Transforming Auckland into a bicycle-friendly city: Understanding factors influencing choices of cyclists and potential cyclists

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Abstract

Like many other cities in the world, Auckland has been very much a car-based city for decades with a car modal share of almost 80%. Our ultimate goal is to help improve sustainability in transport in Auckland. Promoting the use of active modes, including walking and cycling, is no doubt one of the key strategies that should be considered. Our research question is, 'If we were going to transform Auckland into a bicycle-friendly city, how should we invest in bicycle infrastructure and facilities in order to maximise the benefits to society?' In order to answer this question, a first step is to determine the motivators of and deterrents to cycling in Auckland. In this paper, we first conduct a comprehensive literature review of the lessons from international experience focussing on what factors were found to have significant influence on the decision to use bicycles as a mode of transport. Based on experience of successful countries such as the Netherlands, Denmark and Germany, the means to make it safe and convenient to cycle are identified. We then present a survey designed to identify the factors influencing Aucklanders' decision to commute by bicycle or not, as well as cyclists' and potential cyclists' route choice criteria. In particular, the web-based survey tool was designed to capture cyclists' chosen route information interactively with a Geographic Information System. A comprehensive analysis of the survey results conducted at the University of Auckland is discussed, including the factors influencing the decision to cycle and route choice as well as spatial analysis of the characteristics of the chosen routes of cyclists. We conclude that there are five main factors missing in Auckland: (1) safety; (2) a well-connected network of cycle-ways; (3) convenience; (4) policies to discourage car use; and (5) a good public transportation system integrated with cycling facilities.

1 Introduction

Like many other cities in the world, Auckland has been very much a car-based city for decades. Tin Tin *et al.* (2009a) analysed the New Zealand (NZ) Journey-to-Work Statistics over a 15-year period (1991-2006) and concluded that increased car use from 1991 to 2006 occurred at the expense of active means of travel, including walking and cycling, as the trends in public transport use remained unchanged during that period. Auckland's transport system currently accommodates 4.2 million passenger trips each day, with modal shares of 80% private transport (mainly car), 16% active modes (mainly walking) and 4% public transport (mainly bus) (Auckland Council, 2011). This shows that Auckland's transport system is not sustainable at all

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as it is heavily reliant on fossil fuels. As summarised in May & Crass (2007), a sustainable transport system should:

- Promote health (social sustainability);
- Increase equity within and between generations (social sustainability);
- Be affordable and efficient (economic sustainability);
- Use resources within renewal or replacement rates (economic and environmental sustainability); and
- Minimise the use of land (economic and environmental sustainability).

Applying this philosophy to transport planning, cycling is no doubt one of the most sustainable modes among all the transport modes, while the use of cars is definitely not sustainable. Cycling promotes health, does not require non-renewal resources like fossil fuels, does not produce vehicle emissions, poses less risk to other road users, and occupies much less space than cars.

Based on Census statistics of journeys to work in NZ, the modal share of bicycles is only 2.3% nationwide while in Auckland it is 0.9%, whereas the modal share of car trips is 74.8% nationwide and 78.8% in Auckland (NZSTATS, 2006). Lindsay *et al*. (2010) estimated that a 5% of modal shift of short trips by motor vehicles nationwide is consistent with the goal of 30% modal share of urban trips by walking and cycling in the current New Zealand Transport Strategy (MoT, 2008). However, based on the data collected from a marketing survey conducted by Sport and Recreation NZ (SPARC) and the Cancer Society of NZ to segment adults in terms of physical activity and healthy eating habits, Sullivan & O'Fallon (2006) found that the percentage in the 'precontemplation' stage, i.e. those who do not even consider using a bicycle, was as high as 45% for Auckland. For school children, Mackie (2009) found that the most significant barriers to students cycling to school for six intermediate schools were: the route to school, the amount and speed of traffic, crossing busy roads, and personal and bike security. As a result, the need for safe routes to school was a very clear priority for students and parents.

Promoting the use of active modes, including walking and cycling, is no doubt one of the key strategies to improve sustainability in transport (Auckland Council, 2011). Our objective is to determine what might have been the deterrents to cycling in Auckland and what motivators might be effective to promote cycling.

2 Literature Review on International Experience

In this study, we first conducted a comprehensive literature review of the lessons from international experience from successful countries such as the Netherlands, Denmark and Germany, and unsuccessful countries such as UK and USA, focussing on what factors were found to have significant influence on the decision to use bicycles as a mode of transport. The factors with most significant effect can be classified into five categories: (1) safety; (2) a well-connected network of cycleways; (3) convenience; (4) policies to discourage car use; and (5) a good public transportation system integrated with cycling facilities.

An earlier version of the literature review is presented in Mirza & Wang (2011). A summary is depicted in Table 1.

Table 1 Summary of a literature review on motivators of and deterrents to cycling

			Motivators																														Deterrents													
			Safety								Cycleways									Discourage Car use							Convenience						PT		Convenience						Discourge Car Use	Cycleways	Safety					
	Reference	Case Study	Safety Education	Low Traffic Volume	Presence of Safety Cameras	Low Traffic Speed	Better Lighting	Higher Population Density	Good Land-use Mix	Shorter Commuting Distances	Beautiful Scenery	Continuous Bike Facilities	Infrastructure	Smooth Surface Quality	Traffic Calming for Cyclists	Direct Route (Shorter Distances)	Flat to Moderate Hills	Off-street Path	Segregated Bike Paths and Routes	Presence of Safety Cameras	Increase Fuel Cost	Limited Auto Parking	Speed Limit in Residential Area (30 km/h)	Car Free Zones	Give Cyclist Priority (Cycling Right-of-way)	Low Traffic Speed	Secure Parking at Work	Availability of Rental Bikes	Detailed Hardcopy Maps	Presence of Shower and Locker at Workplace	Providing Internet Route	Promotional programs and Financial incentives	Linking Bicycles with Public Transport	Parking Facilities at Stations	Type of Destination	Time of Departure	Dress Code	Longer Travel Time	Employment Status (i.e. part/full-time, etc.)	Adverse Weather Condition	Pollution & Noise	Gradient	Dangerous Traffic Condition	Lack of Daylight	Percentage of Heavy Traffic	Street with Auto Parking	Number of Difficult Intersections	Inconsiderate Drivers
1	Betz *et al*., 1993	USA																													*		*															
2	Antonakos, 1994	Michigan	*	*		*								*					*							*									*	*	*											
3	Hopkinson & Wardman, 1996	Britain																																				*										
4	Stinson & Bhat, 2003	USA		*								*		*			*		*																			*							*	*	*	
5	Dill & Carr, 2003	USA											*																																			
6	Stinson & Bhat, 2004	USA	*						*	*			*				*					*					*			*								*		*			*	*				
7	Hunt & Abraham, 2007	Canada						*	*			*			*		*																									*						
8	Gatersleben & Appleton, 2007	UK	*										*				*		*																					*		*			*			
9	Tilahun *et al*., 2007	USA																																														
10	Martens, 2007	The Netherlands																															*	*														
11	Dill & Voros, 2007	USA		*		*			*			*	*	*		*			*							*	*			*			*		*				*	*		*						
12	Wardman *et al*., 2007	UK																									*			*		*																
13	Parkin *et al*., 2008	UK census		*															*																													
14	Pucher & Buehler, 2008a	USA	*																*					*			*		*		*	*	*															
15	Pucher & Buehler, 2008b	Review (Denmark, Netherland, Germany)	*						*										*				*	*	*		*	*	*		*	*	*										*					
16	Akar & Clifton, 2009	USA	*		*		*		*	*		*		*	*	*			*	*	*								*														*					
17	Koorey *et al.*, 2009	Christchurch																									*			*																		
18	Winters & Teschke, 2010	Vancouver (Canada)																	*																													
19	Winters *et al.*, 2011	Vancouver (Canada)		*			*				*						*	*	*						*															*	*							

