PATREC

PLANNING AND TRANSPORT RESEARCH FORUM 2010

Empty Cells, Damned Half-Truths and Pseudo-Statistics: The Lot(tery) of the Bicycle Planner

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1 Introduction

> ***Sir Humphrey****: Unfortunately, among the many extraordinary qualities politicians undoubtedly possess, reasonableness isn't necessarily the first that springs to mind. Not when one contemplates the average Minister and our Minister is very average.*
>
> (*Yes, Minister*. Episode 13. The Quality of Life)

> ***Translated for context****: Unfortunately, among the many extraordinary qualities transport data undoubtedly possess, 'fit for purpose' isn't necessarily the first that springs to mind. Not when one contemplates average transport data and our travel survey data are very average.*

The 'I didn't see him/her' defence is a cliché when it comes to incidents involving motor vehicle drivers and cyclists on the road. The same statement could equally be used to describe much mainstream transport planning as far as cyclists are concerned and the absence or incorrect use of data on bicycle use has led to distortion of resource allocation away from projects to benefit cycling safety (Ker, 1994).

Most transport planners have no choice but to operate in the netherworld of imperfect information, and when it comes to cycling the information is more imperfect than most. The less good the information, the more important it is to understand its limitations, but this is rarely attempted. This is particularly important when using a number of different sources each of which has its own limitations and which may differ from, or even contradict, each other.

The temptation, however, is to grab hold of any information, however imperfect it might be, and treat it like gold, when a little investigation would separate the nuggets from the pyrites - the true gold from the fool's gold.

There have been three major travel surveys for Perth over the past 35 years: 1976, 1986 and 2003-6. A Perth travel survey was commissioned for 1996, but was abandoned when quality control monitoring demonstrated a range of significant problems with the collection, coding and analysis of the data.

The timing of these surveys has been made to coincide with Census years and allow comparison with and validation against Census data. However, even Census data, despite being based on a near-100% sample, needs to be interpreted with caution. In the case of the journey to work, for example, weather conditions on Census day can have a substantial impact on the mode of travel – especially in the case of cycling and walking.

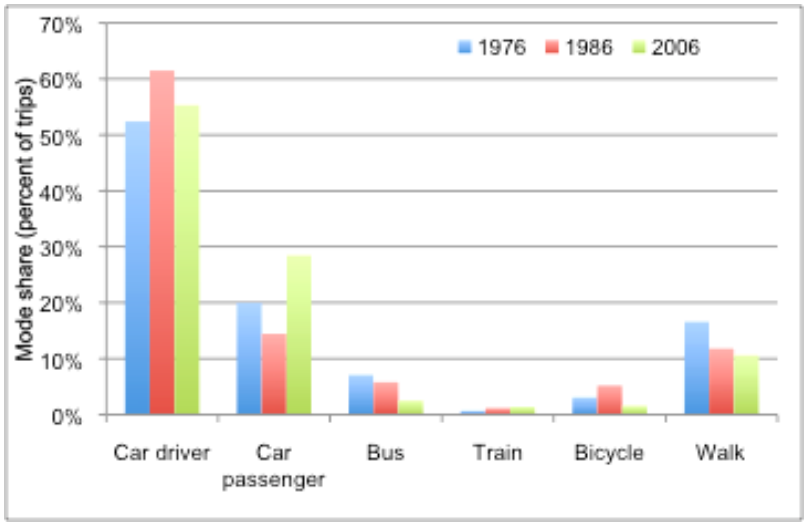
We also have ten years of annual bicycle counts at locations on the Perth Bicycle Network, with consistency of count sites, including screenlines, and time of year.

This paper reviews key sources of data on cycling in Perth and exposes shortcomings and contradictions that need to be investigated and addressed if cycling is to be given due attention in transport planning.

2 Mode Share

The most fundamental parameters of interest relate to the level of cycling activity and how this has changed over time.

Data from the 1986 and 2003-6 travel surveys for Perth appear to show that the bicycle mode share has collapsed from 5.2% in 1986 to 1.6% in 2003-6. In 1976, the bicycle mode share was estimated to be 3.1% of trips, indicating either a sharp reversal of trend after 1986 or problems of comparability between the three surveys (Figure 1).



Sources: 1976 data from *Home Interview Survey 1976: Observed Travel Characteristics.* Perth Transport 2000 – Technical Paper No 4. Office of the Director general of Transport: Perth, WA. 1986 data from tabulations provided by Transport WA in the early 1990s. 2003-6 data from PARTS (undated) and more detailed tabulations provided by Peter Lawrence (Department of Planning) in personal communications.

Figure 1 Bicycle mode share for Perth: 1976, 1986 and 2003-6

This clearly requires further investigation in the light of, for example, Perth Bicycle Network Counts that have consistently shown increasing usage on the PBN for over a decade. In 2008, it was reported that:

- "Overall for the whole count in 2008, (Group A and B sites, and Fremantle and Perth Cordon) there has been an increase of 28% from 2007.

- Overall for the whole count in 2008, (Group A and B sites, and Fremantle and Perth Cordon) there has been an increase of 207% from the baseline counts" [of 1999] (ARRB, 2008)

In part, increasing numbers of cyclists can be attributed to population growth, even with a decrease in mode share. However, increases in the PBN counts are substantially greater than population growth over the same period, so it is likely that the bicycle usage measured in the PBN counts is not representative of the overall experience in Perth or that there are some substantial comparability issues with the 1986 and 2003-6 Perth travel surveys.

