Impediments to Walking as a Mode Choice

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Impediments to Walking as a Mode Choice

D. Walton[1,2] and S. Sunseri[1]

1 Opus Central Laboratories, 138 Hutt Park Road, Lower Hutt, New Zealand
2 University of Canterbury, P O Box 2400, Christchurch, New Zealand

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PO Box 2840, Waterloo Quay, Wellington, New Zealand
Telephone 64-4 931 8700; Facsimile 64-4 931 8701
Email: *research@landtransport.govt.nz*
Website: *www.landtransport.govt.nz*

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Dr Darren Walton is Research Manager of Behavioural Sciences at Opus Central Laboratories and Senior Adjunct Fellow at the University of Canterbury. Darren's research in applied psychology centres on the social factors related to infrastructure development and management. Darren is currently programme leader a five-year FRST-funded research programme examining Sustainable Household Travel.

Sicily Sunseri is a researcher in the Behavioural Sciences unit at Opus Central Laboratories. She has B.A. (Hons) in Social Anthropology and Political Science. Sicily specialises in qualitative methods and interviewing techniques.

Contents

Executive summary 9
Abstract 12
1. Introduction 13
1.1 Research Questions 15
2. Study One: Observational data of close-living park-and-riders 17
2.1 Method 17
2.1.1 Details of observations 17
2.1.2 Procedure 17
2.2 Results 17
2.3 Discussion 19
3. Study Two: Survey of Walkers and Car Users 20
3.1 Method 20
3.1.1 Participants 20
3.1.2 Materials 20
3.1.3 Procedure 21
3.2 Results 23
3.2.1 Location differences 23
3.3 Differences between walkers and drivers accounting for location differences 24
3.3.1 Perceptions of time and distance 24
3.3.2 The effect of anti-social environments 26
3.3.3 Parking charges at the journey destination 27
3.3.4 Trip chaining 27
3.3.5 End-of-day fatigue 27
3.3.6 Weather 28
3.3.7 Time factors 28
3.3.8 The walking environment 28
3.3.9 Social influences 29
3.3.10 Enjoyment/inconvenience of walking 29
3.3.11 Fitness 29
3.3.12 Overall analysis 29
4. Discussion 31
4.1 Limitations and Future Research 33
4.2 Conclusions 34

5. Recommendations 35
5.1 Improve definitions and methodologies concerning walking mode types 35
5.2 Where possible, improve the rain shelter infrastructure by providing better shelters and covered walkways 35
5.3 Establish a mechanism to make park-and-rides less convenient and discourage those with the ability to walk 36
6. References 37
Appendix 39

Executive summary

This research is comprised of two studies that investigate supposed impediments to walking when controlling for distance and mode-type. The walking considered in these studies is defined as the access sub-mode by Tolley (2003) and considers walking to and from a train station. Commuters who live close to and yet use 'park-and-ride' facilities provide a unique, natural experiment to reveal real impediments to walking. This group of drivers demonstrate an irregular break in car dependency by driving their cars to the station in order to use public transport. The key question is why cars are used instead of a normal walking trip, when car dependency is clearly broken by using a public transport leg within the overall journey. Understanding the factors that encourage these commuters to start their journeys by car provides insights into genuine impediments to walking.

The main study is conducted by a survey that measures attitudes to walking in a case-control design comparing walkers and individuals who live less than 1 km from the train station where their vehicles are observed in the park-and-ride. Samples of each type of commuter are taken from Auckland and Wellington to allow an understanding of the generalisability of differences observed between the walkers and drivers.

In addition, a secondary study observes the use of the park-and-ride facilities by a survey of vehicle licence plates over five consecutive days, in the same facilities on two occasions during both the summer and winter seasons. Results of these observations indicate that patterns of park-and-ride use vary according to summer and winter but that these patterns are independent of groupings of walkers and drivers, meaning that the time of the observations has no overall effect on whether or not people choose to drive or walk to the station.

Eleven factors are drawn from the background literature. These factors concern the reasons people use vehicles for short trips. They are also concerned with known effects on the increase or reduction of walking trips. Items to measure these factors form part of the 62-item survey and collectively measure the influence of:

(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,
(9) enjoyment of walking,
(10) fear of crime, and
(11) concern for time.

In addition, several other items establish the relative perceptions of walking times and distances. These items allow the assessment of the reasonable distance and time that

respondents would accept in making a short walking trip for the purposes of commuting via public transport and for the comparison of walking speeds. The results indicate differences between the locations of Auckland and Wellington but no differences between the relative distances, times (and therefore speeds) perceived for walking between those who actually walk and drivers of vehicles. The reasonable distance accepted is 820 metres which is a walking trip expected to be undertaken in 9-10 minutes.

Factors thought to influence the uptake of walking such as time, distance, fatigue, the carriage of goods and concern for crime, are not found to be real impediments to the walking journey considered as an access sub mode. The results of this survey show only four factors relevant to studying the choice of whether to walk or drive a short journey. Factors such as:

- the weather (fine or raining),
- the belief that park-and-rides are appropriately used by people who live close,
- the availability of a car, and
- the belief that a park-and-ride provides convenience,

best predict whether someone will walk or drive to the station.

Previous studies have conflated not only different walking sub-modes, but also 'walking' and 'cycling' categories. The two studies referred to here are discussed in terms of the methodological issues with walking studies.

The conclusions are:

1. A reasonable walking distance for the access sub-mode of travelling to the train station is perceived to be around 820 m.

2. When distance is controlled and appropriate comparison groups are obtained, the impediments to walking found in research elsewhere almost all disappear.

3. The 'chance of rain' has an influence on the choice to drive vis-à-vis fine weather that aids the decision to walk.

4. The convenience of the car, when it is provisioned by the free parking opportunity in a monitored facility, prompts the reasonable walking trip to be replaced by a car trip.

5. Factors thought to influence the uptake of walking, such as time, distance, fatigue, the carriage of goods, and concern for crime are not found to be real impediments to the walking journey when considered as an access sub mode.

The research themes support a set of recommendations:

1. Improve definitions and methodologies concerning walking mode types.

2. Where possible, improve rain shelter infrastructure by providing better shelters and covered walkways.

3. Establish a mechanism to make park-and-rides less convenient to those with the ability to walk who live less than 1 km away from the facilities.

Abstract

Conducted in 2005, this study evaluates a case-control design of contrasts between walkers and drivers to address factors influencing the uptake of walking as a mode choice. With samples drawn from Auckland and Wellington, New Zealand, this research uses a 62-item survey to examine a number of factors: fear of crime; trip-chaining/car dependency; weather; distance/time; social pressure, fatigue and fitness, parking charges, enjoyment of walking, inconvenience, and geography. To avoid factors such as car dependency or the inability to walk, participants are selected because they live a short distance from public transport parking facilities. The group of drivers demonstrate an irregular break in car dependency by driving their cars to the station in order to use public transport. The results indicate that for parking facilities, convenience creates demand. Poor weather has an influence on the decision to drive, and fine weather improves the likelihood of walking. Previous studies claim decisions to walk are impeded by certain factors. While location effects are observed between the groups, these results suggest that such factors are in fact inconsequential.

1. Introduction

Encouraging walking is strategically important for reducing reliance on vehicles, reducing congestion, improving public health and underpinning sustainable transport (Ministry of Transport, 2002). However, despite government strategies and recognition of the importance of walking to multi-modal travel, there appears to be a worldwide decline in walking trips. In Britain, walking trips were found to have declined 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 to multi-modal travel has declined from 21.2% of all walking trips in 1990 to 14.8% in 2004, therefore approximately matching the trend observed elsewhere.

