Australasian Transport Research Forum 2011 Proceedings
28 – 30 September 2011, Adelaide, Australia
Publication website: http://www.patrec.org/atrf.aspx

30 years of travel in Melbourne: 1978/79 and 2007/08

Craig A. McGeoch

Arup Pty. Ltd.

201 Kent St, PO Box 76 Millers Point Sydney NSW 2000

Email for correspondence: craig.mcgeoch@arup.com

Abstract

This paper compares travel behaviour for Melbourne reported in the 1978/79 Melbourne Home Interview Travel Survey and the Victorian Integrated Survey of Travel and Activity, conducted some 30 years later in 2007/08.

Key behavioural indicators used in transport planning analysis are examined and compared, including weekday peak period and all-day travel by mode, travel generation rates, trip length frequencies, average trip lengths and public transport mode share by time of day and purpose.

The outcomes provide useful insights into the travel patterns and behaviours of Melbournians that are of relevance in transport planning and policy analysis.

They may be further considered in the context of land-use, demographic, transport network development and transport policy impacts that have occurred in Melbourne over this 30 year period, and the influences that these have had on travel. Of interest are not only the changes in travel behaviour, but also those behaviours that have remained stable.

1. Introduction

The planning of transport policy and infrastructure for cities requires an understanding of the current personal travel behaviours of residents. But just how much does travel behaviour change over time? Can historical information reveal anything about the influences of city form, social structure and the effectiveness of transport policies on our travel behaviours?

The most effective way for transport planners to gather an accurate description of the travel behaviour of people living in an area is by the conduct of a household travel survey (TUTI, 2009). Surveys of this type have been conducted in major Australian cities for many years. This paper compares travel behaviours for Melbourne as reported in the 1978/79 Melbourne Home Interview Travel Survey and again in the Victorian Integrated Survey of Travel and Activity, conducted 30 years later in 2007/08.

The survey area for both the 1978/79 and 2007/08 surveys was the Melbourne Statistical Division, as defined at the time of the survey. Over this 30 year period, the boundaries of the MSD expanded eastwards and household and population numbers grew, however trip making by Melbourne residents grew at an even greater rate, although not for all travel modes.

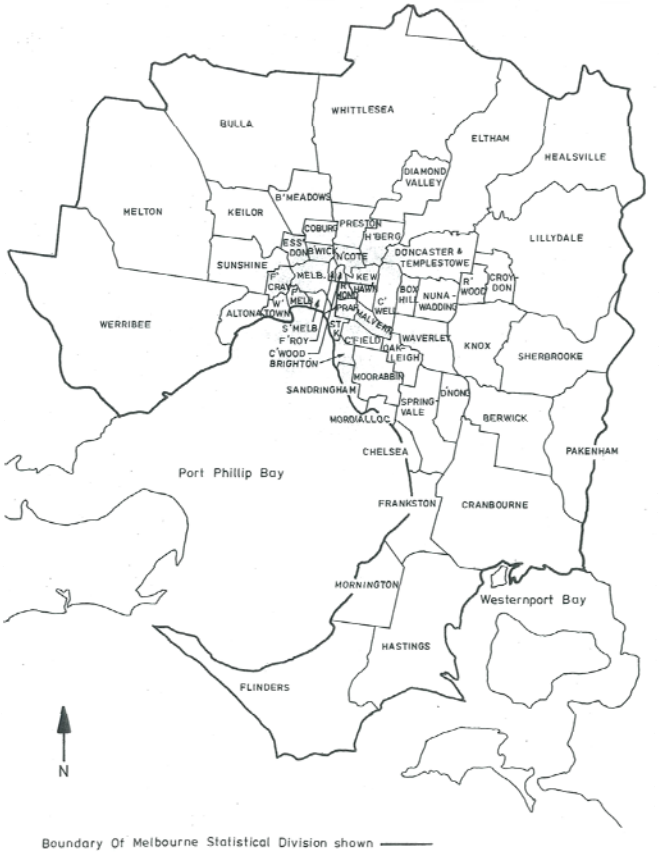
While trip making grew substantially, there was relatively minor occurrence of ‘peak spreading’ over the 30-year period, and trip length frequencies were relatively stable, however there were some changes in average trip lengths for certain modes. The share of motorised travel by public transport decreased in both morning and afternoon peak periods and also over the whole day.

2. The 1978/79 and 2007/08 surveys

2.1 1978/79 Melbourne home interview travel survey (HIS78)

The 1978/79 Melbourne Home Interview Travel Survey was conducted over the period July 1978 – May 1979 for the then Victorian Ministry of Transport. The purpose of the survey was "to obtain data on personal travel habits and associated personal characteristics for residents of domestic households in the Melbourne Statistical Division" (MoT, 1981a). The Melbourne Statistical Division was then defined by ABS 1976 census boundaries. The survey area of the 1978/79 survey is shown in Figure 1.

Figure 1. 1978/79 Melbourne Home Interview Travel Survey – 1976 Melbourne Statistical Division and Local Government Areas Surveyed (Ministry of Transport, 1981)



Survey respondents were asked to complete details of all trips made by persons older than four years of age in the household from 4:00am on the previous day (the 'travel day') to 4:00am on the day of the survey interview.

Interviews were conducted by interviewers visiting survey households on Tuesdays to Saturdays only, so as to collect information on travel for 'average weekdays' excluding weekends and public holidays. As such the HIS78 data represent travel on "typical weekday travel movements" only[1].

The number of household interviews successfully completed across the 56 municipalities within the MSD of that time was 11,387.

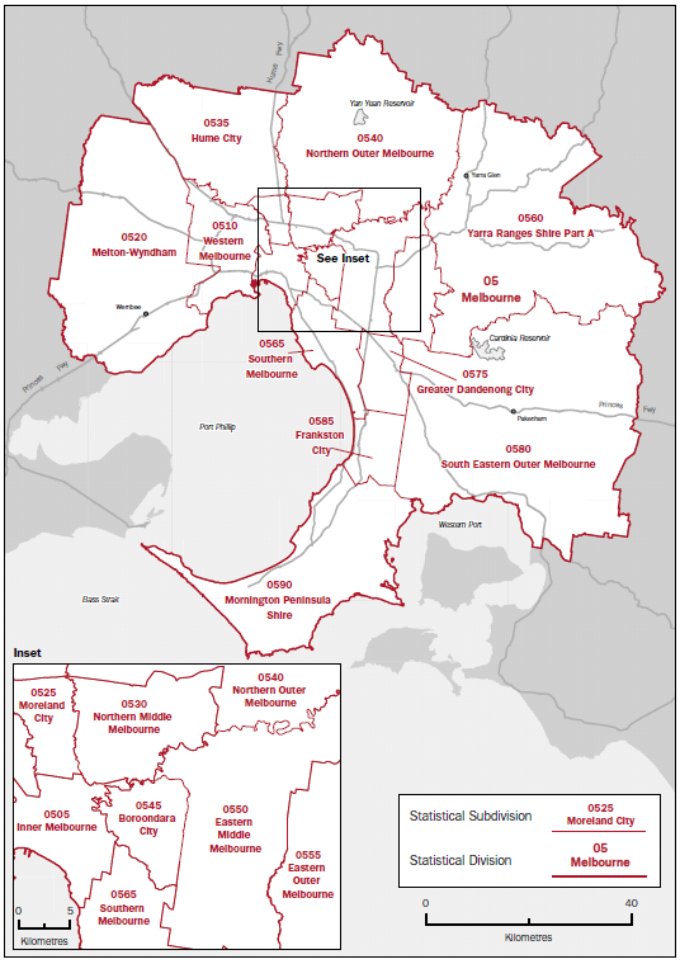
[1] Also as part of the 1978/79 survey, individuals in households willing to assist in future transport studies were asked to complete a mail-back questionnaire on weekend travel. The number of forms returned to the Ministry was 5,613 (MoT, 1981b). These data were not coded or analysed at the time of MoT's reporting and were not available for the analysis of this paper.

