Abstract for 2003 ATRF Conference

Measuring the impacts of internet usage on travel behaviour in the Sydney Household Travel Survey

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The growth in internet usage is so significant that many believe it is changing the way people do things - including the way they travel. However, research on how and to what extent it is actually affecting travel, particularly in the Australian context, has been limited. Examining the effect on travel is important as it can help transport planners and policy makers better understand travel patterns and demand for the future. In recognition of the growing importance of the internet, the Transport Data Centre (TDC), the primary source of transport data for New South Wales, undertook a special supplementary study on internet usage in 2000-2001 to *investigate the impacts of internet usage on travel behaviour*.

The Sydney Household Travel Survey (HTS), the source of the most comprehensive data on travel behaviour for households in the Greater Sydney Metropolitan Region (GSMR) was used as the instrument for this supplementary study.

This paper reports on the outcome of this study. It provides information on the demographic and trip-making characteristics of internet and non-internet users. This includes comparisons of trip rates, mode distribution and purpose distribution between users and non-users. It also reports on findings on whether the most popular uses of the internet, namely, internet banking, internet shopping and internet browsing are substituting for trips.

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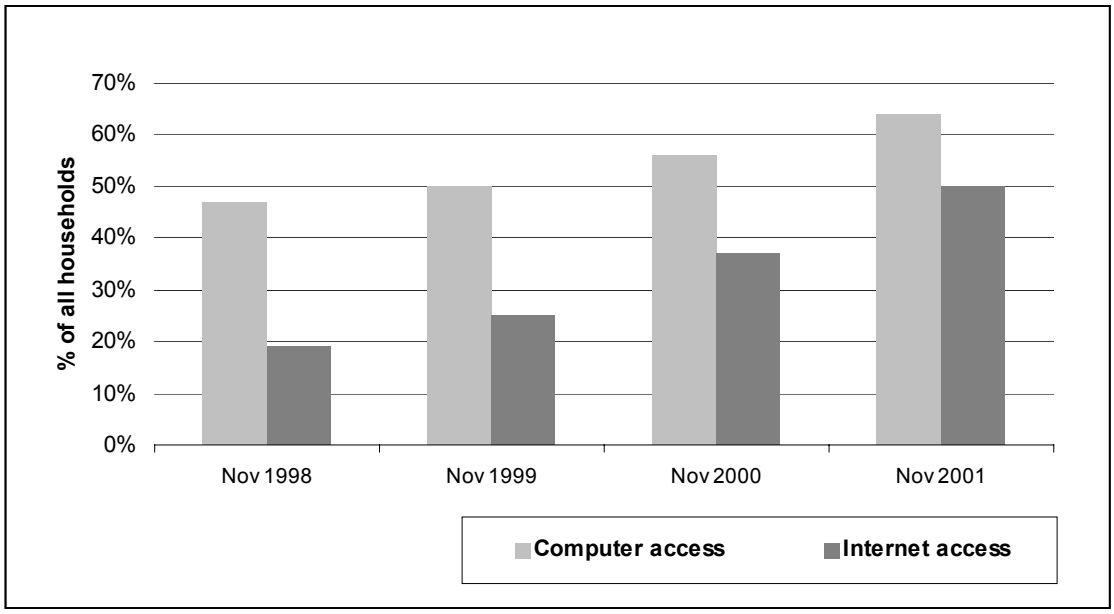
Grace Corpuz and John Peachman

1. INTRODUCTION

Computer and internet usage has been growing steadily in Australia in recent years. Based on data from the Australian Bureau of Statistics (ABS, 2000), internet uptake of Australian households has grown from about one in every five households (19%) in November 1998 to about one in every three (37%) by November 2000 (See Figure 1.1). The ABS predicted that this ratio would rise even further to about one in every two Australian households by the end of 2001. More recent results from Nielsen/Net Ratings as cited by NOIE (2002) estimated that 52% of Australians households were online, 49% via a home PC as at September 2001. This level of access placed Australia seventh in internet penetration, behind countries such as Sweden and Hongkong (58%), South Korea (56%), Singapore (56%), US and New Zealand (54%).

