IMPEDIMENTS TO WALKING AS A MODE CHOICE

Author: Dr D. Walton, Research Manager, Behavioural Sciences, Opus Central Laboratories, Adjunct Senior Fellow, University of Canterbury, B.Sc(hons), Ph.D

Co Author(s): Ms Sicily Sunseri

Presenter: Dr Darren Walton

Abstract

This study evaluates a case-control design of contrasts between 110 drivers of a walkable distance and 238 walkers to address factors influencing the uptake of walking as a mode choice. To overcome the issue of car dependency or the inability to walk, drivers are selected from those whose cars were found parked in a park-n-ride and who live less than 1km of that car park. This unique group of drivers exhibit a break in car dependency by using public transport but still do not walk to the station. The research uses a 62-item survey to examine twelve factors: Fear of Crime; Trip-Chaining/Car Dependency; Weather; Distance/time; Social Pressure; Fatigue and Fitness; Parking Charges; Enjoyment of Walking; Inconvenience; and Geography. The samples are drawn from two locations: Auckland and Wellington, New Zealand. The results establish that the convenience of a car park at the station induces park-n-ride demand within the 1000m radius despite the ability of people to walk, and that no other factor adequately accounts for the decision-making. Notwithstanding, poor weather has an influence on the decision to drive, and fine weather improves the likelihood of walking. These results are compared within a literature that suggests walking is impeded by the distance, fear of crime and concern for time. While location effects are observed between the groups the results suggest factors thought to influence the uptake of walking have inconsequential impacts on mode choice decision-making.

Dr Darren Walton
Research Manager, Behavioural Sciences
Opus Central Laboratories
138 Hutt Park Road, Gracefield, Lower Hutt
Ph 04 5870663, Fax 04 587 0604
darren.walton@opus.co.nz

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D. Walton and S. Sunseri
Opus Central Laboratories, Lower Hutt, New Zealand

Introduction

The encouragement of walking is strategically important for reducing reliance of vehicles, reducing congestion, improving public health and underpinning sustainable transport (Ministry of Transport, 2003). However, despite government strategies and recognition of the importance of walking to multi-modal travel, worldwide there appears to be a decline of walking trips. In Britain, walking trips were found to decline by 16% between 1995/97 and 2005 (Department for Transport, 2005). A similar trend has been observed in the United States (McCann & DeLille, 2000). In New Zealand, it is estimated that walking trips have declined from 21.2% in 1990 to 14.8% in 2004, therefore approximately matching the trend observed elsewhere.

This study evaluates a case-control design of contrasts between 110 drivers and 238 walkers to address factors influencing the uptake of walking as a mode choice. To overcome the issue of car dependency or the inability to walk, drivers are selected from those whose cars were found parked in a park-n-ride and who live less than 1km of that car park. This unique group of drivers exhibit a break in car dependency by using public transport but still do not walk to the station, despite needing to walk at the completion of their public transport journey.

Several problems relating to definitions of walking occur in the research context. Evaluating travel survey datasets raises concerns for what constitutes a trip-leg, journey, 'tour' or even a destination (O'Fallon and Sullivan, 2004). Although walking is obvious to identify, its purpose varies and therefore the influences on its uptake are altered. Tolley (2003) usefully defines four different types of walking: (1) Access Mode (2) Access sub-mode (3) Recreational/leisure (4) Circulation/Exchange. Walking for access means undertaking a walking trip for purpose, such as a walk to work, and might be contrasted with 'circulation/exchange' which is the sort of activity of walking without a definite destination, such as walking around shopping malls. Walking for leisure is not considered in this research; the concern is primarily with the access sub-mode, walking to-and-from public transport.

Defining a 'walkable distance' is fundamental to the concerns for impediments because distance and walkability are correlated (Cervero and Kockelman, 1996). James, John and McKaskill, (2001) defined a walking trip as anything under 2km and subsequently found 78% of people regard this as too far, concluding 'distance' is the major impediment to walking. The result is repeated by the three studies examined in the US Department of Transportation's (1993) review where distance is found to be the leading factor impeding walking, reported with twice the frequency of any other factor. Notwithstanding, it is reasonable to suppose people walk much further than 2km a day; as much as five times this amount in healthy adults (Tudor-Locke, 2002).