Research into the fundamental influences on walking has been criticised as methodologically weak and incapable of supporting the many claims made about the alteration of urban form (Handy, 1996). Recent efforts have focused on developing typologies of the level of service afforded by pedestrian networks and have raised key concerns regarding 'walkability' (Landis et al., 2001; Parks & Schofer, 2006) and 'permeability' (Allen, 2001). However, even with such conceptual refinements to characterise infrastructure, the influence of 'permeability' is on psychological considerations such as 'perceived distance' and 'frustration'. Although recognised, these sorts of influences on decisions to adopt particular travel modes, and more particularly the attitudinal impediments to the uptake of walking, have not been well researched, and are poorly understood (Ulberg, 1989; Wigan, 1995).

Conducted in 2005, this research used samples drawn from Auckland and Wellington, New Zealand. The study evaluates a case-control design of contrasts between 110 drivers and 238 walkers in order to address factors influencing the uptake of walking as a mode choice. To avoid including the factors of car dependency or the inability to walk, participants lived a short distance (less than 1 km) from public transport parking facilities. This unique group of drivers demonstrate an irregular break in car dependency by driving their cars to the station in order to use public transport, despite needing to walk once their public transport journey has ended.

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 & 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) Leisure/recreation, (4) Circulation/exchange. Walking for access means undertaking a walking trip for a 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. The nature of the trip also relates to issues of definition. Confined trips

within shopping malls, for example, are typically excluded from travel survey datasets (Wigan, 1995).

Defining a 'walkable distance' is fundamental to the concerns for impediments because distance and walkability are correlated (Cervero & Kockelman, 1996). James, John and McKaskill, (2001) defined a walking trip as anything under 2 km. However, they found that 78% of people regard this as too far to walk and concluded 'distance' is the major impediment. The result was repeated by the three studies examined by the US Department of Transportation's (1993) review where distance was found to be the leading factor impeding walking, reported with twice the frequency of any other factor.

Table 1.1 USDOT (1993) Review of walking studies.

Reasons for not walking	City			% believing following changes would increase walking	
	Seattle	Toronto	Ottawa		
Distance	33%	47%	56%	Reduce crime/safer Streets	19%
Too slow; takes too long	14%	12%	14%	Education; awareness of health benefits	15%
Weather	8.7%			More sidewalks	14%
Dislike walking/lazy	6.4%			Improved street crossings	8%
Difficult to carry things	5.7%	50%	48%	More trails , paths and places to walk	5%
Inconvenient	5.7%			Better street lighting	4%
Fear of crime	3.3%			Enforcing pedestrian laws	3%
No time	2.0%			Nothing more should be done	29%
Darkness	1.7%				
No sidewalks	1.3%				

Notwithstanding, it is reasonable to suppose people walk much further than 2 km a day and as much as five times this amount by healthy adults (Tudor-Locke, 2002). New Zealand data indicate that walking trips made for social/recreational purposes are on average greater than 2 km and walking trips made for shopping are on average greater than 2.5 km. However, the same dataset indicates trips made for the purpose of changing mode are on average just 875 m. 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 (see Wigan, 1995) resulting in one case where 'short trips' are defined as less than 8 km (Mackett, 2003). There seems to be a temptation to suppose the fact that a walkable distances can be as much as 2 km because people do this for leisure, shopping or ordinary walking around, and impose this distance on different categories of walking, such as the access, and access sub-modes. Forward (1998) recognises that distance is controlled for when people regard walking as relaxing, pleasant and a personal freedom. Unfortunately, most studies fail to control for

distance or provide adequate controls for comparisons of attitudes between walking subgroups.

Several studies investigate and classify the impediments to walking. James, John and McKaskill (2001) report five reasons considered as impediments: Time, Infrastructure, Comfort, Community Climate and Free Choice. They conclude that improvement in 'community climate' or what they describe as soft factors are more likely to influence walking trips because 20% of people report that improvements to the community climate would increase walking compared with just 9% reporting infrastructure changes. The finding is repeated throughout the literature (Cervero & Duncan, 2003; cf Newman & Kenworthy, 1991). Micro-aspects of design have been found to be 'too micro' to be examined as the principal determinants of mode choice (Cervero, 1993).

Two researchers have undertaken interviews or surveys of people in a bid to understand why short trips, regarded as potentially walkable, are undertaken by car. Forward (1999) concludes that the convenience provided by the car, as well as 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; requirement for the car to be used at work; poor weather and other factors (including lighting & social concerns).

However, self-reported impediments to walking may not be real impediments (Ministry of Transport, 2003). In the Seattle study cited in the USDOT, 'fear of crime' is ranked seventh and identified as a reason for not walking by only 3.3% of people. Six times as many people (19%) identify 'reduce[ing] crime/safer streets' as likely to increase the uptake of walking. What is perceived or reported in surveys may not match with the actual reasons people choose not to walk, or elect to travel by car.

Existing literature fails to identify the different modes of walking and thereby reveal whether differential factors are involved. The objective of this research is to identify the factors effecting 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.

1.1 Research Questions

1) When controlling for distance, what factors distinguish drivers and walkers, as well as the purposes of walking, given: (a) weather, (b) the walking environment, (c) parking prices, (d) social norms and influences, (e) fitness/fatigue, (f) variability in travel times, (g) inconvenience of walking (or, whatever makes a walking trip less likely), (h) car dependency for trip chains, (i) enjoyment of walking (j) fear of crime, and (k) concern for time?
2) What is considered 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?
4) For those people who live less than 1 km from a park-and-ride, do the patterns of use change across seasons or days of the week?

Two studies were undertaken to respond to the four aims identified. These studies are closely related in that the first observational data could be used to corroborate the findings of the broader survey-based investigation.

2. Study One: Observational data of close-living park-and-riders

2.1 Method

2.1.1 Details of observations

Woburn and Waterloo stations are situated in urban Lower Hutt, approximate to Wellington city in the lower North Island. Number plate details of all the parked vehicles were collected from the Woburn and Waterloo Station park-and-rides for five days on two separate occasions. The address of the registered owner of each unique plate was then obtained from the motor vehicle registry. Each address location was compared for its proximity to the station and those addresses which were within 1 km were separately identified. The station car parks have a capacity of 600 vehicles and were at nearly full capacity on each day of observation, resulting in around 3000 observations, repeated on two occasions. The proportion of all car trips to the park-and-ride of less than 1 km was 10-15%.

2.1.2 Procedure

Analysis of the frequency of park-and-ride use in the two categories of parked vehicles (live close and other) was undertaken using a simple chi-square analysis of independence for the variables; (a) days or week, (b) season of observation and (c) category of vehicle. An analysis of the interaction between the three variables using a log-linear model was established to be unnecessary.

2.2 Results

The test of independence between the variables, season of observation, the number of days parked, and the category of vehicle, indicates that the habit of taking the car to the park-and-ride is established independent of the proximity to the station (X^2 (5703) = 223.01 df = 4, $\rho < 0.001$). That is, there is no evidence that single, one-off events create a need to use the park-and-rides by those that live close to the station; the pattern of behaviour is the same as those who use the park-and-ride from beyond the supposed walking distance. Table 2.1 outlines the frequency of responses for the days for each type of user, defined by the distance they lived from the station.

The test for independence for the season by the category of driver found in the park-and-ride indicates no association (X^2 (5703) = 1.86 df = 1, $\rho < 0.67$). This indicates that the season of the year has no particular impact on the pattern of behaviour of people living close the facilities and implies that concerns for darkness, for example, have no impact on decisions to use the facility. The data are represented in Table 2.2.

Table 2.1 The cross tabulation and chi-square analysis of proximity to the station and frequency of parking within the park-and-ride by number of days.