3 Response Rates and Trip Rates

A partial explanation could be differences in methodology, eg response rates and the extent to which short trips are (un)reported. Low response rates to travel surveys produce higher trip rates per person (Brög and Ker, 2009, pp98-100) and short trips can be problematic if the survey doesn't adequately prompt respondents to think about activities as well as travel.

Overall, the average 2003-6 trip rate per person (3.48 per person per weekday) is consistent with the rates recorded in 1986 (3.43) and 1976 (3.57), but this does not rule out compensating errors of lower response rate (and, hence, higher trip rates) and poorer reporting of short (largely walking and cycling) trips in 2003-6.

It also needs to be noted that the population for each of the three surveys (1976, 1986 and 2003-6) was different.

- In 1976, trips made by children under 5 years were not recorded;
- In 1986, trips made by children under 9 years were not recorded;
- In 2003-6, the surveys were designed to capture trips by all persons irrespective of age.

However, data for 2003 (40% of the 2003-2006 total survey responses) indicate that the 9-year age threshold made only a very small difference to the bicycle mode share (increasing it from 1.60% to 1.64%). Even the largest variation that could result from these differences would not account for the apparent differences in mode share between the years.

There is an issue of serious concern in the interpretation and use of travel survey data. It is important to identify the extent to which apparent changes in mode shares between 1986 and 2003-6 are real and to what extent they are artefacts of the survey methodology and effectiveness. The Department of Transport should undertake an investigation of the 1986 and 2003-6 surveys to assess this.

Nevertheless, the change in cycling mode share shown in Figure 1 is so substantial that the trend is generally regarded as real, if only by implication through acceptance of the 2003-6 value as a replacement for the 1986 one in transport planning, although the precise magnitude of the change might be open to question.

4 Trip Purposes

According to the Perth Travel Surveys, there has been a major shift in the purposes for which people cycle in Perth, with:

- Increases in the importance of work and 'other' (primarily leisure) trips;
- Decreases in school and shopping trips (Figure 2).

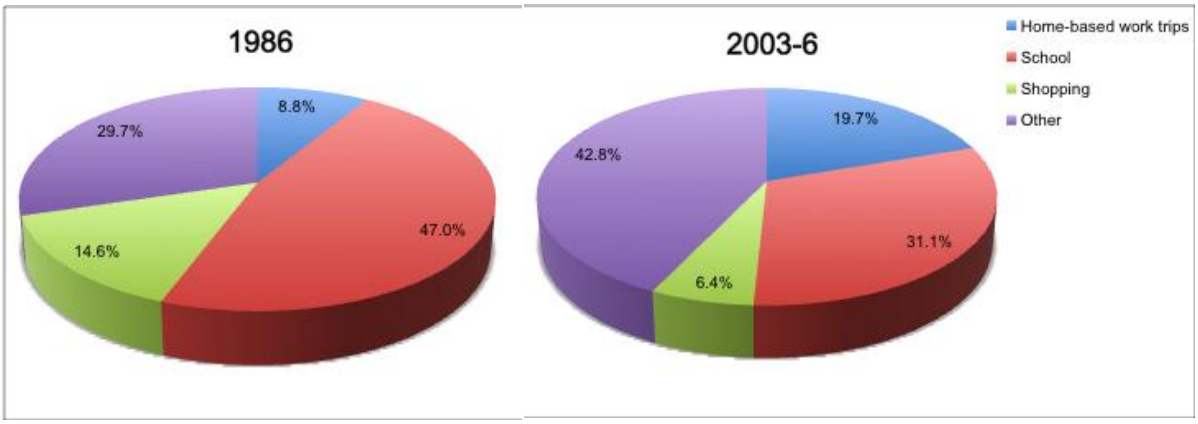


Figure 2 Cycle trip purposes: 1986 and 2003-6

In the ten years prior to 1986, travel surveys showed virtually no change in the relative importance of trip purposes (Figure 3), although there was a substantial difference in the mode share of cycling.

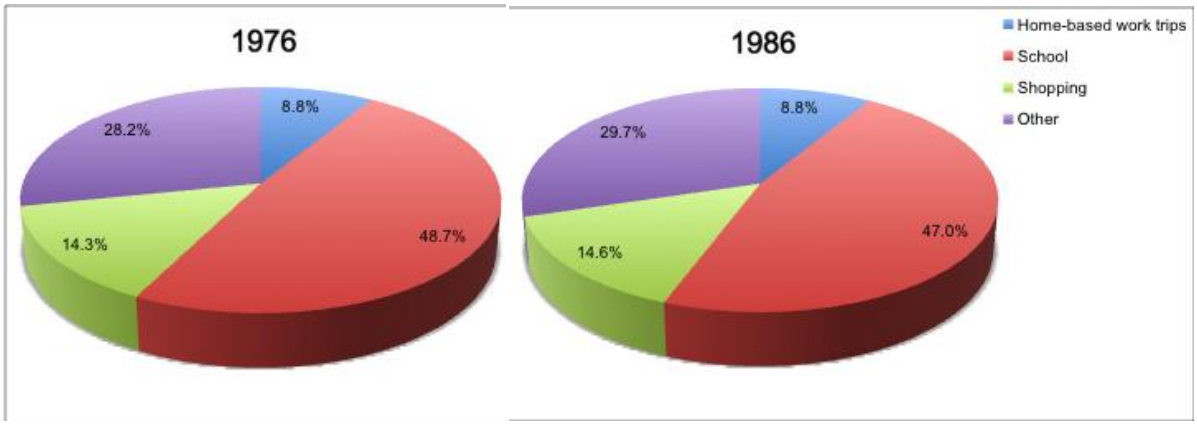


Figure 3 Cycle trip purposes: 1976 and 1986

Not surprisingly, the trips that appear to have become more important are those most likely to be catered for by the progressive implementation of high standard regional facilities, first under the Perth Bikeplan, 1985, and then as part of the Perth Bicycle Network Plan, 1996.