2.2 Victorian integrated survey of travel and activity (VISTA07)

The VISTA07 was undertaken to obtain a primary source of information for the development of transport analysis tools and models for personal travel, and to understand and quantify travel behaviour in major urban centres in Victoria (TUTI, 2009).

The VISTA07 was undertaken from May 2007 – June 2008. It surveyed 17,100 households in Metropolitan Melbourne, Greater Geelong, Ballarat, Bendigo, Shepparton and Latrobe, of which 11,400 households were in the Melbourne Statistical Division, as defined by ABS 2006 census boundaries. The MSD boundaries for 2006 expanded from those of 1976 to the east (however not to the west, south or north), encompassing additional areas of the Yarra Ranges and Cardinia. The 2006 MSD boundaries are shown in Figure 2.

Figure 2. 2006 Melbourne Statistical Division (Australian Bureau of Statistics, 2006)



All members of surveyed households were asked to fill in a travel diary for one specified day of the year, with survey staff dropping off and later collecting the self-completed travel diaries (DoT, 2009).

Survey respondents were asked to complete details of all trips made by persons older than four years of age in the household from 4:00am on the previous day (the 'travel day') to 4:00am on the day of completing the survey.

The VISTA07 collected details of travel on weekdays and weekend days.

The period between these two surveys spans a time of significant social and demographic structural change, which saw increases in incomes, participation of women in the workforce,

car ownership, education rates etc., which all had impacts on travel behaviour. This paper presents observations on the changes in travel behaviour that are observed in the data, but does not attempt to provide explanatory models relating changes in travel to these social and demographic changes.

2.3 Sample summary and statistics

As the HIS78 collected data on weekday travel only, all of the analyses and comparisons presented in this paper were derived from examination of the weekday data from VISTA07. The results presented in this paper relate to average weekday travel only, and exclude weekend travel for which information was not available from the HIS78 data.

Table 1 shows a summary of the HIS78 and VISTA07 weekday survey samples. The 'estimated' results refer to outcomes that are obtained from application of the relevant weighting factors for households and persons, computed by expansion of the survey sample against stratified categories for households and population by Local Government Area.

Table 1. Survey sample summary statistics, weekday travel in MSD

	HIS78		VISTA07		Change in Weighted Estimate
	Sample	*Estimated*	*Sample*	*Estimated*	
Households – MSD	11,387	848,452	8,327	1,279,018	+51%
Residents	34,475	2,577,627	21,710	3,593,169	+39%
Residents 5 years and older	31,948	2,380,061	20,431	3,368,428	+42%
Average household size	3.03	3.04	2.61	2.81	-8%
Average vehicles per household[1]	1.21	1.19	1.69	1.63	+37%
Number of persons making trips	27,251	2,011,287	17,671	2,900,512	+44%
Number of unlinked weekday trips	99,937	7,365,454	76,961	14,125,478	+92%
Number of linked weekday trips	89,542	6,554,790	64,286	11,609,122	+77%
Number of linked weekday motorised trips	73,808	5,388,871	55,382	9,853,686	+83%

1: excluding motorcycles and trucks

While a total of 11,432 households within the MSD were sampled in VISTA07, this being around the same number of households for HIS78, a subset 8,327 of these reported on weekday travel and were hence used for the comparisons of this paper.

Between 1978/79 and 2007/08, the weighted estimate of households within the MSD increased by 51% and the weighted estimate of residents within the MSD increased by 39%, giving a decrease in average household size. The weighted estimate of linked trips made by persons within the MSD increased by 77%.

2.4 Linked trips, unlinked trips and mode priorities

Table 1 provides a summary of the number of 'unlinked' and 'linked' trips from each of the surveys. An unlinked trip is defined as travel from one place to another without changing the method of travel and without changing the number of persons in the vehicle. For example, a journey from home to the city by car and train would be reported as two unlinked trips – a car unlinked trip from home to the railway station and a train unlinked trip from the station to the city. The purpose of the car unlinked trip is described as 'to change mode of travel'.

The trip information collected in home interview surveys is in the form of 'unlinked' trips. In traditional transport modelling analyses, these trips are converted to 'linked' trips in order to

gain an understanding of overall travel patterns and purposes[2]. This is done by deleting those trips with the trip purposes 'to change mode' and incorporating the trip information relating to the appropriate unlinked trips into data describing one linked trip. For the example above, the two unlinked trips would be converted to one linked trip with the mode 'train' and the purpose of travelling to the city. The origin of the linked trip would be home and the destination would be the city.

This linking depends on assigning the main mode of the trip according to a set hierarchy or priority of modes. The HIS78 and VISTA07 originally used a different basis of mode priorities to develop linked trip files. In order to provide consistency for comparisons between the two data sets, the HIS78 unlinked trips data were re-processed for this analysis using the VISTA07 mode priority conventions (Appendix A) to obtain a 'new' linked trips file.

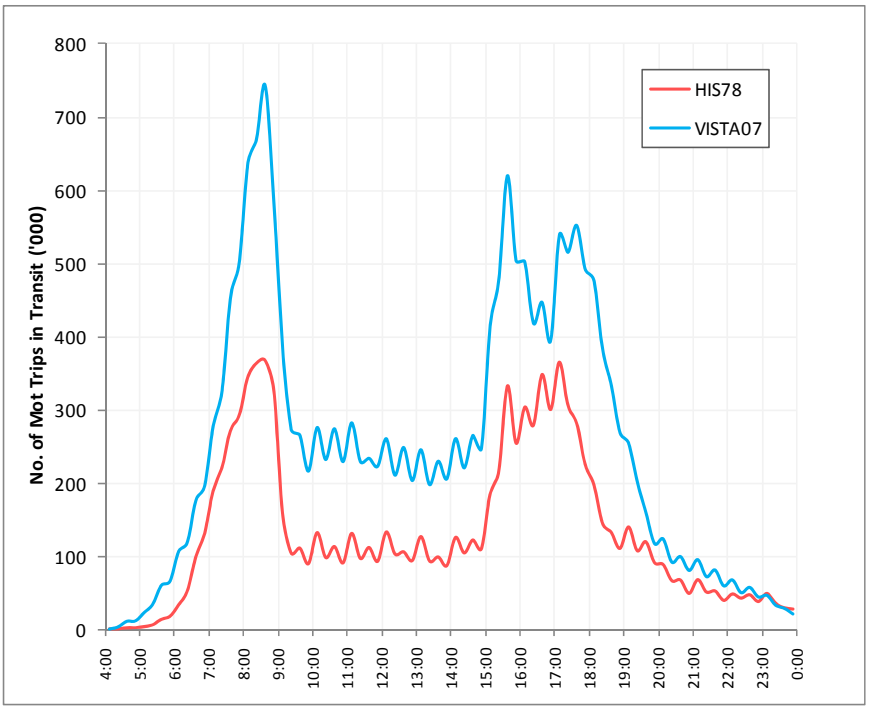
Unless directly annotated otherwise, all data presented in this paper are derived from analysis of weighted estimates of linked trips based on VISTA07 mode priority conventions.

