Table 3: Mode use by gender and employment status (% average weekend day trips)**  
(Source: VISTA 07; Weekend trips; MSD residents aged 20-65)

Mode	Work Status					
	Full-time work		Part-time or casual work		Not employed	
	Male	Female	Male	Female	Male	Female
Vehicle Driver	<b>70</b>	<b>57</b>	67	58	56	48
Vehicle Passenger	<b>13</b>	<b>25</b>	<b>13</b>	<b>27</b>	<b>17</b>	<b>37</b>
Public transport	3	4	<b>7*</b>	<b>2</b>	8*	4
Walking	10	13	9	10	16	10
Bicycle	<b>2</b>	<b>1*</b>	3**	1*	2*	0**
Other	2	1	1*	1*	0**	1**

Significant gender differences at the  $\alpha=.10$  level are displayed in bold.

\* Estimate has a relative standard error of 25% to 50% and should be used with caution

\*\* Estimate has a relative standard error greater than 50% and is considered unreliable for general use

**Table 4: Weekday mode use by Gender and Occupation (% of trips)**  
(Source: VISTA 07; Total trips made by MSD residents aged 20-65)

Occupation	Mode	Full-time work		Part-time or casual work	
		Male	Female	Male	Female
Managerial/ Professional	Vehicle Driver	68	64	66	73
	Vehicle Pass.	<b>4</b>	<b>9</b>	5*	8
	PT	11	10	<b>11</b>	<b>5</b>
	Walking	13	15	11	12
	Bicycle	<b>4</b>	<b>1*</b>	4*	1*
	Other	<b>1</b>	<b>1</b>	<b>3*</b>	<b>0*</b>
Sales, Clerical, Admin Workers	Vehicle Driver	65	66	66	73
	Vehicle Pass.	6	8	8*	10
	PT	15	13	<b>16</b>	<b>6</b>
	Walking	10	12	7*	9
	Bicycle	<b>3*</b>	<b>1*</b>	3*	0*
	Other	<b>1*</b>	<b>0*</b>	0**	1**
Technicians, Trades, Drivers, Labourers	Vehicle Driver	<b>81</b>	<b>71</b>	69	71
	Vehicle Pass.	<b>6</b>	<b>14</b>	11	11
	PT	5	7	10	9
	Walking	6	7*	7	8
	Bicycle	<b>2</b>	<b>0*</b>	1**	1**
	Other	1	1*	2**	0**
Community and Personal Service Workers	Vehicle Driver	74	75	67	76
	Vehicle Pass.	6*	7	6*	10
	PT	9*	6	<b>15</b>	<b>5</b>
	Walking	8*	11	9*	9
	Bicycle	2*	1*	1**	-
	Other	1**	1*	1**	0**

Significant gender differences at the  $\alpha=.10$  level are displayed in black.

\* Estimate has a relative standard error of 25% to 50% and should be used with caution

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Comparisons between these results and those obtained for Melbourne a decade or so earlier (Morris *et al.* 1996) are suggestive of some important changes occurring in mode usage. In particular it would seem that a shift in mode usage towards more 'sustainable' transport (public transport, walking and cycling) is evident among men and women working full-time in



professional occupations and in sales, clerical and administrative roles. This is indicated by comparatively lower levels of car usage (especially, as car drivers), increased patronage of public transport and more travel being made by cycling. These observations suggest that significance testing for temporal variations in travel patterns between these two time periods would be a useful extension to this paper.

Shifts in behaviour are considered to be important in helping to explain the unprecedented increases in public transport usage that have been observed in Melbourne over the past decade. Between 1996 and 2006, Melbourne witnessed an increase of approximately 35 per cent in the number of adults using public transport for their usual trip to work or study (Jelfs 2008). This is the biggest increase observed in any of Australia's capital cities. Over the past five or six years in particular, Melbourne has experienced a sudden and very strong growth in patronage of sustainable modes of transport (Webb and Gaymer 2009). Such a strong increase in public transport patronage is linked to increased residential growth, gentrification of Melbourne's inner city areas, changes in economic structure, a strong economy with near full levels of employment coupled with strong growth of CBD employment in the financial and business sector and government services, substantial increases in the relative costs of private car travel (through higher fuel prices and charges for CBD parking), significant increases in public transport investment and a stronger and more strategic focus on integrated land-use and transport planning. Attitudinal factors, such as increasing concern for the environment and concern for health and personal fitness are also indicated as being important factors underpinning the mode shift to public transport (Webb and Gaymer 2009). Work by Bell (2008) indicates the three main drivers of the patronage growth to be population growth, CBD job growth and petrol price increases; however, as Gaymer (2010) notes, a large proportion of the growth on metropolitan trains was not explained in the latter analysis and was, in fact, labelled as 'other factors'.