However, questions need to be asked about the comparability of the 2003-6 surveys with previous surveys, including:

- Whether short trips are adequately captured in the 2003-6 survey;
- Whether other sources of evidence (eg surveys of travel to school as part of the School TravelSmart program) can corroborate the recorded 2003-6 cycle mode share. Note, however, that such surveys are likely to measure the amount of cycling for a specific purpose (eg travel to school) and need to be related to what appears to be an even more precipitate fall in the amount of cycling to school between 1986 and 2003-6.

If the reduction in the school and shopping shares of cycle trips were in the context of an increasing level of cycling activity, this might not be a cause for concern. However, even with a rapidly-increasing population between 1986 and 2003-6:

- All trip purposes except work account for fewer trips on total in 2003-6, and even work shows only a small but almost certainly not statistically-significant rise (Figure 4, left); and
- All trip purposes account for fewer cycle trips per person per day, with shopping virtually disappearing from the statistical radar (Figure 4, right).

Total cycle trips **Cycle trips per 1000 population**

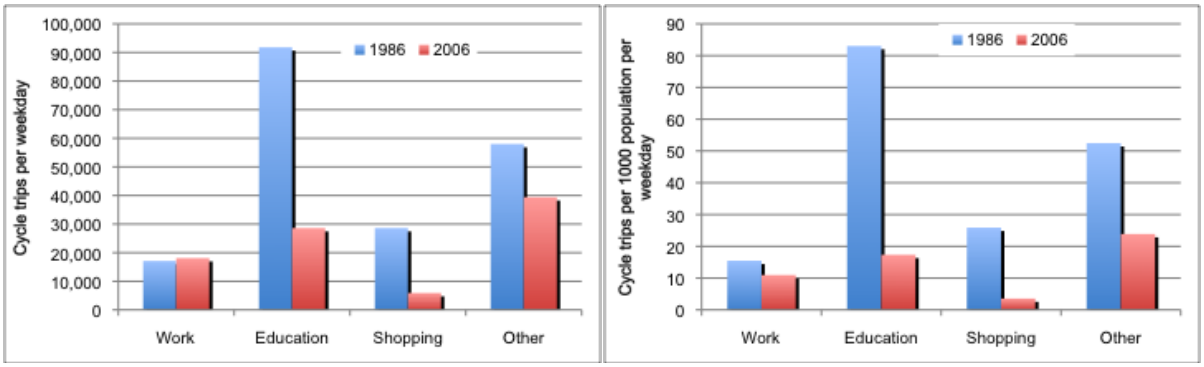


Figure 4 Cycle trips per weekday: 1986 and 2003-6

An alternative explanation, however, in the case of the loss of short shopping trips might lie in changes in shopping habits, with fewer trips for a small number of items and either consolidation into weekly shopping trips or trip-chaining (eg shopping on the way home from work) with car-based trips.

4.1 Work Trips

The PARTS surveys record 92,000 bicycle trips per weekday, of which 19.7%, or 18,100, were trips to or from work, for the period 2003-2006.

The 2006 Census recorded 6,791 trips to work for the Perth Metropolitan Region (1.16% of trips), wholly by bicycle, and a further 682 by bicycle and one or more other modes (ABS, 2008).[1]

Unlike school and shopping trips, the PARTS data imply a higher rate of cycling than might be expected from an alternative source (in this case, the Census).

One problem with using Census journey-to-work data is that, as a record of travel on a single day, it can be heavily influenced by the weather. Census day in 2001 and 2006 was fairly typical of August in terms of weather. In 1996, however, the previous night was very cold (2.0 ºC minimum) and it had been raining for several days (Table 1). It is not surprising, therefore, to see a low value for cycling mode share of work commuting and we cannot deduce that 1996 was the low point nor that the cycle mode share has been increasing since then.

Table 1 Bicycle journey to work data comparisons

	1976	1986	1991	1996	2001	2006
Census: Journey to Work [(a)]						
Bicycle trips	n/a	n/a	5,344	4,690	5,580	6,791
Total trips	n/a	n/a	412,401	454,630	499,320	585,534
Bicycle mode share	n/a	n/a	1.30%	1.03%	1.12%	1.16%
Weather on Census Day[(c)]						
Minimum overnight temperature	n/a	n/a	n/a	2.0ºC	9.9ºC	11.1ºC
Maximum daytime temperature	n/a	n/a	n/a	18.8ºC	18.8ºC	16.6ºC
Rainfall	n/a	n/a	n/a	5.2mm	1.6mm	0.0mm
Rainfall previous 2 days	n/a	n/a	n/a	15.2/4.0mm	5.0/2.2mm	3.8/4.2mm
Perth Travel Surveys [(b)]						
Bicycle commuting trips	7,520	17,700	n/a	n/a	n/a	18,100
Total commuting trips	546,800	806,000	n/a	n/a	n/a	878,800
Bicycle mode share of commuting trips	1.4%	2.2%	n/a	n/a	n/a	2.1%

(a) The Census only records the journey to work, even if other activities (eg dropping of a child at school) are accessed along the way. Travel survey data are for home-based work trips (ie direct home to work), Since multi-purpose trips are inherently less likely to be undertaken by bicycle, it is not unexpected that travel surveys show a higher bicycle mode share than the Census. Growth in multi-purpose trips also helps explain the low growth in travel survey commuting trips between 1986 and 2003-6.

