

IATUR 29th Annual Conference

17-19 October 2007 Washington DC USA

**Travel Behaviour of Women, Men and Children:
What Changes and What Stays the Same?**

By

Duncan Ironmonger, Department of Economics, University of Melbourne and
Philip Norman, Department of Infrastructure, Victoria



IATUR 29th Annual Conference 17-19 October 2007 Washington DC USA

Travel Behaviour of Women, Men and Children: What Changes and What Stays the Same?

Duncan Ironmonger, Department of Economics, University of Melbourne and
Philip Norman, Department of Infrastructure, Victoria

Abstract

Knowledge of travel behaviour is important for public infrastructure planning and travel time research reveals some remarkable constants over long periods of time. For example the journey to work in Melbourne has remained roughly constant over more than 150 years at an average time of 20 minutes and the total travel time budget of just over an hour a day is apparently the same as it was in ancient Rome.

Analysis of trends in the travel behaviour of Melbourne women, men and children collected from travel diaries collected from 1994 to 2002 indicates that some things change and some things stay the same.

Although Melbourne has extensive train, tram and bus networks, car travel, either as driver or passenger, is the dominant mode, 67% of all trips and 74% of travel time.

Women car drivers had a significant increase in hours and km per week, and in average speed travelled. There are no significant changes in the hours, km per week or average speed for men as car drivers, but possibly a small reduction in trips per week.

Trips per week for women car passengers were significantly reduced, only partly offsetting the increase in trips as drivers. For child passengers there is a significant increase in the average distance and average time per trip but no significant increase in the number of trips per week. Thus children had a significant increase in total hours and total km per week as car passengers.

The paper also explores what changes and what stays the same in the use of non-car modes of travel and the total travel time budgets of women, men and children.

Introduction

Knowledge of travel behaviour is important for public infrastructure planning and travel time research reveals some remarkable constants over long periods of time. For example the journey to work in Melbourne has remained roughly constant over more than 150 years at an average time of 20 minutes and the total travel time budget of just over an hour a day is apparently the same as it was in ancient Rome.

Yacov Zahavi did extensive research in the 1970s on travel time budgets. Ausubel and Marchetti (2001) commenting on this research say “The results were invariant, about one hour per day, measured over the year and the entire adult population. Recent measures give the same result from Australia to Zambia. Interestingly, the travel-time budget was about one hour 5,000 years ago”.

However, the University of Minnesota Metropolitan Survey Archive gives a rather different interpretation of Zahavi’s work. This archive is supported by the United States Department of Transportation for whom Zahavi worked as a consultant. The archive reports: “In the transportation profession Zahavi is most commonly remembered for his identification of the “traveltime budget”, which he first defined as the time spent by a average car on an urban road network. Later he found it more productive to work with the daily “traveltime budget” of a “traveler” using all available travel modes. His studies convinced him that the traveltime budget was stable and predictable, but not necessarily constant. It can, for example, change over time, vary from one place to another, and needs to be established by measurement before being used. Nevertheless, Zafavi is often associated with the simplistic idea that average travel time in urban areas has to be “constant” at all times and in all places at about one hour a day.”

Analysis of trends in the travel behaviour of Melbourne women, men and children collected from travel diaries collected from 1994 to 2002 indicates that some things change and some things stay the same.

The paper is in five sections –

- I. Melbourne Travel Data 1994 - 2002
- II. Estimating Travel Trends 1994 - 1999
- III. The Demographic Structure of Modes of Travel
- IV. Trend Travel Projections 1991 – 2006
- V. Travel Time Budgets for Women, Men and Children

I. Melbourne Travel Data 1994 – 2002

The Victorian Activity and Travel Survey (VATS) is a household-based sample survey that was conducted over the years 1994 to 2002 to provide a detailed description of daily travel and activity patterns of the population of the metropolitan area Melbourne, Victoria’s capital and its largest city of more than three million people.

The VATS survey recorded all travel by all modes by all members of responding households in the survey. Each household was asked to provide information for a specified day. However, the survey was a continuous process covering all 365 days of the survey years, thus enabling seasonal variations to be observed.

Over nine years some 45,000 households involving 120,000 people gave usable responses to the VATS. In 1994 the survey involved on average 20 households per day; in subsequent years a lower sample of 14 per day. Initially the survey was weighted to the 1991 Census population. In 2007 the new weights have been calculated using population estimates for each of the separate years.

The re-weighting of the VATS data involves four ideas. These are (1) to use the latest estimates of the population of the Melbourne Statistical Division, (2) to obtain a good representation of the demographic structure of the Melbourne population, (3) to obtain a good balance of the distribution of the population by location within the Melbourne SD and (4) to obtain a precise distribution of travel activities according to days of the week.

It is possible to incorporate all these ideas in just one set of weights.

(1) Latest Population estimates

In September 2006, the Spatial Analysis and Research Branch of the Victorian Department of Sustainability and Environment (DSE) provided annual estimates at 30 June of the Victorian Estimated Resident Population (ERP) for the period 1991 to 2005. These are based on Australian Bureau of Statistics (ABS) published data.

(2) Demographic structure -Age and Sex balance

The estimates are for 18 five-year age groups for each sex with the oldest age group being 85 years and over. For weighting these estimates are combined to eight ten-year age group cells with the oldest group being 70 years and over.

(3) Location – Labour Force Regions balance

For ABS statistics of employment there are nine Labour Force Regions (LFRs) within the Melbourne Statistical Division. These are:

- 21021 Outer Western Melbourne
- 21061 North Western Melbourne
- 21081 Inner Melbourne
- 21121 North Eastern Melbourne
- 21161 Inner Eastern Melbourne
- 21201 Southern Melbourne
- 21241 Outer Eastern Melbourne
- 21261 South Eastern Melbourne
- 21281 Mornington Peninsula

DATA CATEGORIES

Seven major categories of data were obtained which are contained in linked files for data on households, persons, stops (trip-stage), trips (all stages of a single-purpose trip), vehicles, trip chains and trip routes.

Population Categories

The data are analysed for three categories of the population – Women, Men and Children. Children are those aged 0 to 14 years; Women and Men are those aged 15 years or more.

Mode of Travel

The modes of travel are classified into eight types -six types of motorised transport and two non-motorised. These are:

Motorised-

- Car driver
- Car passenger
- Train passenger
- Tram passenger
- Bus passenger (includes school bus)
- Other motorised (taxi, truck, motor cycle and other)

Non-motorised-

- Walking
- Cycling

Variables

For each mode of travel the data involve three main variables –

- (1) number of trips per person per week (tpw)
- (2) average minutes per trip (mpt), and
- (3) average kilometres per trip (kpt).

These three variables are used to derive three additional variables –

- (4) average hours per person per week (hpw)
- (5) average kilometres per person per week (kpw), and
- (6) average speed, kilometres per hour (kph).

The variables (4) to (6) are derived from variables (1) to (3) as follows –

- (4) = (1)x(2)/60. [hpw = tpw x mpt/60]
- (5) = (1)x(3). [kpw = tpw x kpt]
- (6) = (5)/(4). [kph = kpw / hpw] [Also (6) = 60x(3)/(2)]

II. Estimating Travel Trends

When assessing trend lines, the first question is to assess the statistical and practical significance of the trend line coefficients. The constant term was nearly always much larger than the slope coefficient so we need only be concerned about the significance of the slope coefficient. In the next few paragraphs, we explain our approach to assessing fitted trend lines and the construction of projections.

The R^2 value is a useful check on the reliability of the trend line. In particular, we can expect a low value of R^2 when the magnitude of the slope coefficient is small. Hence, we do not reject the trend line merely because R^2 is close to zero. Indeed, data points can exhibit low variability about the trend line and also have a low R^2 . This often happens when the slope coefficient is very close to zero in magnitude. A number of examples turn up in this work, e.g. women car passengers (hours per week), men car drivers (hours per week). However, when the slope is well away from zero, it is usual to find a high R^2 when the data points show low variability about the trend line since the regression itself explains most of the variation about the observed mean value of the y variable, e.g. number of trips per person per week for women car drivers, train trip duration for men and women, kilometres per train trip for men, etc.

Note that in econometric modelling the adjusted R^2 value increases with each new variable added to the model only if the new term actually improves the model. In contrast, the R^2 value always increases when a new variable is added to the model. Since we are not adding new variables to the regression model, it is enough to use the R^2 value as a means of judging goodness of fit. Also, the R^2 value has the virtue of never being negative, whereas the adjusted R^2 value can be negative if the added variable fails to improve the fit.

Let us now consider the statistical significance of the trend line coefficients. In this approach, we suppose that the slope coefficient has 'true' value zero and try to refute that hypothesis. The slope coefficient is judged to be *statistically* significant when the t -statistic associated with that slope coefficient is more than about 2 standard deviations away from zero. The exact multiple depends on the number of degrees of freedom. In our case, there are 5 degrees of freedom (1 for the regression and 4 for the residuals) since there are 6 data points. In the event of the slope coefficient being statistically significant from zero at the 95% level, the 95% confidence interval around the estimated slope coefficient does not contain zero.

The trend analysis of the Victorian Activity and Travel Survey (VATS) for the years 1994 to 1999¹ reveals some constants in the travel behaviour of the population of Melbourne. It also shows some changes in these parameters.

The results of the trend analysis are shown in the following table.

¹ The VATS data for 2000, 2001 and 2002 are not of sufficient quality to be used in this analysis.

VATS Data, Trend Analysis, 1994 - 1999

Summary Tables for Means and Trend Lines

		(1) Trips per person per week (tpw)				(2) Minutes per trip (mpt)				(3) Kilometres per trip (kpt)			
		Mean	Trend	Constant	R ²	Mean	Trend	Constant	R ²	Mean	Trend	Constant	R ²
Car Drivers	Women	13.31	0.245 **	12.45	0.81	16.12	0.048 *	15.95	0.23	5.71	0.091 **	5.39	0.98
	Men	16.39	-0.090 *	16.71	0.24	20.64	0.117 *	20.23	0.23	7.90	0.062 *	7.68	0.43
Car passengers	Women	5.32	-0.028 *	5.42	0.32	20.74	0.177	20.12	0.13	7.07	0.046	6.91	0.05
	Men	2.42	0.035 *	2.29	0.24	20.22	0.163	19.65	0.13	7.09	0.025	7.00	0.02
	Children	16.27	0.052	16.08	0.03	14.33	0.148 *	13.81	0.32	4.68	0.046 *	4.52	0.34
Train passengers	Women	0.84	0.023 *	0.76	0.35	25.46	-0.346 **	26.67	0.92	12.06	-0.155 *	12.60	0.30
	Men	0.93	0.011	0.89	0.24	27.01	-0.413 **	28.46	0.68	13.05	-0.132 **	13.52	0.71
	Children	0.24	0.001	0.24	0.00	20.70	-1.274 *	25.16	0.43	8.18	-0.094	8.51	0.01
Tram passengers	Women	0.67	0.024 **	0.59	0.80	16.47	0.036	16.34	0.05	3.20	-0.008	3.23	0.03
	Men	0.58	0.005	0.57	0.14	16.65	0.148 *	16.13	0.23	3.22	-0.027	3.32	0.06
	Children	0.17	-0.011 *	0.21	0.24	15.19	0.180	14.56	0.02	2.94	0.054	2.75	0.03
Bus passengers	Women	0.61	-0.027 *	0.70	0.52	21.23	0.352 *	20.00	0.50	4.85	0.017	4.79	0.02
	Men	0.51	-0.024 *	0.59	0.48	20.64	-0.514 *	22.44	0.27	5.27	0.043	5.12	0.05
	Children	0.67	0.001	0.66	0.00	22.67	0.676 *	20.30	0.33	6.46	0.605 **	4.35	0.81
Other Motorised	Women	0.18	0.007 *	0.15	0.62	32.44	-1.017 *	36.00	0.37	5.98	0.100	5.63	0.03
	Men	0.52	-0.024 *	0.61	0.31	35.84	-0.031	35.94	0.00	9.05	0.240 *	8.21	0.76
	Children	0.20	-0.017	0.26	0.19	17.27	-0.318 *	18.39	0.25	0.69	0.141	0.58	0.08
Walking	Women	7.58	0.043	7.42	0.06	9.05	-0.024	9.14	0.06	0.65	0.069 **	0.41	0.90
	Men	6.62	-0.057	6.82	0.12	9.21	-0.035	9.33	0.06	0.71	0.075 **	0.45	0.98
	Children	5.02	-0.091	5.34	0.20	9.26	-0.015	9.31	0.01	0.70	0.083 **	0.41	0.75
Cycling	Women	0.18	0.002	0.17	0.01	18.78	-0.378 *	20.10	0.63	2.56	-0.034	2.68	0.05
	Men	0.49	-0.014 *	0.54	0.22	20.29	0.234 *	19.47	0.28	3.54	0.027	3.45	0.03
	Children	0.51	-0.047 *	0.67	0.81	13.31	0.470 *	11.66	0.53	1.26	0.133 *	0.79	0.73

** Significance level is 0.05

* Significance level is 0.33

III. The Demographic Structure of Modes of Travel

Although Melbourne has extensive train, tram and bus networks, car travel, either as driver or passenger, is the dominant mode, 67% of all trips and 74% of travel time.

Women car drivers had a significant increase in hours and km per week, and in average speed travelled. There are no significant changes in the hours, km per week or average speed for men as car drivers, but possibly a small reduction in trips per week.

Trips per week for women car passengers were significantly reduced, only partly offsetting the increase in trips as drivers. For child passengers there is a significant increase in the average distance and average time per trip but no significant increase in the number of trips per week. Thus children had a significant increase in total hours and total km per week as car passengers.

The next section presents a comprehensive analysis of the different modes of travel by the people of Melbourne as revealed by the VATS data for the years 1994 to 1999. The discussion begins with travel by car, the principal mode of travel in Melbourne.

A. Car Driver and Car Passenger

A1. Mean Values

Car driver is the dominant mode of travel for both women and men. Car passenger is the dominant mode for children. The average values of variables for the years 1994 to 1999 are shown in the following tables.

<i>Car Driver</i>	<i>Women</i>	<i>Men</i>	<i>Children</i>
Trips per week (tpw)	13.3	16.4	-
Minutes per trip (mpt)	16.1	20.6	-
Kilometres per trip (kpt)	5.7	7.9	-
Hours per week (hpw)	3.6	5.6	-
Kilometres per week (kpw)	76.2	129.5	-
Speed (kph)	21.3	23.0	-

<i>Car Passenger</i>	<i>Women</i>	<i>Men</i>	<i>Children</i>
Trips per week (tpw)	5.3	2.4	16.3
Minutes per trip (mpt)	20.7	20.2	14.3
Kilometres per trip (kpt)	7.1	7.1	4.7
Hours per week (hpw)	1.8	0.8	3.9
Kilometres per week (kpw)	37.7	17.2	76.3
Speed (kph)	20.5	21.0	19.6

Putting these two modes together gives the averages for total car travel.

<i>Car Driver and Passenger</i>	<i>Women</i>	<i>Men</i>	<i>Children</i>
Trips per week (tpw)	18.7	18.8	16.3
Minutes per trip (mpt)	17.4	20.6	14.3
Kilometres per trip (kpt)	6.1	7.8	4.7
Hours per week (hpw)	5.4	6.5	3.9
Kilometres per week (kpw)	113.8	146.6	76.3
Speed (kph)	21.0	22.7	19.6

A2. Trends - Changes in Mean Values

The simple trend analysis over the six years shows some significant changes.

For **women as car drivers** there are highly significant increases in both the number of trips per week and in the km per trip and moderately significant increase in minutes per trip. Thus women as drivers had a significant increase in hours and km per week, but also in average speed travelled.

For **men as car drivers** there is also an increase in km per trip and minutes per trip, but a small reduction in the number of trips per week. There are no significant changes in the hours, km per week or average speed for men as car drivers.

