Objective measures of a walkable neighbourhood: how do they fit with residents' experiences?

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Running Head: Objective vs experiential measures of walkability

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Abstract

Urban design variables - dwelling density, street design, diversity of land use, destination accessibility and distance to transit (the 5 'Ds')- have been associated with transport mode use, including walking. This paper examines residents' experiences and observations on what makes their neighbourhood pleasant and unpleasant for walking in four Auckland localities with contrasting built environment and socio-economic profiles.

Two GIS-based indices were developed to measure neighbourhood built environment attributes. First, a composite index of access to 33 types of service and amenity destinations (recreational, educational, commercial, health-related, social and cultural) within an 800m neighbourhood buffer. Second, a walkability index comprising four variables: land use mix, dwelling density, street layout and retail building to land area ratio.

Residents in the four localities participated in a photo elicitation exercise. In a facilitated group session residents presented and discussed photographs they had taken of what made their neighbourhood good and bad for walking. In this paper we consider the attributes of a walkable neighbourhood that, through the eyes of residents, were consistent with the items of a streetscape audit instrument and the five 'Ds' and those which reflect attributes of particular places that fall outside those captured by the indices.

197 words

Background

In the space of a few decades the motor vehicle has profoundly altered our mobility behaviours and transformed the design of our cities. Urban environments in the industrialised world have become increasingly attuned to enhancing motor vehicle use and as car ownership rates increase around the globe lifestyle practices and the structure of cities in developing nations are tracking those in the industrialised countries. A more dispersed city is a common outcome of autocentric planning and as a city sprawls the distances between home, work and the other destinations of daily life increase. Greater reliance on the car inevitably follows which is in turn associated with a rise in the prevalence of overweight and obesity (Frank, Andresen, & Schmid, 2004; Popkin, 2009, forthcoming). Reversing this trend requires an understanding of how built environments can be modified to encourage walking for transport and leisure for different population groups.

The development and use of valid and reliable measures are critical to improving understanding of the relationship between the built environment and walking behaviours (Brownson, Hoehner, Day, Forsyth, & Sallis, 2009; Sallis, 2009; Story et al., 2009). As Sallis (2009) notes the development of built environment measures is relatively recent, having developed in tandem with social-ecological models of behaviour. Tracing the history of environmental measures relating to physical activity, Sallis tells of methodological borrowings from a range of disciplines: self report and direct observations from public health and planning, Geographic Information System (GIS) measures from transportation and planning, and aesthetics and social environmental measures from the leisure studies. The techniques in common use can

be categorised as GIS derived measures, systematic observation using audit tools, and perceptual (self report) measures (Brownson et al., 2009).

What built environment attributes should be measured? Conceptual models such as the ANGELO framework (ANalysis Grid for Environments Linked to Obesity) have been useful to distinguish the relevance of factors at macro to micro scales (Swinburn, Egger, & Raza, 1999) and more detailed frameworks such as that developed by Pikora et al. (2003) have identified environmental characteristics tailored to walking behaviours. The latter was informed by an evidence review, interviews with experts and the use of delphi methods. But as Story et al. (2009) explains many of the measures in use have been developed on an ad hoc basis in response to the 'needs of specific times, populations and places' (p.S185). The merits of using common (valid and reliable) neighbourhood measures across studies to aid comparisons and advance understanding has been advocated (Matthews, Moudon, & Daniel, 2009; Saelens & Glanz, 2009) but this does not diminish the importance of identifying variables well matched to the underlying theories on the pathways through which the built environment influences specific behaviours, in particular settings and in the population group/s of interest (Giles-Corti, Timperio, Bull, & Pikora, 2005; Matthews et al., 2009; Oakes, Masse, & Messer, 2009). If scales and indices currently in use to describe and measure ecological level constructs are indeed in their infancy (Oakes et al, 2009) their fitness for use in diverse local contexts warrants ongoing review. Community input into will be a valuable aspect of the process (Brownson et al., 2009).

A diverse range of neighbourhood attributes have been incorporated into the different tools in use – GIS-based, environmental audit and self report. GIS is a valuable technology for managing and integrating data at various spatial scales across large areas. It has been widely used in urban planning research, a field in which a useful evidence base on neighbourhood factors that influence utilitarian walking has amassed (Badland & Schofield, 2005). In a meta analysis of findings from this literature Ewing (2009) concluded that the number and likelihood of walking trips is about equally influenced by diversity (land use mix), design (street network characteristics) and destination accessibility. Similar conclusions were reached for walking for transport in Saelens and Handy's (2008) review of built environment correlates of walking. These urban design measures, generally constructed using GIS software, are more commonly used to assess neighbourhood characteristics relevant to walking for transport than for recreation (Brownson et al., 2009). The relationship between these variables and recreational walking is less clear (Saelens & Handy, 2008).