3 The Survey

3.1 Survey design and administration

A web-based survey was designed to fulfill two objectives: (1) to understand why the current bicycle modal share is so low, what the motivators that can attract potential cyclists are and, in particular, how their decisions to cycle or not are influenced by the built environment; and (2) to understand what factors are influencing the route choice of current and potential cyclists. In order to collect the most comprehensive information on route choices of cyclists, the web-based survey tool was designed to capture cyclists' chosen route information interactively with a Geographic Information System (GIS).

Respondents are first classified into one of the following four categories, namely, cyclists, infrequent cyclists, potential cyclists and non-cyclists, based on whether they are already commuting by bicycle, whether they own a bicycle and whether they are interested in cycling. Obviously, cyclists are the ones who are already commuting by bicycle. Those who own a bicycle but do not commute by bicycle are considered as infrequent cyclists. Ones that do not own a bicycle but are interested in cycling are considered as potential cyclists, while the rest are non-cyclists. Each group will then be addressed with an appropriate set of questions.

A survey was conducted via the University of Auckland intranet during the period 7th April to 6th May 2011. There were over 140 participants in total, including staff and students of the university. An incentive was given as an opportunity to win a NZ$50-coupon for the University Bookshop in a lucky draw.

3.2 Survey Participants

There is a slightly higher percentage of female respondents (55%). The distribution by type, namely, cyclists, infrequent, potential and non-cyclists, are quite different among the two genders. As highlighted in Table 2, 38% of the male respondents are cyclists while only 18% of the female respondents are cyclists.

Table 2 Number of repondents by type and gender

Type	Male		Female		Total	
Cyclist	24	38%	14	18%	38	27%
Infrequent Cyclist	25	39%	35	45%	60	42%
Potential Cyclist	8	13%	23	29%	31	22%
Non-Cyclist	7	11%	6	8%	13	9%
Total	64	45%	78	55%	142	100%

4 Survey Results

4.1 Motivators of current cyclists in Auckland

As shown in Figure 1, the number one motivator of cycling is to improve health and fitness, followed by care for the environment and cycling for fun.

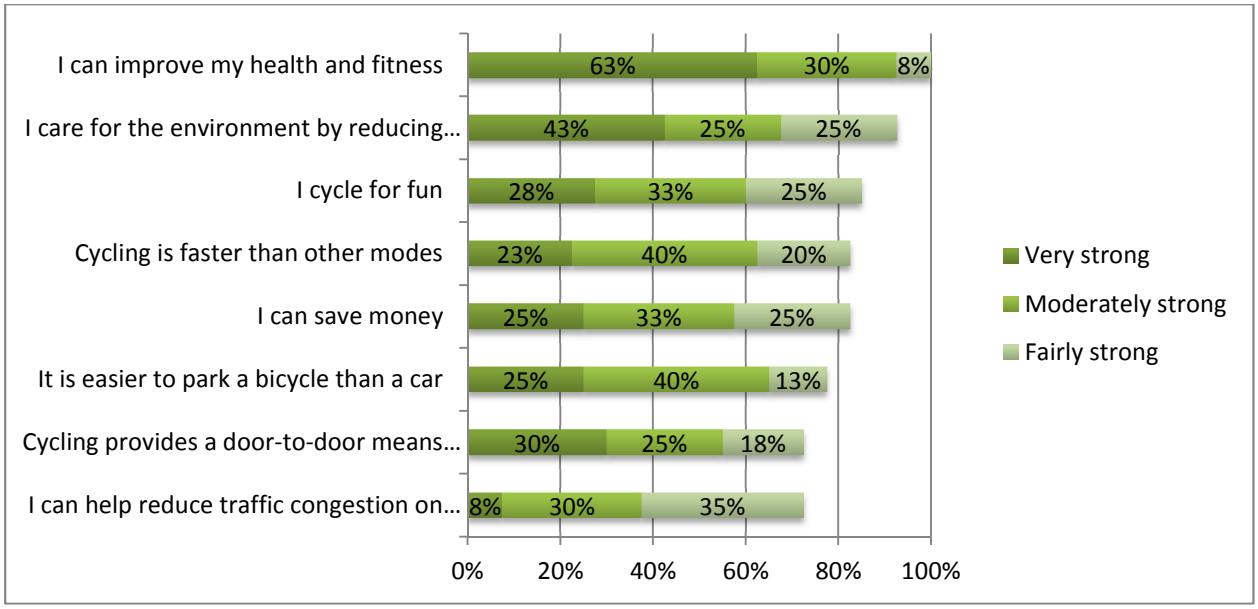

Figure 1 Motivators of current cyclists in Auckland

4.2 Deterrents to cycling in Auckland

4.2.1 Safety

Safety is the number one deterrent to cycling. As shown in Figure 2, safety is the number one deterrent to cycling in Auckland. Other strong deterrents include unfavourable weather conditions and the need to carry things.