As **car passengers** there is a significant reduction in the trips per week for **women**, but only a small offset to the increase in trips as drivers. For **men** there is an increase in the number of trips per week as car passengers but no significant change in average trip duration or distance. For **children** there is a significant increase in the average

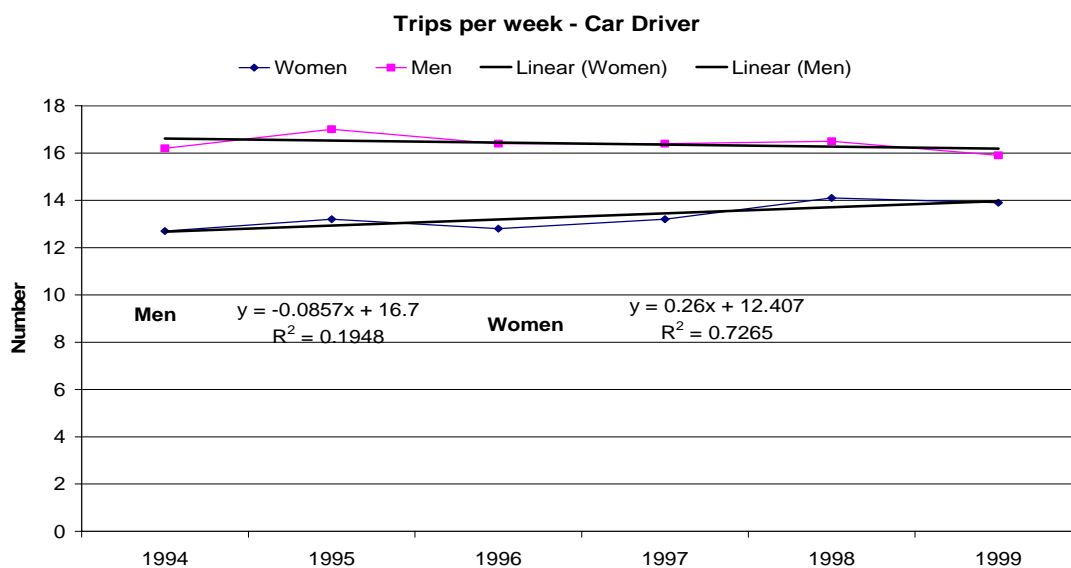
distance per trip and average time per trip spent as a car passenger but no significant increase in the number of trips per week. Thus children had a significant increase in total hours and total km per week as car passengers.

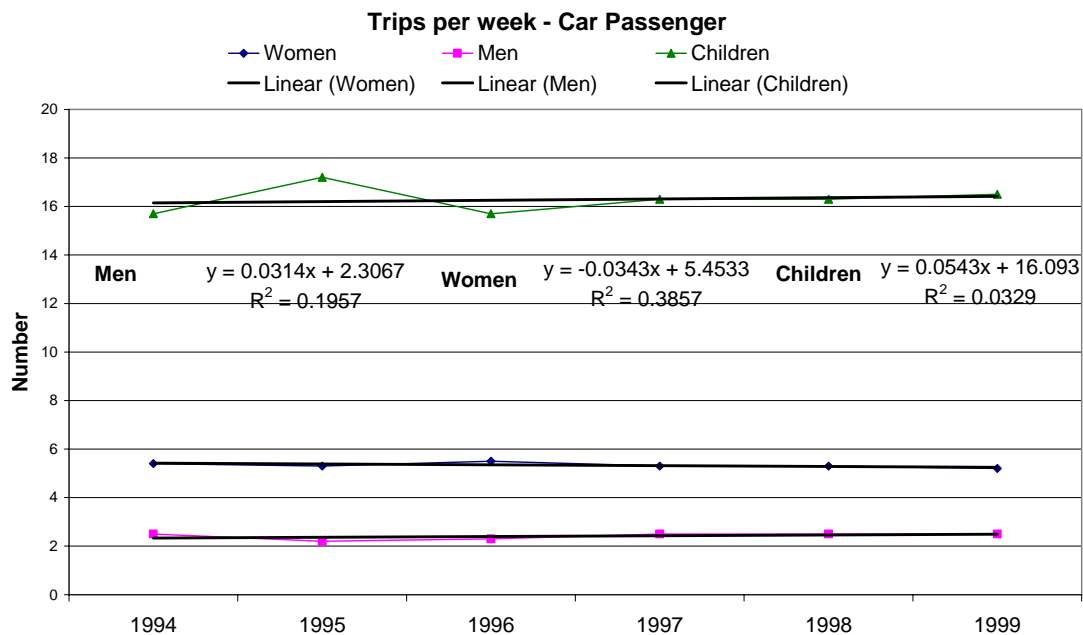
The following Charts show the linear trends in the basic components of car travel.

(1) Number of Trips (trips per week)

The following charts show the average number of trips per week Melbourne women, men and children travelled as car drivers and passengers over the years 1994 to 1999.

The main change was the increase in the number of trips by women as car drivers. This was offset in part by a decrease in the number of trips they made as car passengers. Women drivers increased their average number of car driver trips by 9.4 per cent from 12.7 to 13.9 per week, and decreased their car passenger trips by 3.9 per cent from 5.4 to 5.2 per week. Overall, Melbourne women increased the number of car journeys by 5.5 per cent from 18.1 to 19.1 per week. Men did fewer trips per week as drivers and more as passengers; overall a slight decrease in total car journeys of 1.6 per cent from 18.7 to 18.4 per week.

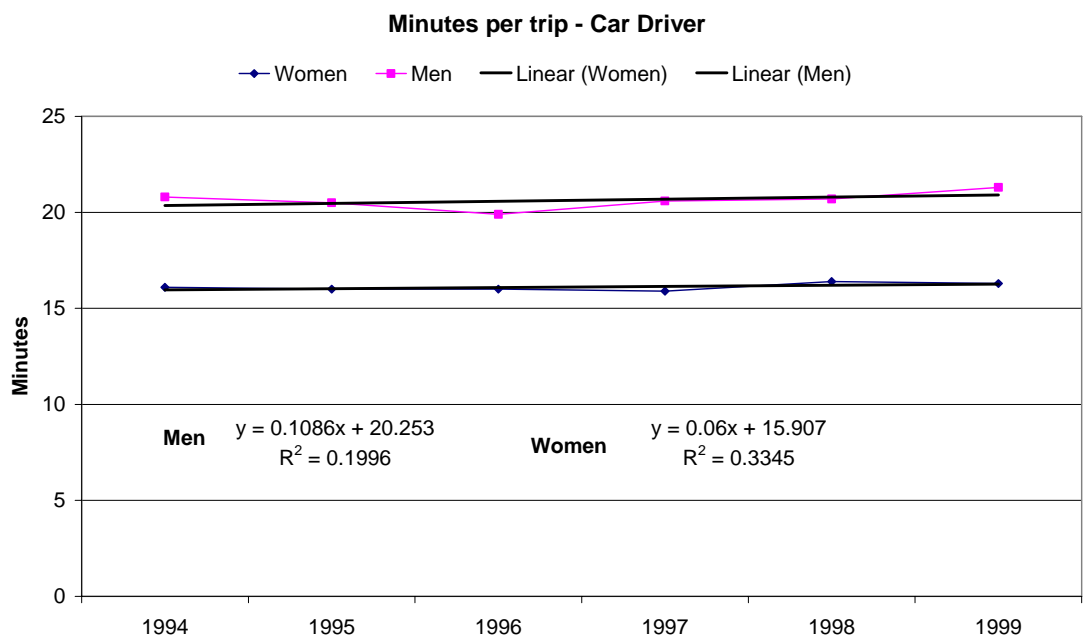


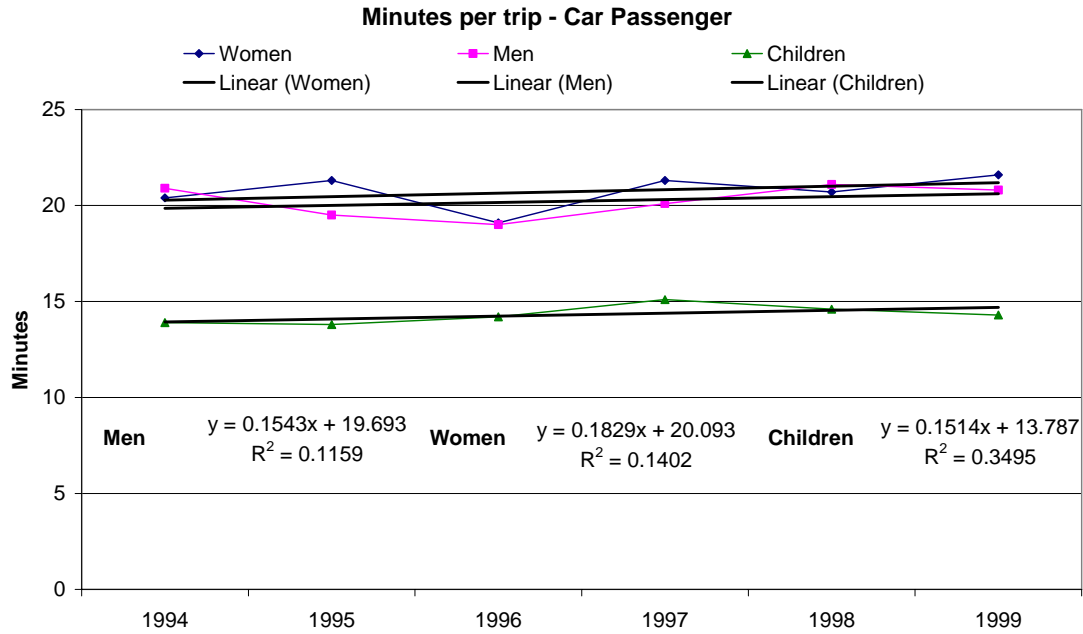


(2) Average Trip Time (minutes per trip)

The following charts show the average minutes per trip Melbourne women, men and children travelled as car drivers and passengers over the years 1994 to 1999.

There were small increases in the average minutes per trip travelled by both women and men as car drivers and by children as car passengers. Women drivers increased their average time per trip by 1.2 per cent from 16.1 to 16.3 minutes, men drivers by almost 2.4 per cent from 20.8 to 21.3 minutes and child passengers increased their average trip time by 2.9 per cent from 13.9 to 14.3 minutes.

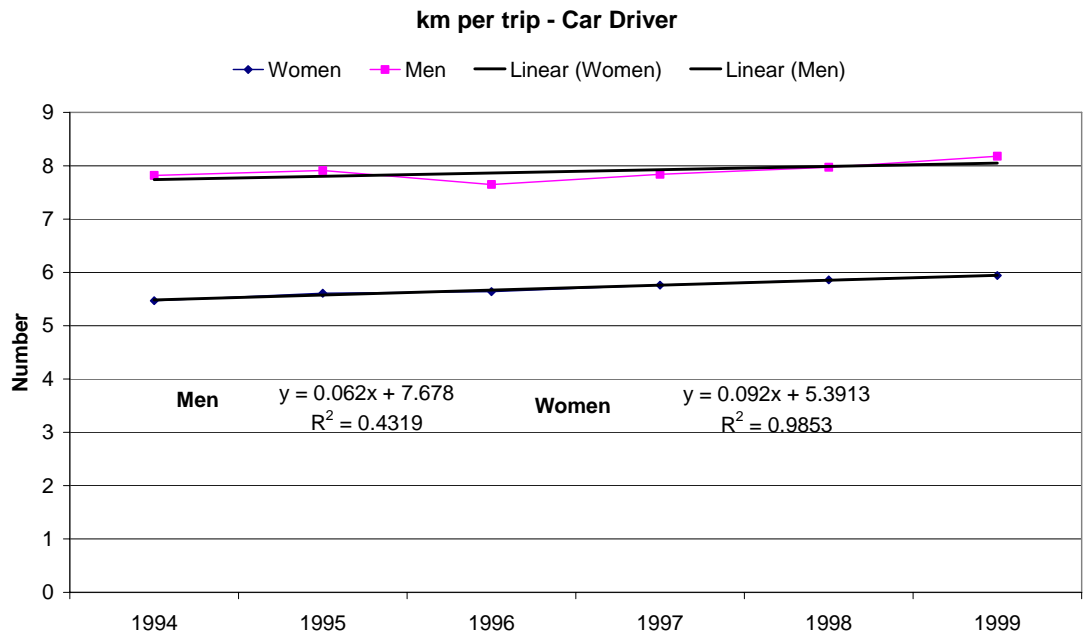


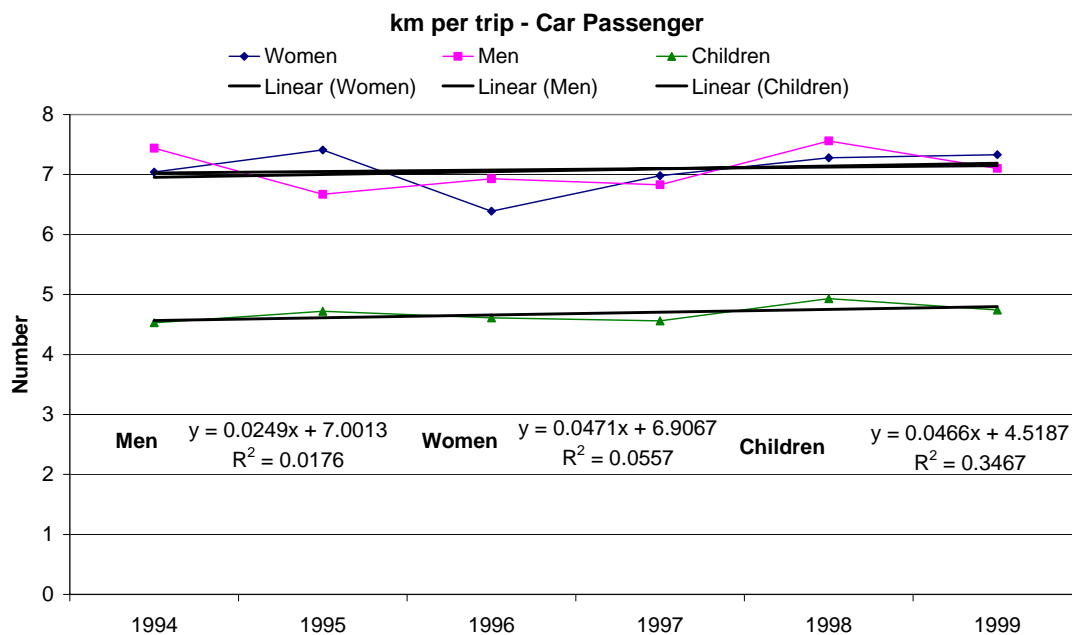


(3) Average Trip Distance (km per trip)

The following charts show the average km per trip Melbourne women, men and children travelled as car drivers and passengers over the years 1994 to 1999.

The main changes were in the average km per trip travelled by both women and men as car drivers and by children as car passengers. Women drivers increased their average km per trip by almost 9 per cent from 5.47 to 5.94, men drivers by almost 5 per cent from 7.82 to 8.18 km and child passengers increased their average trip distance by almost 5 per cent from 4.53 to 4.74 km.