Number of days parked		Live within 850 m	Live beyond 850 m
1.00	Count	98.0	1014.0
	Expected Count	109.0	1003.0
	Adjusted Residual	-1.2	1.2
2.00	Count	114.0	1090.0
	Expected Count	118.0	1086.0
	Adjusted Residual	-0.4	0.4
3.00	Count	116.0	906.0
	Expected Count	100.2	921.8
	Adjusted Residual	1.8	-1.8
4.00	Count	114.0	1093.0
	Expected Count	118.3	1088.7
	Adjusted Residual	-0.5	0.5
5.00	Count	117.0	1041.0
	Expected Count	113.5	1044.5
	Adjusted Residual	0.4	-0.4
Total count		559.0	5144.0

Table 2.2 The cross tabulation and chi-square analysis of proximity to the station and frequency of parking within the park-and-ride by season.

Season of count		Live within 850 m	Live beyond 850 m
Summer	Count	275.0	2580.0
	Expected Count	279.8	2575.2
	Adjusted Residual	-0.4	0.4
Winter	Count	284.0	2564.0
	Expected Count	279.2	2568.8
	Adjusted Residual	0.4	-0.4
Total count		559.0	5144.0

Table 2.3 outlines the relationship between the habitual use of the park-and-ride and its association to seasons of the year. Here a moderate relationship between season and the frequency of use of the park-and-ride is observed (X^2 (5703) = 223.01 df = 4, $\rho < 0.001$). A symmetrical association between season and frequency of use is observed. In summer the frequency park-and-ride use decreases, and then increases in winter.

However, this trend is independent of whether or not the person lives a walkable distance to the station and cannot be explained by an increased uptake of alternative modes in summer or a car dependency in winter**.**

Table 2.3 The cross tabulation and chi-square analysis of week day use and frequency of parking within the park-and-ride by number of days.

Number of days parked		Season of count	
		Winter	Summer
1.00	Count	430.0	682.0
	Expected Count	556.7	555.3
	Adjusted Residual	-8.5	8.5
2.00	Count	474.0	730.0
	Expected Count	602.7	601.3
	Adjusted Residual	-8.4	8.4
3.00	Count	512.0	510.0
	Expected Count	511.6	510.4
	Adjusted Residual	0.0	0.0
4.00	Count	729.0	478.0
	Expected Count	604.2	602.8
	Adjusted Residual	8.1	-8.1
5.00	Count	710.0	448.0
	Expected Count	579.7	578.3
	Adjusted Residual	8.6	-8.6
Total count		2855.0	2848.0

2.3 Discussion

Changes in the use of park-and-ride in winter suggest that the influence of weather and degree of darkness are factors influencing walking trips. However, such changes apply to those people who live close to the stations as well as those who live further than 1 km. The same changes in variability are observable whether or not an individual lives within a notional walking distance to the station facilities. Thus, while travel behaviour generally varies in summer compared to winter, in this context the decision to walk appears to be independent. An alternative explanation is that people engage in a range of activities in summer that influence their mode choice and therefore prompting a car trip.

3. Study Two: Survey of walkers and car users

3.1 Method

3.1.1 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 these facilities who live less than 1000 m from 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. Therefore, participants consisted of four groups: Wellington walkers (n = 126); Auckland walkers (n = 112); Wellington drivers (n = 80); Auckland drivers (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 respondents (X^2 (3, 348) = 4.35 ρ > 0.05; X^2 (15, 347) = 21.94 ρ > 0.05) for gender and age respectively). However, income effects are observed across the four groups (X^2 (12, 329) = 30.14 ρ < 0.01). 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 (X^2 (12, 329) = 21.7 ρ < 0.001) with this variable being correlated to location (eta = 0.244, ρ < 0.001). This effect is not represented across both mode types. That is, there is no significant difference in the incomes of those who drive versus those who walk (X^2 (4, 106) = 1.276 ρ > 0.05).

Mean self-reported experience with walking varies among the groups (F (3,339) = 59.411 ρ < 0.001). 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). Those who 'strongly agree' to the statement, "it is nearly impossible for me to walk to the station," still claim to walk more than 21% of the time. This rises to over 75% of the time for those who 'strongly disagree' with the statement. Almost all participants walk some part of the journey, with 92.5% of respondents indicating they walk to work, university, school or other destination. The data of one respondent, who declared a disability impeding ability to walk, was excluded from this analysis.

3.1.2 Materials

The survey consisted of 62 items of mixed types (see Appendix for a complete copy). Two items addressed the typical destination and the frequency of walking to the station. Seven items requested the participant's perceptions of the walking distances to the station and the destination, as well as the distance from an available car park to the destination. This was 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 train. 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 seven items specifically addressed the possibility of being witness to acts of anti-social behaviour during the walk home from the station and contained items relating to graffiti, fear of being followed, intimidated, harassed, threatened or panhandled. A further seven items measured key demographics, the number of cars in the household and the time and difficulty of the survey itself.

3.1.3 Procedure

The two samples were separately obtained. Locations for selecting participants were identified based on the number of parking spaces provided by the facilities, the minimum being 50 spaces. Sampling of number plates was undertaken in the mid-morning to exclude cars parked temporarily in the morning, although survey items were included to capture the activities of the respondents to ensure people did indeed use the park-and-ride facility. Walkers were identified on the platform between 7:30-8:30 am by introductory screening questions and handed a survey pack. Drivers were obtained by selecting number plates from all cars in the park-and-ride and then matching these to addresses within a 1 km 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 1 km radius were not surveyed. It is important to note that the park-and ride facilities offer free car parking, and security concerns relating to vehicles and the immediate vicinity of the stations are well managed.

Most analyses were 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. This was done by using ANOVAs with 'frequency of self-reported walking' as a covariate.

Table 3.1 Details of the four Auckland sites.

Station	Date	Surveys distributed	Weather	Park-and-ride
Glen Innes	17/03/06. Started at 8.25 am.	125	Slightly over-cast but fine.	146 car parks. Filled well over capacity: 14 were parked on the on the verge due to overflow.
New Lynn	16/03/06	100	Slightly over-cast but fine.	117 spaces. Filled well over capacity, with cars parking in no allocated car parks and on the road too.
Homai	15/03/06. 7-9am	75	Fine	293, 86 cars collected
Constellation park-and-ride	26/05/06	There were no walking surveys handed out to walkers. A total of 33 train park-and-riders with 14 being sent out.	Not applicable	700 car parks and 98% filled to capacity

Table 3.2 Details of the six Wellington sites.

Station	Date	Surveys distributed	Weather	Park-and-ride
Johnsonville	27/01/06. 7.30 am	46	Mainly fine with some morning cloud in the South and East.	85 car parks, 5 empty.
Melling	30/01/06. 7.30 am	14	Low cloud and fog patches, clearing by dawn. Then mostly sunny with cloudy periods towards the evening.	149 spaces and 26 were empty in the car park.
Petone	25/01/06. 7.30 – 8.30 am.	46	Scattered rain becoming widespread and persistent from late morning.	205 car parks and 3 were empty.
Upper Hutt	26/01/06. 7.30 am.	19	Cloudy periods, especially in the south with drizzle patches possible Cool southerlies.	232 car parks and 19 were empty.
Waterloo Interchange	24/01/06. 7.30 am.	48	Fine at first. High cloud thickened during the day and rain developed from late afternoon but eased again at night.	660 car parks
Woburn	24/01/06. 7.30 am.	10	Fine at first. High cloud thickened during the day and rain developed from late afternoon but eased again at night.	142 car parks

3.2 Results

3.2.1 Location differences

Many differences were detected in the two regional locations. These reflect different levels of service concerning walking. Responses to all survey items indicate a significant difference in the Auckland and Wellington comparison. Table 3.3 lists the mean scores for all items and the mean difference compared on a studentised, two tailed, *t*-test for independent samples. All items showed a location difference.