As can be seen in Table 5, variations in trip purposes – particularly in regard to picking up and dropping off others – lend some credence to dual or multiple roles being played by women who work part-time. The significant roles played by women in supporting and serving the needs of their families is also evident in the travel and activity patterns of women who are not engaged in paid employment. Certainly, chauffeuring tasks feature more significantly in the travel patterns of women who either work part-time or are not in paid work. The shorter trips made by these same groups of women (Table 6) also suggest that more of their activities are local in nature.

**Table 5: Weekday trip destination purposes by gender and employment (% of trips)**  
(Source: VISTA 07; MSD residents aged 20-65; Excludes travel back to home)

Destination Purpose	Work Status							
	Full-time work		Part-time or casual work		Not employed		Total	
	Male	Female	Male	Female	Male	Female	Male	Female
Work-related	<b>54</b>	<b>46</b>	<b>31</b>	<b>23</b>	2*	2	<b>46</b>	<b>28</b>
Education	0	0*	<b>7</b>	<b>3</b>	<b>8</b>	<b>3</b>	2	2
Buy something	<b>11</b>	<b>15</b>	19	19	30	28	<b>14</b>	<b>19</b>
Pickup/drop-off someone	11	12	<b>12</b>	<b>26</b>	<b>15</b>	<b>28</b>	<b>12</b>	<b>21</b>
Personal business	4	5	8	7	14	11	<b>6</b>	<b>7</b>
Social/recreational	16	17	17	17	24	22	17	18
Other	4	4	6	6	7	7	<b>4</b>	<b>5</b>

Significant gender differences at the  $\alpha=.05$  level are displayed in black.

\* Estimate has a relative standard error of 25% to 50% and should be used with caution

**Table 6: Travel time distribution by Gender and Employment Status - cumulative % of trips within time bands and average trip times**

(Source: VISTA 07; Weekday trips by MSD residents aged 20-65)

Travel Time*	Male Work Status				Female Work Status			
	Full-time	Part-time or casual	Not employed	Total	Full-time	Part-time or casual	Not employed	Total
0-15 mins	45	52	61	47	50	64	70	60
0-30 mins	71	75	82	73	76	86	89	83
0-60 mins	93	92	93	93	94	97	97	96
Average trip time	27.2	25.7	22.0	26.5	24.0	19.0	17.5	20.6
Median Trip time	20	15	15	20	15	14	10	15