Community audit tools are used for the direct observation of built environment features that are either unavailable to incorporate into a GIS or more suitable to assess by direct observation (e.g., street surveillance from surrounding houses or footpath quality). Items commonly cluster around personal safety (e.g. traffic volumes and calming devices, lighting, vandalism) comfort (pedestrian infrastructure and maintenance) and neighbourhood aesthetics (views, elevation, building styles) plus observational measures relating to the five 'Ds' density, diversity, design, destinations and presence of, rather than distance to, transit infrastructure (Ewing, 2009). Researchers typically walk along both sides of a selected number of neighbourhood

street segments recording the presence/absence and quality of a range of street features. The Systematic Pedestrian and Cycling Environment Tool (SPACES) used in the research on which this paper is based is an example of an audit tool (Pikora et al., 2002).

Self report survey instruments are typically used to measure perceptions of the neighbourhood environment. A similar range of topics to those included in audit tools are covered, although perceptions of availability and distance to walking-related resources are also often included (Brownson et al., 2009). Photo elicitation methodology is an alternative approach to collecting data on residents' perceptions of the factors that encourage or discourage walking in their local area. The research method uses a combination of photography and discussion of the resulting images, to draw out participants' experiences and views on a topic (Mitchell, Kearns, & Collins, 2007). It is a useful technique for gathering data that highlight issues or features of value, importance or concern for communities (Wang & Burris, 1997). As a technique it is often aligned to social action, with data used to advocate for changes and improvements to institutions, neighbourhoods or environments (Foster-Fishman, Nowell, Deacon, Nievar, & McCann, 2005). With respect to neighbourhood walkability the images taken by local residents act as a catalyst to discussion of the characteristics of the area that make it favourable or unfavourable as an environment for walking

In the paper we consider how data on neighbourhood attributes associated with walkability, constructed or collected using GIS and audit techniques, align with the walking-related experiences of local residents identified using photo elicitation

techniques. The study took place in four contrasting localities in two of the constituent cities within the Auckland urban region: Massey and Te Atatu Peninsula in Waitakere City and Devonport and Albany in North Shore City. Figure 1 indicates the location of the study localities within the Auckland region. Devonport is an older and highly walkable area with a low deprivation profile. Albany is rapidly developing greenfields site, also low deprivation but rated poorly for walkability. By contrast Massey and Te Atatu Peninsula are mid to high deprivation areas, with contrasting walkability profiles. Massey, developed as a commuter belt suburb in the 1960s and 70s and scores poorly on walkability indices. Te Atatu Peninsula, which developed over a similar time period to Massey, as a central service hub and scores well for accessibility and walkability.

The indices and tools used to measure neighbourhood attributes are described and the data obtained for the four localities are presented. We then discuss the extent to which the data from the GIS and audit based instruments capture the range of attributes identified by residents in the study localities through the photovoice exercise.

Methodology

The four case study localities were selected based on GIS[1] measures of built environment attributes associated with walkability and the New Zealand Deprivation Index 2006 (Salmond, Crampton, & Atkinson, 2007). The deprivation index is a meshblock[2]-based index constructed from nine socioeconomic variables drawn from the quinquennial New Zealand Census of Population and Dwellings. The Neighbourhood Destinations Index (NDI) and the Walkability Index, the GIS-based indices applied to determine locality walkability, are briefly described. Both measures

were constructed at the neighbourhood (meshblock) level across four cities as part of the Neighbourhoods and Health Project and URBAN Study respectively[3].

Insert Figure 1

Neighbourhood Destinations Index

A GIS analysis was used to calculate a composite neighbourhood index of access to local destinations. The inclusion of destination types was based on whether walkable access (800m) could be theorised to promote physical activity. Thirty three destination types were included, grouped within the following eight community resource domains: education, transport, recreation, social and cultural, food retail, financial, health and other retail. Appendix 1 lists the amenities, the source of the data and date of data collection. To represent a walkable neighbourhood area, the road network and ArcGIS Network Analyst toolset were used to create 800m service area buffers radiating out from the population-weighted centroid of each census meshblock. Access to each destination type was measured independently for each meshblock and weightings were then applied based on the relative importance of specific destination types as catalysts for physical activity. A composite index score was calculated for each neighbourhood (meshblock). Scores range from 0-31. The higher the NDI score, the more potential destinations within a walkable distance from home were available to a resident.