Table 3.3 Differences in items across locations rank ordered according to size of the mean difference between the two groups.

#	Item	Auckland		Wellington		Mean Difference	ρ
		M	SD	M	SD		
37	If there's a chance of rain I will take the car to the park-and-ride	3.30	1.35	2.47	1.18	0.84	***
8	I don't like to walk at night	3.68	1.36	2.96	1.27	0.73	***
32	I have a weekday morning routine that stays pretty much the same throughout the year	3.90	1.07	3.82	1.07	0.72	*
10	I am often too tired at the end of the day to walk home from the station	2.89	1.33	2.20	1.13	0.70	***
33	I would prefer to walk with someone that I know	3.48	1.14	2.83	1.12	0.65	***
30	I arrive at work fresher if I drive rather than walk to the station	2.92	1.32	2.30	0.95	0.62	***
29	Sometimes it's just more convenient to take the car to the station	3.37	1.26	2.74	1.24	0.62	***
42	It's sometimes too cold to walk to the station	3.12	1.36	2.52	1.21	0.60	***
34	Walking takes too long	2.59	1.23	1.99	0.92	0.60	***
14	I can never tell whether I might need the car when I get back	2.94	1.20	2.39	1.05	0.58	***
13	I'd prefer to walk a more direct route between home and the station	3.55	1.14	2.97	1.18	0.58	***
41	I like the company of others on the bus or train	3.33	1.05	2.80	1.02	0.54	***
11	It's really important that I do not miss connecting with my bus or train in the morning	4.07	1.13	3.54	1.38	0.53	***
20	A walk to the station in the morning is much better than a walk home at the end of the day	3.60	1.21	3.09	1.18	0.52	***
43	I often have too much to carry for walking to the station	2.80	1.29	2.28	1.02	0.51	***
26	Walking times are too variable to reliably meet the train or bus	2.53	1.16	2.01	0.94	0.51	***
40	I won't walk to the station when it's raining heavily	3.85	1.33	3.35	1.44	0.50	**
38	It is nearly impossible for me to walk to the station	1.95	1.11	1.46	0.75	0.48	***
21	I get more chance to think about my day when I drive the car	2.25	1.02	1.80	0.73	0.45	***
22	I probably should walk to the station more often	3.28	1.21	2.85	1.24	0.43	**
19	If I walk to the station I need to walk through unpleasant areas such as alleyways	2.36	1.17	1.94	0.93	0.42	***
18	I can't afford to pay for parking in town	3.75	1.28	3.44	1.36	0.31	*
28	The shoes I wear are inappropriate for walking any real distance	2.73	1.33	2.43	1.17	0.30	*
39	I have more chance of a traffic accident when walking	1.96	1.01	1.75	0.91	0.22	**

Table 3.3 (continued) Differences in items across locations rank ordered according to size of the mean difference between the two groups.

#	Item	Auckland		Wellington		Mean Difference	ρ
		M	SD	M	SD		
53	Congestion on the motorway is easily avoided by taking the train	4.41	0.75	4.39	0.71	0.19	*
54	Free parking by the station should be used by anyone whether or not they use the bus or train	2.36	1.35	2.20	1.17	0.16	*
31	I do not enjoy walking	1.92	1.13	1.76	0.98	0.16	*
23	Walking to the station has benefits for my level of fitness	4.20	0.86	4.06	1.00	0.14	*
9	Parking a car in town is too expensive	4.54	0.84	4.44	0.86	0.10	*
12	My family or friends think I should walk as often as I can	3.36	1.15	3.37	1.07	-0.01	*
51	Park-and-rides are only for people who travel a long way to use the bus or train	2.85	1.15	3.01	1.12	-0.16	*
52	People should be discouraged from using park-and-rides on every day	2.25	1.04	2.58	1.07	-0.33	***
17	A walk to the station is uncomfortable because of strong winds	2.65	1.12	3.01	1.11	-0.35	**
27	I normally walk to the station when the weather is fine	3.37	1.30	3.97	1.21	-0.60	***

\# Question number in the survey (see Appendix)
* $\rho < 0.05$
** $\rho < 0.01$
*** $\rho < 0\ 001$

3.3 Differences between walkers and drivers accounting for location differences

3.3.1 Perceptions of time and distance

Table 3.4 shows 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 significantly in their perceptions of the distance the average New Zealander might walk to the station ($F(3,344) = 0.244$ $\rho > 0.05$). The total represents a walking time of 9 minutes 20 seconds when using the estimates of walking speeds for New Zealand conditions (88 m/minute) observed by Finnis and Walton (2006). When considering time there is a main effect for location, $F(1,327) = 8.742$ $\rho < 0.001$, with Aucklanders estimating the average time to be slightly longer than Wellingtonians. There is no effect for drivers compared with walkers in either location, ($F(1,327) = 1.388$ $\rho > 0.05$ NS). As might be expected from the experimental conditions, the estimated distances to the closest stations are significantly different across locations, ($F(1,336) = 11.21$ $\rho < 0.001$), but there are no differences between drivers and walkers, ($F(1,336) = 0.053$ $\rho > 0.05$ NS), in the two locations.

Table 3.4 Drivers' and walkers' perceptions of the mean walking times and distances that the typical New Zealander might take to walk the station (SD in brackets).

Walking distances, times and speeds	Drivers		Walkers		Total N = 348
	Auckland	Wellington	Auckland	Wellington	
	N = 30	N = 80	N = 112	N = 126	
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)	15.11 min (8.56)	12.43 min (5.01)	13.24 min (6.50)
Derived walking speeds	62.16 m/min	69.28 m/min	53.39 m/min	66.67 m/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)	624 m (N = 27)	824 m (N = 151)

N = Sample size

Table 3.5 outlines the means and standard deviations of responses to the 34 Likert scales items. Higher scores represent stronger agreement with the item.

Table 3.5 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	ρ
		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	***
26	Walking times are too variable to reliably meet the train or bus	2.71	4.118	2.19	1.054	0.52	
38	It is nearly impossible for me to walk to the station	2.07	1.324	1.60	0.821	0.47	**
34	Walking takes too long	2.65	1.240	2.18	1.070	0.47	**
42	It's sometimes too cold to walk to the station	3.17	1.302	2.70	1.289	0.46	**
30	I arrive at work fresher if I drive rather than walk to the station	2.87	1.226	2.46	1.122	0.41	**
10	I am often too tired at the end of the day to walk home from the station	2.78	1.272	2.44	1.253	0.34	*
43	I often have too much to carry for walking to the station	2.70	1.251	2.46	1.131	0.24	
28	The shoes I wear are inappropriate for walking any real distance	2.76	1.325	2.53	1.214	0.23	
22	I probably should walk to the station more often	3.20	1.208	3.01	1.238	0.19	