Figure 1.1 Computer and Internet Usage in Australia



Source: Use of the Internet by Householders, Australia (Cat 8147.0), November 2000, ABS

The internet is undeniably impacting significantly on many areas of our lives. It is becoming an increasingly important tool for communication, banking, business, education, shopping, recreation and entertainment. The internet provides mobility, albeit 'virtual mobility', by enabling engagement in activities otherwise requiring physical travel. However, how and to what extent it actually affects travel had at the time of this study not been extensively explored. The existing literature on the subject is not particularly extensive and appears to be somewhat divided on how exactly internet usage affects travel behaviour, and whether overall it tends to increase or decrease trip rates. Certainly, studies based on empirical data are very scant.

In recognition of the growing importance of the internet, the Transport Data Centre (TDC), the primary source of transport data for New South Wales, undertook a special supplementary study on internet usage in 2000-2001. This study aimed to

investigate the impacts of internet usage on travel behaviour. This paper reports on the findings of this study. The results will be valuable to transport planners in gaining a better understanding of the travel patterns and demand for the future. The findings will also be particularly interesting to transport strategists looking at the internet's capacity to substitute for physical mobility and its potential for attaining sustainability objectives by reducing travel.

The Sydney Household Travel Survey (HTS), the most comprehensive source of data on travel behaviour for households in the Sydney Greater Metropolitan Region (GMR) was used as the instrument to collect the required information. Using existing survey infrastructure and personnel, the study on internet usage was conducted as a supplementary survey linked to the main HTS. This provided an invaluable opportunity to cross-classify data on internet usage with the full range of geographic, demographic and travel data collected in the main HTS.

2. METHODOLOGY

Households in the HTS sample were randomly selected across the GMR using a stratified three-stage cluster sampling method. For all persons aged 15 years and over, basic questions on the usage of the internet were added to the main survey during the fourth year (2000-2001) of the HTS. A total of 6,785 persons provided data for these questions. Information was collected on the following data items:

- Whether the internet was used in the last month;
- Number of days the internet was accessed in the last month;
- Number of times the internet was used to purchase or order goods or services in the last month; and,
- Number of times the internet was used to pay a bill or transfer funds in the last month.

The data collected was compared with demographic and trip data in the HTS in order to understand the characteristics of internet users as well as determine whether their usage was affecting trip behaviour. For this paper, the focus of the analysis was to compare internet users with non-users rather than look at the frequency of internet usage in relation to trip-making. As will be demonstrated, this approach was sufficient to establish differences in travel behaviour with respect to usage of the technology.

In addition to these basic internet usage questions, a supplementary questionnaire was developed to collect further detail about the nature of internet transactions and whether these were resulting in *trip substitution* ie. internet transactions were replacing trips to conduct the same transactions. In addition, the supplementary questionnaire asked respondents about their *perception* of the effect of their internet usage on their travel behaviour. This supplementary questionnaire was tested in the field in September 2000 and then implemented from November 2000 to June 2001. Data was collected from 1,487 persons aged 15 years and over who indicated in the main survey that they had used the internet in the last month .

3. COMPARISON OF INTERNET USERS AND NON-USERS

In this section, the characteristics of internet and non-internet users are described and compared. The differences are evaluated for indications of a possible effect of internet usage which are then further explored in later sections.