New Zealand data indicate that walking trips made for social/recreational purposes are on average greater than 2km and walking trips made for shopping are on average greater than 2.5km. However, the same dataset indicates trips made for the purpose of changing mode are on average just 875m.[1] Methodologically, walking-for-access should be separated from other walking trips. Despite this, the literature addressing walking and 'short trips' is replete with examples where different walking modes are conflated, and even cycling is included in some evaluations, resulting in one case where 'short trips' are defined as less than 8km (Mackett, 2003).

A number of researchers have undertaken interviews or surveys of people to understand why short trips, regarded as potentially walkable, are undertaken by car. Forward (1999) concludes convenience of the car and concern for time are the main factors impeding walking. Mackett (2003) considers very short trips and identifies nine factors preventing walking: Heavy goods; passengers; concern for time; distance; convenience; additional destinations; the requirement the car be used at work; poor weather and other factors (including lighting & social concerns).

There is no consistent pattern in the literature examining factors impeding walking. The objective of the proposed research is to identify the factors affecting walking as a mode choice for short trips within a quasi-experimental case-control design. Within these considerations the following general aims can be developed:

1) When controlling for distance what factors distinguish between drivers and walkers in the walking for access sub-mode among (1) weather (2) the walking environment, (3) parking prices, (4) social norms and influences, (5) fitness/fatigue, (6) variability in travel times, (7) inconvenience of walking, (8) car dependency for trip chains, and (9) enjoyment of walking (10) fear of crime (11) concern for time?
2) What is determined to be a reasonable distance to walk to the train station and does the individual's perception of this distance influence their mode choice?
3) Are the factors that impede mode choice location specific?

Method

Participants

A total of 348 survey respondents were included for analysis and comprised two groups: (1) regular walkers to the train or bus facilities and (2) 'Park-and-Ride' users (hereafter referred to as 'drivers') of the facilities who live within 1000m of the 'bus or train station' (hereafter referred to as 'the station' whether or not this was a bus, train or mixed interchange). Participants were solicited from two locations: Auckland and Wellington. Consequently, participants consist of four groups: Wellington Walkers (n = 126); Auckland Walkers (n = 112); Wellington Park-and-Riders (n = 80); Auckland Park-and-Riders (n = 30). Respondents indicating disability were excluded from the analysis.

Respondents were evenly represented by gender (52% males) and reported a mean age of 33 years. Gender and age were represented evenly across all four categories of respondent ($\chi 2$ (3, 348) = 4.35 p. >.05; χ^2 (15, 347) = 21.94 p. >.05 for gender and age respectively). However, income effects are observed across the four groups ($\chi 2$ (12, 329) = 30.14 p. < .01). This is explained by a location effect as Auckland users of public transport are far more likely to report earning a lower household income than those in Wellington (χ^2 (12, 329) = 21.7 p. < .001) with this variable being correlated to location (eta .244, p.<.001). This effect is not represented across both mode types, there is no difference in the incomes of those who drive (χ^2 (4, 106) = 1.276 p. > .05). Mean self-reported experience with walking varies among the groups (F (3,339)= 59.411 p.<001). Auckland Drivers have less self-reported experience (around 26% frequency of walking) compared with Wellington Drivers (41%) or either of the walking groups (72% and 85% for Auckland and Wellington walkers respectively). Responses to the claim that it is "nearly impossible for me to walk to the station" indicate those who strongly agree, still claim to walk about more than 21% of the time. This rises to over 75% of the time for those who strongly disagree with the statement.

Materials

The survey consisted of 62 items of mixed types.[2] Two items addressed the typical destination and the frequency of walking to the station. Seven items requested perceptions of the walking distance to the station, to the destination and from an available car park to the destination, estimated in both distance and perceived walking time. One item recorded the closest intersection to allow calculations of actual distances to corroborate self-reported distances, and to determine geography. Two similarly formatted items requested the perceived normal walking distance of an average New Zealander who takes the station. Thirty-four items were developed to address nine categories of influence on the walking trip and requested agreement on a 5-point Likert Scale from 'Strongly disagree to Strongly agree'. Items addressed (1) weather (2) the walking environment, (3) parking prices, (4) social norms and influences, (5) fitness/fatigue, (6) variability in travel times, (7) inconvenience of walking, (8) car dependency for trip chains, and (9) enjoyment of walking. A separate set of 7 items specifically addressed the possibility of being witness to acts of anti-social behaviour throughout the walk home from the station and contained items relating to graffiti, being followed, intimidated, harassed, threatened or panhandled. A further seven items measures key demographics, number of cars in the household and the time and difficulty of the survey itself.