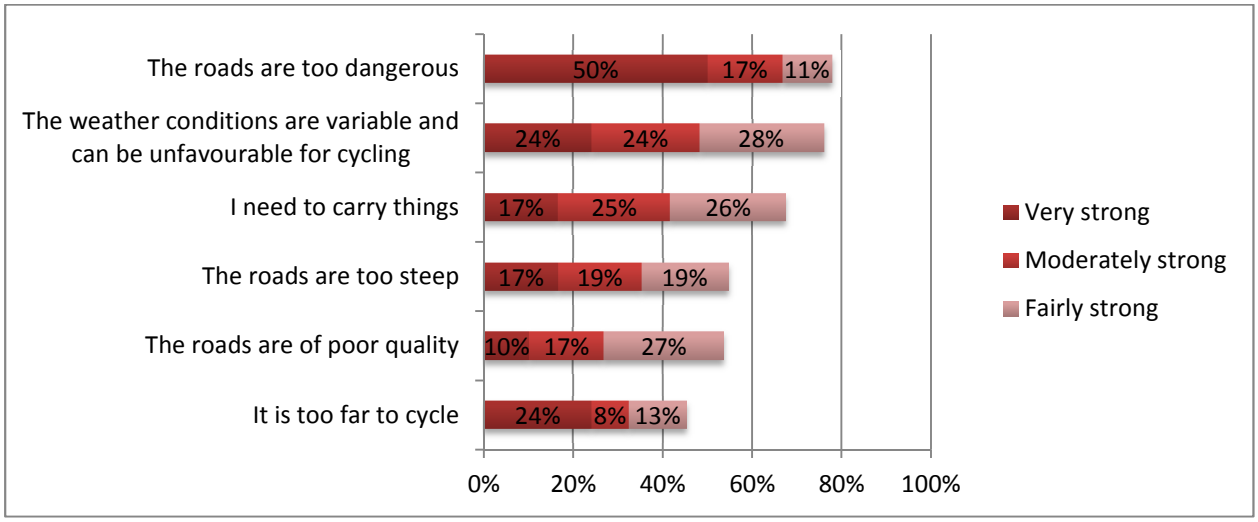

Figure 2 Deterrents to cycling

Women are more concious about safety. As shown in Figure 3, 65% of male cyclists are cycling to work even though they are feeling unsafe while only 50% of female cyclists are doing so.

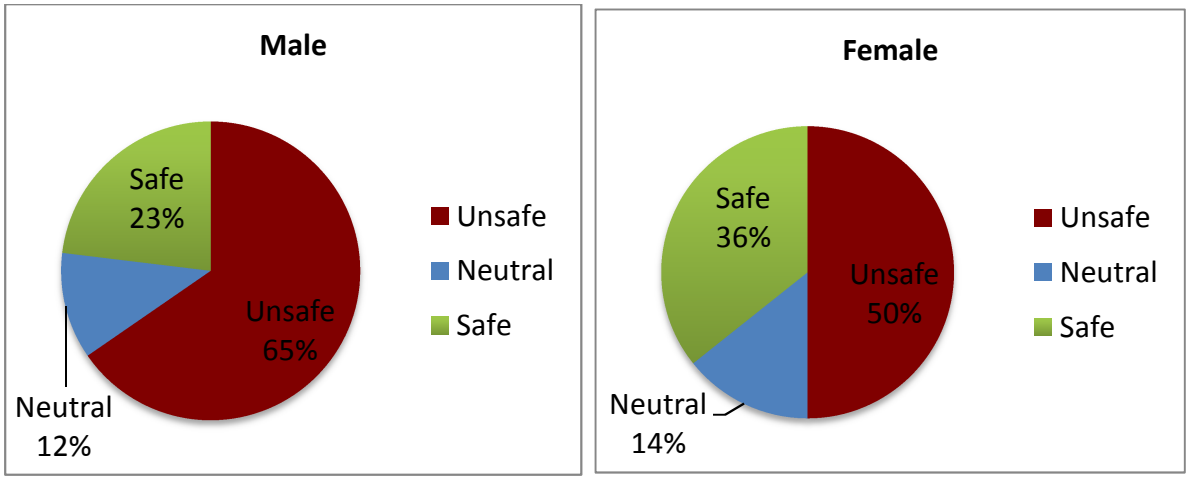

Figure 3 Cyclists' perception about safety

Not wearing a helmet may or may not be a good idea. Wearing a helmet is currently mandatory in Auckland. As shown in Figure 4, 48% of cyclists and 52% of infrequent, potential and non-cyclists are neutral towards making it not mandatory. Nevertheless, 43% of cyclists do not think that this is a good idea while only 24% of the others have negative feelings about it.

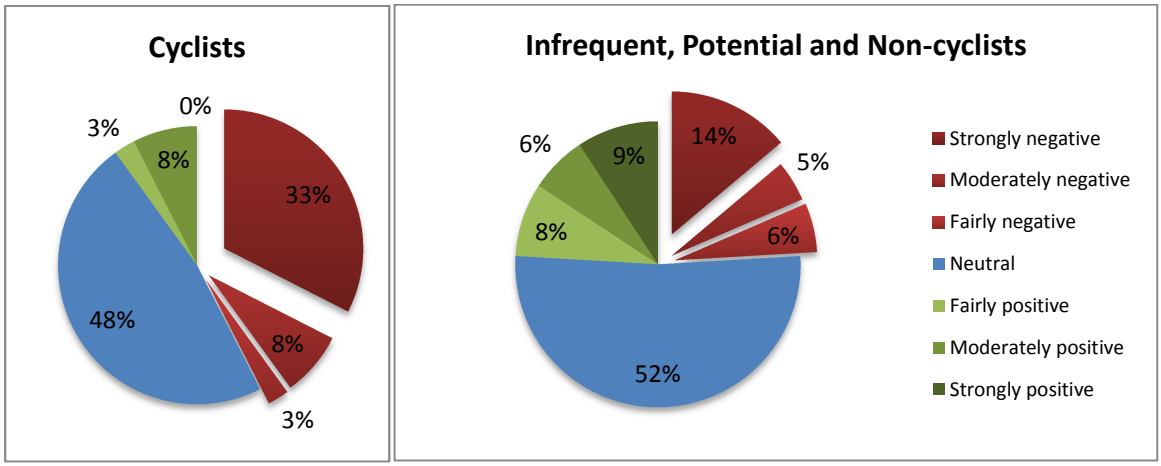

Figure 4 Influence of making wearing a helmet NOT mandatory

Everyone prefers less interactions with traffic and riding in safer conditions. Although cyclists and the others have different priorities in terms of their wishes, as highlighted in yellow in Table 3, both groups consider that improvement in safety at major junctions, reduction in traffic volume with less car, bus and truck traffic, enough lighting after dark and provision of special bicycle streets are preferred characteristics. Cyclists also consider other aspects that are related to their safety important, including strict enforcement of cyclists' rights, reduction of roadside parking, and motorists assumed by law to be responsible for almost all crashes with cyclists, as highlighted in blue in Table 3.

4.2.2 Provision of cycleways

Provision of a cycleway separated from traffic for the entire route is the number one motivator. As shown in Figures 5 and 6, all cyclists and 80% of infrequent, potential, and non-cyclists wish that there is a cycleway separated from traffic for the entire route.