Walkability Index

The walkability index was calculated using combined measures of street connectivity, dwelling density, land use mix, and retail floor area ratio, and was generated using GIS software, ArcInfo 9.1 as specified in Frank et al. (2009) and Leslie et al. (2007).

Street connectivity was estimated by calculating intersection density (comprising the number of intersections per square kilometre within 20 metres of each meshblock boundary). *Dwellings density* was calculated using mesh-block data for the number of occupied private dwellings taken from the 2006 census (Statistics New Zealand, 2007) and land use and zoning data provided by the territorial authorities. Dwelling density was calculated by dividing the number of dwellings by the residential land area for each meshblock. Land use and zoning data were also used to categorise land use into commercial, residential, industrial, open space, and 'other' within each meshblock and applied to calculate *land use mix* using an entropy index (D'Sousa et al., 2006). *The retail floor area ratio* was determined by using building outline data sourced from the territorial authorities. The net retail area was then calculated by dividing the retail floor area by the total retail parcel area within each meshblock (Leslie et al., 2007). A higher value indicated less parcel space allocated to car parking at retail sites within the meshblock. The four measures were classified into deciles and recoded into values from 1 (1^{st} decile) to 10 (10^{th} decile). The walkability index for each meshblock was calculated by summing the four 1 to 10 scores, resulting in a possible score from 4 to 40.

SPACES NZ

SPACES is a street audit instrument developed by researchers at the University of Western Australia. It is used for recording street level data on physical environment

features that may influence walking behaviour (Pikora et al., 2002). The measure was adapted for use in New Zealand and is being used in the URBAN study.

Photo elicitation

Photo elicitation exercises were conducted in the four localities, in Massey and Te Atatu Peninsula in 2006 and in Albany and Devonport in 2008. Participants, who were of mixed age and gender, all lived in the locality. Groups of 8-10 residents in each area met on two occasions, the first time for a briefing about the project and the second time to present and discuss photos they had taken in the intervening period. They were invited to take photos relating to neighbourhood features that made the local area a good or not-so-good place for walking. The discussions were audio taped, transcribed, and imported into Nvivo software (QSR, VIC, Australia). Thematic analyses of data were undertaken independently for each locality. The analyses of text were accompanied by a set of photographs taken and annotated by the study participants and subsequently selected by group members as best representing their observations and experiences in each locality.

Data from then NDI and Walkability Indices were collated for the four localities. Neighbourhood specific SPACES data is not presented but the scale's item coverage is discussed. The data and scale items are considered in light of the thematic analyses of the subjective experiences, observations and talk of residents arising from the photo elicitation process in each of the study areas and the extent to which they are consistent or discrepant with the residents' views is discussed.

Results

Mean meshblock level scores for the NDI, Walkability and NZDep for the study localities are reported in Table 1 along with the range of values for the meshblocks in the localities

Insert Table 1

Locality size is a function of physical, social and service use boundaries and corresponded to the 'suburb' of residence in the eyes of participants. Within the localities meshblock scores ranged widely for all three indices.

Residents' experiences of the localities as pleasant/unpleasant for walking were generally consistent with the NDI and walkability scores reported for the areas in Table 1. The images produced and the walking experiences and observation reported in the Devonport locality were overwhelmingly positive: pleasant outlooks, ample walkways and numerous destinations. Negative images and talk relating to a need for footpath and walkway maintenance and graffiti removal were produced but these did not colour the enthusiasm with which residents described their walking experiences. Te Atatu Peninsula was also depicted as an attractive walking environment and positive images and accounts far outweighed negative ones. Poor footpath and alleyway conditions, rubbish, graffiti and vandalism were all recorded but they were talked about as minor impediments in a predominantly favourable environment. Residents in Massey and Albany also identified aspects of their neighbourhoods that made them pleasant places to walk, particularly with respect to rural, bush and other natural outlooks. However in both of these areas many of the images taken and the

discussion of walking in the locality honed in on negative attributes or the absence of features that would have encouraged walking. For example Albany residents described a lack of footpaths, dead end footpaths, high traffic volumes, and long distances to places all frustrating their efforts to walk locally. Similar issues, as well as bushy gullies inhibiting passage between neighbourhood streets and a range of safety concerns, tarnished experiences of walking in Massey.