(b) The 1976 travel survey excluded trips by children under 5 years; the 1986 survey excluded trips by children under 9 years. This has no effect on comparisons of work trips.

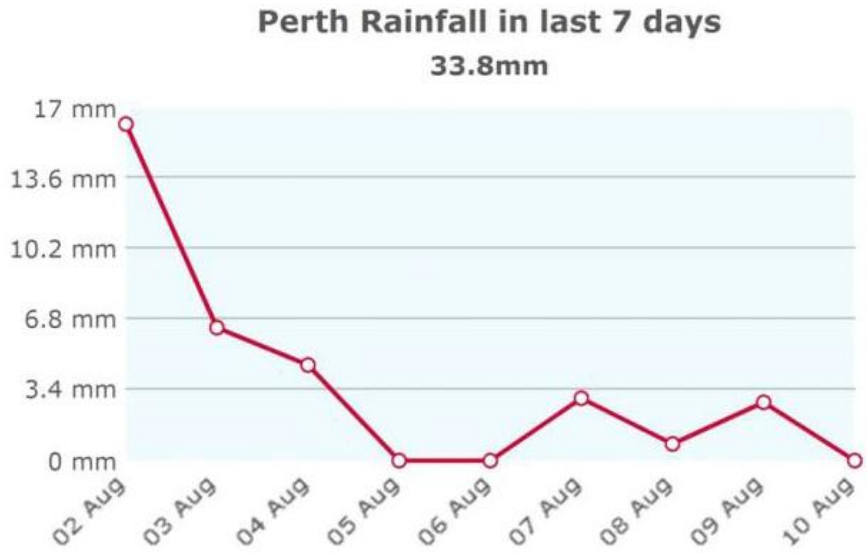
(c) Weather data (Bureau of Meteorology, 2011) are recorded for the 24 hours to 9am on the stated day. Rainfall and maximum temperature are therefore as recorded for the day after Census day while the minimum overnight temperature is as recorded for the date of Census day itself.

[1] Peel added only 79 bicycle-only trips (and no multi-mode bicycle trips) to the total, so has been ignored for the purposes of time-series comparisons.

The Census data are often taken to imply a slow resurgence in cycle commuting to and from work after a decline to 1996, although this would be affected by the unfavourable weather conditions of both 1996.

The Australian Bicycle Council (ABC, 2009) simply states that there was a 21% increase in cycling to work in Perth (16% if multi-mode trips are included) between 2001 and 2006 and only indirectly acknowledges that almost all of this was the result of the increase in employment and, hence, the total number of journeys to work.

Census Day 2011 (9th August) was dry (0mm of rain) and was preceded by several days of light rain (Figure 5) after a prolonged spell of wet and stormy weather. The overnight overnight minimum was slightly below and the daytime maximum temperatures slightly above average for August – and there is still likely to be a substantial encouragement effect from Cadel Evans' winning the Tour de France – so don't be surprised if the 2011 Census, when published, shows a higher-than-expected cycle mode share for journey to work in the Perth Metropolitan Area.



Source: http://www.watercorporation.com.au/R/rainfall.cfm

Figure 5 Perth rainfall leading up to Census Day 2011 (9th August – data recorded as '24-hrs to 9am 10th August)

5 Seasonality

The Census is in the least favourable part of the year for cycling in Perth, when temperatures are low and rainfall high, so we cannot use the Census to estimate the overall importance of cycling to and from work. Although August is not the lowest month (Figure 6), activity at the beginning of the month is likely to be closer to the July level (the lowest month).

The issue of seasonality is of fundamental importance in relating data collected at a single point in time (or even a few weeks at the same time of year, as with the PBN counts) and the overall level of cycling activity in Perth. Data for multiple PBN sites show an apparently logical seasonal variation for levels of cycle use (Figure 6), with a factor of 1.6 between low and high months (July and March/October/November, respectively).

To make any comparison between the Census (early August) and PBN counts (April), we should make an adjustment of around 25% or so to the Census figures.

Source: http://www.transport.wa.gov.au/cycling/20320.asp

Figure 6 Seasonality in cycle usage in Perth, 2010

It is tempting to look at the latest year's data and accept them as true. Whilst they are undoubtedly 'fact', they should not automatically be taken as representative. For example, the 2009 count data show a very different winter pattern from 2010 (Figure 7). The winter of 2010 was one of the driest on record, whereas that of 2009 was closer to the long term average in terms of rainfall (Figure 8). The winter of 2011 looks likely to be similar to 2009, given the cycling data for June (Figure 7) and the heavy rainfall so far.