3.1 DEMOGRAPHY AND GEOGRAPHY

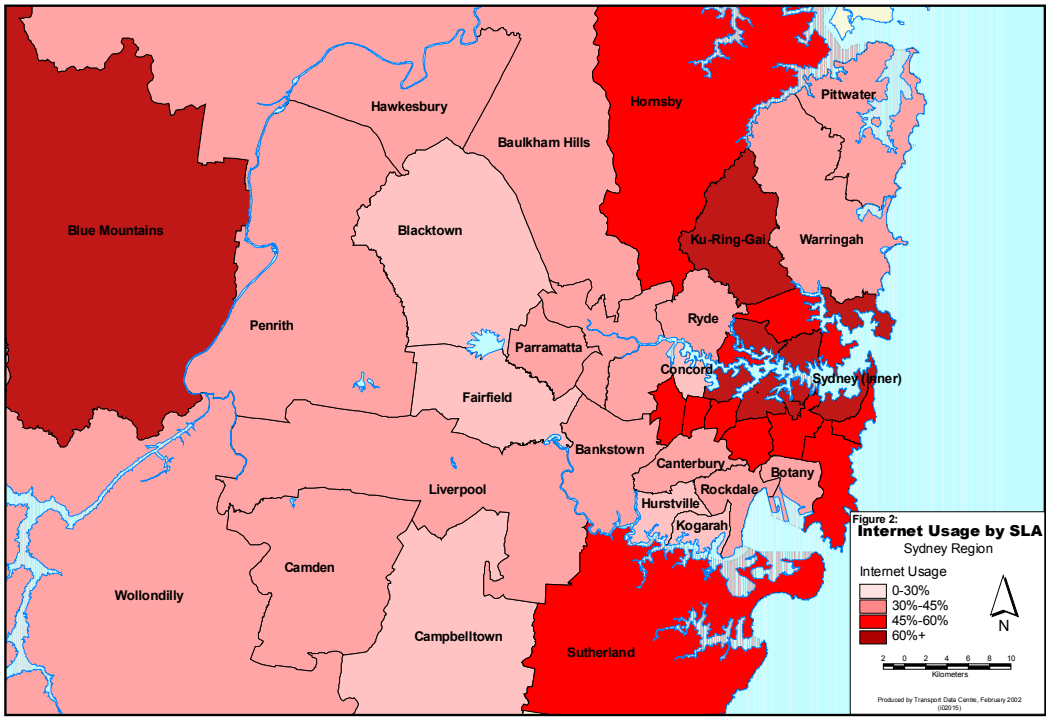
The profile of internet users is notably different to that of non-users. Internet users are generally (1) more likely to be *male* (2) much *younger* on average than non-users (3) much more likely to be *full-time workers or students* and (4) much more likely to have a *high income* (Table 3.1). These results are consistent with the findings published by the Australian Bureau of Statistics.

Table 3.1 Demographic Distribution

	Internet user	Non-internet user
Gender		
Male	54.2%	45.8%
Female	45.8%	54.2%
	100.0%	*100.0%*
Age		
15 to 25	25.1%	10.1%
25 to 44	48.4%	34.4%
45 to 64	24.6%	31.9%
65 and over	1.9%	23.6%
	100.0%	*100.0%*
Labour Force Status		
Full-time work	58.3%	34.1%
Pensioners	3.9%	33.0%
Full-time study	17.7%	3.8%
Part-time/casual work	12.9%	13.2%
Keeping house	4.2%	11.6%
Other	3.1%	4.2%
	100.0%	*100.0%*
Income		
$0-$6,239	18.0%	16.7%
$6,240-$10,399	6.8%	25.3%
$10,400-$25,999	16.0%	26.4%
$26,000-$41,599	21.4%	18.7%
$41,600 or more	37.8%	12.9%
	100.0%	*100.0%*

The proportion of internet users also varies significantly by area. *By far the highest concentrations of internet users are in the areas ringing the Sydney CBD* viz. Inner Sydney, Lower Northern Sydney, Eastern Suburbs and Inner Western Sydney. The Hornsby-Ku-Ring-Gai area also has a very high concentration of internet users. (Figure 3.1)

Figure 3.1 Proportion of Internet Users By Geography



3.2 TRIP CHARACTERISTICS

Figures 3.2 and 3.3 show the mode and purpose distributions respectively of internet users in comparison to non-users. Internet users tend to use proportionally more public transport (especially train) and walking than non-internet users. However, it cannot be assumed that this is *caused* by their internet usage, since there is a high concentration of internet users in areas (such as those ringing the Sydney CBD) where public transport is more readily available and there is less reliance on car.

Internet users also have proportionally more work and education related trips. This would be expected from the higher proportion of full time workers and students among internet users. However, it is notable that there are proportionally less shopping and personal business trips for internet users. As will be shown in later sections, there is evidence to suggest that this may be due to the substitutional effect of the internet for these types of trips.

