How Walkable is Melbourne?

The Development of a Transport Walkability Index For Metropolitan Melbourne.

Place, Health and Liveability Research Program

Billie Giles-Corti, Suzanne Mavoa, Serryn Eagleson,
Melanie Davern, Rebecca Roberts & Hannah Badland

THE UNIVERSITY OF MELBOURNE
MELBOURNE SCHOOL OF POPULATION & GLOBAL HEALTH

McCaughey VicHealth
Community Wellbeing Unit

Recommended citation:

Giles-Corti, B., Mavoa, S., Eagleson, S., Davern, M., Roberts B., Badland, H.M., (2014) Transport Walkability Index: Melbourne. McCaughey VicHealth Centre for Community Wellbeing,
Melbourne: The University of Melbourne.

ISBN Numbers:

978-0-9804620-3-6 (Digital); 978-0-9804620-4-3 (Print)

Photography:

Jana Petrakov

CONTENTS

EXECUTIVE SUMMARY

Creating walkable compact cities is a global priority, and also a priority in Melbourne. There is a growing body of evidence showing that city design has a profound impact on the willingness and ability of residents to walk for transport. Higher density, mixed use developments with connected street networks encourage more local walking for transport. Encouraging active forms of transportation is not only beneficial for traffic management and the environment, but is also very beneficial for the health and wellbeing of residents.

This report outlines the development of a Transport Walkability Index. Drawing on research initiated in the United States and further developed in Adelaide and Perth, we have developed and mapped a walkability index with three components found to be associated with walking for transport: mixed use planning, population density and street connectivity. This could be used by decision-makers to identify areas for renewal to increase local walkability; and to monitor progress towards creating more walkable neighbourhoods over time.

We welcome feedback about the transport walkability index and its use to inform policy and practice.

NOMENCLATURE

ABS	Australian Bureau of Statistics
ANDS	Australian National Data Service
AURIN	Australian Urban Research Infrastructure Network
GIS	Geographical Information System
LGA	Local Government Area
MPA	Metropolitan Planning Authority
RMF	Regional Management Forum
SA1	Statistical Area 1

INTRODUCTION

Creating walkable neighbourhoods is a global priority and a priority in Melbourne.[1] Compact walkable neighbourhoods promote active modes of transport including walking, cycling and public transport use.[2] Walkable neighbourhoods provide individuals and communities with a range of tangible health, economic and environmental benefits[3] by: increasing physical activity levels,[2] which reduces the risk of obesity;[4] improving neighbourhood social capital[5] and sense of community,[6] lowering the risk of traffic incidents,[7] increasing local economic spend[8] and reducing greenhouse gas emissions.[9] Hence, there is growing recognition that creating walkable communities would not only be good traffic management and the environment, but would also produce important health benefits.[2]

Walking for transport is defined as walking *en route* to destinations or to public transport. There are a variety of reasons why people choose walking as a means of transport: it is low cost, easier than driving for some, some have no choice because they are unable to drive (e.g., children, adolescents or older adults), while for others it is convenient. However, the ability of residents to walk locally, depends on the way their neighbourhood is designed. Walking for transport is more likely if neighbourhoods have well-connected street networks, a variety of local destinations including public transport, and there is adequate residential and employment density to support local shops, services and public transport.[10] Evidence from Australia and across the world shows that residents of more walkable neighbourhoods (i.e., connected street networks, mixed use planning and higher densities) are around twice as likely to walk for transport as those living in 'low' walkable neighbourhoods.[11-14]

There is consistent evidence that the combination of higher residential densities, well-connected street networks and mixed land uses are positively associated with people walking for transport to local destinations.[10, 11, 15] Hence, across the world, these variables have been combined into a transport walkability index using a methodology first developed by Frank in the United States,[4, 16] then trialled in Adelaide Australia for the PLACE study[17] and further developed in Perth for the RESIDE study.[11, 18] Using this index, people living in neighbourhoods with connected street works, higher population density and a variety of local destinations (e.g., jobs, shops, services,) score higher on the transport walkability index. In contrast sprawling areas with cul-de-sacs, lower population densities and fewer local destinations receive a lower score.

The Transport Walkability Index has numerous applications including the ability to inform policymakers and planners where investment is required to improve the walkability of an area. If repeated over time, it can be used to monitor progress over time. Can the walkability of an area be enhanced? Some of the options available to improve walkability include improving the street network connections for walking; focussing urban densification and development around public transport hubs which provide local shops and services; and designing new greenfield developments, and retrofitting sprawling neighbourhoods, with medium to high density developments with active street frontages.[19] The walkability index could therefore be used to provide input into planning future communities and urban renewal. Hence this report describes the development of a Transport Walkability Index for Metropolitan Melbourne. The index was calculated using spatial data in Metropolitan Melbourne and visualised in a thematic map.

Calculating the Transport Walkability Index

The Transport Walkability Index has been calculated based on the collaboration between health researchers and geographical information specialists working together to answer the question "What makes a pedestrian-friendly neighbourhood and how can it be measured?" The goal is to measure transport walkability, the importance of the input datasets and measurement procedures.