\*Note that the percentages within each travel time range are cumulative

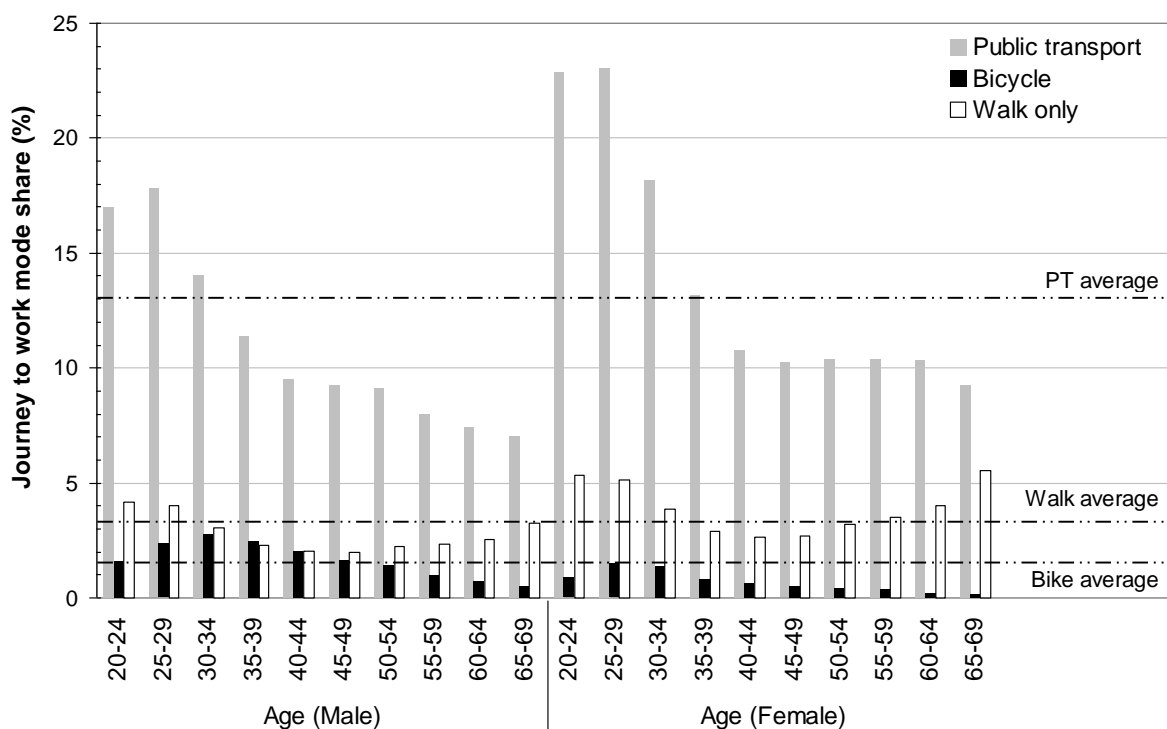
A slightly different view of travel emerges if work journeys are considered in isolation. Using data from the 2006 Census of Population and Housing compiled by the Australian Bureau of Statistics (ABS), it is evident that a higher proportion of women use at least one mode of public transport on their way to work compared to men, and this difference is consistent across all age groups (Figure 3). This difference is most striking for women aged 20-29, who report a public transport mode-share that is approximately 5 percentage points higher than their male counterparts. Walking is also comparatively more important for working women than men, whereas cycling is higher among working men.<sup>3</sup> Of interest, too, are the recently released results of an ABS survey of public transport usage which show a greater frequency of usage of public transport by persons aged 18-34 years than older age groups - and especially for those living in the inner areas of Melbourne comprising the Metropolitan Public Transport Zone 1 (Australian Bureau of Statistics 2009).

This may at first seem to contradict the findings based on VISTA 07 presented previously, which revealed strong use of the private vehicle by those women not in full-time work. However, direct comparisons cannot be strictly made. Figure 3 aggregates all workers together for the population at large and focuses on just one trip type: work. What this additional information does show is that there is a strong propensity for women to use public transport to access work, but for activities besides work, there are household pressures that require more flexible transport modes. For work journeys at least, it seems reasonable to conclude that working women are strongly underpinning the increases in public transport usage and walking. Working men are also an important market segment for these two modes, along with cycling.

<sup>3</sup> Confidence intervals are not shown in Figure 3 as values are obtained from the Census and therefore represent actual population estimates.

**Figure 3: Variations in weekday travel to work using public transport, cycling and walking, by age and gender**

(Source: Australian Bureau of Statistics, 2006 Census of Population and Housing: Journeys to work by usual MSD residents)



Differences between men's and women's travel patterns are even more readily apparent once employment status and level of labour force participation are taken into account. For women in particular, levels of workforce participation bear a close association with the presence of dependent children in households. As Table 7 shows, women working part-time are more likely to have dependent children.

**Table 7: Proportion of working aged women (aged 20-65), by work status and presence of children living at home**

(Source: VISTA 07; MSD residents)