Figure 3.2 Mode Distribution By Whether Internet User

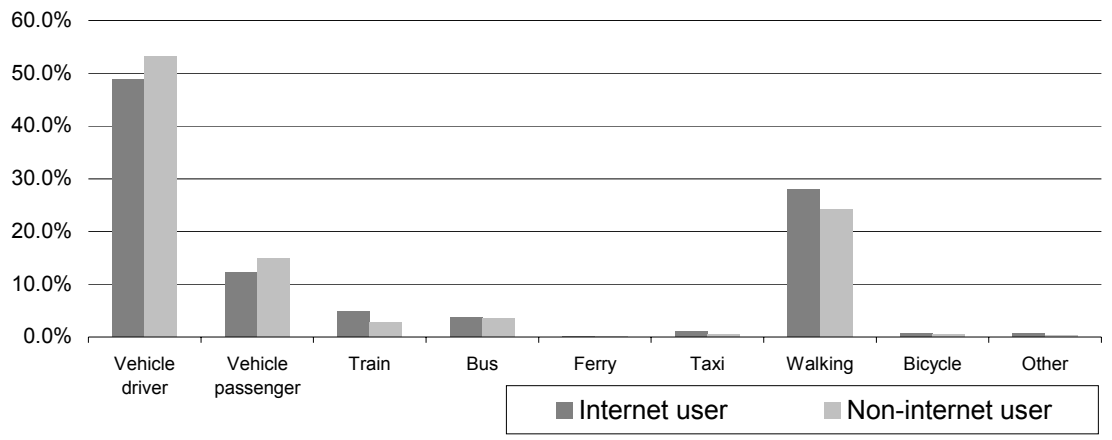
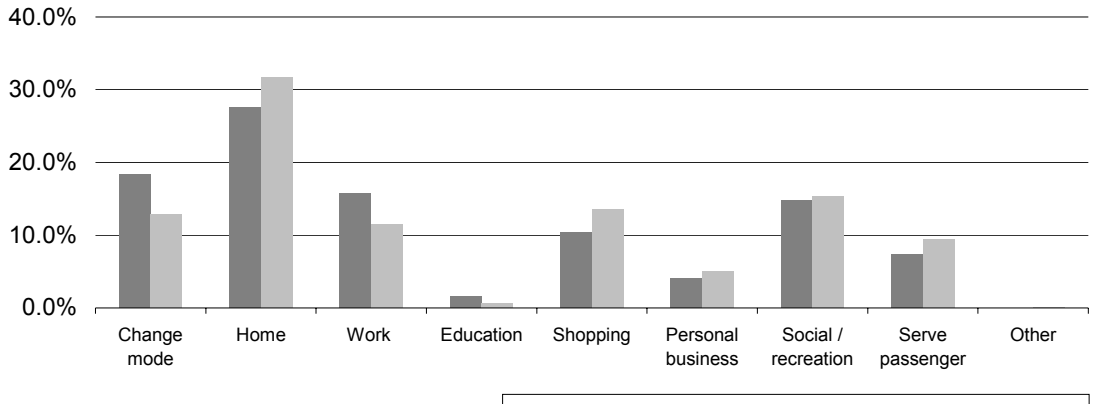


Figure 3.3 Purpose Distribution By Whether Internet User



The trip rates of internet users and non-users were also compared and the results are shown in Table 3.2 below. The figures indicate that the total trip rate per day for internet users (5.07) is significantly higher than that for non-users (3.79). The trip rate per mode is also consistently higher for internet users. These differences are all statistically significant.

It is also notable that *the trip rate for internet users is always higher for every trip purpose*. The differences in trip rates are statistically significant except for trips for three purposes. Two of these purposes, interestingly, are shopping and personal business/services, the types of trips which are most likely to be affected by internet usage. *These results clearly show that internet users are making more trips overall and for most purposes than non-users except for shopping and personal business.* This is consistent with the purpose distribution shown in Figure 3.3 where it was shown that internet users make proportionally less shopping and personal business

trips than non-users. It is possible that internet usage exerted a substitutionary effect on shopping and personal business trips so that the trip rate for these purposes are not higher as are other trip purposes for internet users but only similar in level to those who are non-internet users. This hypothesis is examined in the following section.

Table 3.2 Person trip rates by *Mode / Purpose* by Whether internet user

	Internet user	Non-internet user	Significance (Two-tailed)*
Mode			
Car	3.02	2.56	0.000
Train	0.24	0.10	0.000
Bus	0.20	0.14	0.000
Walk	1.48	0.94	0.000
Other	0.13	0.05	0.000
All trips	5.07	3.79	0.000
Purpose			
Change mode	0.96	0.51	0.000
Home	1.40	1.20	0.000
Work and work related	0.78	0.45	0.000
Education	0.09	0.02	0.000
Shopping	0.52	0.50	0.282
Social / recreation	0.75	0.58	0.000
Personal business/services	0.21	0.19	0.105
Serve passenger	0.36	0.34	0.472

* Using the T-test for equality of means

The preceding tables demonstrate clearly that the average trip rate for internet users is higher than that for non-users, for all modes and for most purposes. However, it was also demonstrated in Section 3.1 that the demographic and geographic *profiles* of internet users are different to those of non-users. Consequently, it is possible that the differences in trip rates between the two groups may only be due to these different profiles. As an example, 58% of internet users are full time workers, but only 34% of non-users are full time workers (from Table 3.1), in which case we would expect to find (as we do in Table 3.2 above) that the work and work related trip rate is higher for internet users than non-users.