Table 3.5 (continued) 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	ρ
		M	SD	M	SD		
31	I do not enjoy walking	1.97	1.079	1.79	1.011	0.19	
18	I can't afford to pay for parking in town	3.72	1.328	3.55	1.318	0.17	
17	A walk to the station is uncomfortable because of strong winds	2.93	1.133	2.80	1.174	0.13	
21	I get more chance to think about my day when I drive the car	2.07	0.910	1.96	0.868	0.11	
14	I can never tell whether I might need the car when I get back	2.72	1.179	2.63	1.153	0.09	
9	Parking a car in town is too expensive	4.55	0.774	4.47	0.872	0.08	
39	I have more chance of a traffic accident when walking	1.90	0.990	1.82	0.946	0.08	
8	I don't like to walk at night	3.31	1.386	3.27	1.337	0.04	
19	If I walk to the station I need to walk through unpleasant areas such as alleyways	2.11	0.961	2.13	1.088	-0.02	
20	A walk to the station in the morning is much better than a walk home at the end of the day	3.33	1.142	3.36	1.229	-0.03	
53	Congestion on the motorway is easily avoided by taking the train	4.33	0.762	4.40	0.724	-0.07	
13	I'd prefer to walk a more direct route between home and the station	3.17	1.118	3.24	1.220	-0.08	
54	Free parking by the station should be used by anyone whether or not they use the bus or train	2.18	1.222	2.26	1.250	-0.08	
11	It's really important that I do not miss connecting with my bus or train in the morning	3.63	1.394	3.78	1.271	-0.15	
32	I have a weekday morning routine that stays pretty much the same throughout the year	3.74	1.178	3.89	1.032	-0.15	
41	I like the company of others on the bus or train	2.91	1.098	3.06	1.042	-0.16	
23	Walking to the station has benefits for my level of fitness	4.00	0.933	4.17	0.910	-0.17	
12	My family or friends think I should walk as often as I can	3.16	1.208	3.36	1.048	-0.20	
33	I would prefer to walk with someone that I know	2.90	1.194	3.21	1.154	-0.31	*
52	People should be discouraged from using park-and-rides on every day	2.01	0.881	2.56	1.081	-0.55	***
51	Park-and-rides are only for people who travel a long way to use the bus or train	2.35	1.044	3.09	1.097	-0.74	***
27	I normally walk to the station when the weather is fine	3.08	1.415	3.86	1.173	-0.78	***

\# Question number in the survey (see Appendix)
* $\rho < 0.05$
** $\rho < 0.01$
*** $\rho < 0\ 001$

3.3.2 The effect of anti-social environments

The six items concerning the perceived likelihood of witnessing anti-social behaviours on the walk home are combined into a scale with an acceptable level of inter-item correlation (Cronbach alpha = 0.90). The combined items have a mean scale score of 10.08 (that is, a 10% chance of witnessing anti-social behaviour) and a standard deviation of 10.26.

These data are not normally distributed, as is common with self-reported assessments of the likelihood of events. A non-parametric statistical test is used. The Kruskall-Wallis H test establishes that there are differences in the mean rankings for Aucklanders (whether drivers or walkers) compared to Wellingtonians ($H(3, 336) = 51.62$ $\rho. < 0.001$) but that there are no significant differences between the mode types of either Aucklanders or Wellingtonians. Perceptions of the likelihood of witnessing anti-social behaviour are different for Wellington and Auckland. From the derived mean scores, Aucklanders perceive that they are about 60% more likely to witness acts of anti-social behaviour on their walk home compared to Wellingtonians.

Accepting that the differences in locations may be an artefact of the method of data collection, the important finding is that there are no differences in the perceived likelihoods of witnessing such acts between drivers and walkers in either of the locations. This indicates that an exaggerated perception of the nature of the social environment and more particularly fear of such things as anti-social behaviour, are unlikely to have any influence on the walking trip. Formally, the variable of whether or not one chooses to take a car or walk the distance to the station is independent of assessments of the likelihood of encountering anti-social behaviour. Gender, however, is related to perceived likelihood of encountering anti-social behaviour ($U = 11712$, $df = 334$ $\rho < 0.01$). Individual and location factors clearly affect the perceived likelihood of encountering anti-social behaviour but this does not translate to decisions on whether to walk or drive.

3.3.3 Parking charges at the journey destination

For the people that decide to use public transport, parking charges at the journey destination appear to have a similar influence to perceptions of anti-social behaviours. However, when controlling for the observed differences in the groups concerning income, parking charges do not relate to mode choice, $F(1,319) = 2.941$ $\rho > 0.05$. Concern for parking charges is related to income but under these quasi-experimental controls the influence of parking charges is independent of decisions to walk or drive to the station, suggesting that the termination of the 'car trip' is not influenced by the costs associated with the parking charges at the ultimate destination.

3.3.4 Trip chaining

Needing the car at the end of the day and carrying materials are moderately correlated ($r(303) = 0.352$ $\rho < 0.001$). Combined, these items show significant differences between drivers and walkers ($F(1,335) = 5.693$ $\rho < 0.01$) and a location effect with Aucklanders more inclined to agree that they have a need for a vehicle ($F(1,335) = 20.13$ $\rho < 0.001$).

3.3.5 End-of-day fatigue

Tiredness at the end of the day was measured with two items (questions 10 & 20). These items also reveal a location difference ($F(1,336) = 59.146$ $\rho < 0.001$), but no effect for drivers compared with walkers ($F(1,336) = 3.442$ $\rho > 0.05$ NS).

3.3.6 Weather

Table 3.5 outlines the influence of the weather conditions, measured with five items that cover concern for wind, rain and cold. The items do not combine well into a single scale (Cronbach Alpha = 0.54) and tend to indicate each factor is responded to differently or has a different influence. The two items concerning rain are highly correlated ($r(340) = 0.598$ $\rho < 0.001$) showing a consistency of response. However, overall, wind shows no effect for distinguishing walkers from drivers ($F(3,337) = 2.334$ $\rho > 0.05$ NS), whereas strong effects are indicated for rain and cold. When considering rain, main effects are observed for location ($F(1,335) = 65.70$ $\rho < 0.001$) and for drivers compared with walkers ($F(1,335) = 19.91$ $\rho < 0.001$) but they do not interact to explain the variability observed. The opinion that a walk may be too cold is similar.

A main effect is observed for Auckland compared with Wellington ($F(1,339) = 12.109$ $\rho < 0.001$) and for drivers compared with walkers ($F(1,339) = 12.67$ $\rho < 0.001$) but importantly, no interaction effect is observed. As there is some local influence on the weather, with Wellington being less variable and typically slightly cooler, it might have been expected to develop some difference in the concern for these influences on the walking trip. However, the distances are short and the measures do not develop the differences. Except, again members of the Auckland sample are more inclined to agree with the claims that the weather influences their decision-making than members of the Wellington sample, notwithstanding the likely influences which would predict Wellingtonians to be more concerned about cold, wind and rain.

3.3.7 Time factors

Four items concerning time were measured; the time it takes to walk, variability in walking times, missing the bus or train, and the directness of the pedestrian route. Table 3.5 illustrates that each of these factors distinguishes drivers from walkers, but again despite moderate correlations between the items, each effect does not combine conveniently into a single scale item, as combined they have an unacceptably low Cronbach's alpha ($\alpha = 0.39$). Preference for the directness of the route is location specific, with Aucklander's preferring more direct routes than Wellingtonians ($F(1,338) = 11.46$ $\rho < 0.001$) or alternatively regarding the indirectness of the route to be an impediment. However, the difference does not appear across the samples of walkers compared to drivers ($F(1,338) = 0.037$ $\rho > 0.05$ NS). Similar location differences are observed for the importance of connecting with public transport and the variability of walking times. The belief that walking takes too long distinguishes drivers ($F(1,337) = 15.144$ $\rho < 0.001$) from walkers, the latter being less likely to agree that it takes too long. Again, this is different across locations ($F(1,337) = 12.579$ $\rho < 0.001$).

3.3.8 The walking environment

Five items recorded non-weather related environmental factors including walking at night, walking with people, the company on public transport, the risk of having an accident and the unpleasantness of alleyways. Each of these factors shows a location effect but no differences between drivers and walkers, except the preference to walk with a friend. In

this case, walkers in both locations indicate greater levels of agreement that it is preferable to walk with someone they know ($F(1,338) = 5.145$ $\rho < 0.05$).