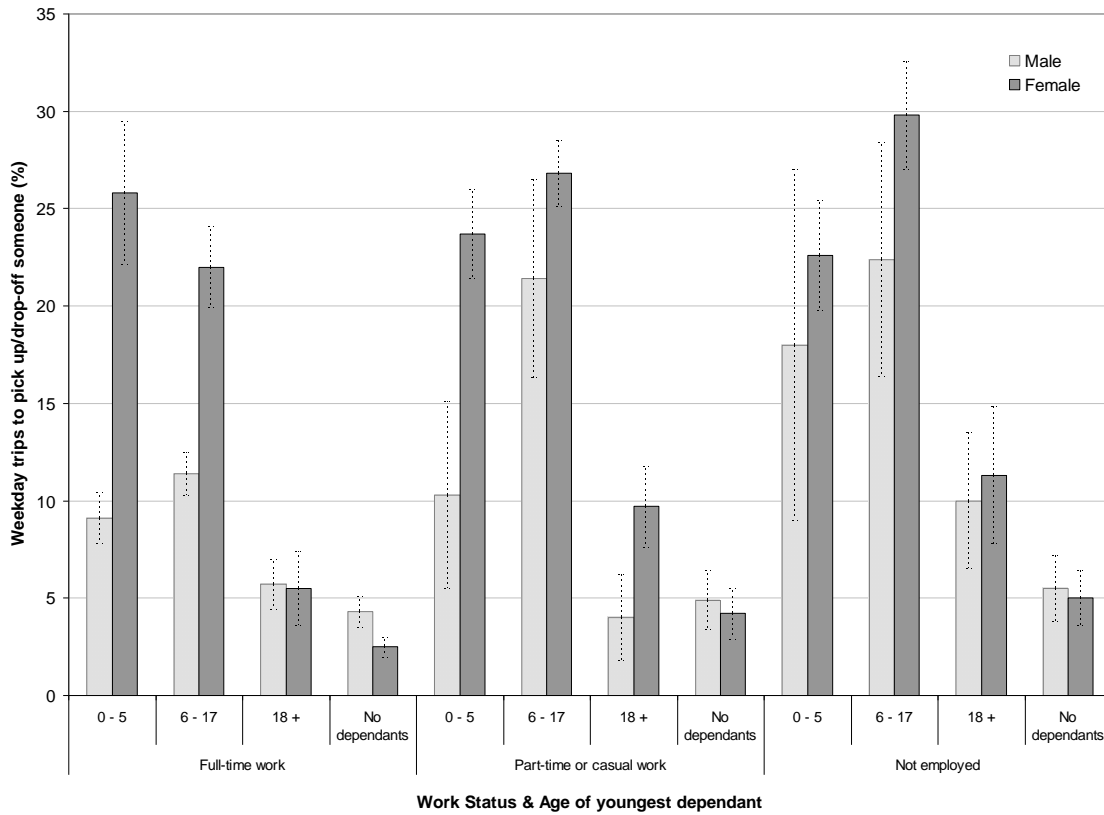
Children	Work status			Total
	Full-time work	Part-time or casual work	Not employed	
A) No children living at home	23.5	11.4	10.7	45.7
B) Children living at home	14.7	22.4	17.2	54.3
... by age of children				
0 - 5	2.5	6.8	7.6	16.9
6 - 17	6.9	10.3	5.4	22.6
18 +	5.4	5.3	4.2	14.8
<b>Total</b>	<b>38.2</b>	<b>33.8</b>	<b>27.9</b>	<b>100.0</b>

Differences between cohort groups A & B significant at the  $\alpha=0.05$  level; Cell relative standard errors are all less than 25%.

The combined effect of work status and dependants is clearly demonstrated in Figure 4, where chauffeuring travel is summarised. Women in all work arrangements are shown to undertake a significant passenger-servicing role when they have dependent children. It is noted that males who work part-time or are not employed also provide a substantial chauffeuring role, although a larger survey sample may reveal this to be at a typically lower level than women.

**Figure 4: Trips to pick-up or drop-off someone**

(Source: VISTA 07; Weekday travel; MSD residents aged 20-65; 95% confidence limits shown)



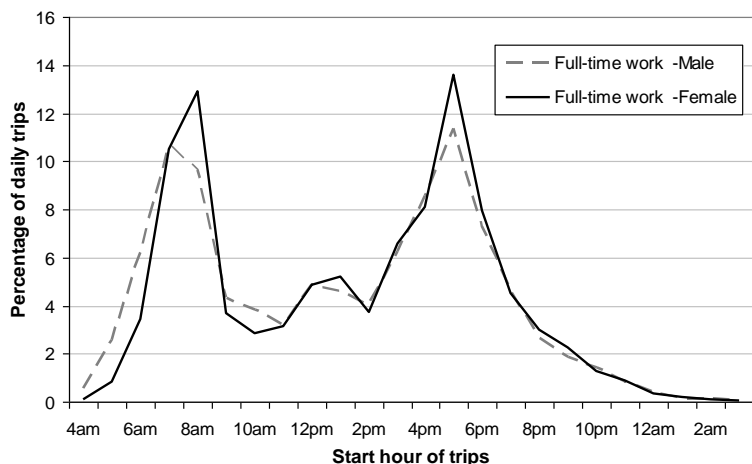
## Section 5. Variations in travel activity by time of day