3. Travel peaks

3.1 Peak periods by mode

A key element of the analysis was identifying the characteristics of travel in peak demand periods, first of all identifying when these occur. Travel peaks were identified by accumulating all (linked) trips commencing within or finishing within or spanning time period bins. This is referred to as 'trips in transit' and represents a measure of the travel demand load on the transport network. Figure 3 shows the pattern of motorised trips by all persons in transit (i.e. including persons travelling by private car as driver or passenger and by public transport modes, but excluding motorcycle, walk and bicycle modes) in the MSD in 1978/79 and 2007/08, accumulated by 15 minute time period bins.

Figure 3. Weekday MSD motorised person trips in transit by quarter-hour, HIS78 and VISTA07



[2] eg this is the current practice for the Melbourne Multi-Modal Strategic Travel Model (MITM) maintained by the Victorian Department of Transport, and is thus the relevant approach for the analysis of this paper. Some other recent modelling practices focus instead on trip 'tours' or 'activities' eg refer to Milthorpe and Daly (2010).

Figure 3 illustrates that there has been substantial growth in the number of persons travelling by motorised modes on the Melbourne network from 1978/79 to 2007/08. Peak 15-minute motorised travel loads on the network in the AM and inter-peak periods have doubled, with growth in PM peak loadings being only slightly lower. Two distinct PM peaks have appeared in 2007/08, these being at around 3:30pm, associated with school finishing time, and the traditional work finish period of 5:00-6:00pm.

One-hour and two-hour morning and afternoon travel peaks were identified by accumulating trips commencing within, finishing within or spanning one-hour and two-hour time period bins stratified across 15-minute time intervals. Table 2 shows the one-hour and two-hour AM and PM peak periods by mode.

Table 2. Peak demand periods by mode, MSD weekday trips

Mode	1-hr AM		2-hr AM		1-hr PM		2-hr PM	
	HIS78	*VISTA07*	*HIS78*	*VISTA07*	*HIS78*	*VISTA07*	*HIS78*	*VISTA07*
Car	8:00-9:00	8:15-9:15	7:15-9:15	7:45-9:45	16:15-17:15	15:15-16:15	15:15-17:15	15:15-17:15
Train	7:15-8:15	7:45-8:45	6:45-8:45	7:15-9:15	16:15-17:15	16:45-17:45	15:45-17:45	16:15-18:15
Tram	7:45-8:45	7:45-8:45	7:15-9:15	7:15-9:15	16:15-17:15	17:00-18:00	15:15-17:15	16:45-18:45
Public Bus	7:45-8:45	7:45-8:45	7:15-9:15	7:15-9:15	15:45-16:45	15:15-16:15	15:15-17:15	15:15-17:15
School Bus	8:15-9:15	8:00-9:00	7:45-9:45	7:45-9:45	15:15-16:15	15:15-16:15	14:30-16:30	14:30-16:30
Motorised	**8:00-9:00**	**8:00-9:00**	**7:15-9:15**	**7:45-9:45**	**16:15-17:15**	**15:15-16:15**	**15:15-17:15**	**15:15-17:15**
Bicycle	8:00-9:00	7:45-8:45	7:15-9:15	7:15-9:15	15:15-16:15	17:00-18:00	15:00-17:00	17:00-19:00
Walk	8:00-9:00	8:15-9:15	7:15-9:15	8:15-10:15	15:00-16:00	15:00-16:00	14:45-16:45	15:00-17:00

Notes: Car includes car driver and car passenger trips, excludes taxi
Motorised excludes motorcycle trips, includes taxi

The table shows that the peak travel demand periods are at different times for each mode and that those who travel by car typically do so later in the morning than those who travel by public transport modes.

The one-hour morning peak period has not changed substantially for any mode between 1978/79 and 2007/08 with the exception of train travel, which has moved to a later time. The two-hour morning car peak has moved to a later time, which strongly influences the motorised modes peak.

The PM peak is more widespread than the AM in both 1978/79 and 2007/08, and over this time has separated into more distinct school and work related one-hour peaks, although the overall two-hour motorised peak time period has not changed.

3.2 Travel by time of day and mode

The number of person trips in transit by mode and peak period in 1978/79 and 2007/08 is shown in Table 3. The figures for each mode are derived for to the two-hour peak periods identified in Table 2.

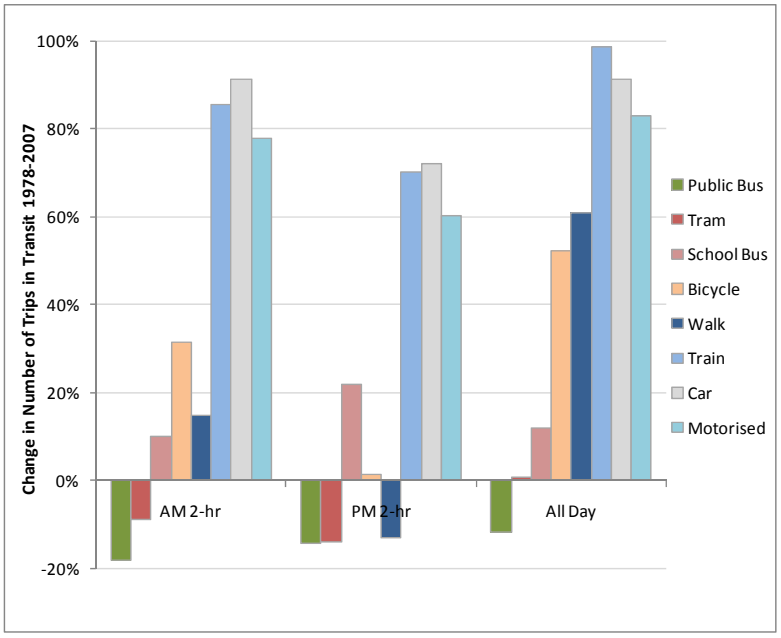
Table 3. Weekday weighted MSD person trips in transit (000's) by mode and period, HIS78 and VISTA07

	AM 2-hr			PM 2-hr			All Day		
	HIS78 AM	*VISTA07 AM*	*Δ AM*	*HIS78 PM*	*VISTA07 PM*	*Δ PM*	*HIS78 Day*	*VISTA07 Day*	*Δ Day*
Car	968.7	1,852.1	+91%	1,100.8	1,894.4	+72%	4,578.9	8,757.7	+91%
Train	113.8	211.2	+86%	114.7	195.2	+70%	296.4	588.5	+99%
Tram	64.3	58.6	-9%	65.2	56.1	-14%	211.9	213.8	+1%
Public Bus	54.3	44.4	-18%	65.7	56.4	-14%	182.3	160.8	-12%
School Bus	35.5	39.0	+10%	38.6	47.0	+22%	83.6	93.6	+12%
Motorised	**1,237.7**	**2,201.1**	**+78%**	**1,377.8**	**2,208.6**	**+60%**	**5,388.9**	**9,853.7**	**+83%**
Walk	304.6	349.2	+15%	354.1	308.5	-13%	944.0	1,517.1	+61%
Bicycle	43.0	56.5	+32%	46.8	47.3	+1%	121.3	184.8	+52%

Notes: Car includes car driver and car passenger trips, excludes taxi
Motorised excludes motorcycle trips, includes taxi

Figure 4 illustrates the scale of change in trips in transit by mode and period from 1978/79 to 2007/08.