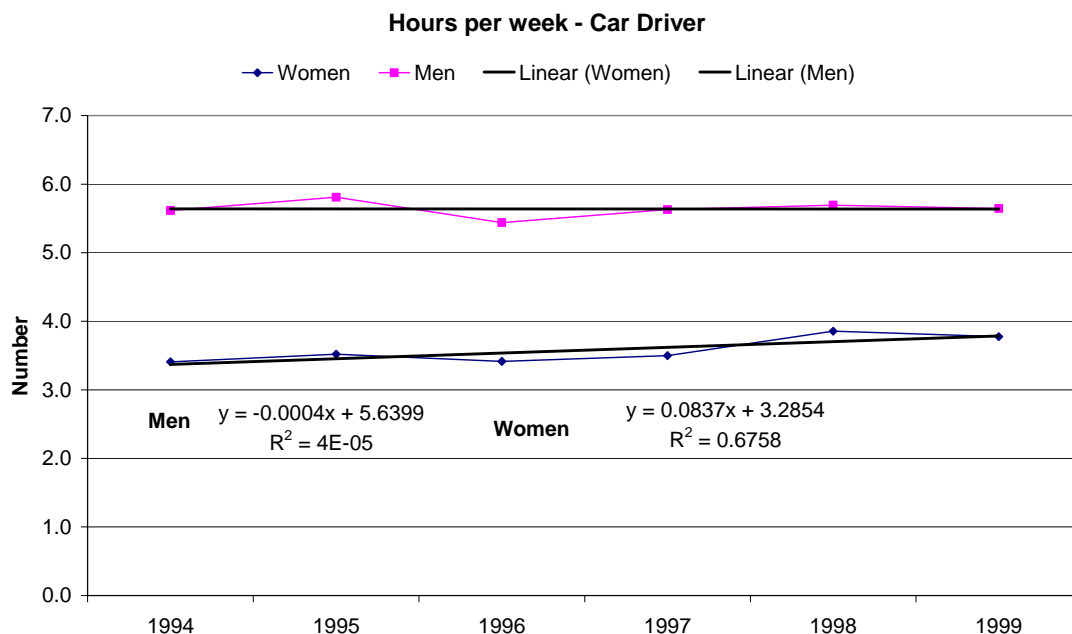


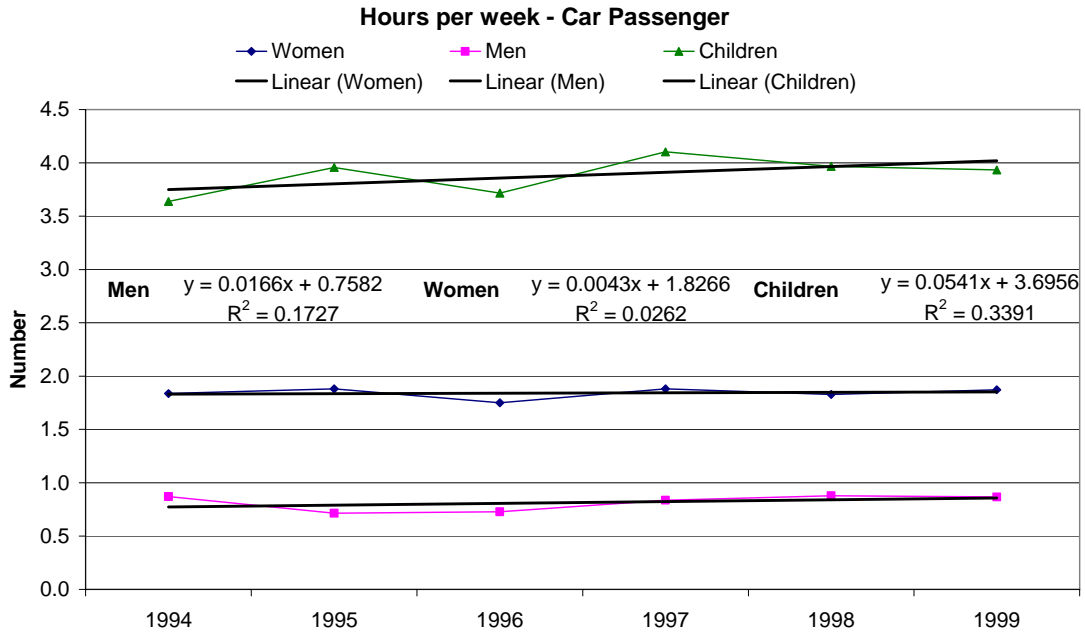


(4) Average Time per Week (Hours)

The following charts show the average hours per week Melbourne women, men and children travelled per week as car drivers and passengers over the years 1994 to 1999.

The main changes were in the average hours per week travelled by women as car drivers and by children as car passengers. Women drivers increased their average hours by 11 per cent from 3.41 to 3.78 and child passengers increased their average hours by 8 per cent from 3.64 to 3.93 per week.

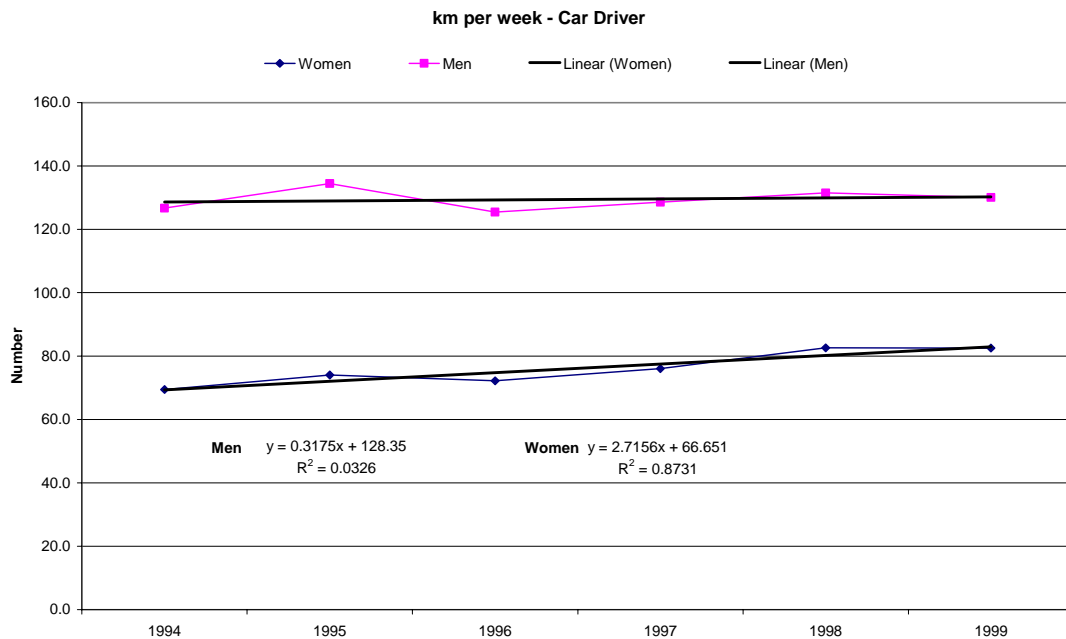


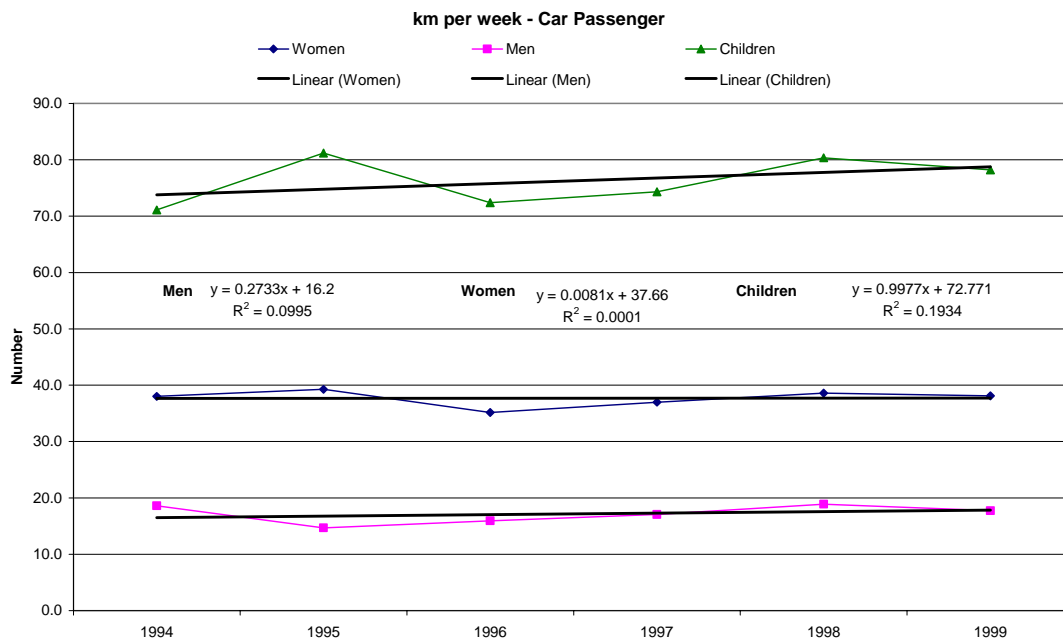


(5) Average Distance per Week (km)

The following charts show the average distances Melbourne women, men and children travelled per week as car drivers and passengers over the years 1994 to 1999.

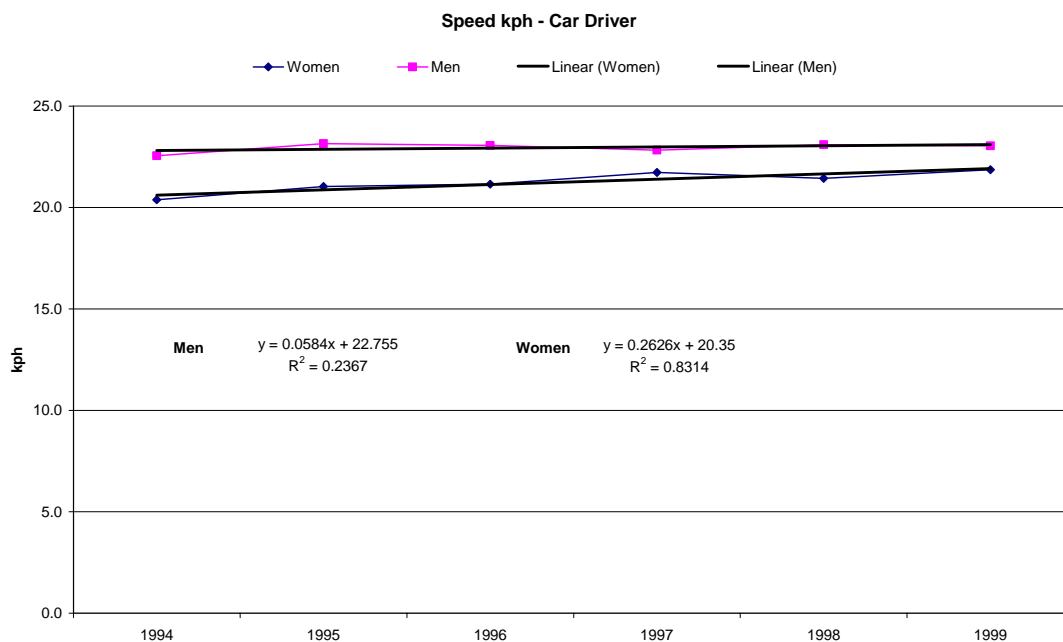
The main changes were in the average distance per week travelled by women as car drivers and by children as car passengers. Women drivers increased their average distance by 19 per cent from 69.5 to 82.6 km and child passengers increased their average by 10 per cent from 71.1 to 78.2 km per week.

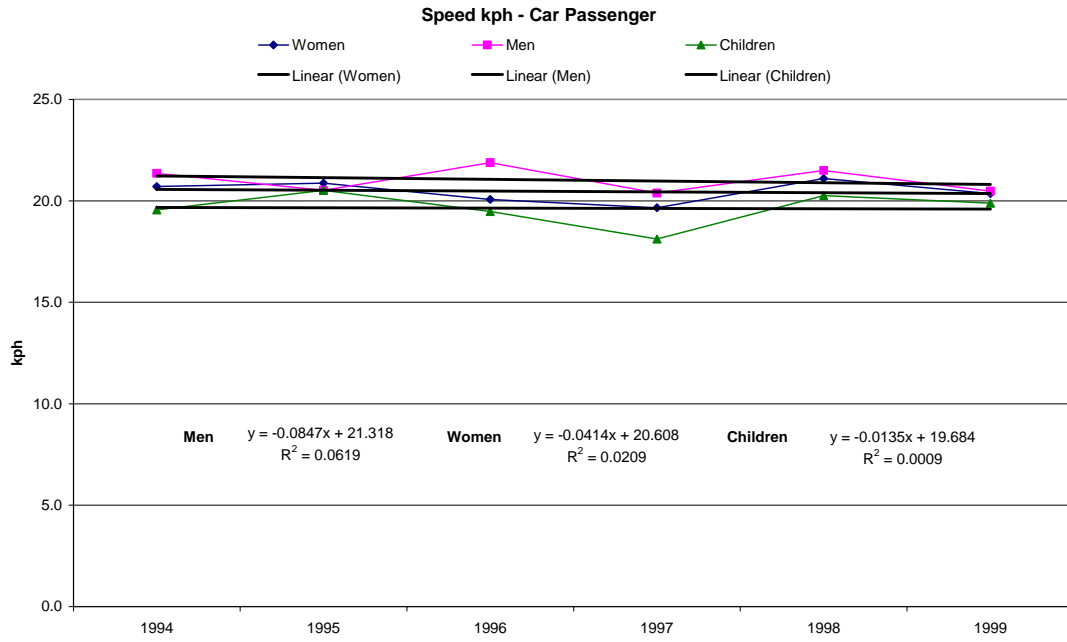




(6) Average Speed (kph)

The following charts show the average speeds that Melbourne women, men and children travelled by car either as drivers or as passengers over the years 1994 to 1999. The only significant change was an increase in the average speed of women car drivers from 20.4 to 21.9 kph.





B. Public Transport (Train, Tram and Bus)

B1. Mean Values

In terms of total km per week, train travel dominates the public transport sector. It also has more trips per week, more km per trip and a much higher speed than either tram or bus transport. The average values of variables for the years 1994 to 1999 are shown in the following tables.

<i>Train Passenger</i>	<i>Women</i>	<i>Men</i>	<i>Children</i>
Trips per week (tpw)	0.84	0.93	0.24
Minutes per trip (mpt)	25.5	27.0	20.7
Kilometres per trip (kpt)	12.1	13.1	8.2
Hours per week (hpw)	0.36	0.42	0.08
Minutes per week (mpw)	21.4	25.1	5.0
Kilometres per week (kpw)	10.1	12.1	2.0
Speed (kph)	28.4	29.0	23.8

<i>Tram Passenger</i>	<i>Women</i>	<i>Men</i>	<i>Children</i>
Trips per week (tpw)	0.67	0.59	0.17
Minutes per trip (mpt)	16.5	16.7	15.2
Kilometres per trip (kpt)	3.2	3.2	2.9
Hours per week (hpw)	0.18	0.16	0.04
Minutes per week (mpw)	11.0	9.8	2.6
Kilometres per week (kpw)	2.15	1.88	0.51
Speed (kph)	11.7	11.6	11.6

<i>Bus Passenger²</i>	<i>Women</i>	<i>Men</i>	<i>Children</i>
Trips per week (tpw)	0.61	0.51	0.67
Minutes per trip (mpt)	21.2	20.6	22.7
Kilometres per trip (kpt)	4.9	5.3	6.5
Hours per week (hpw)	0.22	0.18	0.25
Minutes per week (mpw)	13.0	10.5	15.2
Kilometres per week (kpw)	2.95	2.67	4.30
Speed (kph)	13.7	15.4	17.1

B2. Trends - Changes in Mean Values

The simple trend analysis over the six years shows some significant changes.