Table 3 Top Ten Wishes

Factor	Cyclists		Infrequent, Potential and Non-cyclists	
	Rank	Percentage	Rank	Percentage
There is a cycleway separated from traffic for the entire route	1	100%	1	80%
Improvements in safety at major junctions, e.g. advanced stop lines, traffic signal priority for cyclists, etc.	2	98%	2	79%
Strict enforcement of cyclist rights by police and courts	3	93%	13	64%
Secure indoor/covered bicycle parking at destination	4	93%	5	71%
Reduction in traffic volume with less car, bus and truck traffic	5	90%	4	73%
The route has enough lighting after dark	6	90%	10	67%
Reduction of roadside parking	7	85%	19	59%
Cycling takes less time than other modes	8	80%	20	57%
Be able to take the bicycle on public transport	8	80%	9	68%
Motorists assumed by law to be responsible for almost all crashes with cyclists	10	78%	17	61%
Provision of special bicycle streets that limit car speeds and give cyclists priority over the entire width of the road	10	78%	10	67%
Good weather conditions	30	33%	3	76%
The route is flat	32	23%	5	71%
The route is away from traffic noise and air pollution	28	36%	7	69%
No need to carry bulky or heavy items	12	75%	8	69%

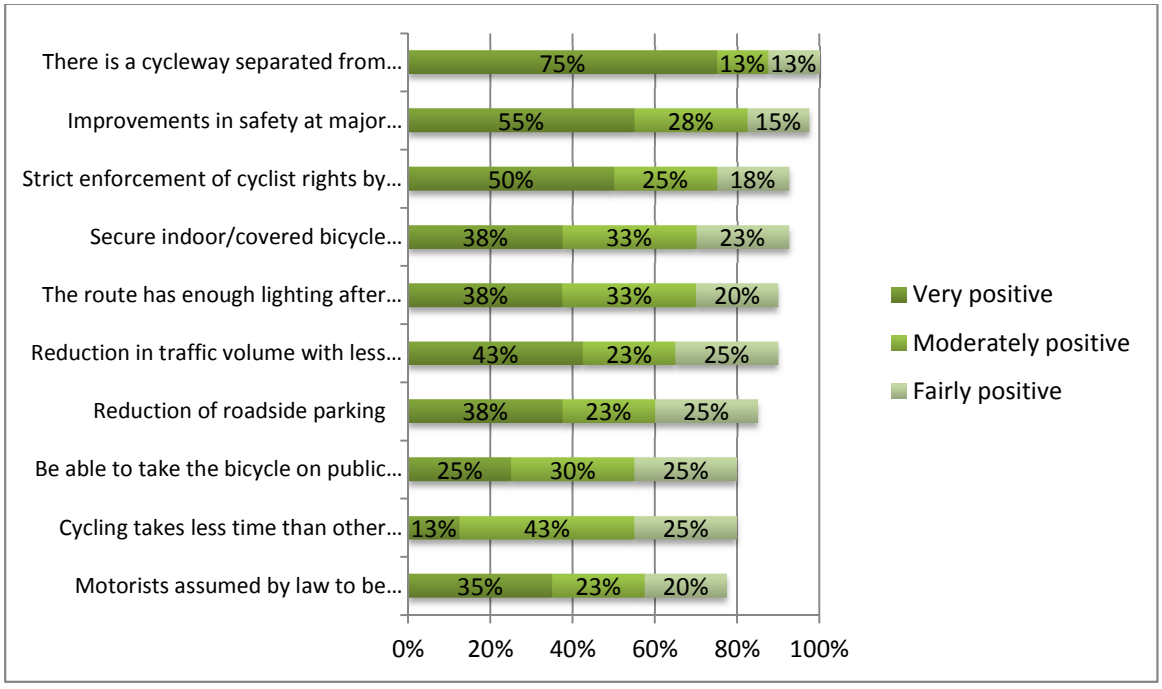

Figure 5 Top ten wishes of cyclists

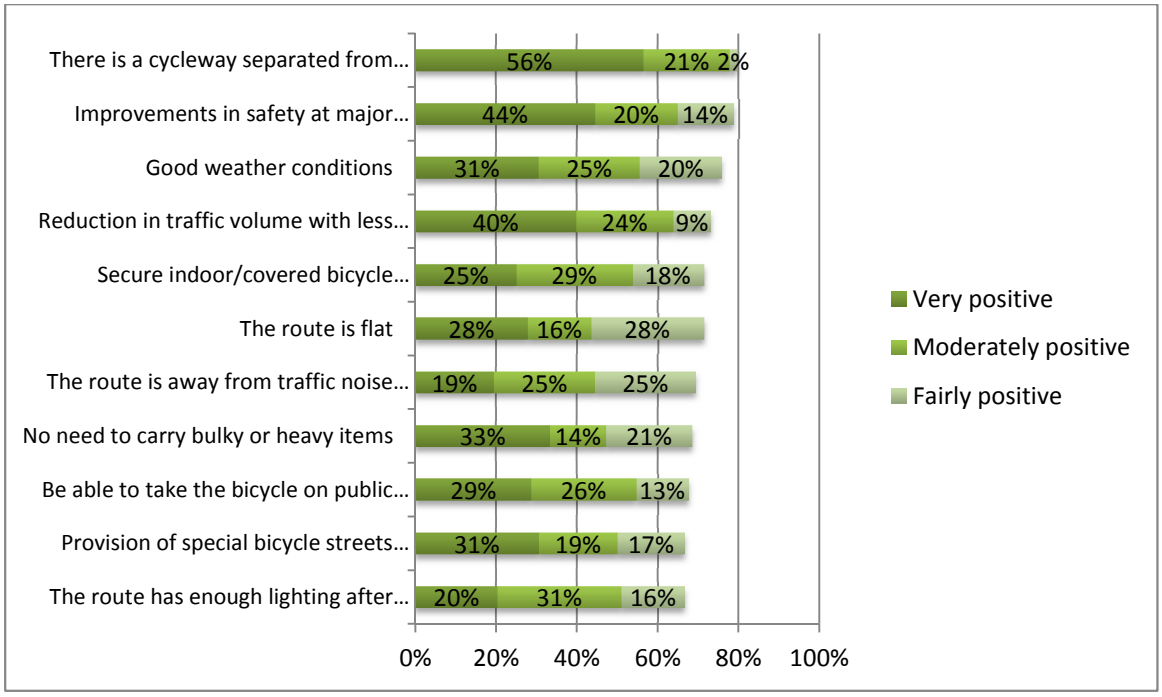

Figure 6 Top eleven wishes of infrequent, potential, and non-cyclists

Good surface quality, adequate width, being separated from traffic and continuity of cycleways are very important to everyone. As shown in Table 4, although cyclists as compared with the others have different priorities when it comes to preferred route characteristics, both groups have exactly the same set of top ten desired route characteristics. Among the ten, as highlighted in Table 4, good surface quality, adequate width, being separated from traffic, away from traffic noise and air pollution, and continuity of cycleways are the qualities that both groups are looking for at higher priority. The breakdowns of the percentage of respondents considering these factors to have positive influence are summarised in Figures 7 and 8.