As shown in Figures 5 to 8, travel and activity patterns also display interesting temporal variations. These figures are based on the same breakdown of gender and employment status employed in the previous section. It is readily apparent that women make more trips than men during the morning peak period, regardless of whether they are employed in full-time work or part-time work or are not employed. This is likely to reflect a range of travel tasks related to running the household, such as taking kids to school, university or college; providing lifts for other family members to train stations and bus stops; running household errands; or shopping for food and other goods. The amount of travel made in the evening peak by women who work full-time work is also slightly higher than is the case for men, but is broadly similar in most other respects (Figure 5). Men in full-time work, however, leave home earlier than their female counterparts, with their peak starting time occurring about one hour earlier.

In the afternoons, the peak level of travel activity occurs much earlier for women who either work part-time or are not in paid work, and this is presumably related closely to school finishing times (Figures 6 & 7).

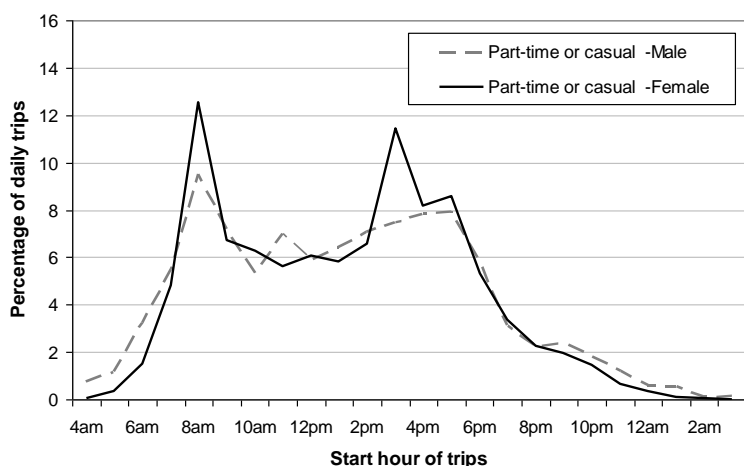
**Figure 5: Time of travel – Full-time workers**

(Source: VISTA 07; Weekday trips by MSD residents aged 20-65)



**Figure 6: Time of travel – Part-time and casual workers**

(Source: VISTA 07; Weekday trips by MSD residents aged 20-65)



**Figure 7: Time of travel – People of working age not employed**

(Source: VISTA 07; Weekday trips by MSD residents aged 20-65)