For **women** there are highly significant increases in the number of trips per week as **tram passengers** and moderately significant increase in the number of trips per week as **train passengers**. Both **women and men** had highly significant decreases in the average number of minutes per trip as **train passengers**. These decreases were accompanied by significant decreases in the average km per trip. **Men tram**

² Includes school bus

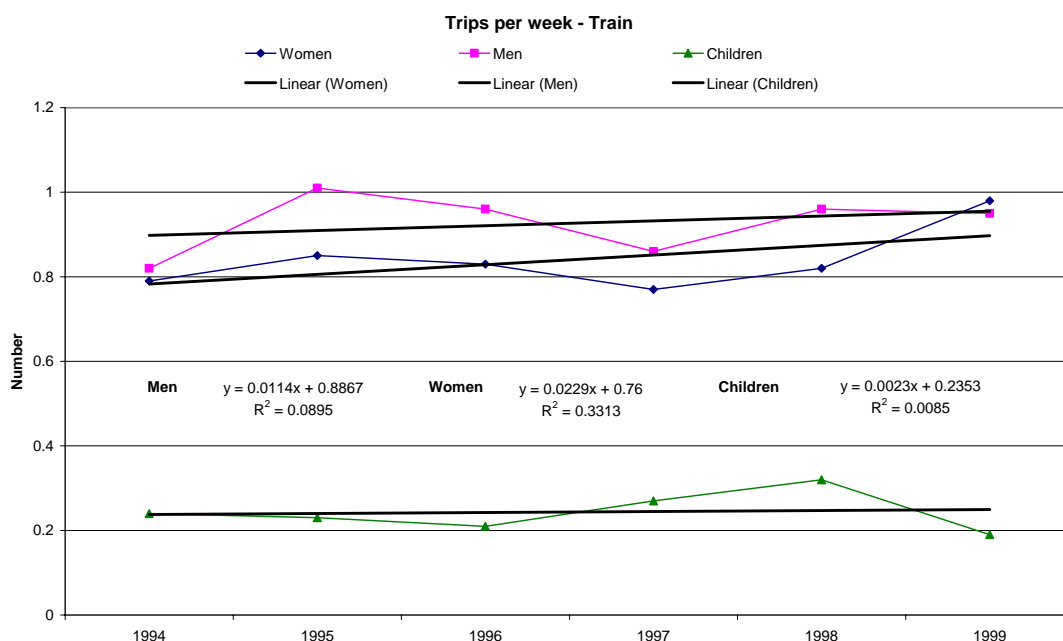
passengers had a significant increase in minutes per trip but a decrease in mpt as **bus passengers**. Both **women and children** had significant increases in minutes per trip as **bus passengers**.

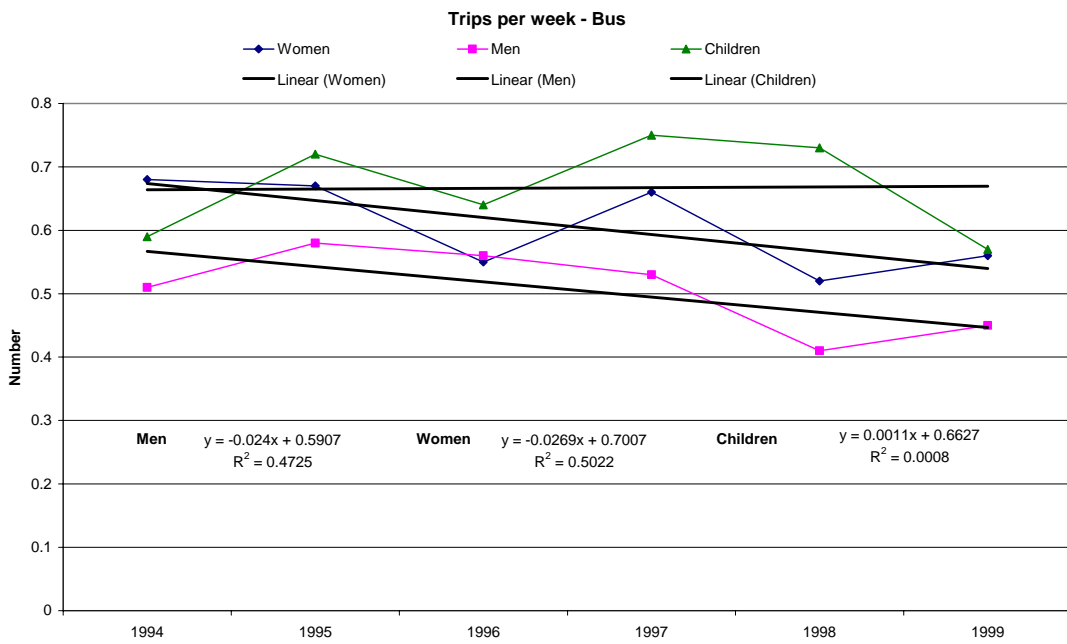
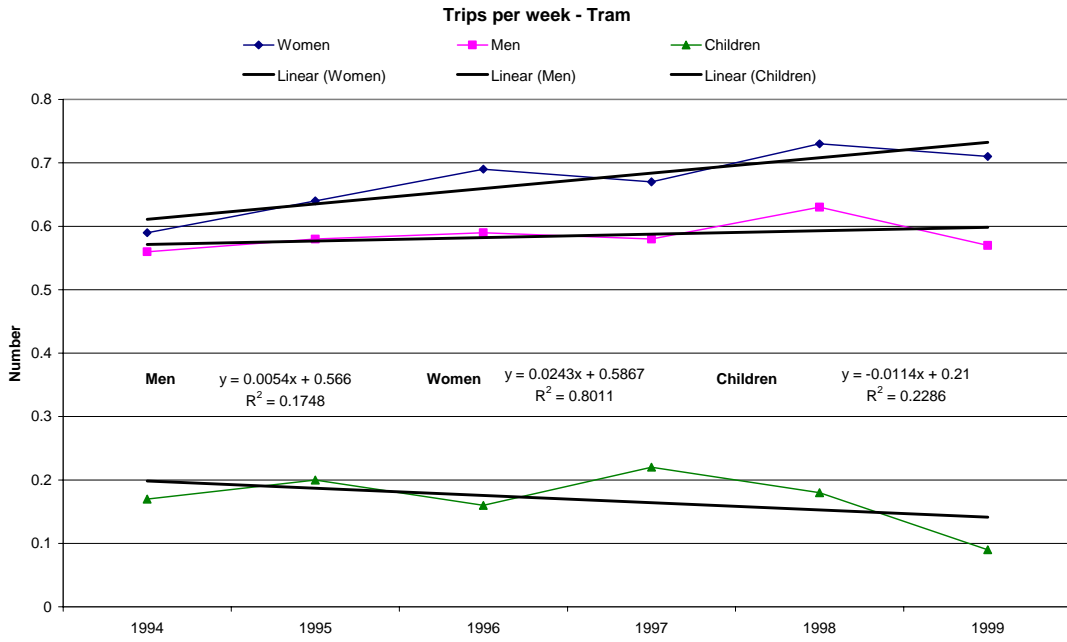
The high apparent decreases in number of trips per week by bus passengers for both women and men and child tram passengers were rejected as exceeding credibility being greater than four per cent per annum. Similarly the excessive decrease in minutes per trip for child train passengers and the excessive increase in km per trip for child bus passengers were also rejected.

The following Charts show the linear trends in the basic components of public transport travel by train, tram and bus.

(1) Number of Trips (trips per week)

The following charts show the average number of trips per week Melbourne women, men and children travelled as car drivers and passengers over the years 1994 to 1999



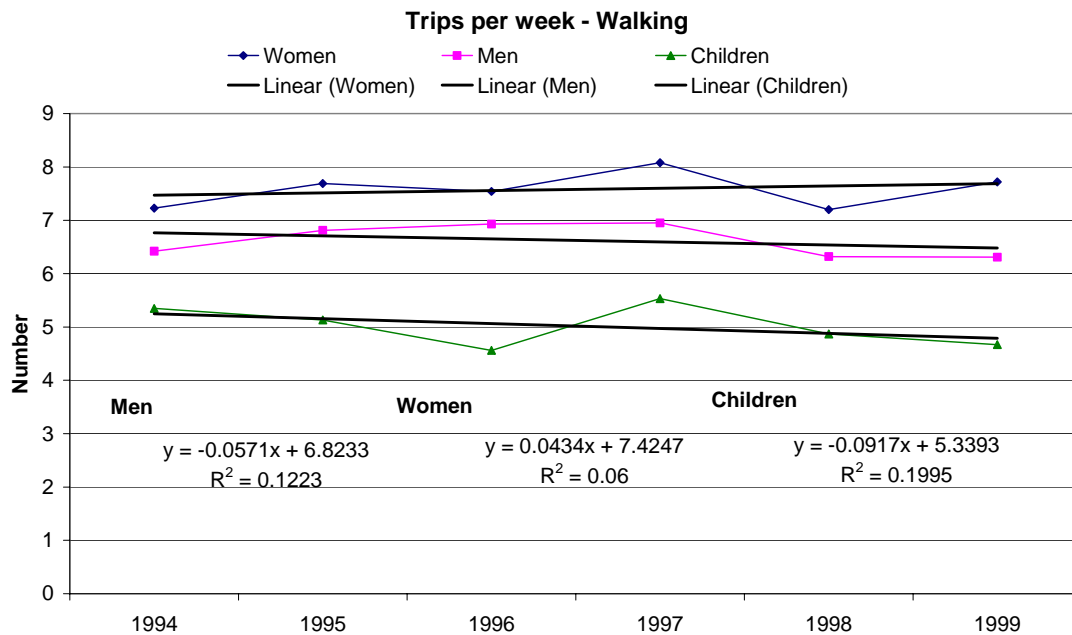


C. Non-Motorised Travel (Walking and Cycling)

In terms of total trips per week, walking dominates non-motorised travel. However cycling trips are of course much faster, almost 12 kph compared with walking about 4.5 kph. The average values of variables for the years 1994 to 1999 are shown in the following tables.

<i>Walking</i>	<i>Women</i>	<i>Men</i>	<i>Children</i>
Trips per week (tpw)	7.58	6.62	5.02
Minutes per trip (mpt)	9.1	9.2	9.3
Kilometres per trip (kpt)	0.65	0.71	0.70
Hours per week (hpw)	1.15	1.02	0.77
Minutes per week (mpw)	68.8	61.0	46.4
Kilometres per week (kpw)	5.0	4.7	3.5
Speed (kph)	4.3	4.6	4.5

<i>Cycling</i>	<i>Women</i>	<i>Men</i>	<i>Children</i>
Trips per week (tpw)	0.67	0.59	0.17
Minutes per trip (mpt)	16.5	16.7	15.2
Kilometres per trip (kpt)	3.2	3.2	2.9
Hours per week (hpw)	0.18	0.16	0.04
Minutes per week (mpw)	11.0	9.8	2.6
Kilometres per week (kpw)	2.15	1.88	0.51
Speed (kph)	11.7	11.6	11.6



D. All Modes (Motorised and Non-Motorised)

In terms of the number of trips, women and men do an average of just over four per day (28 per week), whereas children average only 23 trips per week. Men take longer and further trips than women and hence, on average, travel 74 minutes and 39 kilometres more per week than women. Children travel just over five hours per week and travel only 87.3 kilometres, only half the distance travelled by men.

The average values of variables for the years 1994 to 1999 are shown in the following table.

<i>All Modes</i>	<i>Women</i>	<i>Men</i>	<i>Children</i>
Trips per week (tpw)	27.7	28.5	23.1
Minutes per trip (mpt)	15.6	18.4	13.5
Kilometres per trip (kpt)	4.72	6.13	3.78
Hours per week (hpw)	7.47	8.70	5.21
Minutes per week (mpw)	448.0	522.0	312.0
Kilometres per week (kpw)	135.6	174.4	87.3
Speed (kph)	18.1	20.0	16.8

The econometric explorations of the demographic composition of the different modes of travel in Melbourne presented in sections II and III are used in Section IV to make projections of the data back to 1991 and forward to 2006.

As mentioned throughout the paper, major changes are detected in the travel behaviour of women, particularly large increases in trips and kilometres as car drivers and as tram passengers. Increases in these modes are sufficiently strong to carry forward in to women's total travel. Women's total all modes trips, kilometres and hours per week all increase strongly over the period 1994 to 1999, and hence into the projections over the period 1991 to 2006.

Why did this happen?

Although our initial hypothesis was this was due to the increasing participation of women in paid work, analysis of the origin and destination purposes of trips shows this is not so.

Although the Melbourne travel survey had many categories of the origin and destination of travel, we have condensed these into four economic categories – *market work, household work, consumption and investment* (Ironmonger, 2006; Ironmonger and Norman, 2006). The consumption category includes trips for recreation, eating/drinking, visit someone, play sport, watch sport, watch concert/ music and stay overnight.

The data show, both for origin and for destination trips, the only significant trend in women's trips is in the consumption category. This increased at the average annual rate of 4.5 per cent. Market work trips increased at the statistically non-significant rate of 0.1 per cent per year.

IV. Trend Travel Projections 1991 - 2006

The projections, both forward to 2006 and backward to 1991, are presented in a series of charts in the Appendix to this paper. As in Section III, the discussion of these projections is covered in three parts -

- A. Car Driver and Car Passenger
- B. Public Transport (Train, Tram and Bus)
- C. Non-Motorised Travel (Walking and Cycling)

A. Car Driver and Car Passenger

The major change is in the behaviour of women as car drivers. In 1991 women were doing only three quarters the number of car driving trips as men; by 2006 they were doing the same number. Women increased the kilometres per week as drivers from 62 in 1991 to 103 in 2006 whereas men had hardly any increase – a change from 128 to 132 kpw. By the end of the period the average speed of women drivers had reached, if not exceeded, that of men. In 1991 they were driving at only 87 per cent of men's average driving speed.

Children are the majority as car passengers – about 16 trips each per week, with women only five and men less than three trips a week. For men and women car passengers, the average kilometres per trip was stable at 7.1 whereas for children the average journey increased from 4.4 km in 1991 to 5.1 km in 2006. As a result the average kilometres per week travelled by car for children increased from 72 to 83 and the time as a car passenger from 3.7 to 4.3 hours per week.

B. Public Transport (Train, Tram and Bus)

Women are doing more train trips with somewhat shorter distance per trip but with an overall increase in kilometres per week as train passengers from 9.2 to 11.2 km. For men the average number of train trips seems unchanged but again with shorter distance per trip so men's average train kilometres per week has declined from 12.8 in 1991 to 10.9 in 2006. Children do very little travel by train and it seems to be unchanged over the 15 year period.

Women do more tram journeys than men and travel more kilometres. This relative position increased over the 15 years. By 2006 the trend projections show women travelling 50 per cent more tram trips than men and 60 per cent more kilometres. Again, children do very little travel by tram.

In the third component of public transport in Melbourne, buses, the statistics include school buses as well as ordinary public bus routes. Here children are more frequent travellers than women and women more frequent than men. However the data are so variable that the trends shown by the sample data are unreliable and we accept the hypothesis that there are no significant trends. The projections therefore just use the mean values throughout the projection periods.

C. Non-Motorised Travel (Walking and Cycling)

Walking seems to be unchanged with women doing on average 7.6 trips per week, men 6.6 and children 5.0. The average time per trip is also constant at just over nine minutes per trip.

Cycling shows very few trips by women and their average time per trip has declined. On average, men and children have the same number of cycling trips per week, more than twice that of the average of women. Children and men are also increasing their average minutes per trip; by 2006 the projections are 22.5 minutes for men, 17.8 minutes for children and 15.2 minutes for women.

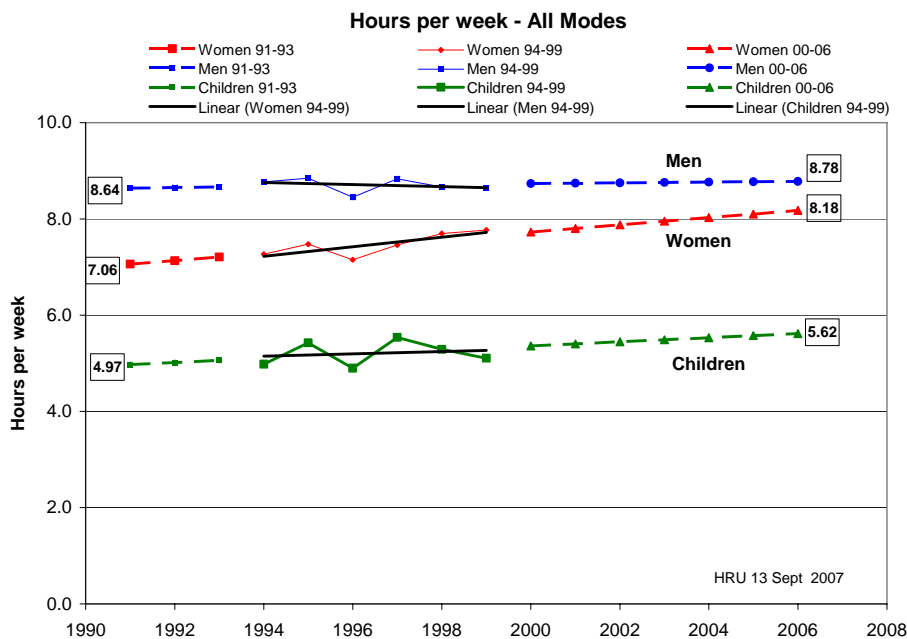
V. Travel Time Budgets for Women, Men and Children

There is no doubting that the *total* time budget available for all activities is 168 hours per week. This is identical for everyone – woman, man and child – and hence the *average* total time budget is also 168 hours per week.