Method

The two samples where separately obtained. Locations for collecting participants were identified based on the size of park-and ride facilities with greater than 50 spaces. Sampling of number plates was undertaken in the mid-morning to prevent the risk that a car was parked temporarily in the morning, although survey items were included to capture the activities of the respondents. Walkers were identified on the platform between 7:30-8:30am by introductory screening questions and handed a survey pack. Drivers were obtained by selecting number plates from all cars in the park-n-ride and then matching these to addresses within a 1km radius of the train station who were then posted survey packs. Only 10-15% of the sampled number plates represented drivers who could be included in the study. Drivers outside the 1km radius were not surveyed. It is important to note that the park-and ride facilities are free car parking, and security concerns, as they relate to vehicles and the immediate vicinity of the stations are well managed.

Most analyses are undertaken using univariate analysis of variance (ANOVA) with two fixed factors: Walkers and Drivers, and Aucklanders and Wellingtonians. Analyses controlled for differences in the group's frequency of walking where relevant to draw the distinction between the preference to drive to the station and the levels of experience with particular issues associated with walking using univariate analysis of covariance (ANCOVAs) entering 'frequency of self-reported walking' as a covariate.

Results

Perceptions of time and distance

Table 1 represents the perceived walking distance that participants thought the average New Zealander might undertake to reach the station, across the two locations. The participants did not differ in their perceptions of the distance the average New Zealander might walk to the station $F(3,344) = .244$ $p.>.05$). The total represents a walking time of 9 minutes 20 seconds when using the estimates of walking speeds for New Zealand conditions (88m/minute) observed by Finnis and Walton (2006). When considering time there is a main effect for location $F(1,327) = 8.742$ $p.<.001$, with Aucklanders estimating the average time to be slightly longer than Wellingtonians but there is no effect for drivers compared with walkers in either location $F(1,327) = 1.388$ p. >,05 NS). As might be expected from the experimental conditions, the estimated distances to the closest stations

are significantly different across locations F(1,336) = 11.21 p. <.001) , but are there are no differences between drivers and walkers F(1,336) = .053 p. >.05 NS) in the two locations.

Table 1. Drivers and Walkers Perceptions of the Mean Walking Times and Distances the typical New Zealander might take to the station (SD in Brackets).

	Drivers		Walkers		Total
Location	Auckland	Wellington	Auckland	Wellington	Total
N	30	80	112	126	348
Perceived average New Zealander's walking distance	865 m (376)	809 m (385)	808 m(383)	829m(346)	820 m(368.4)
Perceived average New Zealander's Walking Time	13.91 min (6.04)	11.67 min (4.56)	15.11min(8.56)	12.43min(5.01)	13.24min (6.50)
Derived walking speeds	62.16 m/min	69.28 m/min	53.39m/min	66.67m/min	61.94 m/min
Individual's estimated walking distance to closest station	1103 m (475)	878 m (455)	1120 m (617)	893 m(510)	980 m(542)
Individual's estimated walking time to closest station	20.24 m/min (22.5)	11.46 m/min (5.45)	18.75 m/min (11.91)	11.75 m/min (8.14)	14.62 m/min (11.34)
Derived walking speeds	54.49 m/min	76.61 m/min	59.73 m/min	76.00 m/min	67.03 m/min
Calculated Distance of closest intersection to train station	1334 m (n = 26)	643 m (n = 68)	973 m (n = 30)	624m (n = 27)	824m (n = 151)

The influence of anti-social environments

The six items concerning the perceived likelihood of witnessing anti-social behaviour on the walk home were combined into a scale with an acceptable level of inter-item correlation (Cronbach alpha = .90). The combined items have a mean scale score of 10.08 (i.e a 10% chance to witness the anti-social behaviour) and a standard deviation of 10.26. The Kruskall-Wallis H test establishes that there are difference in the mean rankings for Aucklanders (whether drivers or walkers) compared to Wellingtonians (H (3, 336) = 51.62 p. <.001) but there are no significant differences between the mode types of either Aucklanders or Wellingtonians. From the derived mean scores Aucklanders are perceive they are about 60% more likely to witness acts of anti-social behaviour on their walk home than Wellingtonians. As expected, gender is related to perceived likelihood of encountering anti-social behaviour (U = 11712, df =334 p. <.01). Individual and location factors clearly affect perceived likelihood of encountering anti-social behaviour but this does not translate to the mode choice decision to travel by car rather than walk.