Figure 4. Change in Weighted Weekday Trips in Transit by Mode and Period, HIS78 to VISTA07



These outcomes show that person travel by car and train has grown strongly over this time, increasing over 80% in the two-hour AM peak and almost doubling on a daily basis. Tram travel has decreased in peak periods but remained steady on a daily basis. One explanation for this may be that the substantial increase in car travel has had impacts on tram operations, affecting the ability of trams to accommodate patronage growth in peak periods. Public bus travel has decreased, while school bus travel has increased. Walk and bicycle trips increased in the morning peak and on a daily basis, however there were fewer walk trips in the two-hour PM peak.

3.3 Peak period 'severity'

The peak period 'severity', measured as the proportion of all-day travel that occurs in the peak period, is also of interest and is shown in Table 4.

Table 4. Peak period severity by mode, MSD weekday trips

% of daily trips	1-hr AM		2-hr AM		1-hr PM		2-hr PM	
	HIS78	*VISTA07*	*HIS78*	*VISTA07*	*HIS78*	*VISTA07*	*HIS78*	*VISTA07*
Car	14%	15%	21%	21%	14%	13%	24%	22%
Train	32%	30%	38%	36%	29%	24%	39%	33%
Tram	25%	19%	30%	27%	21%	18%	31%	26%
Public Bus	23%	23%	30%	28%	25%	30%	36%	35%
School Bus	38%	39%	42%	42%	41%	47%	46%	50%
Motorised	**15%**	**16%**	**23%**	**22%**	**15%**	**14%**	**26%**	**22%**
Bicycle	30%	21%	35%	31%	29%	15%	39%	26%
Walk	29%	16%	32%	23%	31%	14%	38%	20%

The peak periods of Table 4 correspond to the individual peak periods for each mode and survey year (from Table 2), and not to a common period. The table shows that travel by car remains more evenly spread throughout the day than that by public transport, with a lower proportion of total daily car travel occurring in the car peaks.

Generally, most modes have seen some reduction in peak severity, indicating some 'peak spreading', although the reductions are typically minor. The most significant reductions in peak period concentrations of travel are for bicycle and walk modes. One reason for this may possibly be a reduction in walking and cycling to school; it was seen in section 3.2 that school bus travel has increased over the period.

4. Trip purpose

The reasons people travel are important as trips for different purposes will have different characteristics. Table 5 and Table 6 show the proportions of motorised trips made by period and destination purpose for HIS78 and VISTA07. The purpose classifications differed slightly for each of the surveys, however broad comparisons between the two survey outcomes are possible.

Table 5. Motorised trip proportions by time period and destination purpose, weekday MSD trips HIS78

Period	Destination Purpose									
	Home	*Work*	*Education*	*Empl Bus*	*Pers Bus*	*Shopping*	*Recreation*	*Medical*	*Serve Pass*	***Total***
07:15 - 09:15	5.5%	36.6%	32.7%	6.4%	3.2%	2.0%	1.0%	0.6%	12.0%	**100%**
15:15 - 17:15	70.5%	1.6%	0.4%	2.8%	5.5%	6.9%	3.5%	0.5%	8.3%	**100%**
04:00 - 28:00	40.6%	13.6%	8.7%	5.2%	7.8%	8.4%	5.8%	1.0%	8.9%	**100%**

Table 6. Motorised trip proportions by time period and destination purpose, weekday MSD trips VISTA07

Period	Destination Purpose								
	Home	*Work*	*Education*	*Pers Bus*	*Shopping*	*Recreation*	*Serve Pass*	*Other*	***Total***
07:45 - 09:45	9.7%	34.2%	19.0%	6.5%	6.7%	10.4%	13.4%	0.1%	**100%**
15:15 - 17:15	60.6%	3.9%	0.6%	4.9%	8.5%	11.5%	9.9%	0.1%	**100%**
04:00 - 28:00	37.2%	16.6%	5.0%	6.7%	10.5%	15.0%	8.9%	0.1%	**100%**

Of interest is that peak period travel is not necessarily dominated by trips having work as the primary purpose. In both 1978/79 and 2007/08 just over one-third of motorised linked trips in the AM peak had work as the primary destination purpose. In the PM peak, the significant destination purpose in both 1978/79 and 2007/08 was home.

This is of importance in that the analysis of journey-to-work data collected as part of the ABS Census (these are collected for the Census day, and not stratified by time of day) needs to consider that work-related trips comprise only a smaller fraction of motorised travel that occurs in a typical weekday, and are thus not necessarily representative of overall travel patterns.

5. Travel generation

5.1 Trip rates

Trip rates are commonly used in transport planning and modelling work to determine the likely travel generation impacts of new developments, population growth etc. Trip rates are normally related to income levels, and car trip rates to car ownership.

In order to identify the travel generation rates directly related to a particular peak period, as would be required for transport impact or modelling analysis, travel generation was calculated from the number of trips starting or finishing within time periods, and not including trips spanning the period.

Table 7 shows total and motorised trip rates by motorised trip peak period for persons and households in 1978/79 and 2007/08.

Table 7. Trip rates by motorised trips peak period, MSD weekday trips HIS78 and VISTA07

Motorised Trips Peak	Period	Trips per Household		Motorised Trips per Household		Trips per Person		Motorised Trips per Person	
		HIS78	*VISTA07*	*HIS78*	*VISTA07*	*HIS78*	*VISTA07*	*HIS78*	*VISTA07*
AM 1-hr	08:00 - 09:00	1.36	1.40	0.98	1.20	0.45	0.50	0.32	0.43
AM 2-hr (1)	07:15 - 09:15	1.90	1.99	1.46	1.71	0.62	0.71	0.48	0.61
AM 2-hr (2)	07:45 - 09:45	1.77	2.02	1.34	1.72	0.58	0.72	0.44	0.61
PM 1-hr (1)	15:15 - 16:15	1.26	1.22	0.86	1.03	0.42	0.43	0.28	0.37
PM 1-hr (2)	16:15 - 17:15	1.03	0.97	0.93	0.88	0.34	0.35	0.31	0.31
PM 2-hr	15:15 - 17:15	2.09	1.99	1.62	1.72	0.69	0.71	0.53	0.61
All Day	**04:00 - 28:00**	**7.73**	**9.08**[3]	**6.35**	**7.70**	**2.54**	**3.23**[4]	**2.09**	**2.74**

Notes: Motorised trips excludes motorcycle trips

The rates shown in Table 7 relate to the motorised trip peak periods shown in Table 2. It is interesting to note that the motorised trips generation peak does not always correspond to the total trips generation peak (i.e. the peak including motorcycle, walk and bicycle trips). This is evident in the PM peak results for HIS78; the one-hour motorised trips generation peak is from 4:15-5:15pm, and the motorised trip rates by household and person are higher for this period than for the 3:15-4:15pm period, however the total trips generation rate per household and person are lower than for 3:15-4:15pm.

Table 7 shows that AM peak and all-day household and person trip rates have grown from 1978/79 to 2007/08, magnifying the growth in person travel during these periods that resulted from population growth alone. PM peak trip rates have not increased at the rate of AM and daily rates, and this corresponds with the relatively lower growth in PM network travel loadings.