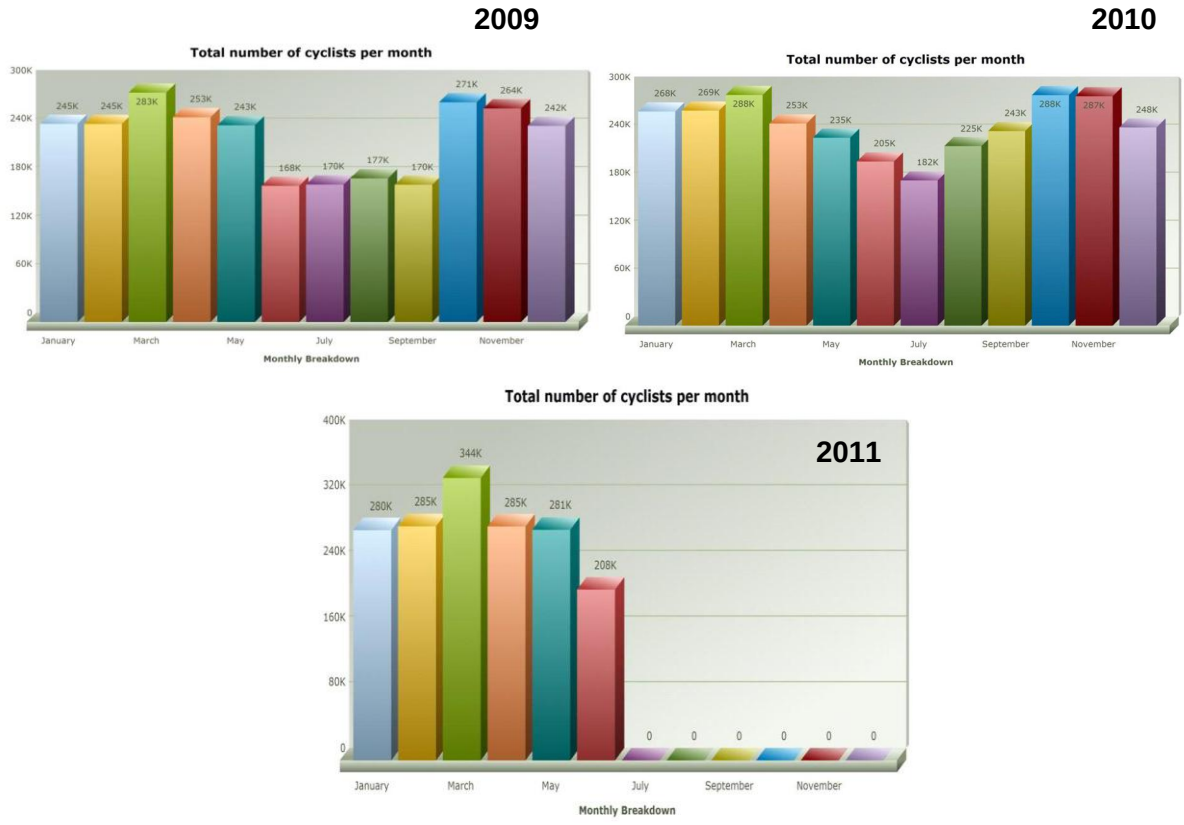
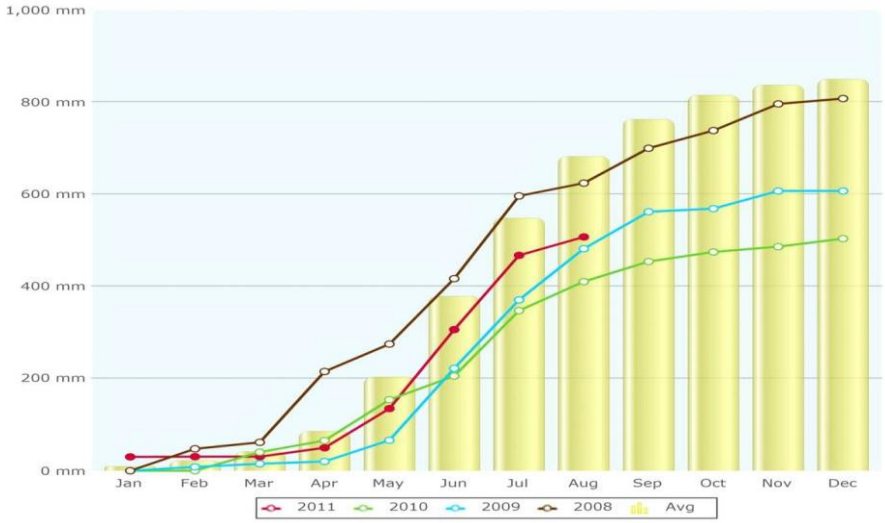