Table 2 outlines the means and standard deviations of responses to the 34 Likert scales items. Higher scores represent stronger agreement with the item. A more detailed account of the influences and the differences observed between locations are reported elsewhere (Walton, 2006).

Table 2. Item responses distinguishing between walkers and drivers when controlling for location rank ordered according to size of the mean difference between the two groups.

#	Item	Drivers		Walkers		Mean Difference	p
		M	SD	M	SD		
37	If there's a chance of rain I will take the car to the park and ride	3.80	1.297	2.59	1.212	1.21	***
29	Sometimes it's just more convenient to take the car to the station	3.88	1.016	2.77	1.249	1.11	***
40	I won't walk to the station when it's raining heavily	4.21	1.163	3.37	1.427	0.84	***

* p.<.05 **p.<.01 *** p.<.001

Overall analysis

A backward Wald (p >. 10) stepwise logistic regression is performed on all variables found to discriminate between drivers and walkers. Included variables were: Income, Gender, Location, Number of cars per household, Education, and the twelve items that discriminate between walkers and drivers listed in Table 2, and the reasonableness of the walking trip distances and times. The final model has the form $\chi 2$ (N=348) = df=7 146.865 p. <.001) and is outlined in Table 3.

Equation 1.

$\hat{g}$ (W) = 6.735 - 2.771 (Auckland_Wellington) -.435(NCars) + .562(Q51) + .455(Q27) -.611(Q29) -.588(Q37)-1.548(Hills)

Overall the equation explains 54.3% of the variance between drivers and walkers (NagelKerke r2 (N= 348) = 0.543 p .< .001). All variables combined explain 58% of the variance (NagelKerke r2 (N= 348) = 0.583 p .< .001). The Hosmer and Lemeshow post-diagnostic suggests the data are a good fit for the model ($\chi 2$ (N=348) =11.233 df =8 p. >.189).

Table 3 shows the significance and the lower and upper odds ratios developed from the logistic regression for each of the variables. Specifically, walkers are more likely to agree that park-n-rides are only for those who need to travel a long way, report they walk when it is fine, are less likely to be put off by the rain, and do not regard it more convenient to take a vehicle. A major contributing factor is the presence of car. Each additional car in the household reduces the likelihood of walking by about 50%. A larger contribution is made by the belief that park-n-rides are meant for people who have to travel a long way to the station. For every increase in the level of agreement with the claim, the odds of being a walker are improved by 75%. Compared to those who disagree with the claim, those who agree are 1.5 times more likely to walk than drive. Living on a hill presents a counter-intuitive result. Those who live on a hill are about 4.5 times more likely to walk than take the car to the park and ride.

Table 3. Logistic regression model resulting from a backward Wald stepwise elimination of variables found to distinguish drivers from walkers.

		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Auckland_Wellington(1)		-2.771	0.446	38.573	1	0.000	0.063	0.026	0.150
	Number of Cars in the Household	-0.435	0.204	4.558	1	0.033	0.647	0.434	0.965
51	P&R's are only for people who travel a long way to use the bus or train	0.562	0.160	12.276	1	0.000	1.754	1.281	2.402
27	Normally walk to the station when the weather is fine	0.455	0.136	11.122	1	0.001	1.576	1.206	2.059
29	Sometimes more convenient to take the car	-0.611	0.170	12.957	1	0.000	0.543	0.389	0.757
37	Chance of rain will take the car	-0.588	0.156	14.153	1	0.000	0.556	0.409	0.755
Live on a hill		-1.548	0.479	10.438	1	0.001	0.213	0.083	0.544
Constant		6.735	1.513	19.823	1	0.000	841.099		

a. Variable(s) entered on step 1: Auckland_Wellington, GENDER, AGE, FITNESS, NCARS, INCOME, EDUCATION, criminality, Q52, Q51, Q27, Q31, Q33, Q30, Q10, Q42, Q34, Q38, Q40, Q29, Q37, Hills, Time, Reasonableness.
b. -2 log Likelihood = 230.411

Discussion

To overcome the influences of car dependency and the false expectation that a comparison group of drivers might reasonably walk we obtained a special comparison group of drivers in park-and ride-facilities, and obtain these in two different cities. The locations present different geographical conditions, levels of service and levels of service for the public transport mode. In addition, we measured people's perceived and actual distances and times and compared these to their impressions of what is reasonable by asking them to estimate typical walking distances and times.