Is it an established fact that human populations have on average maintained a fairly constant amount of time – a travel time budget – of just over eight hours per week?

What do the Melbourne travel time data show on this issue?

Clearly the women of Melbourne have increased the average time per week spent in travel. Using the projections for the period 1991 to 2006, women’s total travel time over the 15 years has increased by 16% from 7.1 to 8.2 hpw. This increase of 1.1 hpw is almost entirely an increase in the time spent driving a car which increased by 37% from 3.2 to 4.3 hpw. Women also increased the time they spent as train and tram passengers but slightly decreased the time they spent as a car passenger.



On average, Melbourne men spend more time travelling than Melbourne women – over eight and a half hours per week, compared with less than eight in the sample survey period. For men there was a relatively small increase in the average time budget; only 1.6% from 8.6 to 8.8 hpw. Nearly all of this time increase was as a car passenger. There was a decrease in time as a train passenger and possibly some increase in the time spent cycling.

The average adult time budget rose to 8.5 hpw (1 hour 13 minutes per day) in 2006.

The average child spends less time travelling than does the average adult. However, over the 15 years from 1991 to 2006 there was an increase of 13% from 5.0 to 5.6

hpw. This increase was almost entirely as car passengers which increased by 16% from 4.7 to 5.3 hpw.

Including the child averages in the aggregate weekly time budget of course lowers the adult average to an “all persons” average of just under 8 hpw (1 hour and 8 minutes per day) in 2006. Our estimate for 1991 is just 1 hour and 2 minutes per day (7.25 hpw).

It seems that there has been some increase in the travel time budget in Melbourne in the last 15 years but again the estimate is just over one hour per person per day.

Conclusions

Men’s travel behaviour changed little; a 2.9 per cent decline in number of trips, a 3.5 per cent increase in kilometres and only a 1.6 per cent increase in hours.

For children there were some significant changes; hours and kilometres per week increased by 13 per cent, but this was done with the same number of trips.

The big change in travel behaviour in Melbourne over the last 15 years has been mainly a story of increasing number of trips, travel distance and travel time of women. Women’s average travel time budget increased by 16 per cent over the 15 year period and their average number of trips per week by 15 per cent.

On average women’s total kilometres per week increased by a massive 33 per cent. The extra trips done by women as car drivers were done at increased average speeds, projected to equal that of men by 2006. Overall, women increased their travel speed over all modes by 15 per cent.

In Melbourne the travel time budget has increased with a similar increase in trip numbers but with double the increase in distance due to the increase in average speed. This confirms the finding of Zahavi of the importance of travel speeds and that people use the ability to travel at greater speed to make more and further trips whilst keeping a relatively stable travel time budget.

1 October 2007

Acknowledgements

In the preparation of this paper, the authors are particularly indebted to the research assistance of Mrs Pamela Anderson and Dr Bill Lloyd-Smith of the Households Research Unit of the Department of Economics, University of Melbourne.

References

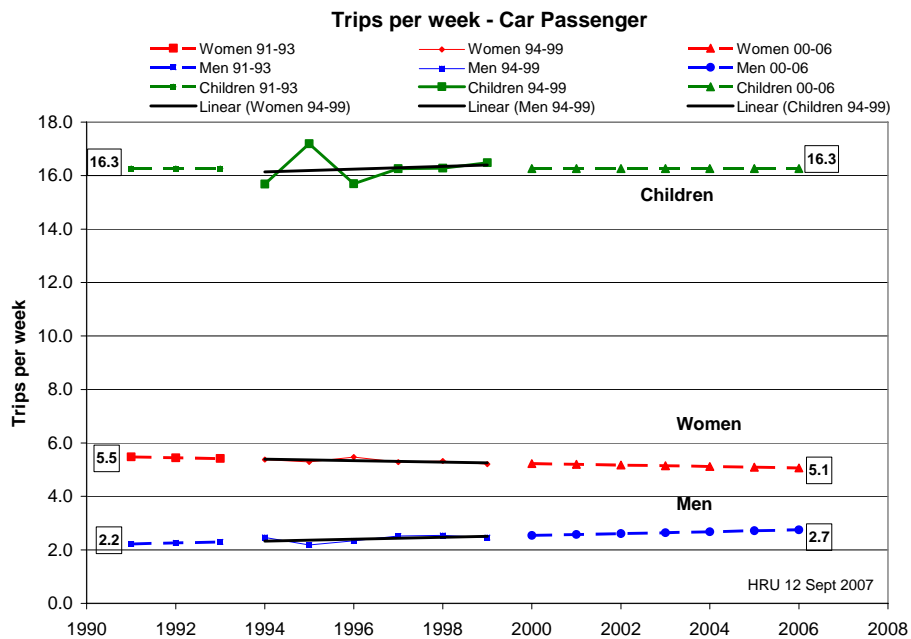
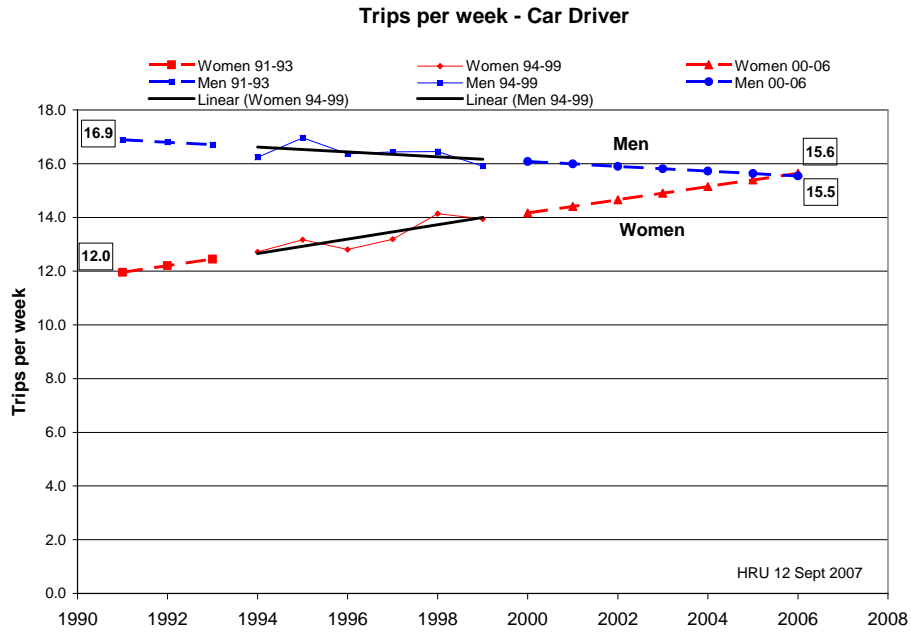
Ausubel J H and Marchetti C (2001) "The Evolution of Transport", *The Industrial Physicist* 7(2):20-24

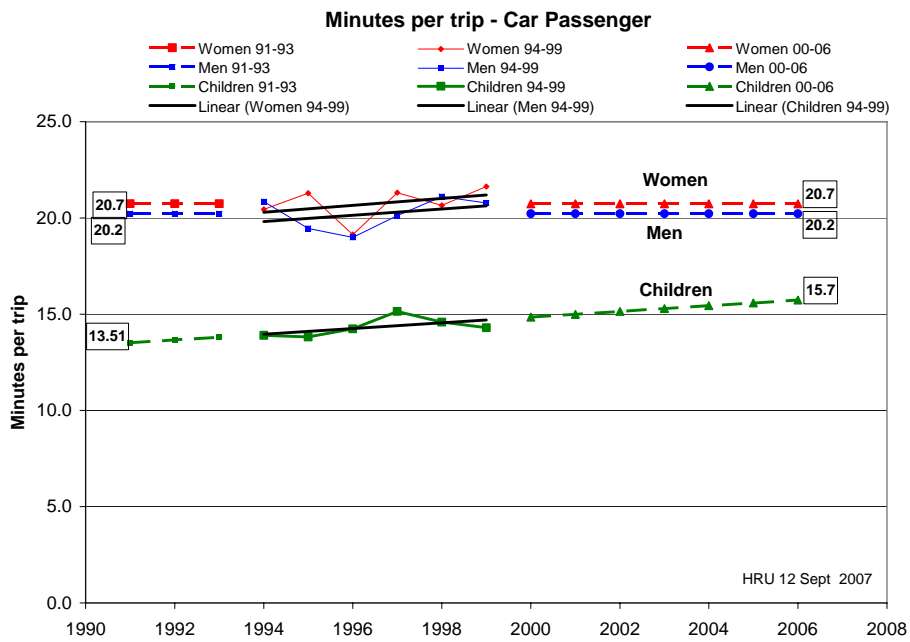
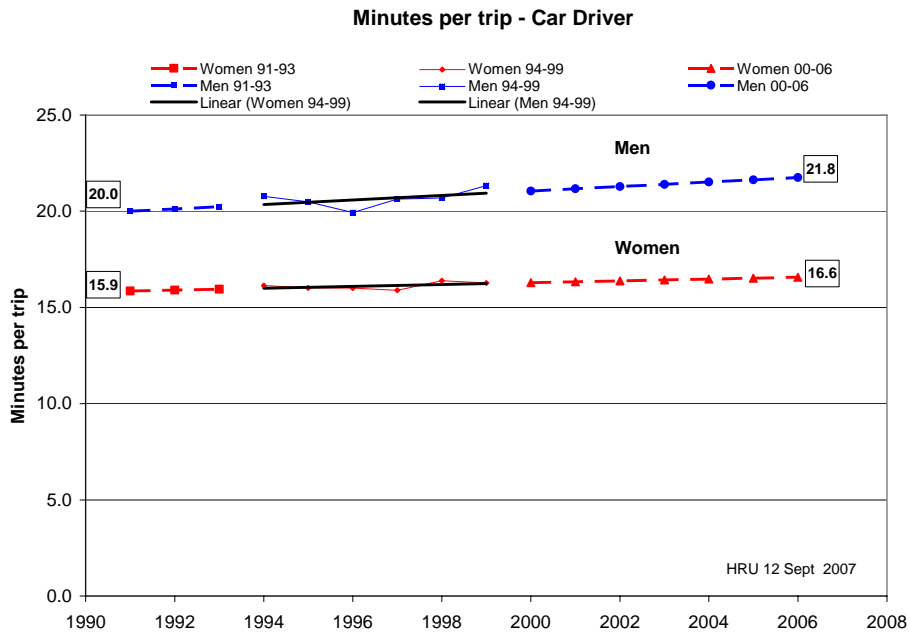
Ironmonger D (2006) *A System of Time Accounts for Melbourne: A Report Commissioned by the Department of Infrastructure, Victoria, Australia* The University of Melbourne, Victoria

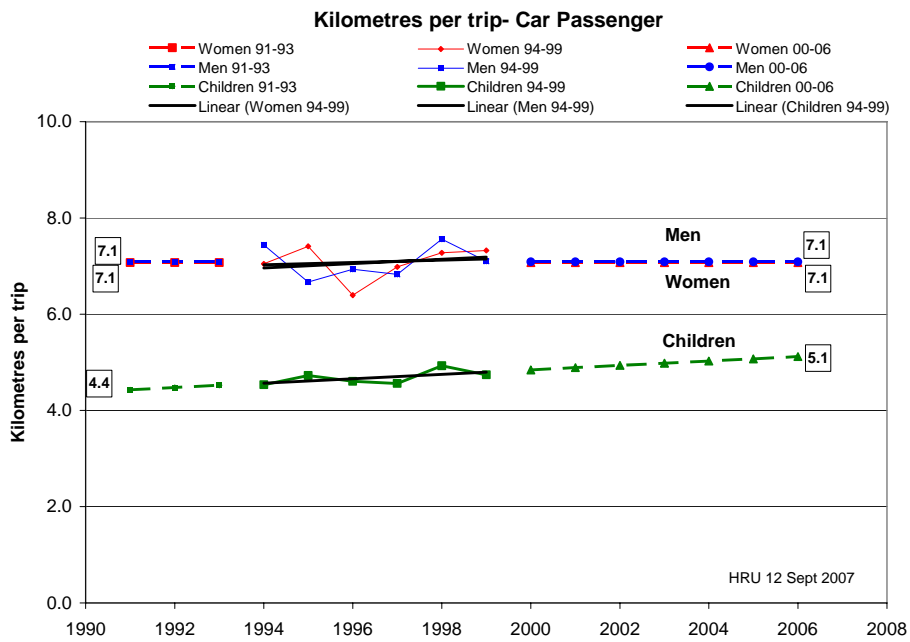
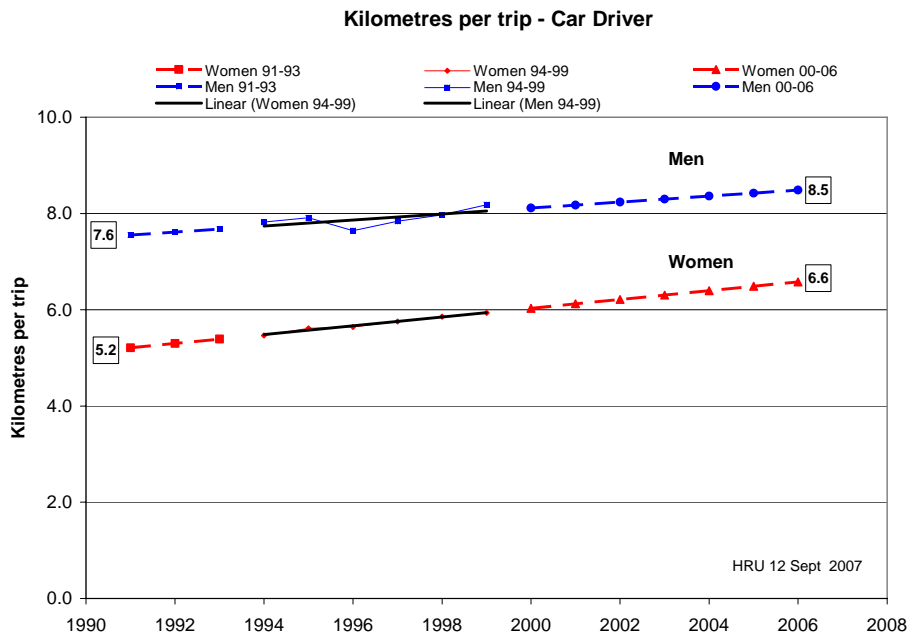
Ironmonger, D.S and Norman P (2006) *A System of Time Accounts for Melbourne. Paper presented to the 28th Annual Conference on Time Use Research, 16-18 August 2006, Copenhagen, Denmark*