Environmental attributes photographed and talked about with respect to locality walking are indicated on Table 2. Some factors were noted consistently across all localities: outlook, access to public open spaces, the presence/absence of connecting walkways, traffic volume and street width, footpath maintenance and proximity to the road, destinations, and graffiti. These items are all covered in the SPACES audit tool. So too are crossings, footpath obstructions and incivilities reported in three of the four areas. Other factors commonly identified related to the quality and maintenance of public open spaces (POS); attributes readily captured in a POS quality audit (Badland, Keam, Witten, & Kearns, 2009; Crawford et al., 2008). Destination accessibility is captured to a limited extent by SPACES NZ and comprehensively by the NDI.

Insert Table 2

However there were a number of items prominent in the photos and talk of walkability in specific localities that were not captured by the indices or SPACES. In the highly walkable, low deprivation Devonport area, public art, heritage and cultural sites were frequently noted as factors that made walking pleasant. For instance, in the words of one participant:

> '…each boat has got a little plinth in front of it and on the plinth is a photo and a historical description of the boat. Some of them are up to and over a hundred years old. You see a lot of walkers, stopping and browsing...' (Devonport)

In the locality viewed least favourably for walking, aggressive dogs, open drains, discarded condoms in parks, disturbing (non traffic) noises, and closed or vandalised amenities were noted (and not elsewhere). The static items could be incorporated into a street audit tool but transitory items such as noises and dogs are difficult to capture reliably. However as participants in Massey explained it was often recurrent encounters with these transitory attributes that reduced their feeling of safety in public streets and other public places. Feeling safe in a local place was portrayed as a fragile emotion and, for the participant quoted below, sustained when a place is well cared for but easily lost when faced with vandalism and poorly maintained spaces.

> It's like someone cares about it because it's been landscaped or there's a path through it, or a park has been made. There hasn't been anything to take that [feeling safe] away. You know it's like it doesn't take much to take it away (Massey)

An accumulation of off-putting attributes affected experiences of walking in Massey. Pylons featured in many of photos – another attribute measured by neither indices nor audit. They were seen as ever present and, as noted in the excerpt below, visually dominant from most parts of the suburb.

> You can hear them humming. They just really dominate this whole area I find for me……You basically can't walk anywhere without walking under one around here (Massey).

Peninsularity, an attribute of two of the localities, was linked positively to walking in two ways: ready access to coastal views and walkways, and a sense of safety.

> 'Also it's more crime free, because there's only one entrance into Devonport and the same way of getting out again…'

Neither of the GIS indices captured this geographic characteristic. However this unique aspect of place was considered relevant to the walking experience.

In terms of the GIS indices, destinations to walk to (NDI) was readily identified as important for neighbourhood walking but of the components of the walkability index, only connectivity surfaced. Street connectivity *per se* was not mentioned but walkways and alleyways were photographed and valued and their absence across gullies noted in Massey.

> A lot of our dead end roads, they're not dead ends, they're only dead ends for motorists. So you get a big sign saying, no through road, but at the end there's a little pathway that carries on. I think it's just lucky for us that we came in before town planners arrived. (Devonport)

Otherwise neighbourhoods were experienced without conscious reference to the morphology of urban spaces. Many attributes included in the SPACES audit tool also

went unmentioned by residents, such as traffic control devices, kerb types, slope, road condition, items possibly directed more to cyclists than walkers.

Several environmental attributes that impeded walking for people of particular age or life stage groups were noted. For example 'D' bars at park entrances designed to exclude motorbikes also effectively barred people with pushchairs or in wheelchairs. Gravel paths were also difficult to negotiate for these groups and, as noted below, path material and conditions were also important for older people.

> This group I walk with, some of the girls are 80 and they've got to be very careful… that bridge gets very very wet…..with the grass cuttings from when they've mowed the lawns it gets quite slippery, so you've got to be very very careful (Te Atatu Peninsula)

Both items, footpath material and obstructions, are covered in the SPACES audit tool.

Discussion

Walking is the most common form of physical activity. It occurs in local streets and public spaces, so knowing how best to encourage walking in all neighbourhoods, as well as in specific places, is important for increasing walking for health and environmental benefits. This four locality study has explored whether existing tools for measuring environmental correlates of walking provided comprehensive coverage of the features identified by residents in the contrasting study neighbourhoods.