Figure 7 Seasonality in cycle usage in Perth, 2009-2011



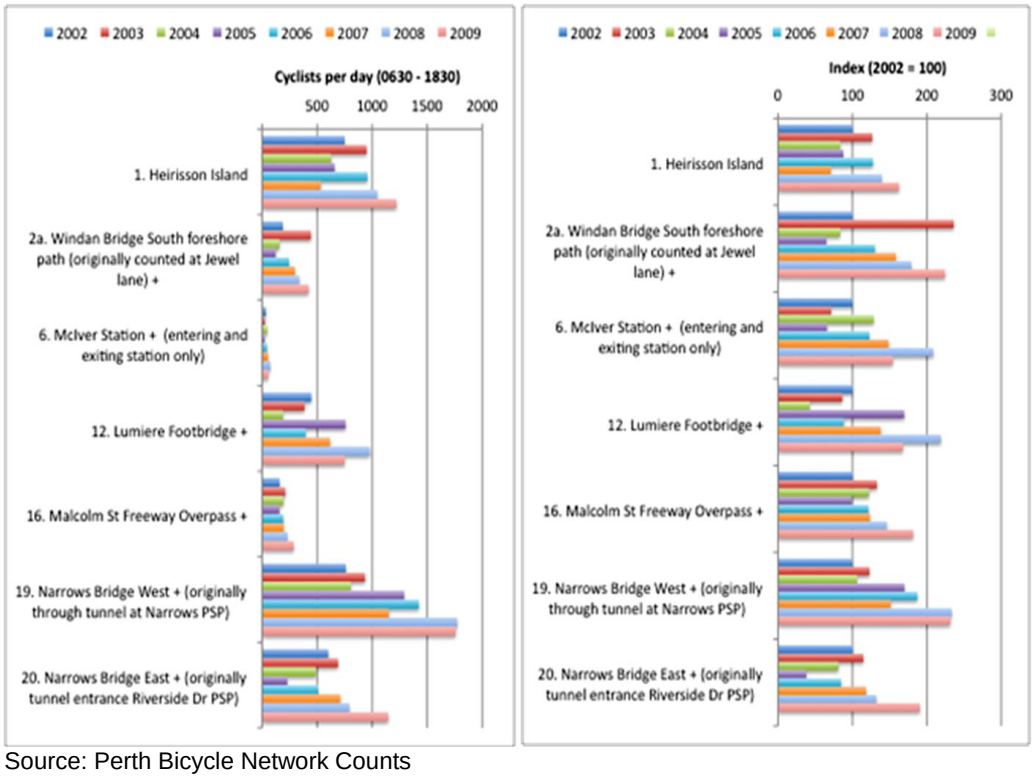
Note: Value for August includes only the first nine days of the month.

Figure 8 Perth rainfall 2008-2011

Seasonality might also affect the rate of change in cycling activity (for example, growth in leisure/recreational cycling might be greatest in Spring and Autumn, when the weather is more conducive, or in Summer, when more people have the opportunity), although there are no data to provide a means of assessing the extent to which this is so.

6 Location of Measurement

Both the amount of cycling activity and the rate of growth can be affected by the location and quality of cycling facility provided. For example, the poor quality of the Causeway/Heirisson Island PSP (one of the PBN count sites) is reflected in both a low level of usage and a very much below average rate of growth of cycle usage (Figure 9) (Ker, 2009).



Source: Perth Bicycle Network Counts

Figure 9 Cycle Use of Perth Bicycle Network (CBD - 12-hour counts)

7 Bicycle Trip Distance

The picture with regard to the amount of cycling activity (Figure 10) is similar to that for trips (Figure 4) but modified by changes in the distances people travelled, for work and leisure/recreation trips in particular, although there was effectively no change in the distribution of journey distances for school/education trips by bicycle (Figure 10). For both work and shopping trips, an important factor in the difference between 1986 and 2003-6 is the substantial drop in short trips (especially less than 1km), which reinforces questions already raised about the effectiveness of the 2003-6 surveys in capturing short trips.