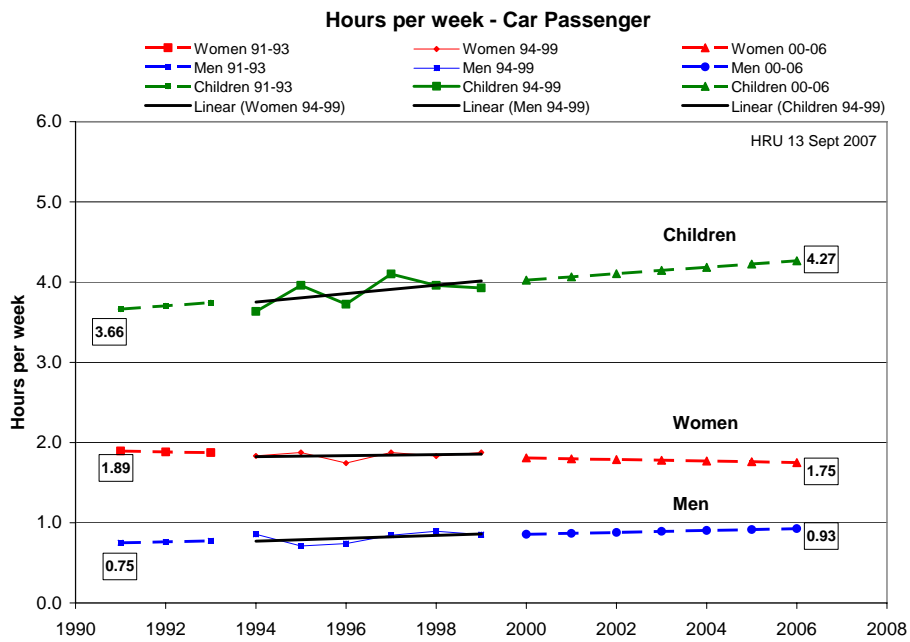
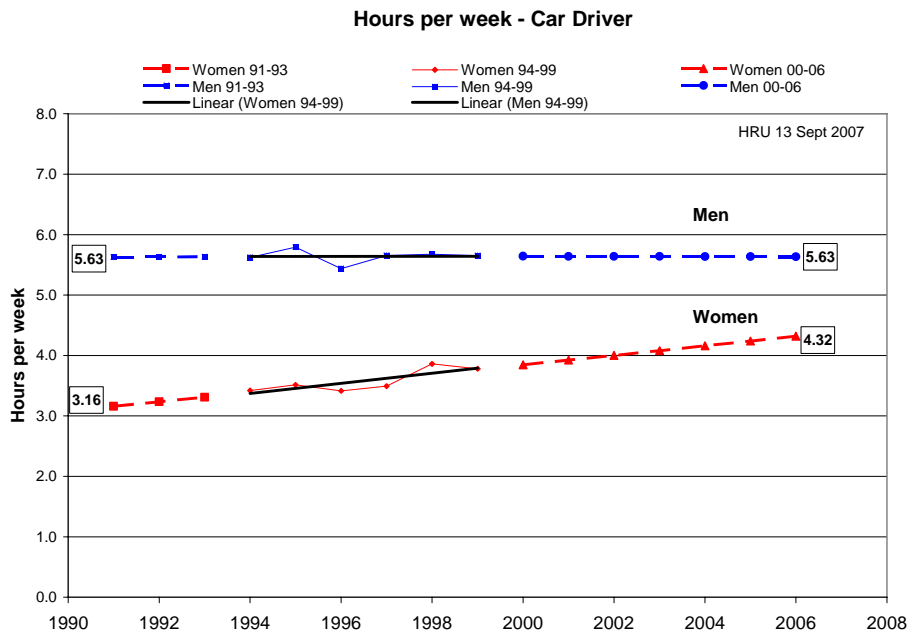
University of Minnesota (2007) "Yacov Zahavi" Metropolitan Travel Survey Archive <http://www.survey archive.org/zahavi.html>

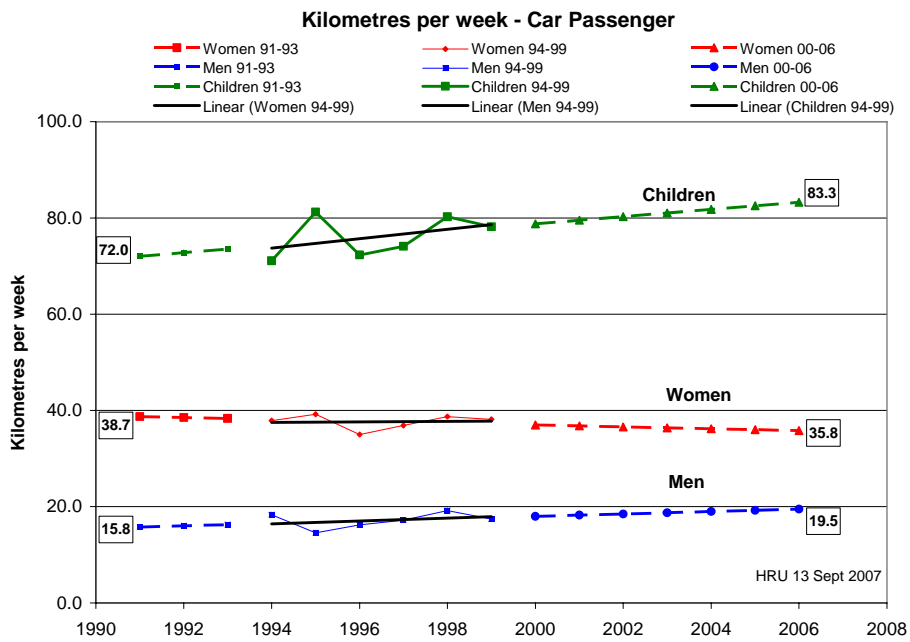
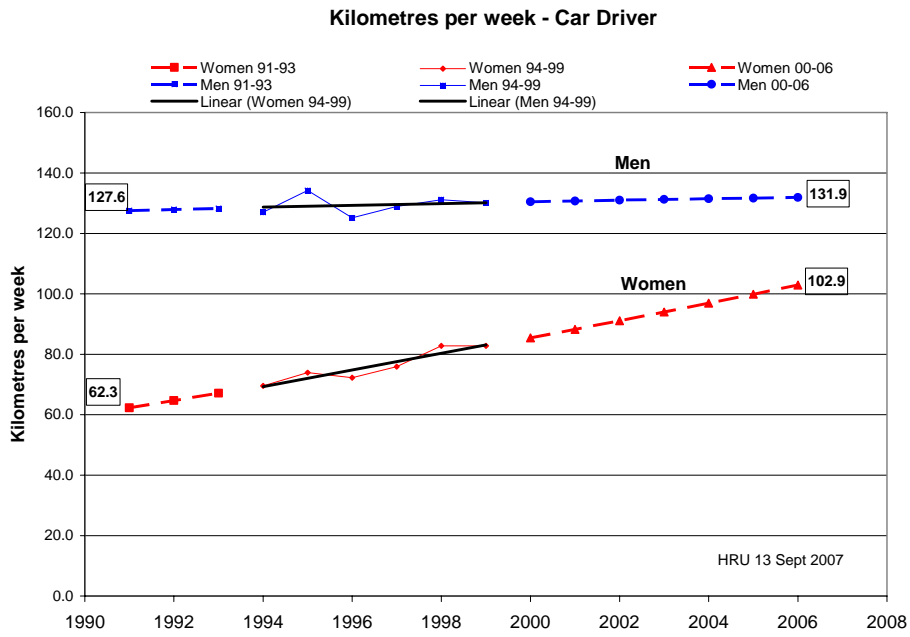
Appendix
Charts

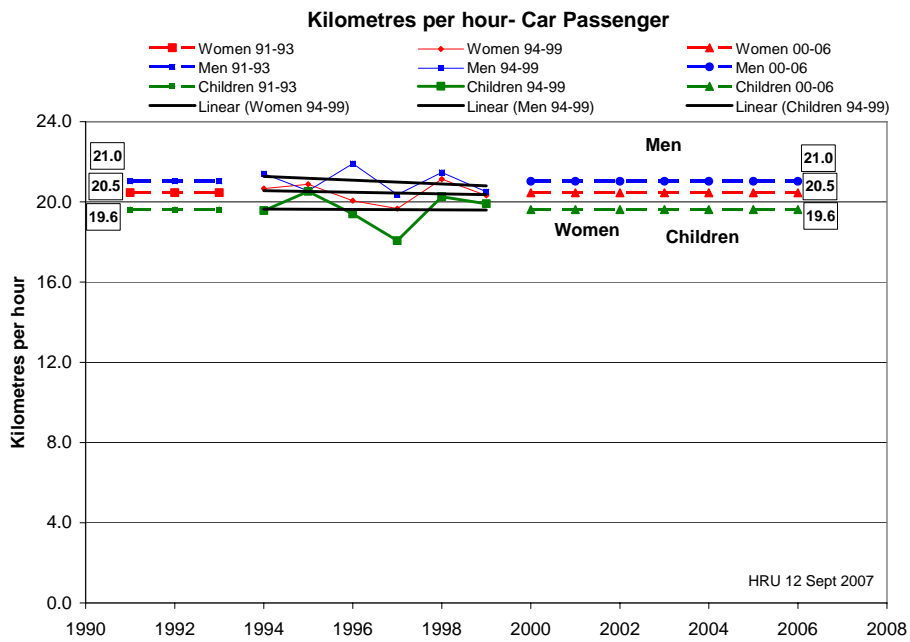
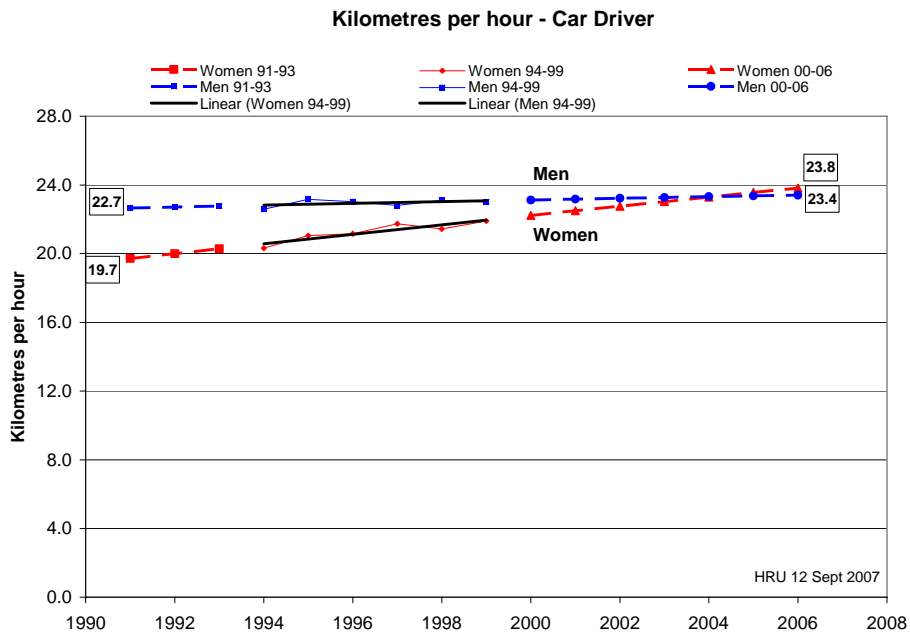




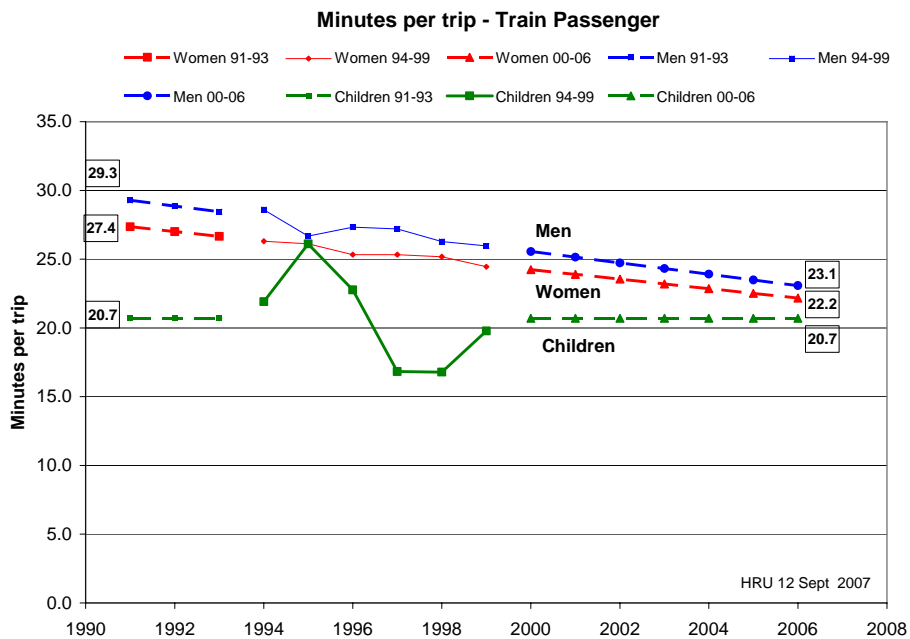
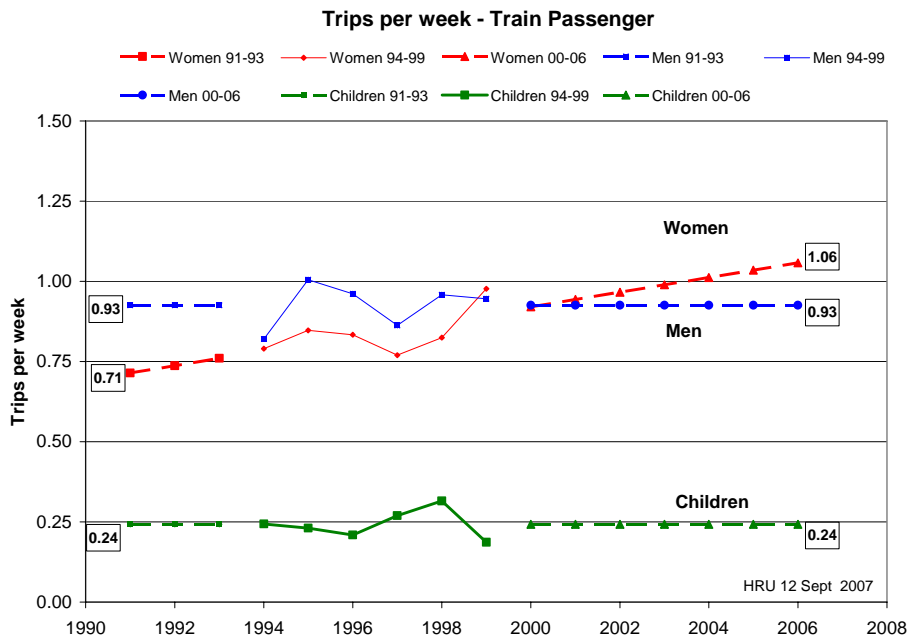