This study finds no support for various contentions in research and policy documents that factors such as the carriage of heavy goods, concern for crime, the need to use the car for other purposes, fatigue, parking charges or even geography might account for the use of the car on the short trip to the train station. In contrast, the convenience of the car park and the availability of car tend to indicate that it is better to interpret that park-n-rides, at least, induce car trips by those who might otherwise walk 1km to the station. The weather has an influence but is tolerated by those who either need to (through the absence of a car) or choose to walk. Living on a hill tends to induce walking, against the expected concern that geography might impede the short walking trip examined.

The counter-intuitive finding that people walk more often from the hills to the station is probably an artificial outcome of the locations sampled. The park and ride facilities are subject to severance by a major motorway. Against the traffic flows it would be very inconvenient for people to use a car, especially in the evenings. On this interpretation the finding supports the main contention that when the convenience of the car is disrupted, even against the notional effort to walk up a hill, the car will not be preferred.

Whether or not the findings of this study generalise to other walking trips undertaken for different purposes is not clear, though the results hold across two separate cities, serviced by different levels of public transport (thus different levels of 'walkability'). The same pattern of results occurs between the comparison groups across the two locations, despite many location influences being recognised.3 Indeed, a clear finding result is that when held constant the apparent reasons found elsewhere to account for the differences on mode choice between walkers and drivers disappear.

Our findings support the literature that suggests the convenience of the car is the dominant factor impeding walking (Forward, 1999; Cervero,1996) when considered as an access sub-mode (as defined by Tolley, 1996). Walking distance is not a significant consideration, albeit controlled to within our comparison groups to being less than 1000m. The perceived typical distance is 820m and the perceived reasonableness of the individual's walking distance calculated against this does not discriminate between those who drive and those who walk.

This study focuses on a relatively narrow definition of walking—that to and from public transport. The idea that fear of others on the walk home may interfere with the uptake of walking is not supported in this research, despite location contrasts, that establish Aucklanders are far more likely to perceive they will be exposed to anti-social behaviours undertaking the walking trip. However, the context of inquiry must be taken into account. Dravitzki, Cleland, Laing and Walton (2003) established that lighting effects held little influence on the comfort of the walking trip but most of these were taken at times when plenty of other people are around to censure any actual anti-social behaviour. In the absence of other people it is possible that walking is uncomfortable as a mode choice. Again however, this possibility does not account for the reason people choose to take their cars to the park-and ride rather than walk.

Perhaps the most fundamental concern is the departure here from findings derived from other datasets, such as travel surveys, indicates that such analyses cannot capture the complexity of decision-making concerning walking without two conditions being met. First, the definition of the walking purpose must be clearly defined. Second, fundamental data about the reasonableness of trip distance must be understood for accurate comparisons between walkers and those who could be reasonably expected to walk, separately considered for each walking type. Extending the comparisons of groups beyond a reasonable distance confounds the detected influences and obscures the results and their interpretation. The temptation for policy and research is to cross the definitional boundaries and conflate walking for leisure or circulation, which may be more than 20mins and more than 2km, with the opportunity to walk for access, which seems to occur to be impeded, ceteris paribus, when it extends beyond 1km (Cervero & Duncan, 2003). If policy is to be directed towards improving the rates of walking it should be broken into the four classifications of walking, and each supported by research that captures the complexities and inter-relationships between travel modes and travel mode choices.

Respondents to this survey identify another key element of concern. A major predictor of mode choice is the belief that park and rides are developed for a particular purpose: to service those who would otherwise have an unreasonable walk. This finding calls into question the intentions of providing park and ride facilities. These facilities induce public transport trips and reduce congestion so they seem appropriately beneficial. However, they also seem to reduce potential walking trips because they provide a convenient opportunity to undertake the journey by car. Establishing a ticketing system that prevents use of park-n-rides on a regular basis by those who live within 850metres of the station, introducing a parking charge, or better, locating the park-n-ride 200-300 metres from the station might reduce the convenience associated with their placement by making the then necessary walk compete with the decision to get into the car.

Limitations and future research

This study did not attempt to examine the micro-aspects of design that influence walking. We did not undertake to measure the permeability of the networks surrounding the stations, nor did we classify the locations according to available measures of ‘walkability’ (eg. Parks and Scofer,2006). This study did not examine hypothetical factors that might be altered to improve the chances that an individual walking. These concerns might be undertaken in future research. In general, comparisons could use the methods used here to establish the perceived reasonableness of the walking distance to obtain accurate comparison groups to evaluate impediments to walking across the other walking types.