Residents' experiences of walking largely mapped to GIS-based measures of the walkability attributes of their neighbourhoods; those 'measured' as more walkable

were also experienced as more walkable. While residents did not articulate their experiences of urban spaces using the terminology of the indices and audit instruments, their photos and discourse were nonetheless consistent with the underlying concepts. The GIS measures of locality walkability resonated, or had face validity, with the experiences of local people. There were a number of SPACES items not commented on by residents such as verge maintenance and road condition. This may reflect more anodyne attributes going unnoticed, and/or consistency in the quality of these items across the Auckland localities. These items may not help discriminate between more and less walkable neighbourhoods in this context. Another item - 'surveillance' (from surrounding houses) - was not mentioned in reference to streets, but alleyways and walkways were experienced as more menacing when out of view of houses. Modifying the item to read alleyways/walkways rather than streets may result in a better variable for differentiating between urban streetscapes in the Auckland region.

Of interest are the locality attributes not covered by the quantitative measures, some of which triggered an emotional response that residents linked to how attractive an environment was for walking. These could be fixed aspects of the landscape such as the electricity pylons in Massey and the cultural and heritage landmarks in Devonport. Others were transient neighbourhood exposures such as encounters with aggressive dogs, a burnt out car in the street, and overhearing abusive exchanges from the street. The memories of a series of such transient experiences can clearly accumulate and develop into a neighbourhood characteristic that encourages or discourages walking. In Massey, the experiences listed were reported as having a negative cumulative

effect on how secure/insecure, pleasant/unpleasant it felt to be on the street. By contrast, a string of equally transient sights or experiences, such as watching para-gliders, were mentioned in Devonport but these tended to entrench the pleasures of walking locally.

Rare neighbourhood features such as pylons can be captured in a locational index but it is more difficult to envisage how to measure transient events. Yet exposure to these sights and experiences, more frequent in some neighbourhoods than others, are likely to influence levels of walking behaviour.

The photo elicitation technique can be used to identify potential attributes for inclusion in measures of neighbourhood walkability. For example, a uniquely New Zealand feature photographed and talked about as enhancing the walking environment was the presence of native bush. As a tool for local action photo elicitation can also be used to facilitate interventions to remedy barriers to a good walking environment in particular places.

Conclusion

This paper has reported on an opportunistic analysis of the correspondence between quantitative and qualitative assessment of walkability in different urban localities. GIS data was aggregated to create locality level measures. Doing so involved the loss of details in the measurement of spaces. More precise contrasting of the GIS and experiential data could have been achieved if residents living in more defined areas

within the study locality had been recruited. The analysis has not attempted to relate environment to behaviour but rather to identify what place-specific neighbourhood environmental attributes identified by residents living in different places are not captured in the tools used in the URBAN study. Latter phases of the URBAN study will investigate the relationship between neighbourhood factors and the physical activity of residents. The analysis does, however, address what Takano and Nakamura (2004) identified as a gap in the literature on participatory research approaches: understanding the characteristics that contribute to more or less walkable neighbourhood environments.

Endnotes

[1] Neighbourhood selection was based on earlier versions of the GIS measures described, the Community Resource Accessibility Index (Witten, Exeter, & Field, 2003) and measures of street connectivity, population density and land use mix (Rose et al., 2006)

[2] A meshblock is the smallest administrative unit used in the New Zealand Census and comprise a population of approximately 100 people.

[3] The URBAN (Understanding Relationships Between Activity and Neighbourhood) study uses a multi-centred, stratified, cross-sectional research design, to collect physical activity, BMI and neighbourhood perception data from residents in selected neighbourhoods in four New Zealand cities. Twelve neighbourhoods in each city were selected based on higher or lower walkability attributes and demographic composition. Neighbourhoods and Health Project is aligned to the URBAN Study and is investigating, through complementary qualitative investigations, the social practices that support or constrain physical activity in different neighbourhoods for different population groups.