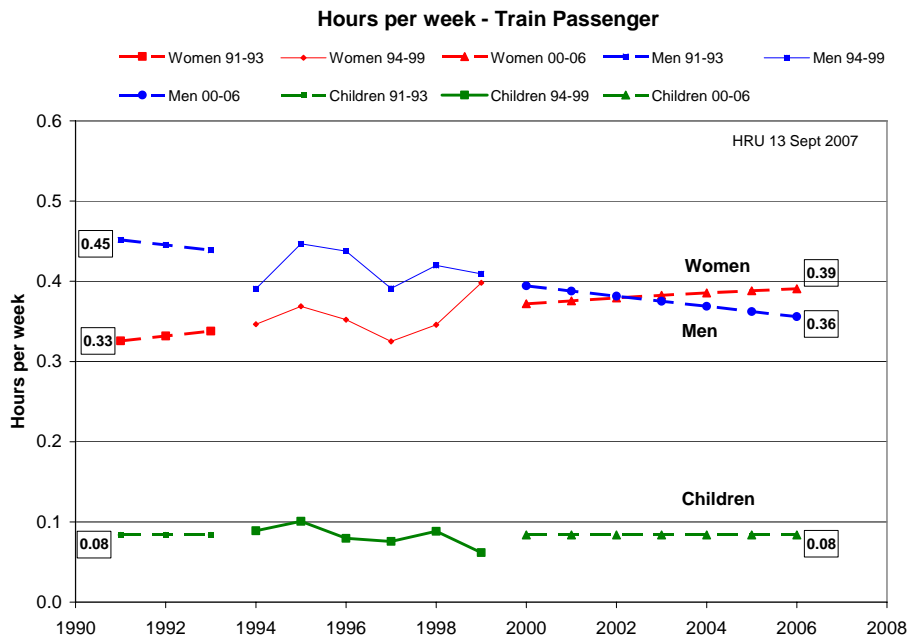
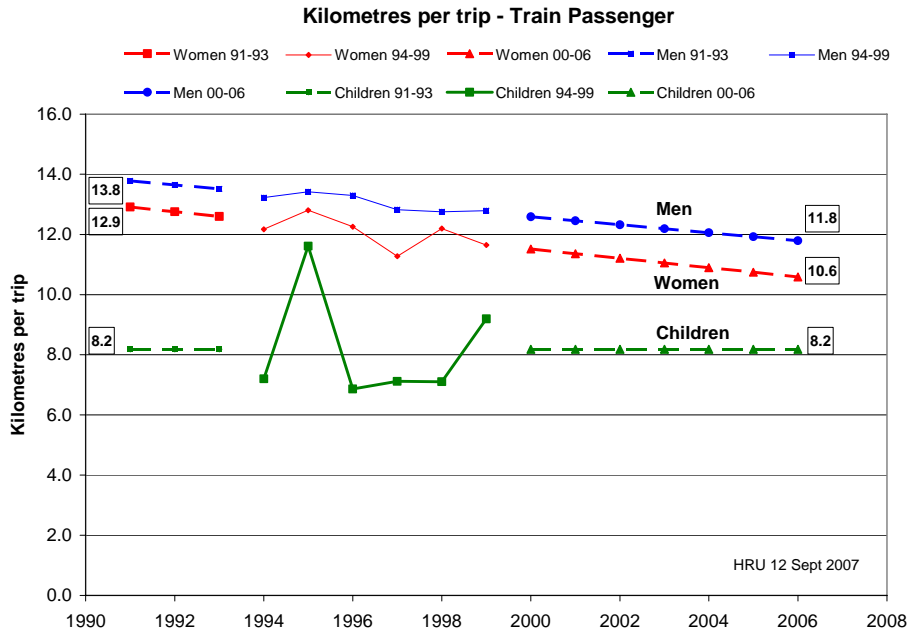


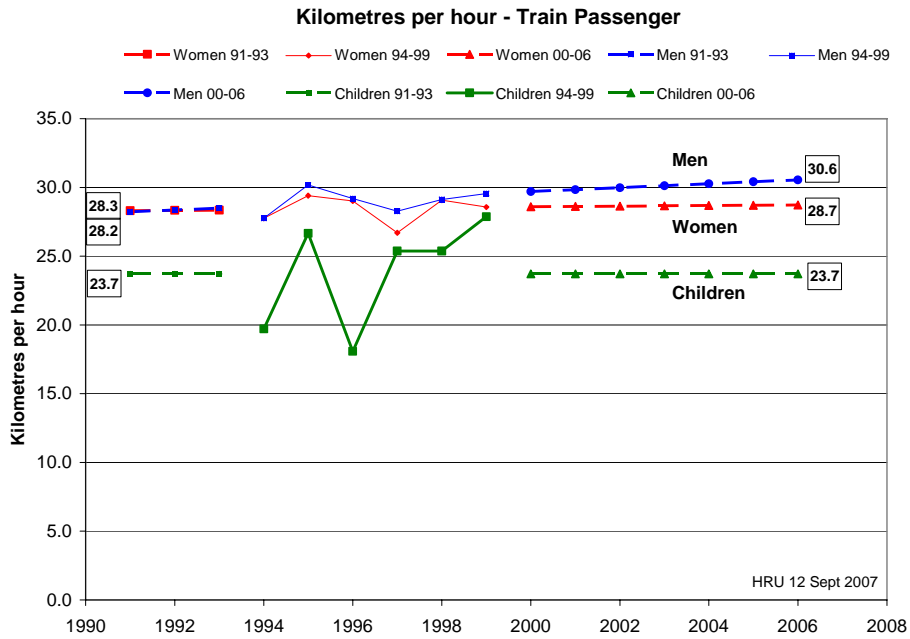
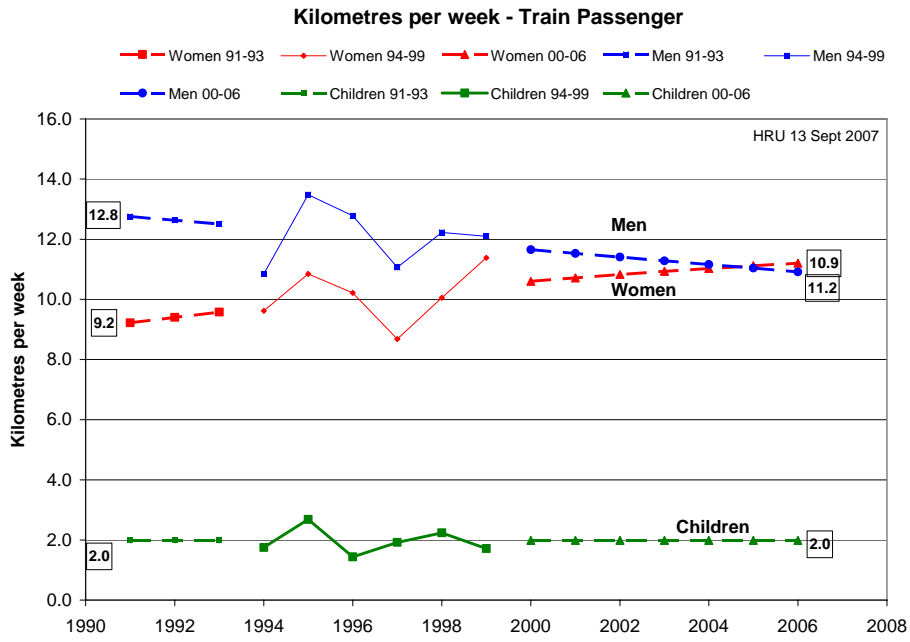




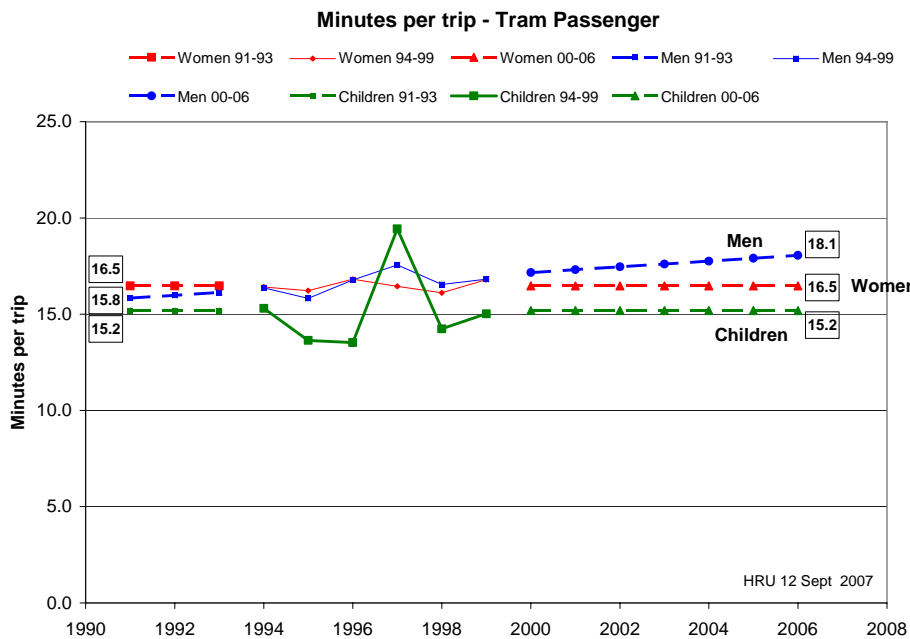
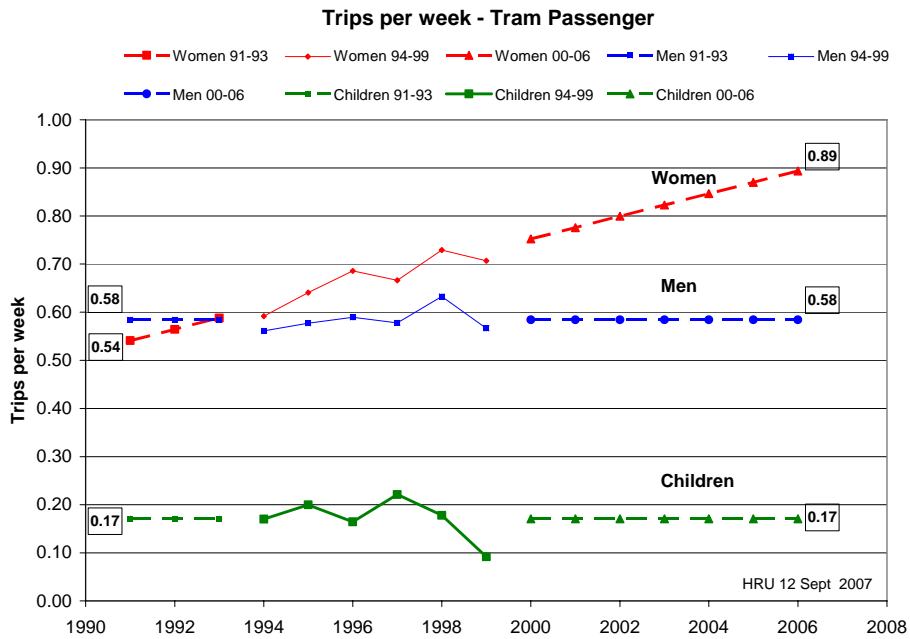
Train Passengers

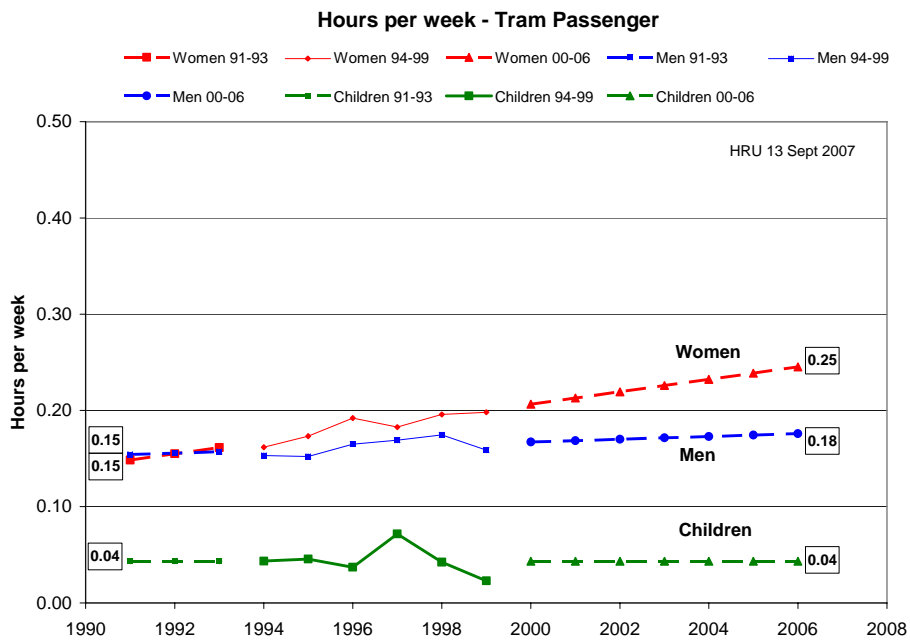
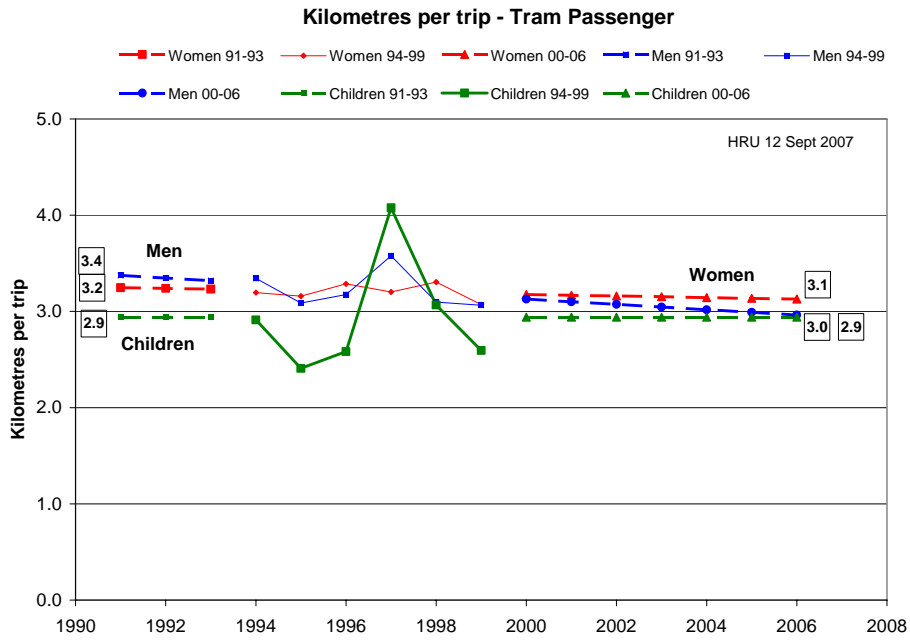


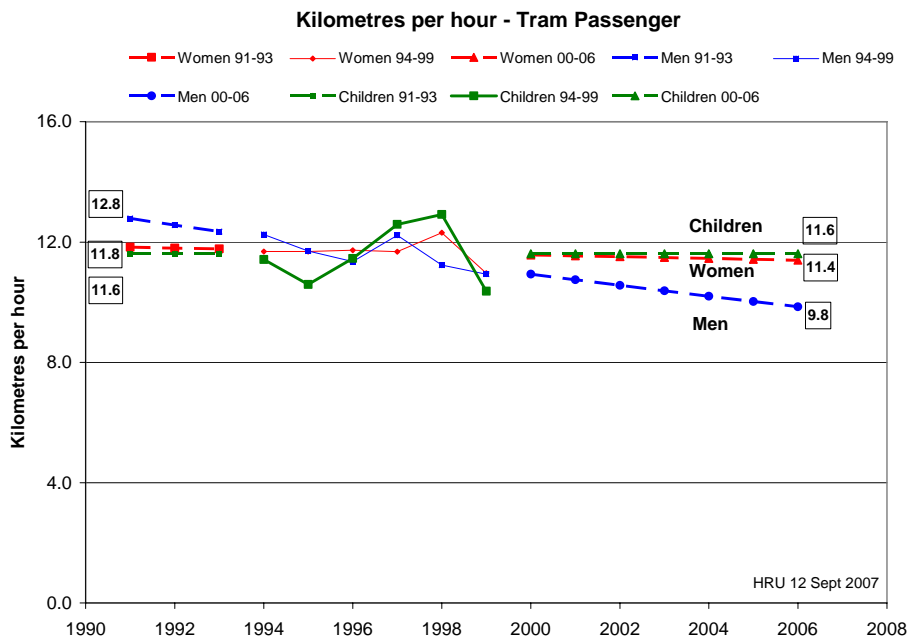
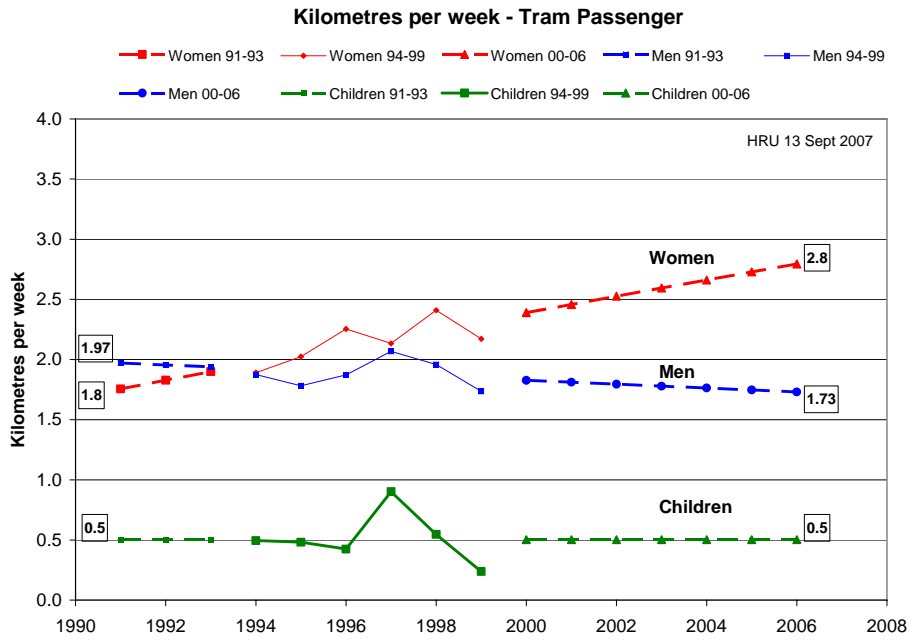