Table 4 Top ten route characteristics

Factor	Cyclists		Infrequent, Potential and Non-cyclists	
	Rank	Positive Influence	Rank	Positive Influence
The route surface is of good quality	1	95%	5	72%
There is a cycleway separated from traffic for the entire route	2	93%	1	80%
The width of the cycleway is adequate	3	88%	2	79%
Less car, bus and truck traffic en route	4	85%	6	71%
The route is sufficiently direct	4	85%	8	66%
The route has speed limit of 50km/hr	6	78%	10	56%
The gradient is reasonable	6	78%	7	67%
The route is away from traffic noise and air pollution	6	78%	9	61%
The cycleway is continuous across minor road intersections	9	73%	3	74%
Advanced stoplines/traffic signal priority for cyclists at major junctions	10	73%	4	73%

Figure 7 Top ten route quality characteristics for cyclists

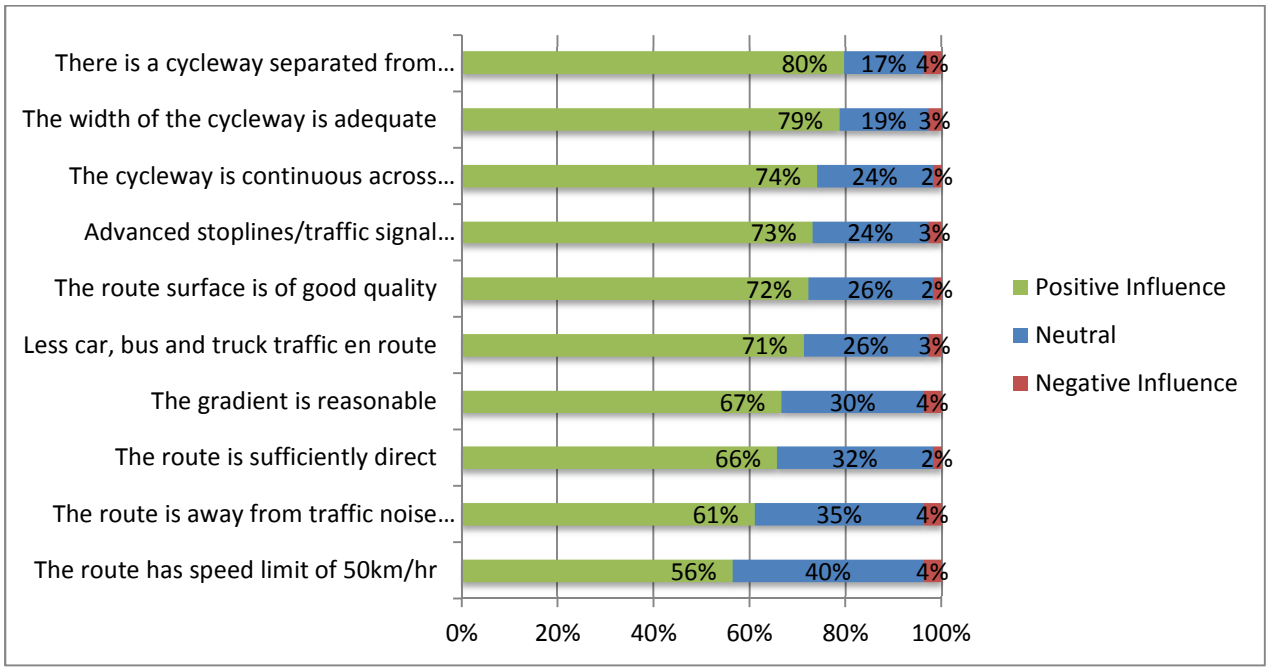

Figure 8 Top ten route quality characteristics for infrequent, potential and non-cyclists

Cyclists and most of the others like to be separated from traffic as well as pedestrians. As shown in Figures 9 and 10, 98% of cyclists and 81% of infrequent, potential, and non-cyclists prefer to ride on cycleways separated from traffic and pedestrians on both sides of the road. As shown in Figures 9 and 10, 88% of cyclists and 69% of infrequent, potential, and non-cyclists prefer to ride on cycleways at least separated from traffic and pedestrians, even if the cycleway is on only one side.

About half of the respondents do not like sharing a lane with buses. As shown in Figures 9 and 10, 45% of cyclists and 56% of the others DO NOT want to share a lane with buses.