3.3.9 Social influences

The question of whether an individual should be encouraged to walk by friends and family was not significant in either location or across drivers and walkers. However, the individual's response to the claim "I should probably walk to the station more often" did show an interaction effect, with the variability being explained by both location *and* the elected mode choice ($F(1, 295) = 6.27$ $\rho < 0.05$). Drivers in Wellington demonstrate a high degree of concern to walk more, but interestingly not as high as walkers in Auckland. Walkers in Wellington are inclined to disagree that they need to walk more. When controlling for the influence of the self-reported frequency of actual walking, the effect is not removed ($F(1,331) = 8.1$ $\rho < 0.01$) indicating that it is not a function of the current relative frequencies of behaviours, but some other factor. The idea that park-and-rides should not be used everyday shows a main effect for walkers and drivers. Walkers are more likely to agree that park-and-ride should not be used every day ($F(1,337)= 19.45$ $\rho < 0.001$) with Aucklanders showing a tendency to be more inclined to agree ($F(1,337) = 4.38$ $\rho < 0.05$).

3.3.10 Enjoyment/inconvenience of walking

In both locations, drivers were more likely to agree with the claim "It's sometimes just more convenient to take the car to the station" ($F(1,336) = 69.98$ $\rho < 0.001$) with Aucklanders being slightly more inclined to agree with the statement ($F(1,336) =16.42$ $\rho < 0.001$). Wearing shoes inappropriate for walking ($F(3,337) = 2.79$ $\rho > 0.05$ NS) and not enjoying walking did not distinguish walkers from drivers ($F(3,339) = 2.357$ $\rho > 0.05$ NS) in either location. However, the claim that one arrives fresher at work after driving to the station distinguishes walkers from drivers, and is magnified by the location effect ($F(1,336) = 3.97$ $\rho < 0.05$). Drivers are more likely to agree with the claim that they arrive fresher, and this is more likely to be the case in Auckland than Wellington.

3.3.11 Fitness

No group was distinguished by the claim that walking had benefits for their level of fitness ($F(3,336) = 1.54$ $\rho > 0.05$ NS). However, Auckland walkers deemed themselves less fit compared with the average score more often than expected X^2 ($N = 308$) $= 17.065$ $\rho < 0.01$.

3.3.12 Overall analysis

A backward Wald ($\rho > 0.10$) 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, the twelve items that discriminate between walkers and drivers listed in Table 3.6, and the reasonableness of the walking trip distances and times. The final model has the form (X^2 ($N = 348$) $=$ df $= 7$ 146.865 $\rho < 0.001$) and is outlined in Table 3.6.

Equation 1

$$\hat{g}(W) = 6.735 - 2.771\,(\text{Auckland/Wellington}) - 0.435(\text{NCars}) + 0.562(\text{Q51: Acceptable to use when live close}) + 0.455(\text{Q27: Fine weather}) - 0.611(\text{Q29: Convenience of Vehicle}) - 0.588(\text{Q37: Chance of rain}) - 1.548(\text{Living on a hill})$$

Overall the equation explains 54.3% of the variance between drivers and walkers (NagelKerke r^2 (N = 348) = 0.543 $\rho < 0.001$). All variables combined explain 58% of the variance (NagelKerke r^2 (N = 348) = 0.583 $\rho < 0.001$). The Hosmer and Lemeshow post-diagnostic suggests the data are a good fit for the model (X^2 (N = 348) = 11.233 df = 8 $\rho > 0.189$).

Table 3.6 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-and-rides are only for those who need to travel a long way, they report that they walk when the weather is fine, are less likely to be put off by the rain, and they do not regard taking a vehicle as more convenient. A major contributing factor is the presence of a 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-and-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 3.6 Logistic regression model resulting from a backward Wald stepwise elimination of the 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		
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. -2 log Likelihood = 230.411									

4. Discussion

To avoid the factors 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 across two different cities. The locations present different geographical conditions 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 little support for various contentions in research and policy documents that factors such as carriage of heavy goods, concern for crime, the need to use the car for other purposes, fatigue, parking charges at the destination, 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 a car indicate that it is better to interpret that park-and-rides, at least, prompt car trips by those who might otherwise walk 1 km to the station. Weather was found to have an influence, but it is tolerated by those who either need (from the lack of a car) or choose to walk. Living on a hill tends to prompt walking, against the expected concern that geography might impede the short walking trip.

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 can be adjacent to major motorways and therefore subject to severance. 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 a car will not be preferred when its convenience is disrupted, even against the notional effort of walking up a hill.

The influence of the weather seems intuitively correct and corroborated by the separate activity of observing the relative frequency of close-living park-and-riders across winter and summer. The weather is influential in two ways. First, fine days prompt walking trips. Second, rain is an impediment to walking. It is important to note that every participant still walks and presumably therefore is exposed to whatever conditions prevail within some leg of their journey (to and from the point of the public transport trip). These distances are approximately equal to the distances represented by the journey to the start of the public transport trip, so presumably the influence of sheltered walkways in the CBD assists overcoming the impediments to walking and aids the uptake of public transport. Note also that wind and cold were not related to the choice of whether or not to take the car.

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. Indeed, a clear finding is that when

held constant the apparent reasons found elsewhere to account for the differences on mode choice between walkers and drivers disappear. The findings are robust against quite different levels of certain factors. There is a high concern for experiencing anti-social activity in Auckland compared to Wellington, and this concern relates to gender insofar as women report a higher concern about alley ways and anti-social behaviour. Women are significantly different in their estimations of the likelihood of encountering antisocial behaviours on a combined scale of six items $t\ (344) = 3.166\ \rho < 0.001$. However, gender is found to be independent of the decision to walk or drive ($X^2\ (348) = .033\ df = 1\ \rho > 0.05$ NS). Estimations of the likelihood of encountering anti-social behaviours do not relate to decisions whether to walk or drive. It follows, unsurprisingly, that there is no interaction effect between gender and the perceived likelihood of encountering anti-social behaviours that relate to decisions to walk or drive.

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 within our comparison groups to being less than 1 km. The perceived typical distance is 820 m 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 of 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 that Aucklanders are far more likely to perceive they will be exposed to anti-social behaviours when 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 were 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 which indicate 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 and separately considered for accurate comparisons between walkers and those who could be reasonably expected to walk. 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 20 mins and 2 km), with the opportunity to walk for access, which seems to occur to be impeded, *ceteris paribus*, when it extends beyond 1 km (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 serve those who would otherwise have an unreasonable walk. This finding calls into question the intentions of providing park-and-ride facilities. These facilities prompt 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-and-rides on a regular basis by those who live within 1 km of the station, introducing a parking charge, or better, locating the park-and-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 make the trip by car.

4.1 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' (e.g. Parks and Scofer, 2006). This study did not examine hypothetical factors that might be altered to improve the chances of 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.

The results of the research are tested for their robustness across different populations by drawing samples from two distinct geographical locations. This report does not attempt to state the exact proportion of people who are prevented from walking by the different factors found to impede walking trips across different walking mode types, across the wider population. There are three reasons.

- First, the research design is deliberately not representative of the general population as it required a very special subset of people (those who elect to drive >1000 m to the park-and-ride) as a comparison group.
- Second, the design is intended to identify the relative influence of factors on the likelihood of walking, not to assess the actual influences of these factors on walking rates. An aside to the main purpose of the study allows a limited case of these inferences. For example, 10-15% of walking trips in the access sub-mode are impeded by the convenience of the park-and-ride.
- Third, extending the findings associated with one walking mode to another (say from access sub-mode to 'walking for leisure') is identified as a serious methodological error.