Note however that these results are for two time-point estimates, and in themselves do not demonstrate that trip rates increase monotonically over time. Analysis of data from other survey years is necessary to determine trends for projections of future changes in trip rates.

This outcome nonetheless has important implications for transport modelling analyses. In conventional transport models, trip rates are commonly assumed to be fixed as a function of

[3] cf a value of 10.15 trips per household on weekdays (all modes) for the Sydney Statistical Division, from 2007 Sydney Household Travel Survey (TDC, 2009)

[4] cf a value of 3.81 trips per person on weekdays (all modes) for the Sydney Statistical Division, from 2007 Sydney Household Travel Survey (TDC, 2009)

zonal land-use and demographic quanta. These outcomes indicate that trip generation rates do vary over time.

5.2 Trip length frequency

In most cities, people make longer (i.e. more 'costly') trips less frequently, and the frequency with which trips of a certain length are undertaken is thus lower as the trip length increases. Of interest is whether trip length frequencies change over time; in particular whether people increasingly make longer trips (in terms of trip times or trip distances), possibly as a result of increasing urban size or increasing incomes and ability to budget for longer trips.

Figure 5 and Figure 6 show weekday trip length frequencies for motorised trips from HIS78 and VISTA07, measured by travel distance and travel time respectively. Travel distances were taken from the trip distance estimates coded in the survey data files. Times are taken from the reported start and finish time of trips.

Trip length frequencies are shown for trips undertaken in the two-hour AM and PM peaks and also for all trips on the survey days. The peak period curves were derived for the relevant two-hour motorised peak times of each survey, thus the HIS78 and VISTA07 AM curves are not for an identical time of day (refer Table 2), however the PM and daily curves are.

Figure 5. Weekday motorised MSD trip distance frequencies, HIS78 and VISTA07

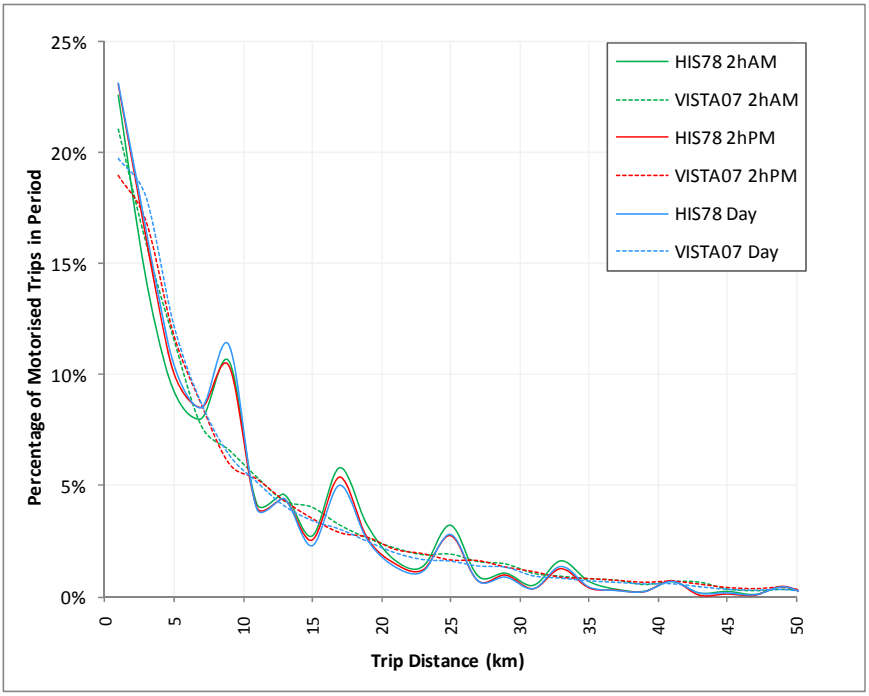
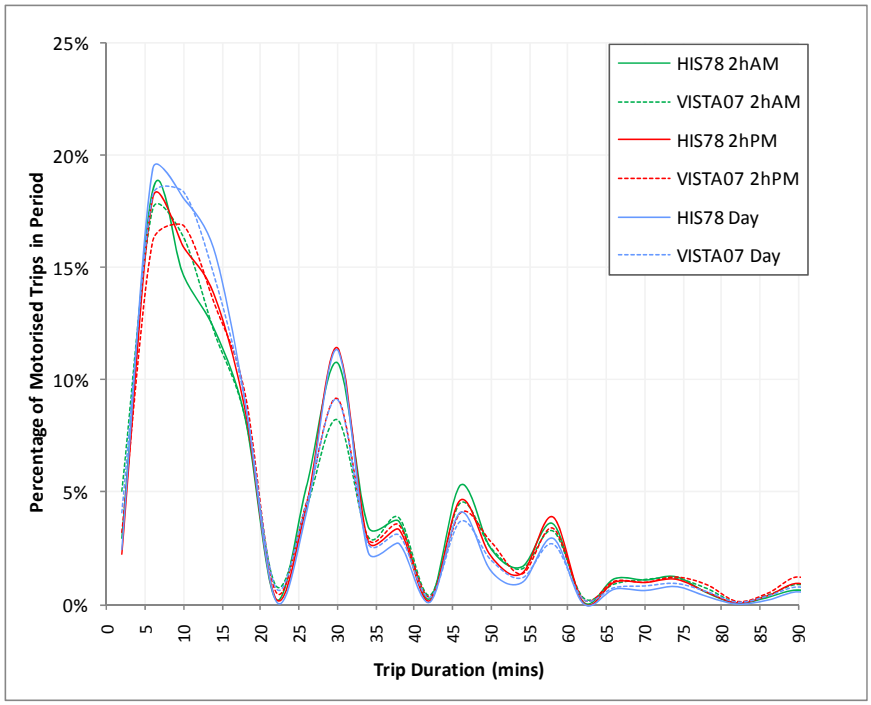


Figure 6. Weekday motorised MSD trip time frequencies, HIS78 and VISTA07



The VISTA07 used sophisticated GIS geocoding and mapping to determine trip distances, whereas the HIS78 used the respondents' reported estimates of travel distance, so the distance estimates of VISTA07 are likely to be more accurate than those for HIS78, leading to the 'smoother' appearance of distance distribution curves.

Furthermore, the tendency of respondents to report departure and arrival trip times as figure rounded to the nearest five minute time interval (eg someone who departed at 09:33 may record this as a 09:35 departure), is likely to explain the low values in the travel time distribution curves at around 22, 42 and 63 minutes, and the strong peak at a value of 30 minutes.

Figure 5 and Figure 6 nevertheless show that not only are motorised trip distances and times strongly consistent by time of day, even though the boundaries of the MSD had expanded, the frequency of motorised trips by length and time within Melbourne was strongly consistent between 1978/79 and 2007/08.

5.3 Average trip lengths

The average overall trip distances and times by travel mode and motorised peak period are shown in Table 8 and Table 9. As for the analysis of trip length frequencies, the peak period values were derived for the relevant two-hour motorised peak times of each survey, thus the HIS78 and VISTA07 AM values are not for an identical time of day (refer Table 2), however the PM and daily curves are.