Total cycle-km **Cycle-km per 1000 population**

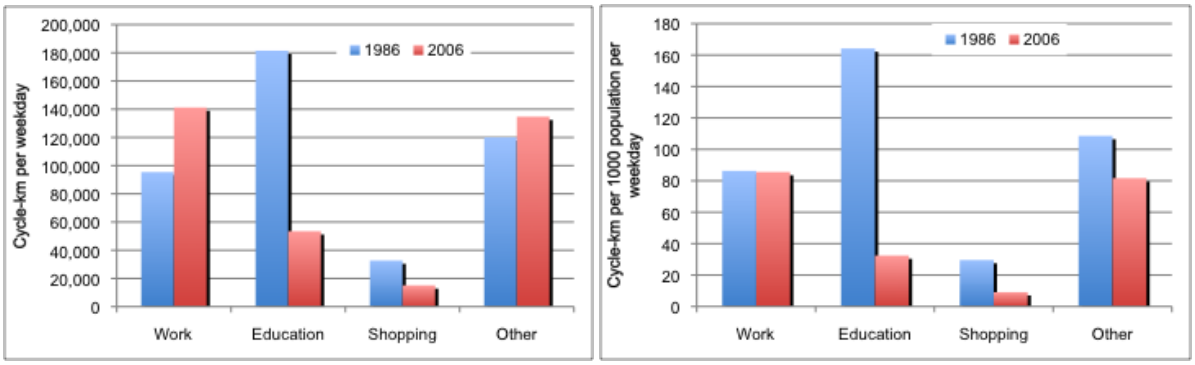


Figure 10 Cycle travel per weekday: 1986 and 2003-6

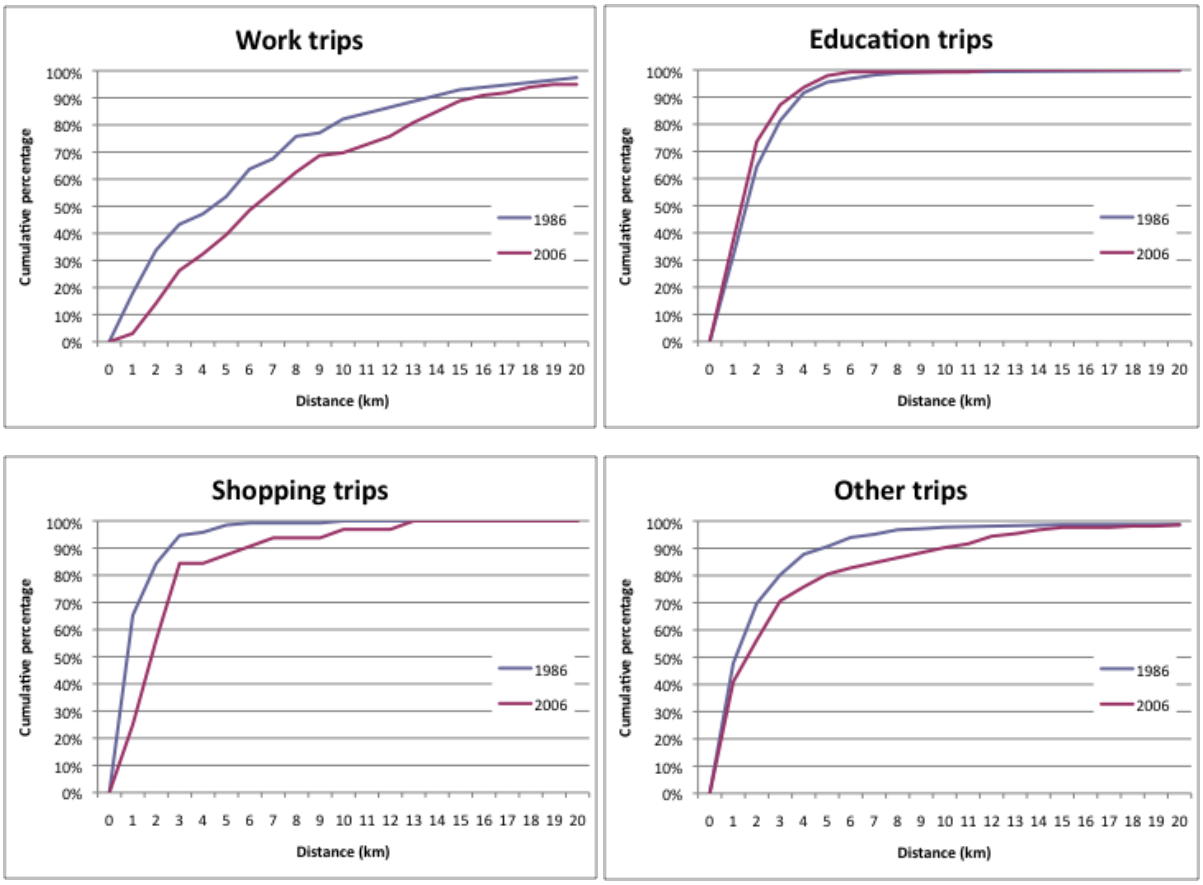


Figure 11 Trip length distributions: 1986 and 2003-6

8 Changes since 2003-6

8.1 Petrol Prices

There has been evidence of increased use of public transport and other non-car modes with increasing petrol prices. However, it is by no means clear that petrol prices alone would have had a substantial impact between 2005/6 and the present day – the pump price of unleaded petrol (ULP) is no higher than it was in 2005/6 and the real price (ie after allowing for inflation) is actually lower than it was then (Figure 12).

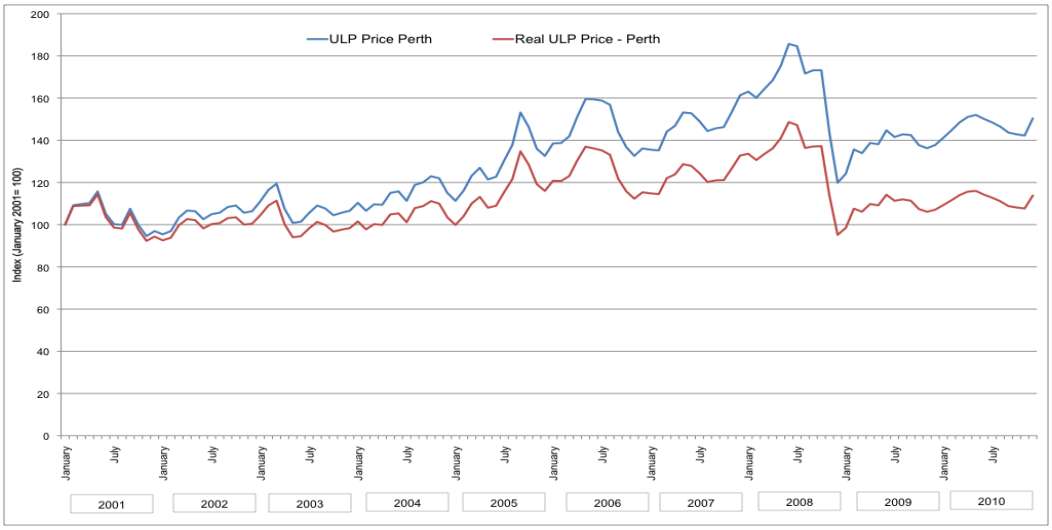


Figure 12 Petrol prices: Perth, 2001 – 2010

Petrol price is only one factor affecting cycle use, but in the absence of other evidence the 2003-6 travel surveys might be expected to be a reasonable indicator of the current situation. The data, however, suggest that there is a ratchet effect (a reversal of petrol prices does not reverse the cycling activity trend) or that other factors can have an even greater effect. For example, a 60% increase in the pump price of petrol between 2002 and 2008 (30% real increase – ie relative to the consumer price index) was associated with a 160% increase in what is largely cycle commuting to work in the Perth CBD (Figure 13). It is not clear to what extent this is a causal relationship, as there have been other influences, such as health and fitness campaigns, concerns about the contribution of car use to global climate change and, more prosaically, increases in car parking charges in the City of Perth, but it does support using petrol price as one predictor of cycling activity.