To clarify any 'demographic profile effect', the trip rates for internet users and non-users were compared within homogenous demographic groups. Tables 3.3 and 3.4 below show the trip rates for the two groups broken down by the key demographic variables Sex, Age, Labour Force Status, Income and Sub-Statistical Division (SSD).

Table 3.3 Person trip rates by *Demographics* by Whether internet user

	Internet user	Non-Internet user	Significance (Two-tailed)*
Gender			
Male	4.98	3.78	0.000
Female	5.16	3.80	0.000
Age			
15 to 24 years	5.23	3.87	0.000
25 to 44 years	5.06	4.22	0.000
45 to 64 years	4.93	3.90	0.000
65 years and over	5.00	3.02	0.000
Labour Force Status			
Full time work	5.16	4.13	0.000
Retired / Pensioner	4.61	3.17	0.000
Full time study	5.04	4.37	0.069
Part time / Casual work	5.10	4.53	0.015
Keeping house / Unemployed	4.47	3.60	0.002
Other	6.00	3.93	0.054
Income			
$0-$6,239	4.56	3.77	0.000
$6,240-$10,399	5.49	3.09	0.000
$10,400-$25,999	5.12	3.95	0.000
$26,000-$41,599	4.99	4.24	0.000
$41,600 or more	5.27	4.21	0.000

* Using the T-test for equality of means

Table 3.4 Person trip rates by *Geography* by Whether internet user

Sub-Statistical Division (SSD)	Internet user	Non-internet user	Significance (Two-tailed)*
Inner Sydney	5.20	4.90	0.426
Eastern Suburbs	5.86	3.74	0.000
St George-Sutherland	5.25	4.35	0.015
Canterbury-Bankstown	5.23	3.51	0.000
Fairfield-Liverpool	4.35	3.55	0.017
Outer South Western Sydney	4.56	3.34	0.000
Inner Western Sydney	5.76	4.64	0.014
Central Western Sydney	4.71	3.47	0.001
Outer Western Sydney	4.48	3.88	0.069
Blacktown-Baulkham Hills	4.38	3.23	0.000
Lower Northern Sydney	5.32	4.08	0.001
Hornsby-Ku-ring-gai	5.31	3.63	0.000
Northern Beaches	5.47	4.19	0.001
Gosford-Wyong	5.02	3.69	0.000
Newcastle	5.02	3.72	0.000
Wollongong	4.59	3.79	0.024
Illawarra SD Balance	3.87	3.38	0.361

* Using the T-test for equality of means

Tables 3.3 and 3.4 clearly suggest that the higher trip rates for internet users compared with non-users are by and large *not* due to the different demographic and geographic profiles of the two groups. In all cases, the trip rate for internet users were higher than for non-users, irrespective of Sex, Age, Labour Force Status, Income or SSD category.

The significantly higher trip rates for internet users was unexpected given a then prevailing view that the most likely effect of internet usage would be trip substitution resulting in *lower* trip rates. The pervasiveness of the actual effect across the demographic groups was even more intriguing. Is the internet usage *causing* these high trip rates? Or, are internet users *already* high trip-making individuals, more likely to be early adopters of technology, and perhaps with an aim to optimising their travel efficiency through that technology?

It has been recognised by the researchers as early as in the development of this study that cross-sectional data would be limited in establishing any causal relationships or even in understanding the dynamics of the interaction between internet usage and travel behaviour. As shown above, it merely shows the trip-making characteristics of internet users as differentiated from non-users. The incidence of some effect can be gleaned from the result because of the high level of consistency and significance in the findings but the nature of the impact can only be speculated on. In the absence of longitudinal data which is superior in making such impact measurements, more detailed supplementary questions about the internet transactions undertaken were added to the HTS to better understand the nature of the effect of internet usage. The data obtained from these questions are discussed in the next section.