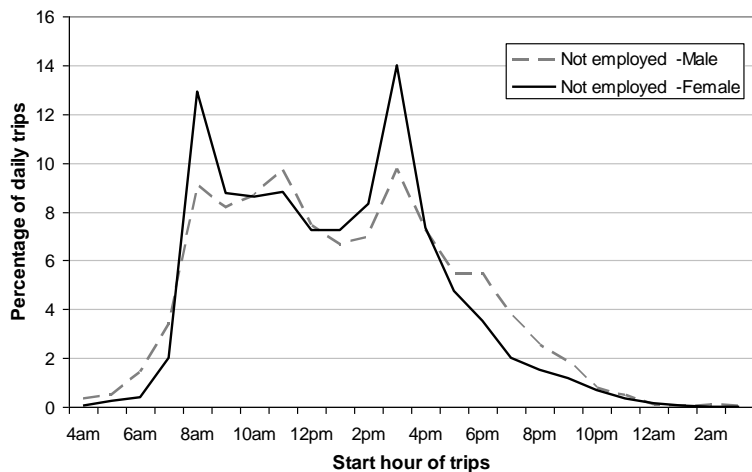
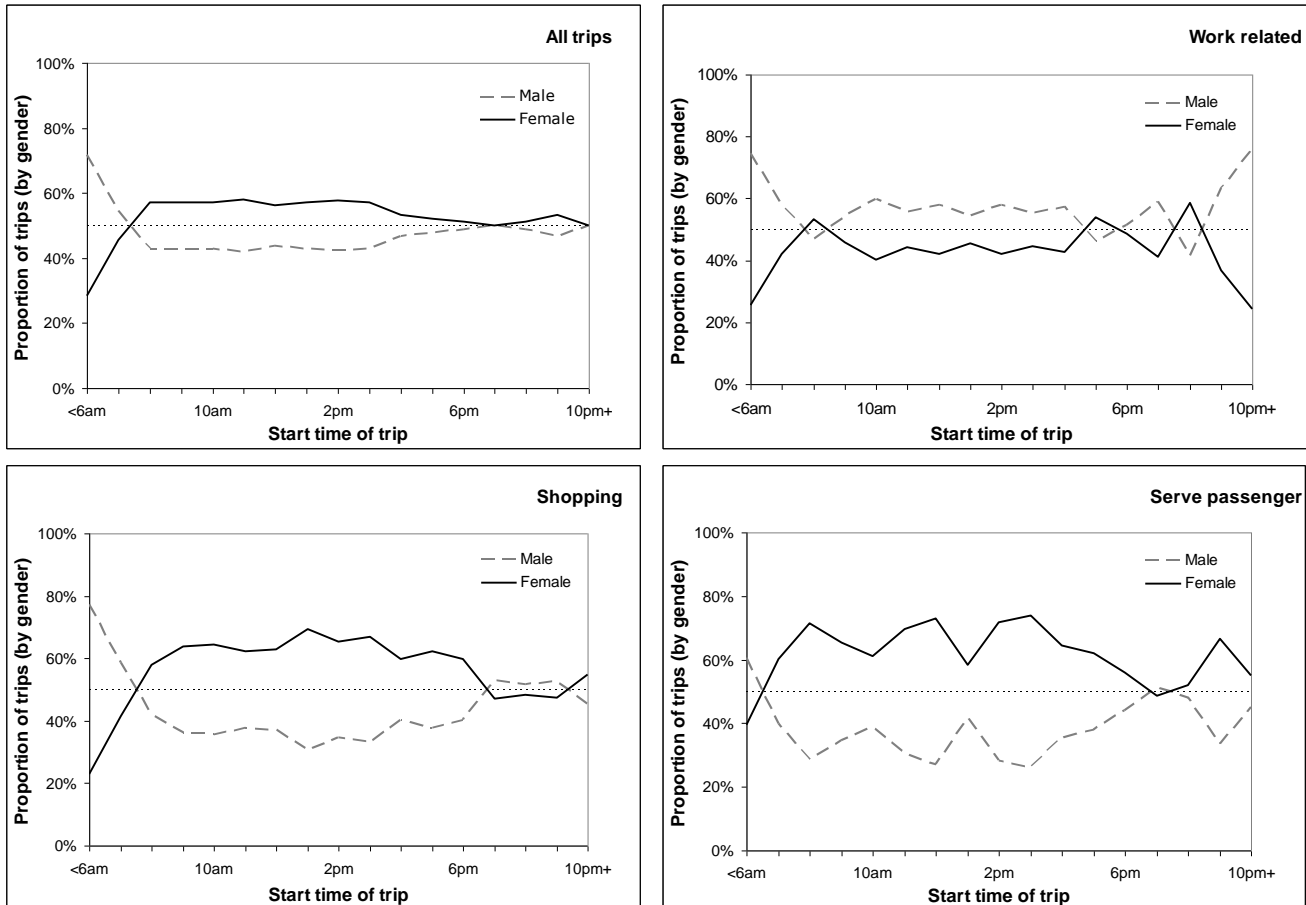


Figure 8 brings together information on the time and purpose of travel to compare the amount of trips being made by males and females at any given hour of the day on weekdays. It can be seen that apart from travel in the AM peak (and work-travel more generally), there are almost always more women than men travelling in Melbourne across the day.

**Figure 8: Gender differences relating to daily travel for different purposes**  
 (Source: VISTA 07; Weekday Trips; All MSD residents)



## Section 6. Transport Modelling

The previous sections have outlined distinct trip making characteristics based on a relatively small number of criteria: age, gender, work status, dependent children, time of day, travel purpose and day of the week. If complex transport network operations are to be planned for, and policy responses considered fully, some of these interactions would ideally be considered in standard transportation modelling tools.