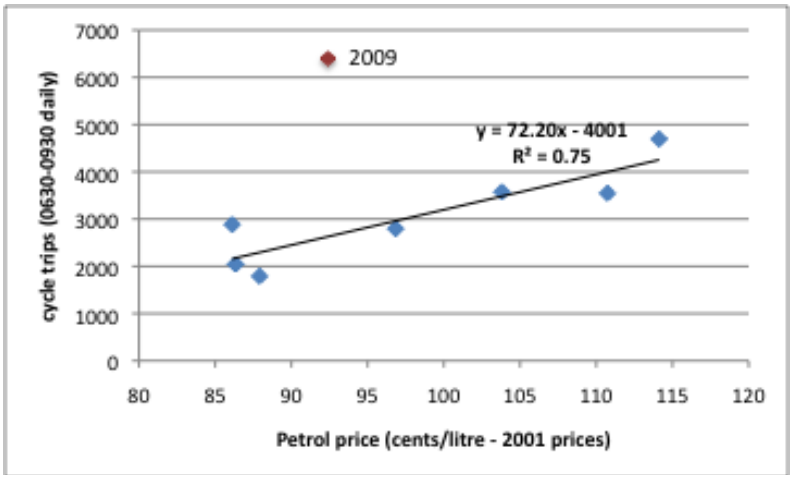


Figure 13 Petrol price and cycle usage (Perth CBD Cordon, 0630-0930)

8.2 TravelSmart

The WA Government's TravelSmart Household program has been rolled-out from 2000 after a successful pilot in South Perth in 1997. The majority of this program has been since 2003. TravelSmart Household achieved an average 58% increase in bicycle trips from 2000-2006 (measured over 143,000 residents - http://www.transport.wa.gov.au/14960.asp). The program was expanded to 450,000 residents by 2008 (http://www.transport.wa.gov.au/14961.asp).

The Perth and Regions Travel Survey collected the largest amount (40%) of data in 2003 and 20% in each of the following three years (2004-2006).

If half the 2000-2006 TravelSmart program was reflected in the 2003-6 PARTS data, the continuing program to 2008 would have increased the bicycle mode share of trips from 1.6% to 2.0%. Further implementation of TravelSmart since 2008 would have further increased the bicycle mode share.

Typically, TravelSmart has the smallest impact on work trips (Ker, 2011), so it is likely to go some way towards reversing the loss of school and shopping trips apparent between 1986 and 2003-6.

9 Conclusion

If Perth Travel Survey data are to be believed, there has been a long-term decline in the importance of cycling in transport activity, whether in terms of trips or cycle-km of travel. Although there has been an increase in cycle travel (km) for work purposes, this largely reflects the increase in Perth's population and increasing commuting trip distances.

There has been an apparent major shift of cycle activity away from short trips (especially school and shopping trips) to longer trips (especially work and leisure/recreation trips). At the same time, the length of trips other than school trips has increased. These trends are consistent with the emphasis on establishing regional cycle routes and networks while less obvious attention has been paid to local cycling facilities and routes.

Measured changes in the importance of short trips may be real (eg changes in trip and activity patterns) or an artefact of survey methodology. Further investigation is required to assess the importance of these.

These trends are not inconsistent with the continual growth in cycling activity measured in the Perth Bicycle Counts, which are largely undertaken on high-standard routes in the inner and middle areas of the Perth Metropolitan Region. These count locations are primarily those that serve longer-distance work and leisure/recreation cycling.

For a regional cycling network strategy, the challenge is to build on the strengths evident in existing trends in bicycle usage (longer work and leisure/recreational cycling) while enhancing opportunities to reverse reductions in cycling for school and shopping purposes. This is likely to require:

- extending and completing regional networks to increase the range of longer trips for which cycling is an feasible option; and

- increasing the extent to which local destinations can be accessed via the regional network – for example by establishing links between the regional network and local destinations or serving local as well as regional destinations directly.

There are substantial differences between 2003-6 and previous (1976 and 1986) travel surveys for Perth that make use of 2003-6 data somewhat problematic. The Department of Transport should be requested to undertake an investigation of the 1986 and 2003-6 surveys to assess this, both for its own sake and to identify issues that need to be addressed in the development of the next round of Perth Travel Surveys.

The 2003-6 PARTS travel data are also likely to underestimate the importance of cycling in 2011, as the majority of the TravelSmart household program has been undertaken since the surveys were carried out. The 2011 level of cycle activity could be 25% higher than indicated by PARTS for this reason alone. The extent of this change, coupled with likely changes in cycling activity resulting from increased petrol prices, demonstrates the value of developing means for intermediate updating of travel survey data using other, more frequently recorded, sources of data. Such methods would also assist in verifying apparent changes in cycling activity between periodic measurements such as travel surveys.

Alternative sources of data on cycling activity (Census; Perth Bicycle Network Counts) suffer from being specific in time (both) and place (PBN counts) and are potentially unrepresentative and unreliable for this reason. The Census is undertaken in August, a month in which the level of cycling is not only below the annual average but is also highly affected by weather conditions in particular years.

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