4. IS INTERNET USAGE SUBSTITUTING FOR TRIPS?

The Supplementary Internet Survey was designed to collect further detail about the nature of internet transactions and whether these were resulting in *trip substitution* ie. internet transactions were replacing trips to conduct the same transactions. In addition, the supplementary questionnaire asked respondents about their *perception* of the effect of their internet usage on their travel behaviour by purpose and mode.

Respondents who used the internet to (a) pay a bill or transfer funds, ie banking; (b) purchase or order goods or services, ie shopping; or (c) browse at least once in the last month were asked for more details about each of their *last* internet banking, shopping or browsing transactions. *(Important note: the word 'browse' is used here for convenience, but within the context of the survey it refers to actually obtaining a specific piece of information using the internet,* not *general 'surfing')*. Respondents were asked:

- How they would have undertaken the transaction if they had been unable to use the internet at the time;
- What *main* mode of transport they would have *most likely* used if they would have made a trip to undertake the transaction; and,
- Whether the trip would have been an *additional* or special trip for that purpose or a trip that would have been made as part of another trip.

The key findings are shown in the following tables. Table 4.1 indicates that, irrespective of whether the internet activity is banking, shopping or browsing for information, *approximately one third of internet activities appear to be substituting for a trip*. In these cases, the respondent would have undertaken a trip if the internet was not used for the transaction. These respondents are differentiated from those who would have undertaken a non-trip alternative which includes, amongst others, telephone banking, telephone purchases, information-gathering by telephone and mail-order. Table 4.2 also indicates that *the majority of the substituted trips from using the internet would have been made by car*. This effect is strongest when the activity is shopping.

However, respondents indicated that only about half of the trips replaced by internet usage would have been a special trip solely for that purpose rather than a trip undertaken along with other trips (Table 4.3). This provides some measure of the extent to which respondents will undertake multiple related activities in a single trip. For example, respondents may pay all the bills in a single trip to the post office or bank rather than make a special trip to pay a single bill if the internet were not used. The results indicate that out of the cases where a trip would have been made if the internet were not used, respondents will undertake the task or trip along with other trips (ie no trips were actually substituted) half of the time. The other half of the time, they will make a special trip to undertake the activity.

Table 4.1 Alternative activity to internet usage

Alternative activity	Internet activity		
	Banking	Shopping	Browsing
Would not have undertaken activity otherwise	0%	14%	24%
Would have undertaken a non-trip alternative*	71%	51%	47%
Would have undertaken a trip	**29%**	**35%**	**29%**
Total	100%	100%	100%

* Includes banking, purchases and information-gathering by telephone, mail order, etc.

Table 4.2 Mode for trip alternative to internet usage

Mode	Internet activity		
	Banking	Shopping	Browsing
Car	**57%**	**75%**	**55%**
Train	1%	6%	7%
Bus	2%	5%	7%
Bicycle	1%	1%	1%
Walking	38%	13%	28%
Other	0%	0%	4%
Total*	100%	100%	100%

* Those who will undertake a trip if the internet were not used and who provided a valid response.

Table 4.3 Whether trip alternative is a special trip

Whether special trip	Internet activity		
	Banking	Shopping	Browsing
Special trip	40.2%	55.4%	58.8%
Not a special trip	59.8%	44.6%	41.2%
Total*	100.0%	100%	100%

* Those who will undertake a trip if the internet were not used and who provided a valid response.

In summary, only about a third of internet transactions replaces a trip. Of these, about half would in fact be an additional or a special trip. This implies that approximately 15% of internet transactions may be directly substituting for a trip. Since the types of trips that would be substituted by these internet activities, particularly internet shopping and banking, would be shopping and personal business/services, it would be expected that internet users will make less of these trips as a result of their usage. In fact, we did find in Section 3.2 that internet users make proportionally less shopping and personal business/services trips than non-users.

5. INTERNET EFFECT ON TRIPS BY PURPOSE AND MODE

In the Supplementary Internet Survey to the Sydney HTS, the effect of internet usage on trip-making was further assessed by asking respondents to think about their *whole* internet usage (as opposed to their usage for the previous month) and how this has affected the number of trips they make. They were asked whether they *thought* they made less, more or the same number of trips by purpose and mode as a result of their internet usage ie the questions measured the respondents' perception of the *direction* of any internet effect, not the *magnitude* of the effect. The purpose of these questions was to establish, based on the respondents' perception, whether the trip substitution potential of the internet demonstrated above led to an *actual net reduction* in trips. It is possible, for example, that internet users may be making internet purchases that clearly substituted for shopping trips but on the whole do not think their overall number of shopping trips have declined. The results are shown in Tables 5.1 and 5.2 below.