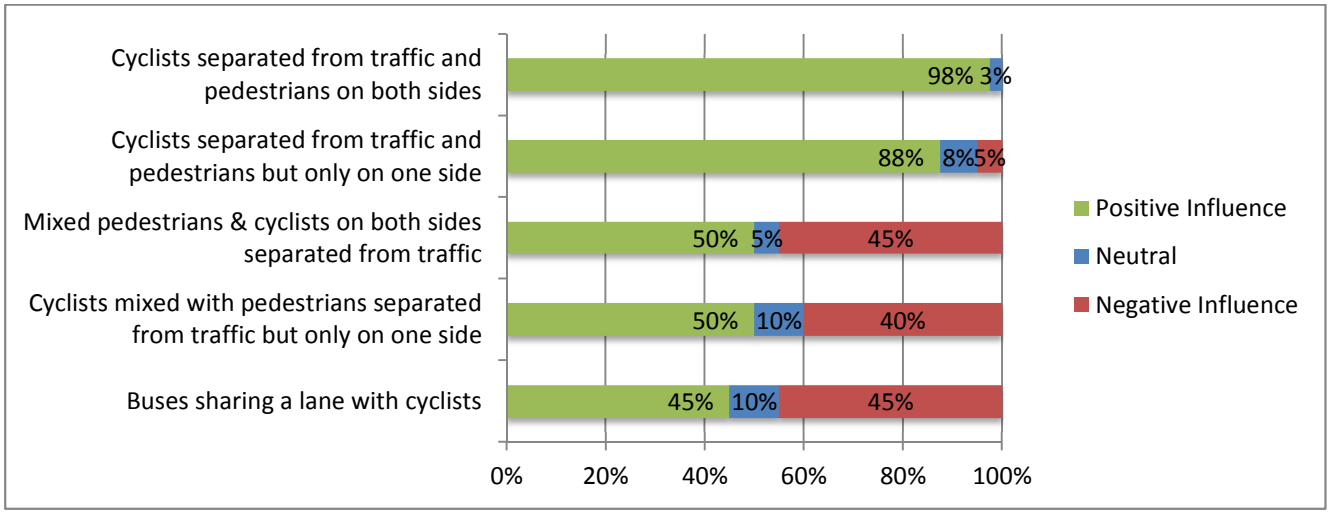

Figure 9 Cyclists' preference on type of cycleways

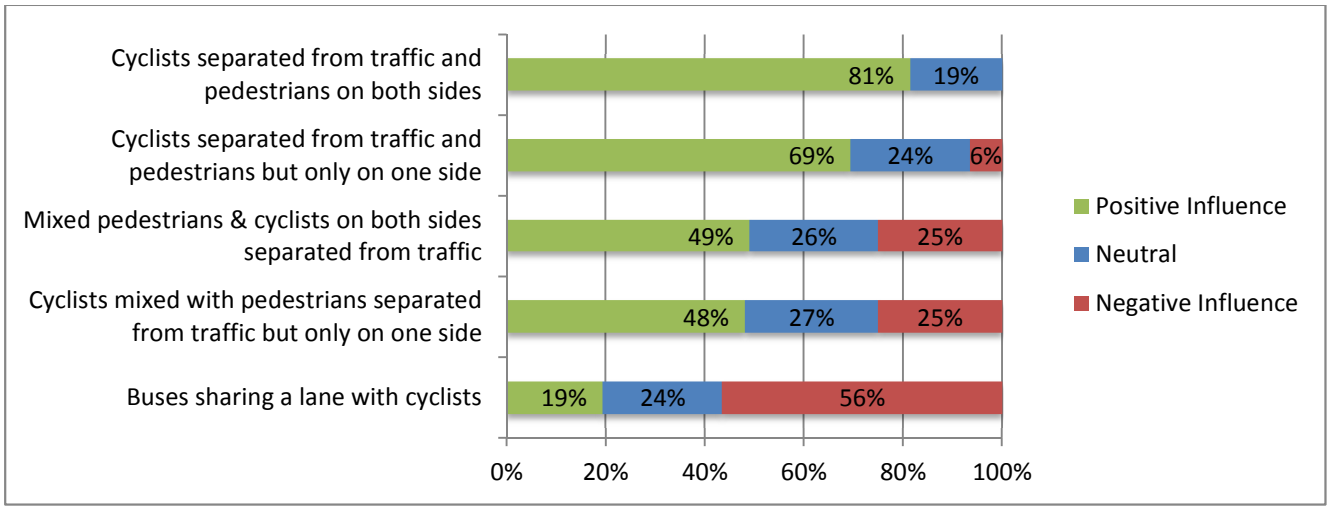

Figure 10 Infrequent, potential and non-cyclists' preference on type of cycleways

Roadside parking causes fear to cyclists. As shown in Figure 11 and 12, 48% of cyclists and 38% of infrequent, potential and non-cyclists have negative feelings towards roadside parking.

The majority prefer parking between traffic and cyclists. As shown in Figures 11 and 12, 95% of cyclists and 83% of infrequent, potential and non-cyclists prefer parking between traffic and cyclists (with segregation between parking and cyclists). The second choice (88% and 72% of cyclists and the others respectively) is a similar arrangement to the first choice, with level difference for cyclists but no segregation between parking and cyclists.

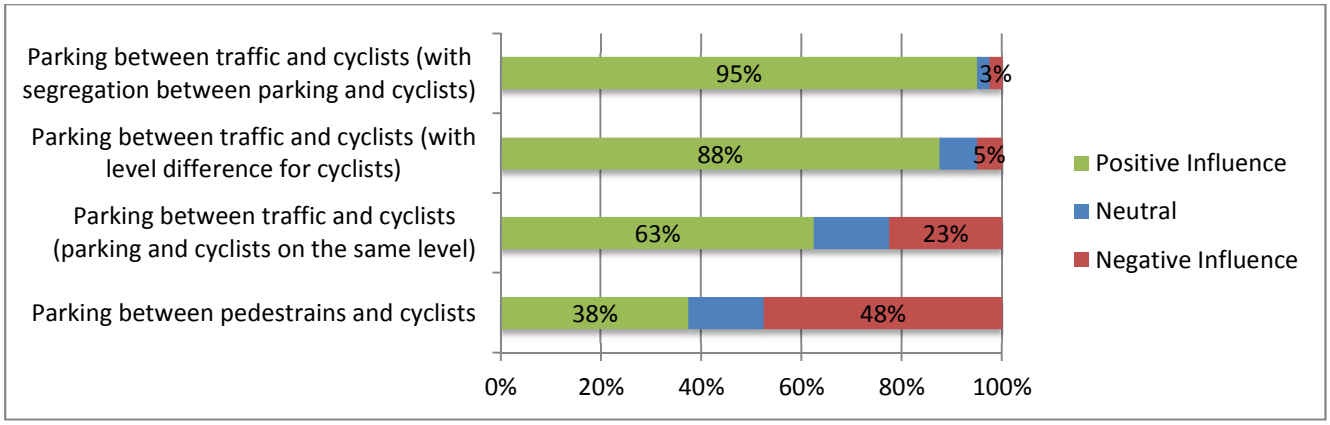

Figure 11 Cyclists' preference on parking arrangement

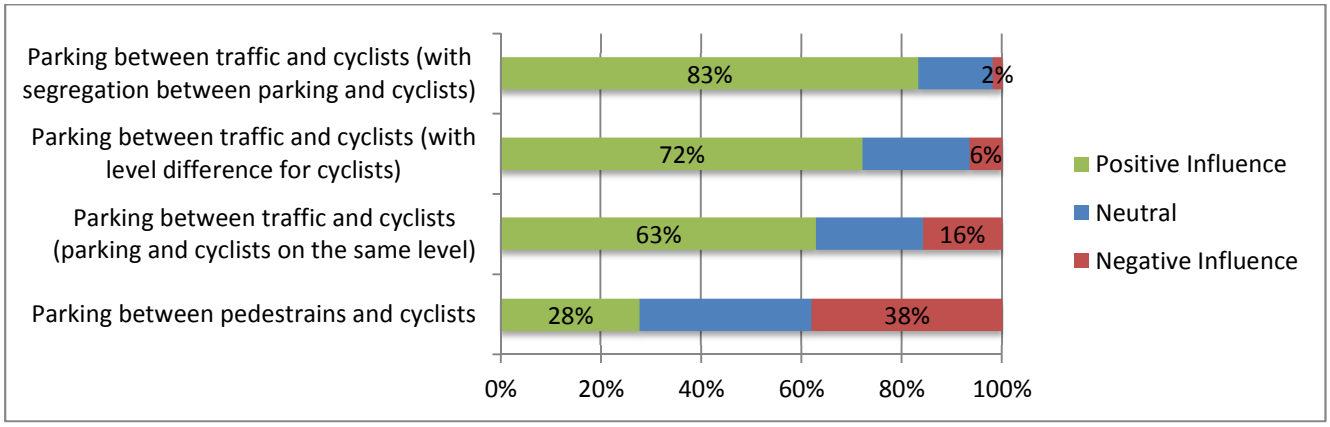

Figure 12 Infrequent, potential and non-cyclists' preference on parking arrangement

4.2.3 Convenience

Secure indoor/covered bicycle parking at destination is important for cyclists and others. As shown in Table 3, the availability of secure indoor/covered bicycle parking is among the top five on the wish list of both groups.