Nonetheless, the findings here can extend to the wider population of walking for the access sub-mode and most likely similar impediments exist for those undertaking walking for access. Importantly, the logic and structure of the method can be extended by drawing similar samples from different walking modes and considering the related influences on their uptake. It is relatively straightforward to extend this work to the

access mode by drawing samples of walkers and those who drive to commute to the inner city.

4.2 Conclusions

A reasonable walking distance for the access sub-mode of travelling to the train station is perceived to be around 820 m, which 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 'chance of rain' which has an influence on the choice to drive vis-à-vis fine weather that aids the decision to walk. Weather aside, the convenience of the car, when it is provisioned by the opportunity for free parking in a monitored facility, prompts 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.

5. Recommendations

5.1 Improve definitions and methodologies concerning walking mode types

From a methodological standpoint walking is an exceptionally complex activity. Although objectively walking seems obvious and simple, the range of influences on the motivation to walk, especially in contrast to its alternatives, makes the study of walking a complex and sophisticated activity. The methods applied in research to date have usually failed to adequately recognise different sorts of walking, control for distance, or compare self-reported impediments to walking with actual behaviours. The NZ Walking Strategy realises this with the recognition that reported impediments to walking need not be real. Still, of significant concern is that previous studies combine walking with cycling, and the inter-relationship of walking with other activities, particularly car dependence, is not well-recognised. Walking is not a separate activity to be marginalised and investigated separately, but an essential component to all other modes of transport and our emphasis on understanding the influences on it needs serious attention.

First among our recommendations is the need to separate the four different types of walking and investigate each fully. This report gives only serious consideration to the access sub-mode. The findings here may generalise to the access mode but this supposition deserves serious, separate investigation. Different methods and techniques should be developed to give serious consideration to the circulation/exchange and leisure modes of walking, especially as influences on these may spill-over to the modes connected with other forms of transport and mobility. There is no simple extension of this study to different walking sub-modes because the sample selection methods used here are unique. To understand the motivations of walkers it is necessary to compare groups of those who actively make a decision to walk with those who could but decide not to. Thus, comparing those who walk for circulation/exchange reasons might be achieved by comparing shoppers who walk with those who make many short vehicle trips to shop locations. Anecdotally this is said to happen in smaller towns where demand for parking is less and the perceived opportunity to obtain a park in a convenient location is high.

5.2 Where possible, improve the rain shelter infrastructure by providing better shelters and covered walkways

The importance of the weather conditions on the decision to walk issues a challenge to researchers. There is a need to identify where in the journey the influence of rain is a genuine concern. When comparing the groups to identify the outcomes listed here it could be overlooked that some part of the journey involves walking, whether or not one drives to the train station. Over 90% of the respondents continue their journey post-public transport by walking. Importantly, the survey items recognise that cold and wind do not seem to contribute to the decision of whether or not to walk; it is rain and sunshine that dually reduce or increase the likelihood of walking. It is reasonable to suppose that the quality of the waiting cover that is offered in a CBD by covered walkways and verandas

assist walkers, and better protection will encourage both walking and the uptake of public transport.

5.3 Establish a mechanism to make park-and-rides less convenient and discourage those with the ability to walk

Park-and-ride facilities were introduced to encourage public transport use, but in practise appear to have an unintended effect. Policy analysts have the challenge to reduce the attractiveness of a convenience designed to encourage the uptake of public transport. A fee-paying system for example may discourage all users of the park-and-ride, rather than just those who would otherwise walk but for the convenience of having an available park at their desired destination. One way might be to apply a ticketing system much like 'residents' parking' for high density areas for those who apply to use the park-and-ride. However, this seems to undermine the potential for one-off use of the system by close-living residents and thereby decrease the opportunity for them to be exposed to public transport and regular use. One alternative is to select sites for park-and-rides that are not in high-density residential areas, although this would defy land use alterations which encourage development around mass transit facilities. A good way to overcome all these issues is to simply move the park-and-ride facility back from the station (about 200m) to force a walking distance that competes with the convenience of driving to the facility. Last, it is reasonable to expect some effect by simply erecting a few signs that suggest park-and-ride are not intended for regular use by people who live close, as the belief that it is acceptable is embedded in the perceptions of those that do use them under these circumstances.

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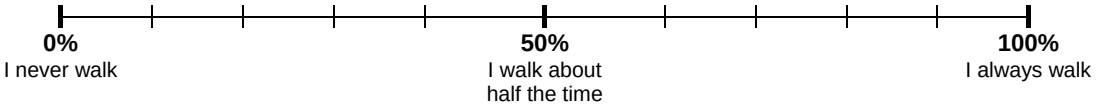
Appendix

Survey Format

Research into Walking as a Mode Choice
Contact:
Dr Darren Walton
Opus International Consultants
Ph 04 587 0663
Email Darren.Walton@opus.co.nz

1. **Have you participated in this survey before?** ☐ No ☐ Yes (you do not need to continue this survey)

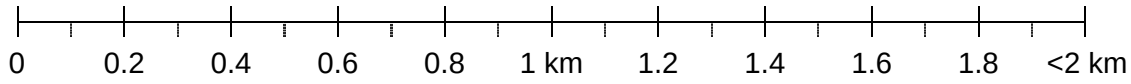
2. **How often do you walk to the train station from your home? (Place an X on the line)**



3. **On a fine day, what do you typically do next after reaching your destination bus/train station in the morning?**

I do not take the train	☐	Catch another bus or train	☐
Walk to work	☐	Get a taxi or other vehicle	☐
Walk to school or university	☐	None of these	☐
Walk to other	☐		

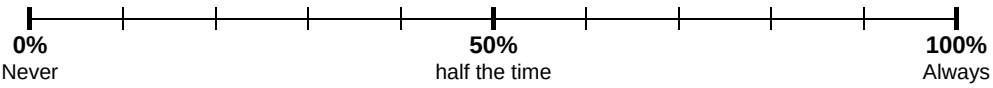
4. **Estimate how far it is between the closest bus/train station and your home? (Place an X on the line)**



5. **How long might it take to walk the distance between the bus/train station and your home?**

.....minutes

6. **How often do you have something else to do before going to the bus/train station from home? (e.g. dropping children off at school) (Place an X on the line)**

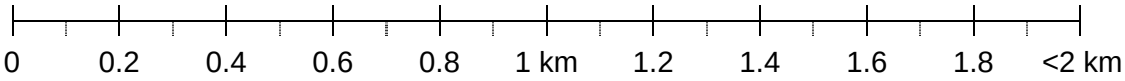


7. **Please state the closest intersection to where you live…e.g. Malone Rd/Galway Ave**

..../..... ....