The results indicate that the majority of the respondents thought that the number of trips that they made remained the same. Twenty percent of respondents indicated that they made less of certain trips as a result of the internet, in particular personal business, educational and private vehicle trips. There was a smaller proportion of respondents saying they made less of work and shopping trips. These results tended to confirm that internet usage can substitute for, and do have a net reducing effect on certain trips.

A very small proportion of respondents reported that their trips *increased* as a result of their internet usage. Since this was the least anticipated result, the reasons supplied for the perceived increase in trips were examined.

Of those that cited that their work and educational trips increased, the principal reason cited was that their internet access was at work or school and thus entailed trip-making to use it, so it is doubtful whether these trips genuinely represented generated trips. Of the small proportion that reported that their shopping trips increased, the main explanation given was that the shopping information obtained from the internet, ie. bargains and locations of retail outlets resulted in travelling to make the purchase. Most of those that reported having made more social trips described how the ease of communication through email facilitated appointment-making and created more opportunities for social contact. However, the largest proportion of respondents reporting that they made more trips as a result of the internet (3.1%) was for recreational trips. The main reason cited was that the information obtained from the internet led to involvement in recreational activities. Another interesting reason supplied was that the time savings from other internet usage, eg. banking afforded more time for leisure.

In general, most of the perceived increase in trips as a result of internet usage could be ascribed to better access to information about certain activities leading to trips to undertake those activities.

Table 5.1 Internet effect by Trip purpose

Effect on number of trips	Work or work-related trips	Educational trips	Shopping trips	Trips for recreation, entertainment or sport	Trips for personal business	Social trips
Less	10.7%	21.8%	7.9%	6.0%	20.4%	3.6%
More	1.0%	1.3%	0.3%	3.1%	0.4%	1.5%
Same	87.5%	74.5%	85.3%	85.5%	74.6%	88.0%
Don't know*	0.8%	2.3%	6.5%	5.4%	4.6%	6.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.2 Internet effect by Mode

Effect on number of trips	Private vehicle trips	Public transport trips	Walking trips
Less	22.1%	6.0%	9.1%
More	1.5%	1.3%	1.3%
Same	74.8%	88.7%	85.9%
Don't know*	1.5%	4.0%	3.6%
Total	100.0%	100.0%	100.0%

* The 'Don't know' responses were included so as not to distort the distribution since these were probably similar enough to the 'Same' response.

6. DISCUSSION

Hjorthol (2001) identified four ways by which new technology (the internet) can interact with the old (physical travel):

- Substitution – the internet replaces trip-making;
- Modification – the internet is used for or alters trip-making;
- Generation – the internet induces trip-making; and,
- Addition – the internet is used in addition to trip-making without any specific interaction between the two.

The results from this internet study indicate that the effect of the internet on travel behaviour is probably a combination of all these, as suggested by Lyons (2002) who stated, 'both substitution and enhancement may simultaneously be at work causing changes to activity patterns and a redistribution of trip-making in time and space…'. It is likely that it is this sort of complex interaction that has created ambiguity and at times seemingly conflicting findings in similar studies.

The findings from the TDC Supplementary Internet Survey indicated that, for the *majority* of people in the GMR, internet usage had zero net effect on travel for each purpose and mode. The qualitative information collected from this study confirmed

that this group largely considered the internet to be more of an *additional* technology that does not necessarily impact on their trip-making at all.

However, the study also indicated that approximately 15% of internet transactions were indeed *substituting* for a trip. This result was based on data obtained by directly asking respondents how they would have undertaken the trip if the internet were not used for the transaction. The evidence also suggested that the internet has a *net reducing effect* for *certain* trips. The most apparent impact is on personal business, shopping and educational trips. This is not a singular result but one that has been seen in the 2001 UK Virtual Mobility Project. The conclusion from this UK study indicated that 'virtual mobility is being used to substitute for increase in travel, with occasional substitution effects, for some activities.' (Kenyon, 2002) The US experience is also similar as indicated in the UCLA Internet Report (Lebo, 2003). This US study reported that 66% of internet purchasers reduced their purchasing in retail stores as a result of their online shopping.