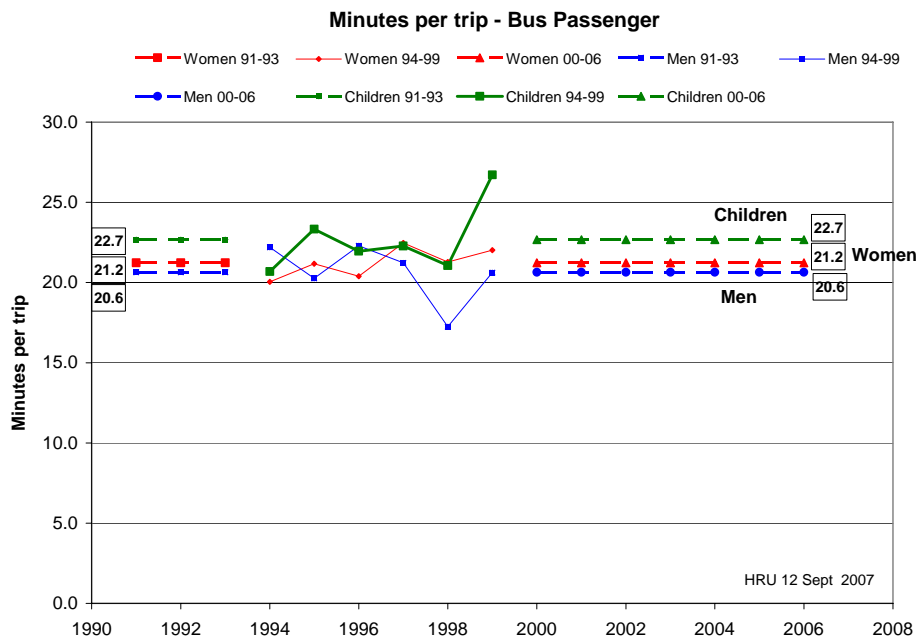
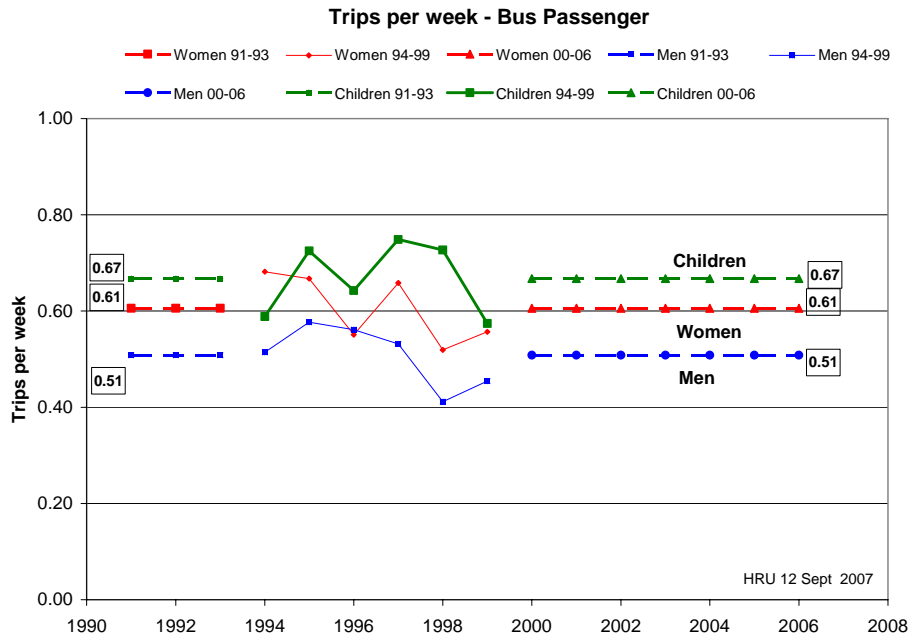
Tram Passengers

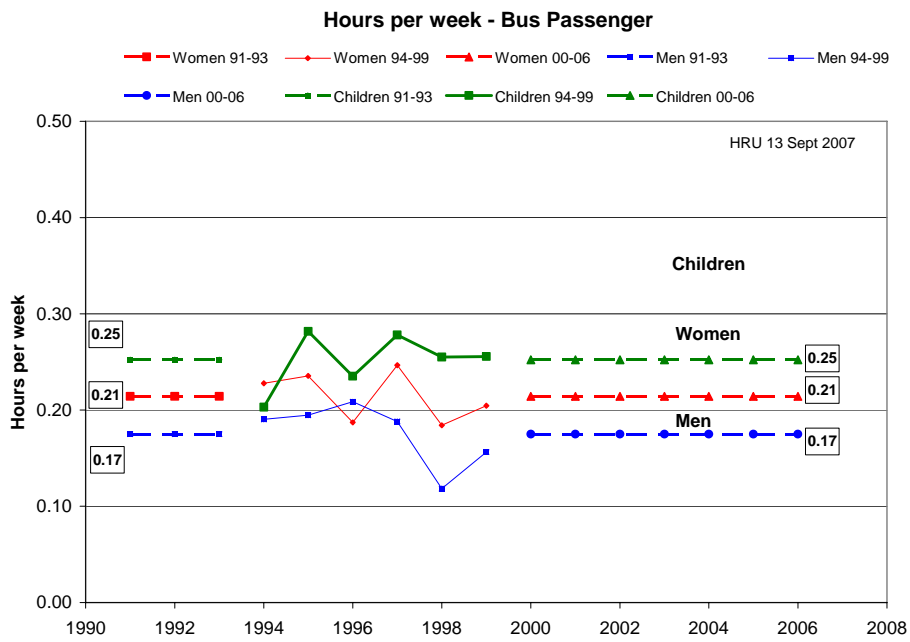
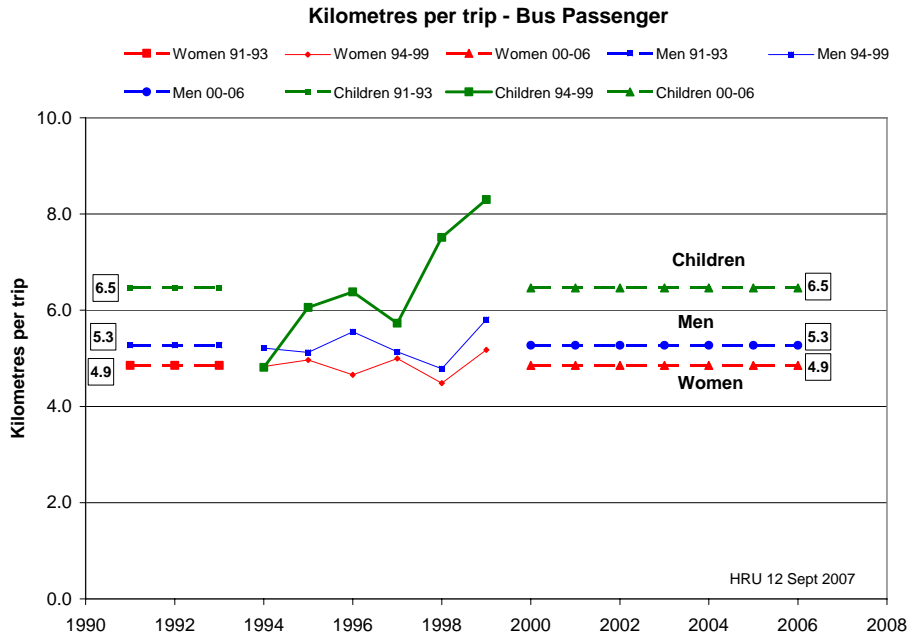


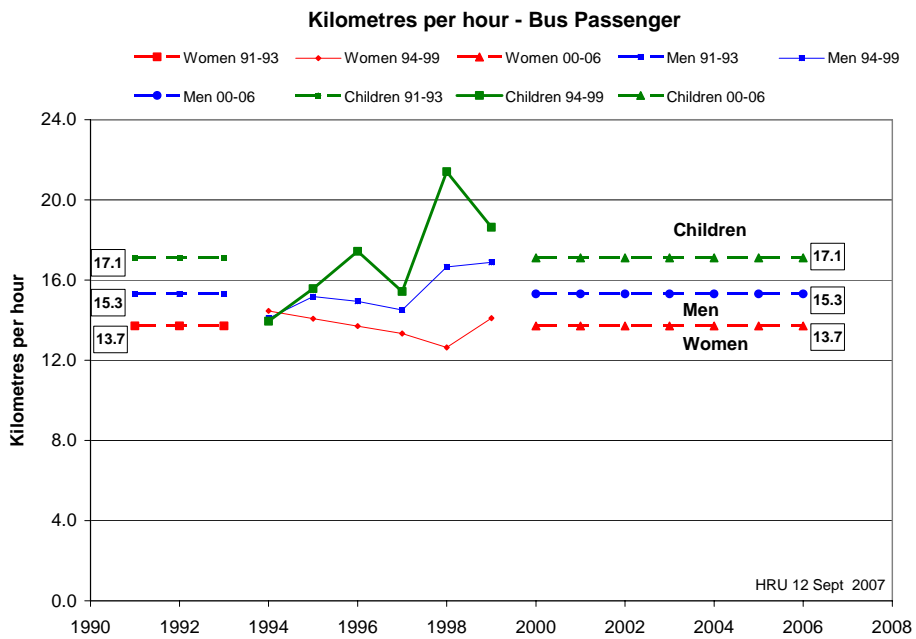
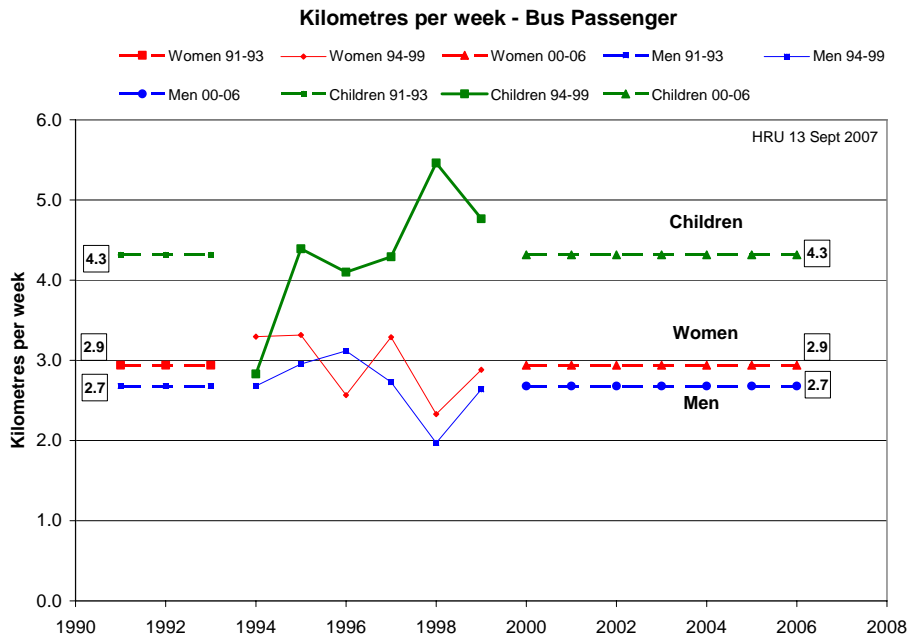




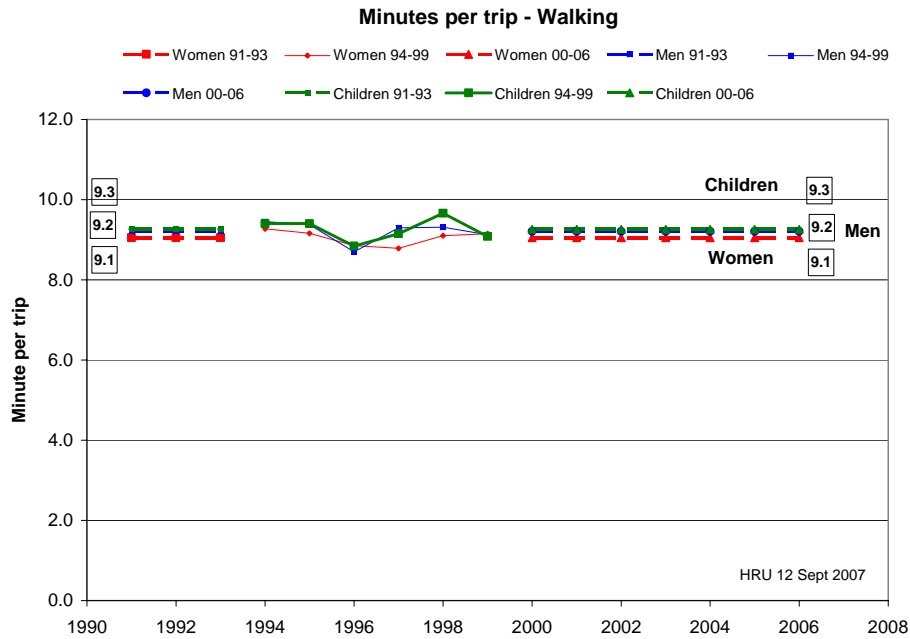
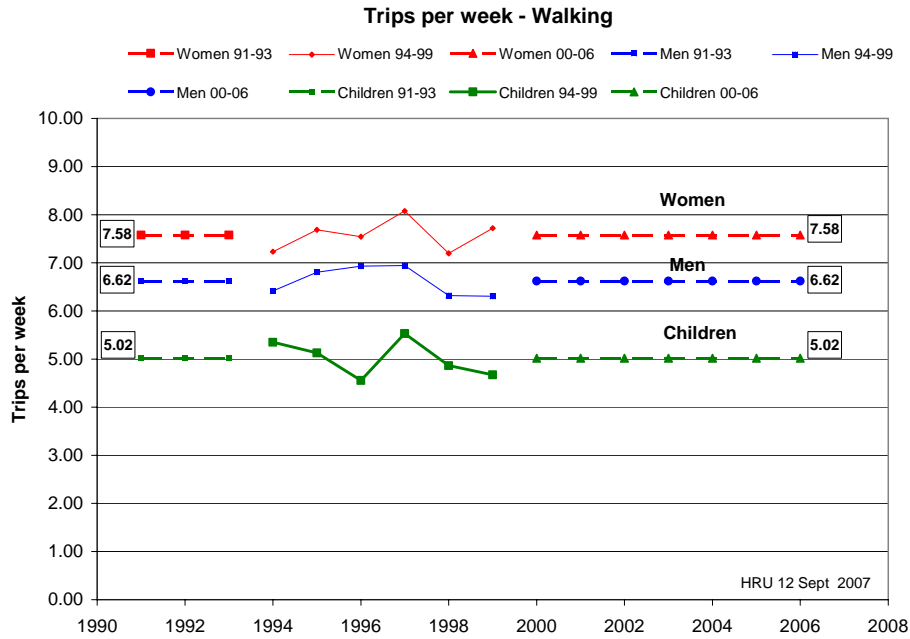
Bus Passengers







Walking



Cycling