Table 8. Weekday average MSD trip distances (km) by mode and period, HIS78 and VISTA07

Mode	AM 2-hr Mot Peak		PM 2-hr Mot Peak		All Day	
	HIS78 AM	*VISTA07 AM*	*HIS78 PM*	*VISTA07 PM*	*HIS78 Day*	*VISTA07 Day*
Walk	1.1	1.0	1.1	1.1	1.1	0.9
Bicycle	2.7	6.1	2.5	5.1	2.6	5.3
Motorcycle	11.7	17.8	17.6	10.0	12.3	13.8
Car Driver	11.7	12.0	10.4	13.6	9.9	11.7
Car Passenger	7.5	7.0	8.0	9.2	8.6	9.5
School Bus	11.3	19.5	12.9	16.8	13.8	17.7
Public Bus	7.6	11.0	8.7	10.0	7.7	10.0
Taxi	5.8	18.5	7.6	8.2	6.7	13.0
Tram	9.2	7.2	7.9	7.5	7.9	6.8
Train	20.6	21.6	19.0	23.2	19.6	21.4

Table 9. Weekday average MSD trip times (minutes) by mode and period, HIS78 and VISTA07

Mode	AM 2-hr Mot Peak		PM 2-hr Mot Peak		All Day	
	HIS78 AM	*VISTA07 AM*	*HIS78 PM*	*VISTA07 PM*	*HIS78 Day*	*VISTA07 Day*
Walk	12.7	13.1	15.1	14.3	14.0	12.4
Bicycle	15.4	24.6	15.1	23.9	15.3	22.4
Motorcycle	23.5	30.2	27.6	17.6	22.5	22.3
Car Driver	24.5	22.1	23.4	23.8	21.2	20.5
Car Passenger	16.8	14.5	17.9	17.3	18.0	17.0
School Bus	36.1	47.4	36.6	42.1	37.0	42.8
Public Bus	34.4	44.7	39.0	48.1	33.9	45.6
Taxi	18.4	35.8	23.9	21.4	19.1	24.9
Tram	39.1	41.7	37.3	47.4	35.7	42.7
Train	56.6	63.5	56.8	68.8	56.4	64.7

The results show that average trips by train were much longer than trips by car, bus or tram in 1978/79 and again in 2007/08. They also show that bus and tram trips, while shorter in distance than car trips, took longer in time both in 1978/79 and 2007/08.

The average annual change in trip lengths and times over the period was quite small for all modes. Taxi trips showed a larger change, however this may be because there are relatively few taxi trips in the data leading to statistical unreliability. Additional time series data would cast further light on changes in the rate of increase in average trip distances and times.

Figure 7 and Figure 8 show the absolute changes in trip distances and times for selected modes by motorised peak period between 1978/79 and 2007/08.

Figure 7. Absolute Change in Average Trip Distances (km) by Peak Period and Mode HIS78 to VISTA07, MSD Weekday Trips

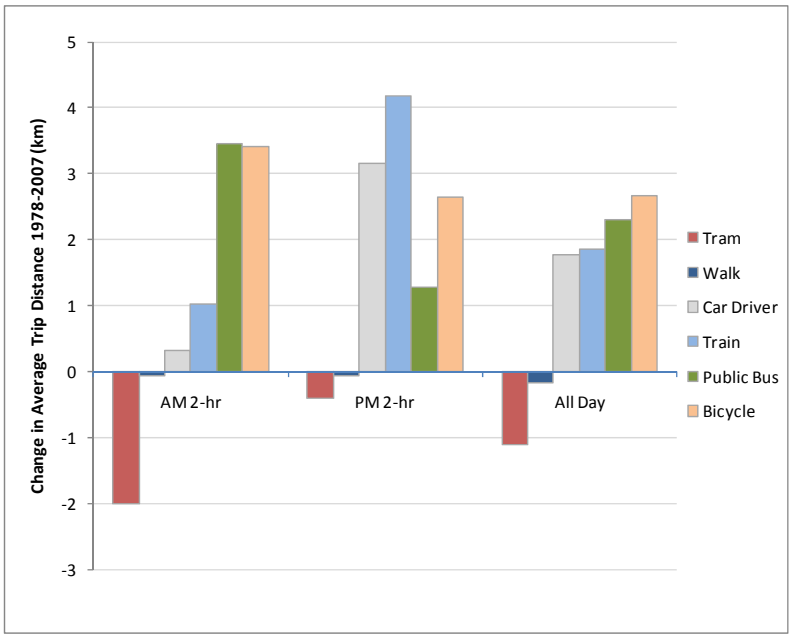
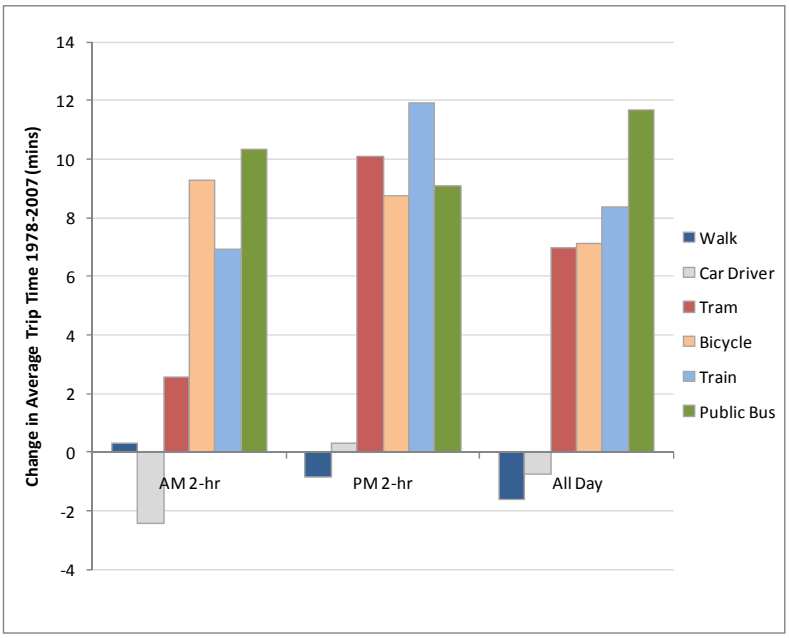


Figure 8. Absolute Change in Average Trip Times (minutes) by Peak Period and Mode HIS78 to VISTA07, MSD Weekday Trips



Average trip distances by car driver, train, public bus and bicycle modes grew for all peak periods from 1978/79 to 2007/08, with PM train trips showing the greatest absolute change having an increase in average trip length of 4.2 km. Walk trip distances decreased slightly on average, and tram trip distances decreased for all periods.

Average travel times for trips by bicycle and public transport modes (train, tram, public bus) increased for each of the time periods from 1978/79 to 2007/08. Car driver travel times did not change substantially over this time, on average decreasing slightly in the 2-hour AM peak and on a daily basis, and increasing slightly in the 2-hour PM peak.

5.4 Average trip distances by home location

A further land-use/transport relationship which is particularly important in the planning process is the degree to which land-use self-containment tends to reduce trip distance or costs. Areas with higher employment, social and recreation opportunity to population ratios would be expected to generally have lower average trip times and distances, and this is an important policy and equity consideration.

Figure 9 and Figure 10 show average weekday motorised trip distances by the home Local Government Area (LGA) of households within the MSD in 1978/79 and 2007/08 respectively. Note that following an amalgamation of Local Governments in Victoria in 1994-95, the number of LGA's in the MSD was reduced from 56 to 31.