Weather conditions do make a difference. As shown in Table 3, 76% of infrequent, potential and non-cyclists will more likely cycle under good weather conditions. It is interesting to note that although only 33% of cyclists expressed that good weather conditions have positive influence on their level of satisfaction on cycling, as shown in Figure 13, 95% of cyclists would cycle less in winter while 84% will more likely cycle in summer.

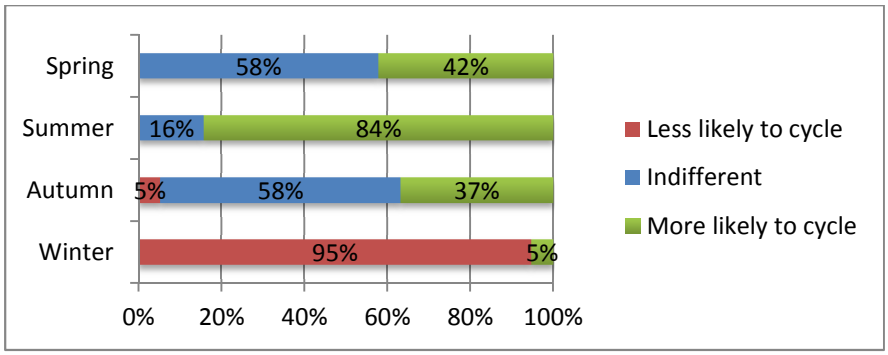

Figure 13 Seasonal effect on decision to commute by bicycle

4.2.4 Policies to discourage car use

Everyone prefers routes with less interactions with traffic and riding in safer conditions: lower speed limit and priority for cyclists. As discussed earlier, everyone prefers less interactions with traffic and riding in safer conditions. In particular, as shown in Table 4, both groups prefer routes with less traffic, lower speed limit, away from traffic noise and air pollution, and with priority for cyclists. This also implies that policies that can discourage car use will also indirectly encourage cycling.

4.2.5 A good public transportation system integrated with cycling facilities

Being able to take the bicycle on public transport is one potential motivator. As shown in Table 3, to be able to take the bicycle on public transport is on the top ten wish list of both groups, with 80% of cyclists and 68% of infrequent, potential and non-cyclists supporting this idea.

4.3 Spatial Analysis of Selected Routes

Spatial analysis of selected routes in terms of route length, number of traffic signals, gradient and elevation are performed, as summarised in Tables 5 and 6. In this paper, the results for two selected routes will be discussed. The chosen routes are compared with the corresponding shortest route, as shown in Figures 14 and 15. In Example 1, the chosen route is 23.9 km long which is 3 km (14%) longer than the shortest route. From the spatial analysis, it is quite clear that the cyclist is trying to avoid traffic signals, which would have caused delay, traffic noise and air pollution; the chosen route has only 30 traffic signals (29% less) instead of 42. The average gradient of the chosen route is higher than that of the corresponding shortest as shown in Table 5; and so is the average climb per 10m-distance as shown in Table 6. This is consistent to the observation that the number one motivation for current cyclists is for exercise and health. In Example 2, the chosen route is 18 km long which is also 14% longer than the shortest route, but only 2.2 km longer. On the contrary to Example 1, the number of signals on the chosen route is more than on the shortest. There is no significant difference between the two routes in terms of average gradient as shown in Table 5. However, a comparison of the climb/drop statistics, as shown in Table 6, indicates that the chosen route has lower average climb but higher average drop per 10m-distance. It appears that the chosen route might have been selected because it is less strenuous than the corresponding shortest one even though the route is longer.

Table 5 Spatial characteristics of selected routes

Characteristics	Example 1		Example 2	
	Chosen	Shortest	Chosen	Shortest
Route Length (km)	23.9	20.9	18.0	15.8
Number of Traffic Signals	30	42	25	20
Average Gradient (degree)	1.8455	1.6814	2.2082	2.2337

Table 6 Route climb/drop statistics

Statistics	Example 1				Example 2			
	Cumulative (metres)		Average per 10m-distance (metres)		Cumulative (metres)		Average per 10m-distance (metres)	
	Chosen	Shortest	Chosen	Shortest	Chosen	Shortest	Chosen	Shortest
Climb	278	236	1.16	1.14	269	244	1.50	1.55
Drop	-287	-249	-1.20	-1.20	-208	-208	-1.16	-1.32

Figure 14 Example 1 - Chosen routes versus corresponding shortest route

Figure 15 Example 2 - Chosen routes versus corresponding shortest route

5 Discussion and Conclusions

As discussed in Section 1, the survey was conducted at the University of Auckland with a sample size of just over 140 staff and students. This can hardly be representative of the Auckland region. Nevertheless, as demontrated later in this section, the results from this survey also support the conclusions drawn from our literature review of international experience and analysis on NZ.

Safety. Cycling in NZ is not safe generally. Tin Tin *et al.* (2010) investigated exposure-based rates and profiles of traffic injuries sustained by pedal cyclists resulted in death or hospital inpatient treatment in NZ. The rate of fatal and hospitalised injuries among pedal cyclists has been increasing over the last decade in NZ. Cyclists had the second highest rate of traffic injuries compared to other major road user categories. Tin Tin *et al.* (2009a) investigated regional and individual differences in cycling and walking to work in NZ over a 15-year period (1991-2006). Among difference regions in NZ, Auckland had the lowest prevalence of cycling and walking. The largest decline in cycling over the 15-year period was among younger age groups, particularly 15-19 year olds. Tin Tin *et al.* (2009b) investigated cyclists' attitudes toward environmental and policy measures that would encourage them to cycle more, particularly for work trips. 55% of respondents considered that reduced motor vehicle speed is important. Of those who reported travelling to work at least once a week, 43% of the respondents would consider cycling more if there were fewer difficult intersections. It is evident that safety is indeed a concern for cyclists as well as those who do not cycle.

Provision of cycleways. The provision of cycleways, in particular in Auckland, is very poor. The top two important factors for cyclists' decision to cycle were the provision of bicycle lanes (88%), and the provision of bicycle paths (76%) (Tin Tin *et al.*, 2009b).