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Figure 1

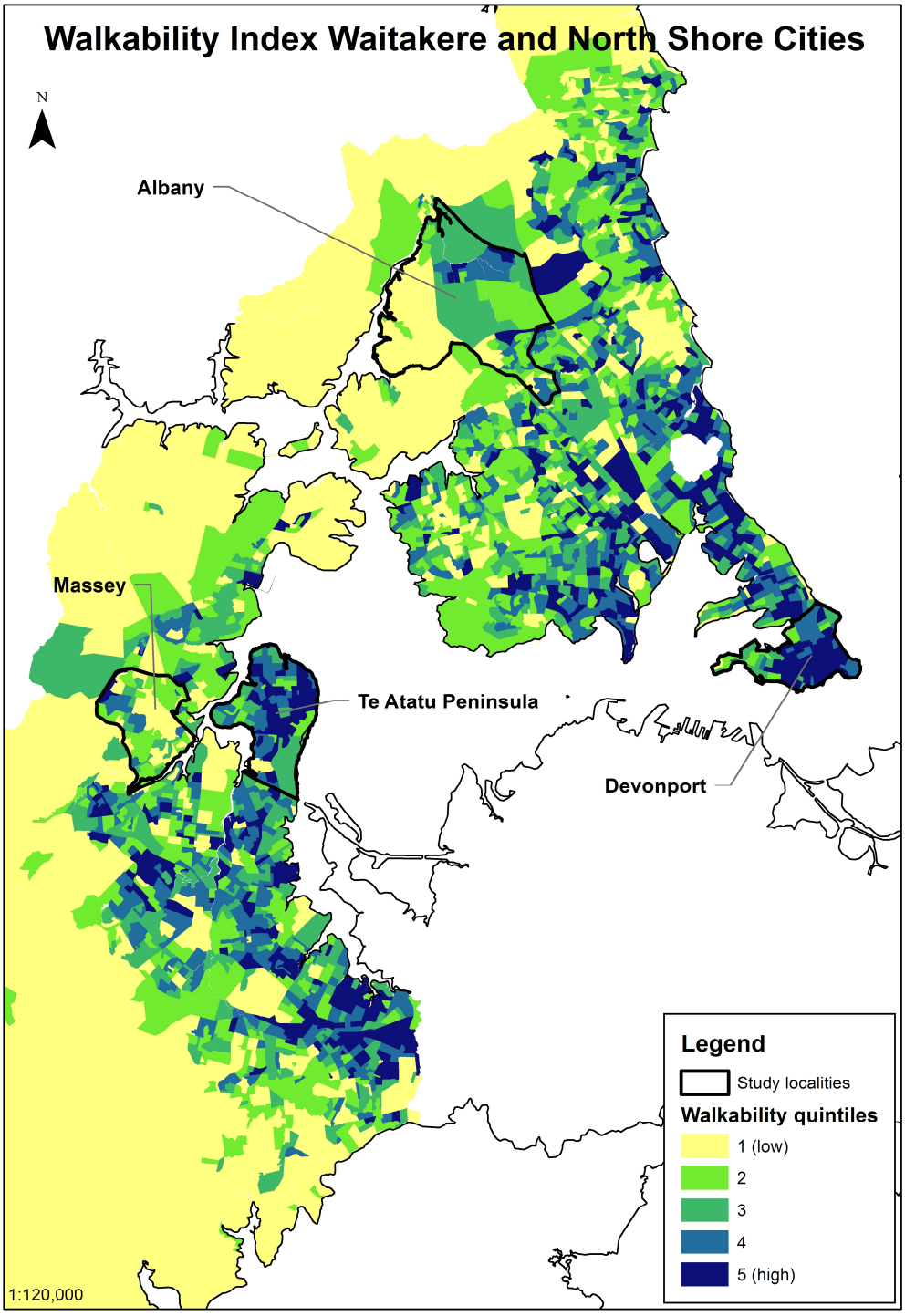
Walkability Index Waitakere and North Shore Cities
N
Albany
Massey
Te Atatu Peninsula
Devonport
Legend
Study localities
Walkability quintiles
1 (low)
2
3
4
5 (high)
1:120,000

Table 1

Locality	Number of Meshblocks	NDI MB mean value	NDI MB range	Walkability MB mean value	Walkability MB range	NZDep06 MB mean	NZDep MB range
Devonport	90	14.4	2.8-26.4	29.7	13-40	2.2	1-8
Albany	70	6.8	0.6-16.3	21.3	10-34	3.0	1-10
Massey	79	7.7	2.8-19.7	19.7	9-30	7.0	2-10
Te Atatu Peninsula	93	10.1	2.8-21.3	28	16-40	6.2	1-9