Figure 9. Average weekday motorised trip distance (km) by home LGA, HIS78

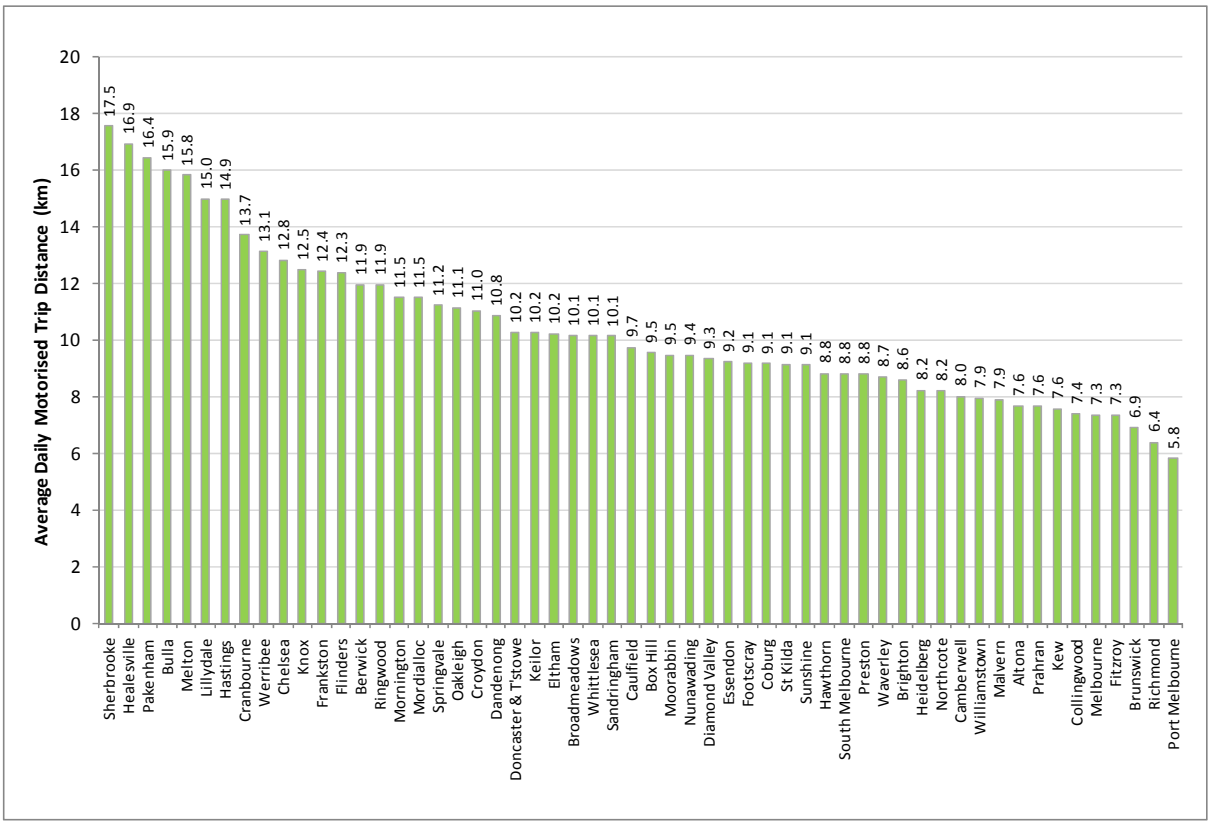
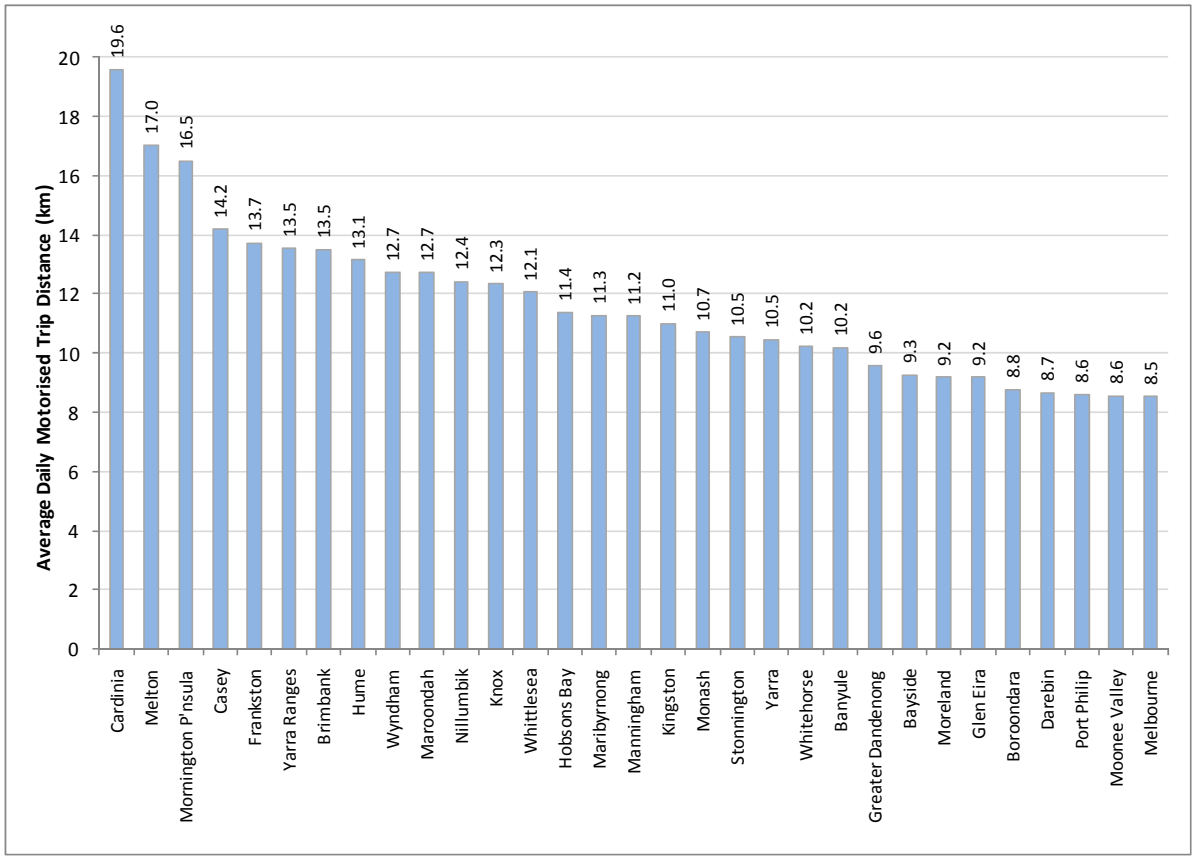


Figure 10. Average weekday motorised trip distance (km) by home LGA, VISTA07



These outcomes strongly illustrate a continuing tendency for travellers in outer areas to make longer trips by motorised modes.

6. Mode choice

Modal choice is known to be influenced by a variety of factors, one of which is the number of vehicles per household, which on average was seen to increase substantially in Melbourne from 1978/79 to 2008/08 (refer Table 1). Densities of development and access to public transport are also key determinants of mode choice. Table 10 shows the public transport share of motorised person trips by motorised peak period from HIS78 and VISTA07.