Convenience. 65% of cyclists consider better bicycle security an important factor in their decision to commute by bicycle, and 61% of commuting cyclists considered the availability of shower facilities at work will encourage them to cycle more (Tin Tin *et al.*, 2009b). In contrast to experience in successful countries, the prevalence of cycling to work did not vary significantly by personal income level over the years; and higher proportions of men compared with women cycled (Tin Tin *et al.*, 2009a).

Policies to discourage car use. As discussed above, Tin Tin *et al.* (2009b) found that reducing speed limit and the number of difficult junctions were considered to be important factors in cyclists' decision to commute by bicycle; and 41% of commuting cyclists considered rising fuel cost to be a significant factor to encourage them to cycle more. For a city with sparse distribution of employment centres like Auckland, strategies to promote the use of bicycles will not be sufficient without integrated policies to discourage car use.

A good public transportation system integrated with cycling facilities. Bike-friendly public transport is considered to be an important factor by 38% respondents (Tin Tin *et al.*, 2009b). The use of PT system together with cycling facilities is particularly important for a city with a hilly terrain like in Auckland.

For a city with a hilly terrain and sparse distribution of employments like Auckland, promoting cycling as a mode of transport is not an easy task. In this study, we conducted a literature review of lessons from international experience, a general

analysis for NZ and the Auckland region based on Census data and literature review, a pilot survey wed-based survey conducted at the University of Auckland with a sample size of about 140 staff and students. We conclude that there are five main factors missing in Auckland: (1) safety; (2) a well-connected network of cycleways; (3) convenience; (4) policies to discourage car use; and (5) a good public transportation system integrated with cycling facilities.

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7 References

Akar, G., & Clifton, K. J. (2009). Influence of individual perceptions and bicycle infrastructure on decision to bike, *Transportation Research Record,* 2140,165-172.

Antonakos, C. L. (1994). Environmental and Travel Preferences of Cyclists. *Transportation Research Record, 1438*, 25-33.

Auckland Council. (2011). *Auckland unleashed: The Auckland Plan Discussion Document*.

Betz, J., Dustrude, J., & Walker, J. (1993). Intelligent Bicycle Routing United States. *Transportation Research Record, 1405*, 21-27.

Dill, J., & Carr, T. (2003). Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them. *Transportation Research Record, 1828*, 116-123.

Dill, J., & Voros, K. (2007). Factors affecting bicycling demand: Initial survey findings from the Portland, Oregon, region. *Transportation Research Record, 2031*, 9-17.

Gatersleben, B., & Appleton, K. M. (2007). Contemplating cycling to work: Attitudes and perceptions in different stages of change. *Transportation Research Part A: Policy and Practice, 41*(4), 302-312.

Hopkinson, P., & Wardman, M. (1996). Evaluating the demand for new cycle facilities. *Transport Policy, 3*(4), 241-249.

Hunt, J. D., & Abraham, J. E. (2007). Influences on bicycle use. *Transportation, 34*(4), 453-470.

Koorey, G., Kingham, S., & Taylor, K. (2009). *Attracting the next 10% of cyclists with the right infrastructure*. Paper presented at the The 7th New Zealand Cycling Conference 2009.

Lindsay, G., Macmillan, A., & Woodward, A. (2010). Moving Urban Trips from Cars to Bicycles: Impact on Health and Emissions. *Australian and New Zealand Journal of Public Health*.

Mackie, H. (2009) 'I want to ride my bike': overcoming barriers to cycling to intermediate schools. *NZTA Research Report 380*.

Martens, K. (2007). Promoting bike-and-ride: The Dutch experience. *Transportation Research Part A: Policy and Practice, 41*(4), 326-338.

May, T., & Crass, M. (2007). Sustainability in transport: Implications for policy makers, *Transportation Research Record*, 2017, 1-9.

Mirza, L., & Wang, J. Y. T. (2011). *Appraisal of Factors Influencing Choices of Cyclists and Potential Cyclists in Auckland*. Paper presented at the The New Urbanism & Smart Transport 2011 International Conference: Towards Liveable Cities & Better Communities, held in Perth, Australia, September 2011.

MoT. (2008). *The New Zealand Transport Strategy 2008*: Ministry of Transport.

NZSTATS. (2006). Table Builder, Journey-to-Work Census Statistics. Retrieved 24/08/2010, from http://www.stats.govt.nz/:

Parkin, J., Wardman, M., & Page, M. (2008). Estimation of the determinants of bicycle mode share for the journey to work using census data. *Transportation, 35*, 93-109.

Pucher, J., & Buehler, R. (2008a). Cycling for everyone: Lessons from Europe, *Transportation Research Record*, 2074, 58-65.

Pucher, J., & Buehler, R. (2008b). Making cycling irresistible: Lessons from the Netherlands, Denmark and Germany. *Transport Reviews, 28*(4), 495-528.

Stinson, M. A., & Bhat, C. R. (2003). Commuter Bicyclist Route Choice: Analysis Using a Stated Preference Survey. *Transportation Research Record, 1828*, 107-115.

Stinson, M. A., & Bhat, C. R. (2004). Frequency of bicycle commuting: Internet-based survey analysis. *Transportation Research Record, 1878*, 122-130.

Sullivan, C., & O'Fallon, C. (2006). Increasing cycling and walking: an analysis of readiness to change. *NZTA Research Report 294*.

Tilahun, N. Y., Levinson, D. M., & Krizek, K. J. (2007). Trails, lanes, or traffic: Valuing bicycle facilities with an adaptive stated preference survey. *Transportation Research Part A: Policy and Practice, 41*(4), 287-301.

Tin Tin, S., Woodward, A., & Ameratunga, S. (2010). Injuries to pedal cyclists on New Zealand roads, 1988-2007. *BMC Public Health, 10*(655).

Tin Tin, S., Woodward, A., Thornley, S., & Ameratunga, S. (2009a). Cycling and working to work in New Zealand, 1991-2006: regional and individual differences, and pointers to effective interventions. *International Journal of Behavioral Nutrition and Physical Activity, 6*(64).

Tin Tin, S., Woodward, A., Thornley, S., Langley, J., Rodgers, A., & Ameratunga, S. (2009b). Cyclists' attitudes toward policies encouraging bicycle travel: findings from the Taupo bicycle study in New Zealand. *Health Promotion International, 25*(1), 54-62.

Wardman, M., Tight, M., & Page, M. (2007). Factors influencing the propensity to cycle to work. *Transportation Research Part A: Policy and Practice, 41*(4), 339-350.

Winters, M., & Teschke, K. (2010). Route preferences among adults in the near market for bicycling: Findings of the cycling in cities study. *American Journal of Health Promotion, 25*(1), 40-47.

Winters, M., Davidson, G., Kao, D., & Teschke, K. (2011). Motivators and deterrents of bicycling: comparing influences on decisions to ride. *Transportation, 38*, 153-168.