Table 2

Photo elicitation Neighbourhood factor	**Massey**	**TAP**	**D'port**	**Albany**	**Data Capture**
Elevation	√				
Outlook					SPACES NZ
-rural	√			√	
-coastal/estuary		√	√	√	
-bush (native flora)	√	√	√	√	
-nature eg wetland	√	√		√	
Access to POS					SPACES NZ
-formal	√	√	√	√	
-wild nature	√	√	√	√	
Maintenance of POS	√	√	√		
Park entrances					
-obscured	√	√	√		
-poor signage	√	√		√	
Street signage	√	√			
Inter connecting walkways					
-presence/absence	√	√	√	√	SPACES /NDI
-aesthetics		√	√		
-surveillance		√		√	SPACES NZ
- enclosure/openness		√		√	
Gullies – severance	√				
Peninsularity		√	√		
Streets:					
- traffic volume	√	√	√	√	SPACES NZ
- quiet/noisy	√	√	√	√	
- width	√	√	√	√	SPACES NZ
- fumes			√		
Footpaths					
- presence/absence	√	√	√	√	SPACES NZ
- maintenance	√	√	√	√	SPACES NZ
- material		√			SPACES NZ
- obstructions	√	√	√		SPACES NZ
Pedestrian crossings	√	√		√	SPACES NZ
Verges-grass					
- width	√	√	√	√	SPACES NZ
- proximity to road	√	√	√	√	
Lights					
- street					SPACES NZ
- parks		√			
Trees –shade			√		SPACES NZ
Gardens – aesthetics and maintenance			√		SPACES NZ
Driveway visibility			√		SPACES NZ
Destinations					NDI
-POS	√	√	√	√	SPACES NZ
-village hub		√	√		
Carparking				√	SPACES NZ

Seats			√		SPACES NZ
Public art			√		
Heritage sites			√	√	
Cultural sites			√		
Vandalism, graffiti	√	√	√	√	SPACES NZ
Incivilities - broken glass -condoms, - rubbish	 √ √ √	 √		 √	SPACES NZ
Dogs -deterrent to walking	√				
Open drains	√				
Disturbing noises (non traffic)	√				
Public toilets - presence/absence -open/closed -maintenance	 √ √ √	 √ √		 √	

Appendix 1. CRAINZ Domains and sub domains and data sources

Domain/sub-domain	Source of data	Year data collected	Scale of data collection
1. Education			
Kindy/daycare/playcentres	Ministry of Education	2008	National
Primary schools	Ministry of Education	2008	National
Intermediate/full primary schools	Ministry of Education	2008	National
Secondary schools	Ministry of Education	2008	National
2. Transport			
Bus stops & train stations	Territorial Local Authority	2008	TLA
3. Recreation			
Accessible green space (sq km)	Modified data from the Ministry of the Environment and Land Information New Zealand	2005/2006	National
Sports facilities (number)	Internet and GeoSmart	2008	TLA
Beaches (sq km)	Data from the Ministry of the Environment and Terra Link International	2005	National
4. Social & Cultural			
Museums/art galleries	Internet	2008	TLA
Public libraries	Internet	2008	TLA
Churches	GeoSmart	2008	TLA
Cinemas	Internet	2008	TLA
Community halls/centres	Internet	2008	TLA
Marae	Takoa directory and Internet	2005	National
Cafes and restaurants	Territorial Local Authority	2008	TLA
Alcohol outlets (hotels, taverns, clubs, bottle stores)	Liquor Licensing Authority		National
5. Food retail			
Supermarkets	Internet	2008	National
Convenience stores/dairies	Territorial Local Authority	2008	TLA
Petrol Stations	Internet	2008	National
Fast food outlets	Territorial Local Authority	2008	TLA
Butchers & Fishmongers	Territorial Local Authority	2008	TLA
Bakeries	Territorial Local Authority	2008	TLA
Greengrocers	Territorial Local Authority	2008	TLA
6. Financial			
Banks, Credit Unions & ATMs	Internet and GeoSmart	2008	National/ TLA
Post offices	Internet and Geo-spatial company	2008	TLA
7. Health			
General practitioners	Ministry of Health	2003	National
Pharmacies	Ministry of Health	2003	National
Plunket	Internet	2004	National
8. Other Retail			
Shopping centres/malls	Internet and GeoSmart	2008	TLA
Video shop	Internet	2008	TLA
Retail - Op Shop	Internet	2008	TLA