Conclusions

A reasonable walking distance for the access sub-mode of travelling to the train station is perceived to be around 820m and this matches with separately obtained travel survey data. When this distance is controlled and appropriate comparison groups are obtained the impediments to walking found in research elsewhere almost all disappear, except ‘rain’ that has an influence on the choice to drive vis-a-vis fine weather that aids the decision to walk. The weather aside, the convenience of the car, when it is provisioned by the opportunity to park it for free in a monitored facility, induces the reasonable walking trip to be replaced by a car trip. Factors thought to influence the uptake of walking such as time, distance, fatigue, the carriage of goods, concern for crime are not found to be real impediments to the walking journey considered as an access sub mode.

References

Allen, A., 2001, Walking as a local transport modal choice in Adelaide. *World Transport Policy and Practice, 7,* pp 44-51.

Cervero, R and Duncan, M. D (2003). *Walking, bicycling and urban landscapes: evidence from the San Francisco Bay area*. University of California Transportation Centre: Berkeley.
Cervero, R and Kockelman, K. (1997). *Travel Demand and the 3Ds: Density, diversity and design. Transportation Research, Part D 2,(3)* pp.199-219.
Cervero, R. (1996). Mixed land uses and commuting: evidence from the American Housing survey. *Transportation Research, Part A 30,(5*). Pp.361-377.
Dravitzki, V., Cleland, B.S. Walton, D and Laing., J. N. (2003). *Measuring commuting pedestrians' concerns for personal safety and the influence of lighting on these concerns.* NZIHT Transit NZ symposium for road safety. Wellington, October, 21-24.
Finnis, K and Walton, D. (2006). Field observations of factors influencing walking speeds. (under review). *Ergonomics*
Forward, S. (1999). *Modes of transport of short journeys: attitudes and behaviour of the inhabitants of Gothenburg.* VTI rapport 437A Swedish National Road and Transport Research Institute.
Handy, S. L. (1996). Urban form and pedestrian choices: study of Austin neighbourhoods. *Transportation Research Record. 1552,* pp.135-144.
James, B., John, G. and McKaskill, J (2001). Potential for increasing walking trips. *Proceedings of Australia: Walking the 21st Century -20-22 February 2001 Perth, Western Australia*.
Landis, B.W., Vattikuti, V.R., Ottenburg, R.M., McLeod, D.S. and Guttenplan, M., 2001, Modeling the roadside environment: A pedestrian level of service. *Transportation Research Record 1773, pp 82-88*
Mackett, R. L. (2003). Why do people use their cars for short trips? *Transportation 30,* 329-349.
Ministry of Transport (2003) *Getting there – on foot, by cycle: A strategy to advance walking and cycling in New Zealand transport.* Wellington, NZ: The Office of the Minister of Transport.
Newman . P. W.G and Kenworthy, J.R (1991). *Cities and automobile dependence: An international Sourcebook.* Aldershot: Gower Technical.
O'Fallon, C. & Sullivan, C. (2005). Trip chaining: Understanding how New Zealanders link their travel. *Transfund New Zealand Research Report No 268:* Wellington: Transfund NZ.
Parks, J. R. & Scofer, J. L. (2006). Characterising neighbourhood pedestrian environments with secondary data. *Transportation Research, Part D, 11,* pp.250-263.
Tolley, Rodney (2005). Providing for pedestrians: principles and guidelines for improving pedestrian access to destinations and urban spaces. July 2003 Department for infrastructure, Victoria. *Accessed 28 August 2005 http://www.livingstreets.org.nz/pdf/providing_for_pedestrians.pdf*
Ulberg, C (1989). Psychological aspects of mode choice: *Final Report prepared for the Washington State Department, Dec 1989.*
US Department of Transportation (1993). *Measures to overcome impediments to bicycling and walking: "Case Study No. 4: National Bicycling and walking study".* Washington :Federal highways administration.

[1] Data derived from the New Zealand Household Travel Survey 1997/98. Any error is the first author's.
[2] A copy of the survey will be included in the final report to Land Transport New Zealand. Requests for copies may be made to the first author.
[3] The differences between locations are outlined in the forthcoming Land Transport New Zealand research report.