Transport models are a systematic representation of the large and complex real-world transport system as it exists and as it might be. The application of transport models enables quantitative transport network performance measures (e.g. network travel times and operating costs, patronage levels) to be generated that act as key inputs to the project appraisal process.

Within Victoria, the in-house strategic transport model used for modelling non-commercial travel is the Melbourne Integrated Transport Model (MITM). The MITM is a multi-modal, multi-purpose, multi-period integrated transport model, capable of modelling demand for personal travel on both the highway network and the public transport network. It is based on the traditional four-step transport modelling process, which covers:

- trip generation and attraction;
- trip distribution;
- mode split; and
- trip assignment.

The MITM has recently been recalibrated and revalidated with the data from the Victorian Integrated Survey of Travel and Activity 2007 (VISTA 07); and can be used as a base from which more detailed models may be developed as required, provided appropriate refinement is undertaken and the associated level of input data is available.

There are already a number of MITM functions which allows some of the complex travel behaviours to be captured. For instance, the MITM models travel demand for the following three time periods: the morning peak (7:00am-9:00am); the inter-peak (9:00am-3:00pm); and the afternoon peak (3:00pm-6:00pm). If required, these time periods may be combined and factored to model daily traffic.

The MITM also models travel for eight home-based trip purposes (white and blue collar work, primary, secondary and tertiary education, shopping, recreation and other) and for six trip purposes for non home-based trips (work-based work, work-based shopping, work-based other, shopping-based-shopping, shopping-based other, and other non-home based).

The trip distribution module of the MITM enables trips from a particular origin to be distributed across all possible destinations based on observed trip-making characteristics and inter-zonal travel costs. Travel demands across metropolitan Melbourne for each of the fourteen travel purposes have been updated using calibrated trip distribution parameters from the VISTA 07 data.

Mode-split models have been developed for the fourteen MITM trip purposes, using a hierarchical binary logit model structure to split the total travel demand between motorised and non-motorised travel, with a further split of the motorised travel between private car travel and public transport travel. These models have been calibrated using the VISTA 07 data.

Currently, the MITM does not segment trips by gender, as it utilises trip generation and attraction rates based on assumed averages for metropolitan Melbourne. It could be argued that the use of the VISTA 07 data to segment trip rates by gender, by geography and by time of day, would enable the MITM to refine the modelling of trip distribution and mode choice and therefore better represent current travel across the transport network. Although, the amount of travel for different purposes is captured implicitly by the detailed trip purpose and travel time information in the model, refinements are worthy of consideration.

From a transport forecasting perspective, the overall 'amount of travel' for a certain purpose (eg. chauffeuring) is more easily incorporated into a model rather than detailed tracking of 'who made the travel'. There are also practical considerations here, with no clear projections of relevant socio-demographic factors (eg. how the share of unpaid household work will shift over the next 30 years). However, there would also be benefits to alternative modelling approaches that incorporate improved socio-demographic factors. Foremost amongst these, policy implications of transport investments could be more clearly linked to affected groups.

Understanding network usage changes at the individual or population segment level would also allow for more targeted interventions and mode-specific marketing to be made.

In relation to specific modal changes, the increased use of active transport modes may require considerable effort to model effectively within a strategic network model. In the current version of MITM, walking and cycling are not separated at the mode-split stage and not assigned to the network. Refinements to separate cycling and walking would firstly involve correct proportioning of the non-motorised travel at the local level. Understanding the amount of walking and cycling between different origin and destination zones would then require more comprehensive mode-specific surveys to be conducted.

Ultimately, it may be relatively easy to better represent the quantum of intra-zonal non-motorised trips. However, it is unlikely (and largely inappropriate) to then assign these trips to the existing strategic transport network. This is because the strategic models typically focus on arterial road networks, which only partially overlap with cycling routes. The interactions between motorised vehicles and bicycles are also not well understood from a route choice or travel cost trade-off perspective. Substantial increases in cycling mode-share (currently just under 2 per cent of all trips) would be required to justify the associated changes in the way the transport network is represented in a strategic transport model such as MITM.