Please answer the following by placing a mark to indicate the most appropriate answer for you	**Strongly disagree**	**Disagree**	**Not sure**	**Agree**	**Strongly agree**
8. I don't like to walk at night	☐	☐	☐	☐	☐
9. Parking a car in town is too expensive	☐	☐	☐	☐	☐
10. I am often too tired at the end of the day to walk home from the station	☐	☐	☐	☐	☐
11. It's really important that I do not miss connecting with my bus or train in the morning	☐	☐	☐	☐	☐
12. My family or friends think I should walk as often as I can	☐	☐	☐	☐	☐
13. I'd prefer to walk a more direct route between home and the station	☐	☐	☐	☐	☐
14. I can never tell whether I might need the car when I get back	☐	☐	☐	☐	☐

15. **Estimate how far it is between your destination station and your regular destination? (i.e. work, school or whatever) (Place an X on the line)**



16. **How long might it take to walk the distance between the station and your regular destination?**

.....minutes

Please answer the following by placing a mark to indicate the most appropriate answer for you	**Strongly disagree**	**Disagree**	**Not sure**	**Agree**	**Strongly agree**
17. A walk to the station is uncomfortable because of strong winds	☐	☐	☐	☐	☐
18. I can't afford to pay for parking in town	☐	☐	☐	☐	☐
19. If I walk to the station I need to walk through unpleasant areas such as alleyways	☐	☐	☐	☐	☐
20. A walk to the station in the morning is much better than a walk home at the end of the day	☐	☐	☐	☐	☐
21. I get more chance to think about my day when I drive the car	☐	☐	☐	☐	☐
22. I probably should walk to the station more often	☐	☐	☐	☐	☐
23. Walking to the station has benefits for my level of fitness	☐	☐	☐	☐	☐

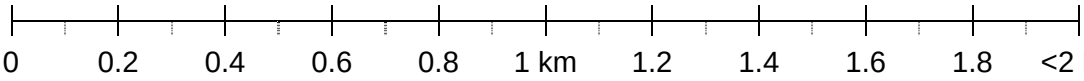
24. **If you drove to your regular destination, estimate how far you'd need to walk from an available car park? (Place an X on the line)**

25. **If you drove to your regular destination, how long might it take to walk the distance from where you park your car?**

.....minutes

Please answer the following by placing a mark to indicate the most appropriate answer for you	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
26. Walking times are too variable to reliably meet the train or bus	☐	☐	☐	☐	☐
27. I normally walk to the station when the weather is fine	☐	☐	☐	☐	☐
28. The shoes I wear are inappropriate for walking any real distance	☐	☐	☐	☐	☐
29. Sometimes it's just more convenient to take the car to the station	☐	☐	☐	☐	☐
30. I arrive at work fresher if I drive rather than walk to the station	☐	☐	☐	☐	☐
31. I do not enjoy walking	☐	☐	☐	☐	☐
32. I have a weekday morning routine that stays pretty much the same throughout the year	☐	☐	☐	☐	☐
33. I would prefer to walk with someone that I know	☐	☐	☐	☐	☐
34. Walking takes too long	☐	☐	☐	☐	☐

35. **Estimate how far the average New Zealander who takes a train would normally walk to the station? (Place an X on the line)**



36. **How long might it take the average New Zealander who normally takes a train to walk to the station?**

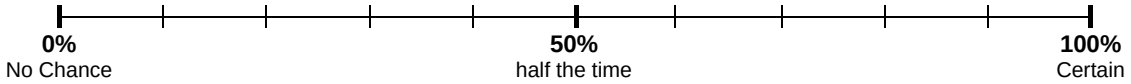
.....minutes

Please answer the following by placing a mark to indicate the most appropriate answer for you	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
37. If there's a chance of rain I will take the car to the park-and-ride	☐	☐	☐	☐	☐
38. It is nearly impossible for me to walk to the station	☐	☐	☐	☐	☐
39. I have more chance of a traffic accident when walking	☐	☐	☐	☐	☐
40. I won't walk to the station when it's raining heavily	☐	☐	☐	☐	☐
41. I like the company of others on the bus or train	☐	☐	☐	☐	☐
42. It's sometimes too cold to walk to the station	☐	☐	☐	☐	☐
43. I often have too much to carry for walking to the station	☐	☐	☐	☐	☐

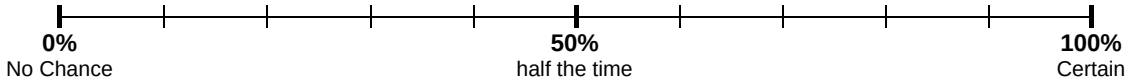
Please estimate the likelihood of the following events if you were to walk home from the bus or train station <u>tomorrow evening</u>? (Place an X on the each of the lines)

44. What day of the week is <u>tomorrow</u>? ☐ Mon ☐ Tues ☐ Wed ☐ Thurs ☐ Fri ☐ Sat ☐ Sun

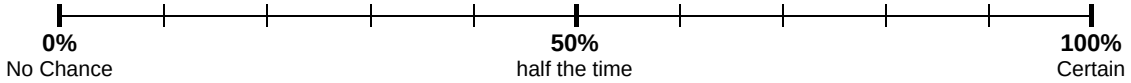
45. What is the likelihood of witnessing an act of vandalism occurring, such as graffiti?



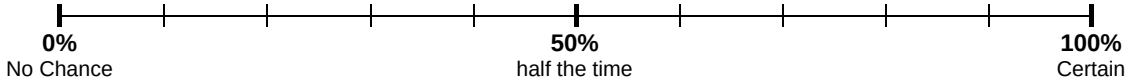
46. What is the likelihood of someone choosing to follow you from the station?



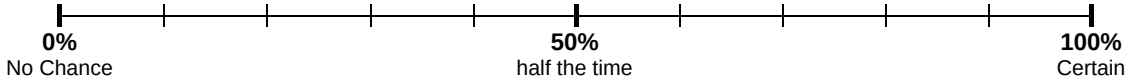
47. What is the likelihood of you feeling intimidated by a group of teenagers?



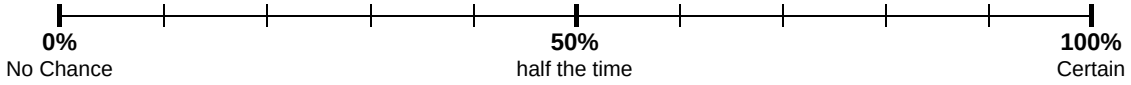
48. What is the likelihood of you being verbally harassed by a stranger?



49. What is the likelihood of you being physically threatened by a stranger?



50. What is the likelihood of you being approached for money (other than for charitable donations)?



Please answer the following by placing a mark to indicate the most appropriate answer for you	**Strongly disagree**	**Disagree**	**Not sure**	**Agree**	**Strongly agree**
51. Park-and-rides are only for people who travel a long way to use the bus or train	☐	☐	☐	☐	☐
52. People should be discouraged from using park-and-rides on every day	☐	☐	☐	☐	☐
53. Congestion on the motorway is easily avoided by taking the train	☐	☐	☐	☐	☐
54. Free parking by the station should be used by anyone whether or not they use the bus or train	☐	☐	☐	☐	☐

What is your highest educational qualification?	Please indicate your annual household income
☐ School Certificate Qualification	☐ $15,000 or less
☐ Sixth Form Qualification	☐ $15-001-$30,000
☐ Higher School Qualification	☐ $30,001-$50,000
☐ Bachelor degree	☐ $50,001-$70,000
☐ Higher degree	☐ $70,001-$100,000
☐ Other post-school qualification	☐ $100,001 or more
☐ None of the above	
☐ Other	

How many cars do you have in your household?	☐ 0	☐ 1	☐ 2	☐ 3	☐ More than 3

Please estimate how physically fit you are for your age…	☐ I don't walk due to disability	☐ Less than Average	☐ About the same as anyone else	☐ Fitter than Average

Please indicate your age group	☐ 17-24	☐ 25-34	☐ 35-44	☐ 45-54	☐ 55-64	☐ 65-74	☐ 75+

Please indicate your gender	How long did this survey take you to fill out?	How difficult was this survey?		
☐ Male	**……minutes**	☐ Very easy	☐ About right	☐ Very hard
☐ Female				

Comments

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OPUS INTERNATIONAL CONSULTANTS

Research into Walking as Mode Choice
Contact:
Dr Darren Walton
Opus International Consultants
Ph 04 587 0663