Table 10. Public transport mode share of motorised trips, MSD weekday trips HIS78 and VISTA07

Motorised Trips Peak	Period	PT Mode Share	
		HIS78	*VISTA07*
AM 1-hr	08:00 - 09:00	24.0%	17.7%
AM 2-hr (1)	07:15 - 09:15	21.4%	16.1%
AM 2-hr (2)	07:45 - 09:45	21.8%	15.6%
PM 1-hr (1)	15:15 - 16:15	21.3%	14.6%
PM 1-hr (2)	16:15 - 17:15	22.0%	16.3%
PM 2-hr	15:15 - 17:15	19.8%	14.0%
All Day	**04:00 - 28:00**	**14.4%**	**10.7%**

Notes: Motorised trips excludes motorcycle trips

Table 10 shows that the public transport mode share of motorised trips decreased in each period from 1978/79 to 2007/08. This is consistent with increases in household vehicle ownership and the substantial increase in car travel observed over the period relative to that by public transport modes (refer Table 3). Further analysis of mode choice by age and gender would be of interest to identify the effects of such social changes such as increased women's participation in the workforce, increased higher education rates etc. on mode choice.

6.1 Trips by mode and purpose

While household and demographic factors are important, mode choice is also influenced by other travel factors including the trip destination purpose. Table 11 and Table 12 show how motorised mode split varies by time of day to different destination purposes for HIS78 and VISTA07 respectively.

Table 11. Public transport mode share of motorised trips by time period and destination purpose, weekday MSD trips HIS78

Period	Destination Purpose									
	Home	*Work*	*Education*	*Empl Bus*	*Pers Bus*	*Shopping*	*Recreation*	*Medical*	*Serve Pass*	***Total***
07:15 - 09:15	2.1%	25.4%	40.3%	5.2%	14.8%	19.0%	23.7%	26.7%	1.1%	**21.4%**
15:15 - 17:15	26.0%	12.9%	34.0%	5.1%	8.0%	7.6%	12.6%	7.8%	3.8%	**19.8%**
04:00 - 28:00	16.0%	21.5%	39.2%	4.7%	8.1%	10.6%	8.5%	14.7%	2.0%	**14.4%**

Table 12. Public transport mode share of motorised trips by time period and destination purpose, weekday MSD trips VISTA07

Period	Destination Purpose								
	Home	*Work*	*Education*	*Pers Bus*	*Shopping*	*Recreation*	*Serve Pass*	*Other*	***Total***
07:45 - 09:45	2.5%	22.3%	30.8%	5.6%	11.1%	7.0%	0.4%	14.1%	**15.6%**
15:15 - 17:15	18.8%	7.3%	38.0%	8.9%	6.1%	6.6%	3.4%	0.0%	**14.0%**
04:00 - 28:00	12.1%	14.9%	31.5%	5.8%	6.7%	6.8%	1.3%	7.0%	**10.7%**

Public transport mode share was generally lower in 2007/08 than 1978/79 for most travel purposes and times, with a few minor exceptions, however the overall distribution of mode splits by purpose remained relatively consistent. Perhaps the greatest change in this behaviour was a move away from use of public transport for recreational and shopping purpose trips over the period from 1978/79 to 2007/08.

7. Discussion

Analysis of household travel survey data for the Melbourne Statistical Division from 1978/79 and 2007/08 provides a highly interesting time series comparison of travel behaviour and patterns over this 30-year period.

Over the course of the period, with eastward expansion of the boundaries of the Melbourne Statistical Division, demographic growth was outstripped by the rate of growth in average weekday travel by MSD residents.

This substantial increase in travel is reflected in Melbourne transport network loads. Peak 15-minute motorised travel demands on the network in the AM and inter-peak periods doubled over this time, with growth in PM peak loadings being only slightly lower.

Person travel by car and train has grown most strongly, almost doubling on a daily basis. Tram travel has decreased in peak periods but remained steady on a daily basis. One explanation for this may be that the substantial increase in car travel has had impacts on tram operations. Public bus travel has decreased, while school bus travel has increased. Walk and bicycle trips increased in the morning peak and on a daily basis, however there were fewer walk trips in the two-hour PM peak.

Only the two-hour PM motorised peak showed evidence of a noticeable reduction in overall peak severity across modes, indicating some 'peak spreading'. Peak spreading was not as evident for the AM peak.

An important outcome is that daily travel and morning peak period travel is not dominated by trips with 'work' as the primary purpose. This is relevant to analysis of journey-to-work data collected as part of the ABS Census, as work-related trips comprise only a smaller fraction of motorised travel that occurs on a typical weekday.

AM peak and all-day household and person trip rates in Melbourne grew, magnifying the growth in travel during these periods that resulted from population growth alone. This outcome has important implications for transport modelling analyses; in conventional transport models, trip rates are commonly assumed to be fixed as a function of zonal land-use and demographic quantities. The findings of this analysis indicate that trip rates do vary over time.

Average trip distances by car driver, train, public bus and bicycle modes grew slightly for all peak periods from 1978/79 to 2007/08. Walk trip distances decreased slightly on average, and tram trip distances decreased for all periods.

There remains a continuing tendency for travellers in outer areas of Melbourne to make longer trips by motorised modes. This highlights that the provision of employment, social and recreation opportunities in outer areas with the goal of increasing self-containment should continue to be an important policy and equity consideration.

The share of motorised trips taken by public transport decreased noticeably in peak periods and across the whole day from 1978/79 to 2007/08. There was a move away from use of public transport for recreational and shopping purpose trips.

This paper presents interesting observations on changes in travel behaviour that are observed in travel survey data, but does not attempt to provide explanatory models relating these changes in travel to social and demographic changes. Further work would be of interest to relate these changes to the significant social and demographic structural changes that took place over the period between the surveys, which had significant impacts on travel behaviour.

8. Acknowledgements

The author gratefully acknowledges the Victorian Department of Transport for making the VISTA07 dataset available for research use.

Appendix A. VISTA07 mode priorities for trip linking

The VISTA07 priority mode approach uses a hierarchy of modes, with the highest priority mode used on any individual stage of a linked trip being assigned as the main mode for the trip. The ordering of the priority modes is as follows:

- Train is priority 1
- Tram is priority 2
- School bus is priority 3
- Public bus is priority 4
- Taxi is priority 5
- Motorcycle is priority 6
- Vehicle driver is priority 7
- Vehicle passenger is priority 8
- Bicycle is priority 9
- Walking is priority 10
- Other mode is priority 11

References

Australian Bureau of Statistics (2006), *'Australian Standard Geographical Classification'*, Cat. 1216.0.

Department of Transport, Victoria (2009), *'Victorian Integrated Survey of Travel and Activity 2007 (VISTA 07)'*, survey release brochure, Victorian Department of Transport, Melbourne.

Milthorpe, F. and Daly, J. (2010), 'Comparison of Trip and Tour Analysis of Sydney Household Travel Survey Data', *Proc. 33rd Australasian Transport Research Forum*, Canberra.

Ministry of Transport, Victoria (1981a), *'Melbourne Home Interview Travel Survey Report 2: Description'*, Victorian Ministry of Transport, Melbourne, p.1.

Ministry of Transport, Victoria (1981b), *'Melbourne Home Interview Travel Survey Report 3: Comparison'*, Victorian Ministry of Transport, Melbourne, p.6.

Transport Data Centre, New South Wales (2009), *'2007 Household Travel Survey, Summary Report, 2009 Release'*, Transport Data Centre, NSW Department of Transport & Infrastructure, Sydney.

The Urban Transport Institute (2009), *'Victorian Integrated Survey of Travel & Activity 2007-08. Survey Procedures and Documentation v1.3'*, The Urban Transport Institute, p.2.