To a lesser extent, the findings also show that internet usage *generates certain types of trips.* Depending on the type of trip, up to 3% of respondents indicated they made more trips as a result of their internet usage. Despite this small proportion, the qualitative information collected regarding this increase justifies the perception. In the main, the ease by which travel inducing information can be accessed and the efficiency in social communication gained through the use of the internet are perceived by users to generate engagement in activities that necessitate trip-making. In this study, the most apparent impact appears to be on social and recreational trips, and to a limited extent to shopping trips. Similar findings were reported in relation to shopping trips in the 1999 Harris Interactive E-Commerce Pulse Study cited by Zmud, et. al. (2001). The Harris Study suggested that internet shopping probably increased traditional shopping trips rather than reduced it. Zmud, et. al. reached similar conclusions in their paper using the results from the Sacramento household travel survey.

In addition to the above findings, there was also evidence to suggest that internet usage can *modify* the *distribution of trips by purpose*. For example, the qualitative information revealed that some respondents undertook more recreational trips as a result of the time saved using the internet for banking. This effect appears to be also occurring with virtual shopping. A number of respondents indicated that they used the internet to shop around for price, quality, or location of outlet in order to facilitate choice without the necessity for multiple trip-making. The virtual shopping activity, therefore, modified the typical shopping behaviour by reducing both the number of trips and the travel time afforded to shopping. This modifying effect of internet usage is further demonstrated in the trip purpose distribution of internet users which show proportionally less shopping and personal business trips in comparison to non-users.

It should be emphasised that in this study, the assessment of the internet effect was undertaken firstly for *each* purpose and then by mode. This was to assist the natural cognitive process whereby respondents thought about the effect of the internet by relating different types of internet usage to analogous trips eg. relating internet banking to personal business trips. The study did *not attempt* to ask about the *overall* effect of the internet on travel ie whether it had an net increasing, decreasing or nil effect on *all* travel, as early testing of this approach showed clearly that it was too unfocussed a question to provide reliable results. Nevertheless, since the proportions of those reporting that they made less trips as a result of their internet usage are *significantly and consistently higher for every purpose* than those reporting they made more trips, the results suggest that the net effect of internet usage on all travel is probably some reduction, at least at the relatively early stage of internet adoption

covered by this study. However, whether this tendency persists with increasing penetration of the internet and changes in usage patterns is not known.

Another significant finding from this study is that *the average trip rate for internet users was significantly higher than that for non-users*. Further analysis showed that this higher trip rate was not explainable by the known differences in the demographic and geographic profiles of users and non-users. Rather, there appeared to be an *inherent* difference in the trip rates between users and non-users, such that even within the same demographic and geographic categories, internet users virtually always had higher trip rates than non-users.

Why would internet users have significantly higher trip rates than non-internet users? Broadly speaking, this could be due to either: (1) internet usage *causing* a higher level of trip making; or, (2) the fact that people who already have a high level of trip making tend to be internet users – partly, perhaps, in an attempt to reduce trips. Although there is some evidence from this study to suggest that internet usage induces certain trips, the proportion of respondents stating this is the case is significantly smaller than those indicating that the internet replaces trips. The findings do *not* support the hypothesis that internet usage causes higher trip rates, at least not to the extent of the differential shown. The evidence from this study instead suggests that internet users are more likely to be high trip-making individuals who, with their usage, may have reduced their trips but remain relatively more mobile in comparison to non-internet users. This is consistent with the demographic profile of internet users which have been shown to be younger, high-income earners. This hypothesis is also consistent with a finding from the 1999 Scarborough Research cited by Zmud, et.al. (2001) that E-shoppers lead highly-active lifestyles and results from the SIKA study (Johansson, 1999) which indicate individuals who make more trips are also those who undertake more non-mobile means of communication, including using the internet.

7. Summary

In summary, the results of this internet survey suggest that internet users, at least at the relatively early stage of internet adoption of this study, are comparatively more mobile than non-internet users. However, their usage of the internet appears to impact on the number and type of trips they undertake, with an overall reduction in their travel. The impact of internet usage was observed to be strongest on shopping, personal business and educational trips. Whether this tendency persists with increasing penetration of the internet and changes in usage patterns cannot be known until further studies are undertaken to monitor the ongoing effects of internet usage.

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