## **Section 7. Conclusion**

The composition of the workforce in Australia has changed considerably over recent decades, reflecting the combined effects of continued increases in women's participation in paid work and changes in economic structure, that have accompanied the shift within major cities to post-industrial economies. Women's participation in the workforce is itself changing over time, as younger women enter the workforce (with experiences, expectations, qualifications and lifestyles that differ considerably from their mothers), coupled with the continued increase in the participation rates for mature age women. In part these changes reflect underlying societal changes in lifestyles and the nature of work, and changing expectations and social mores.

The growing complexity of travel in metropolitan Melbourne is illustrated clearly by the changing travel characteristics of women. Apart from travel to work, women make more trips than men at most other times of the day for all other broad categories of travel, and their travel patterns differ from men in a number of important respects. Gender-based differences in the travel and activity patterns of people of working age are strongly linked with employment status and level of participation in the labour force. These, in turn, are related to life stage (including the presence of dependent children in households).

Women with dependent children continue to play a significant role in the day to day running of households, despite their increasing work focus. Many working women with children or other domestic responsibilities seemingly balance the demands of their work and domestic spheres by placing limits on the hours spent in paid work, through engaging in part-time or casual employment. Private car travel appears to be an important 'enabler' for women in this regard, facilitating paid work to be combined with other roles related to rearing and raising children, keeping house, and so on. Given the tight time constraints and the chauffeuring demands facing many working women, travelling by private car may offer the only realistic transport option open to them for many out of home activities. Women who work part-time and/or have dependent children are shown to be particularly favourably disposed towards car travel, a response that (at least in part) is likely to be due greater household pressures associated with raising children.



By contrast, many younger women of working age appear to be increasing and extending their full-time participation in the workforce, and this increased workforce participation would seem to be a relevant factor contributing to the very strong growth in public transport usage in Melbourne in recent years. Staying in full-time work for longer is likely to be linked to other decisions, about whether or not to marry and when to do so, whether or not to have children and how many, and whether or not to outsource child care and other household work to enable an earlier return to work. For many women currently in the age group 25-34 years these decisions may not yet have been made, and hence it may be too early to tell whether these changes in workforce participation and mode usage will persist in years to come, or whether some of the recent lift in public transport patronage that we have observed in recent years is attributable to a one-off "cohort effect".

There is also tentative evidence of a shift towards the more sustainable modes of transport occurring among particular cohorts of the working-age population, with an increase in the usage of public transport, cycling and walking apparent among younger workers, and among those engaged in professional, managerial and 'white collar' occupations. These differences require more in-depth analysis and rigorous empirical testing but they may well prove to be important in helping to explain the quite dramatic increases in patronage in the sustainable transport modes in Melbourne over the past 5-6 years. The reasons for the unprecedented patronage growth in public transport are considered to be complex and not yet fully understood, but are likely to include underlying societal changes in lifestyles and the nature of work, changes in social expectations about gender roles, structural changes in the economy and the changing residential character of the city. Other underlying factors would also appear to be relevant, including substantially increased investment in sustainable transport modes, a stronger focus on integrated land-use and transport planning and changing preferences in response to perceived increases in the economic, social and environmental costs of travel (including higher fuel and parking costs for private motorised transport). Gaymer's (2010) work adds further weight to the role of attitudinal changes emphasising the importance of health and fitness and the environment. The extent to which these attitudinal shifts are related to cohort effects indicated in this paper, and whether these are contributing to temporary or permanent shifts in demand, are clearly of importance for forecasting and service planning.

Capturing these identified shifts into the formal transport modelling tools is recognised as challenging. Typically, strategic transport models, such as Victoria's MITM, rely on aggregate trip generation factors to be applied across detailed travel purposes. Individual gender differences, and broader household relationships, are not a standard feature of the typical four-step modelling process. Furthermore, adjustments to better describe non-motorised travel in strategic transport models would be unlikely to occur until cycling mode-shares increase substantially, due to the different travelling and network characteristics at play. Representation of such travel may be suited to a different type of model altogether.

The current use of strategic transport models is primarily aimed at providing overall trip generation and distribution calculations. Increased sophistication of models to incorporate identified gender differences would not necessarily alter the observable model outputs.

However, there are real changes occurring in the way we travel as a society, and a tension with how this behaviour is modelled. The use of strategic transport models, by definition, provides limited understanding of the nuances of personal travel changes. Amendments to modelling capabilities, incorporating the development of activity-based modelling, would improve policy outcomes by providing a wider perspective to assess the social impacts and distributional effects of changes to service provision.

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