Input data

Calculating the Transport Walkability Index required the input of three main datasets residential density, street connectivity and land use mix. Figure 1 below outlines the source and geography of these datasets each of which have been imported and harmonised within a Geographic Information Systems (GIS) platform.

Further information relating to the importance of each dataset and the method used to calculate the transport walkability index is outlined below.

Not Applicable Areas

Areas determined as being not applicable for walking for transport have been modelled based on the Australian Bureau of Statistics (ABS) SEIFA index [20] and the criteria for this includes:

- has no usual addresses;
- the usual resident population is less than or equal to 10;
- the area is classified as off-shore or migratory;
- there are less than 6 employed persons;
- there are less than 6 classifiable occupied private dwellings;
- the proportion of people in private dwellings is less than or equal to 20% and
- the denominator of a variable in the index is less than 6.

Residential density

Residential density is an important variable for the creation of walkable neighbourhoods. Higher density neighbourhoods generally result in the creation of more uses of land decreasing the distance between home and local destinations.

For the Transport Walkability Index the gross dwelling density was calculated by dividing the number of dwellings within a small statistical area (defined by the ABS) by the area of the statistical area. More semi-rural areas with very low gross residential densities of less than 3 dwellings per hectare were excluded from the analysis along with areas without a population because they were deemed to represent either a peri-urban or non-relevant environment.

Street connectivity

One factor used to assess the degree of sprawl in a community is the degree to which streets networks are connected. Well connected street networks facilitate both the provision of direct pedestrian routes as well as supporting route diversity when travelling between an origin and destination. Higher levels of street connectivity have been positively associated with walking for transport.[21] The two examples provided in Figure 2 below illustrate the different distances able to be walked in areas of high and low walkable areas.

For the transport walkability index street, connectivity was calculated by identifying intersections with 3 or streets forming an intersection. The number of intersections meeting this criterion was then divided by the area of the SA1. Intersections were extracted from road network data [22].

Land use mix

Neighbourhoods which support walking for transport also include a range of complementary land uses that are located together in a balanced mix, including residential development, shops, employment, and community and recreation facilities. This is because the diversity of destinations means that people are able to walk to services and jobs.

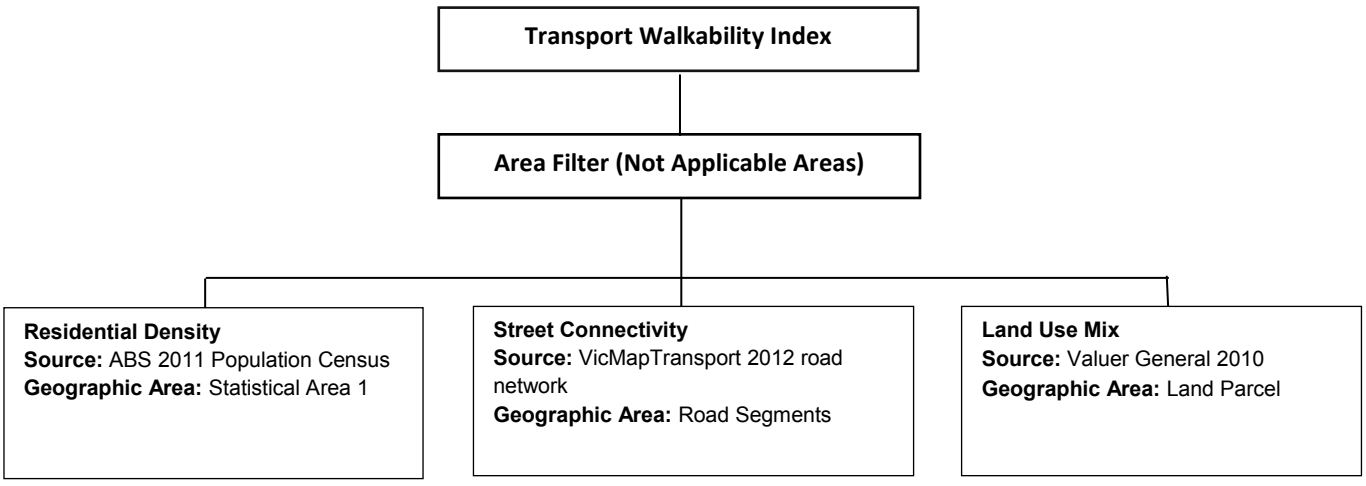

Figure 1: Schematic Diagram of data inputs in to the Transport Walkability Index

Other benefits of a high level of mixed land use for walking are the enhanced vitality and perceived security of areas; these are improved through the increase in natural surveillance, which can be attributed to the higher number of people on the street and in public spaces.

For the Transport Walkability Index, land use mix was derived based on the Valuer-General Victoria (2010) dataset[23]. Using the Australian Valuation Property Classification Code (AVPCC) each land parcel was classified according to five categories: residential, retail, commercial, community (e.g. schools, libraries), and recreation facilities (*excluding* public open space). The land use categories were selected based on research that has shown that these types of land use are associated with walking for transport.[11] Each land parcel was assigned a single land use. Where there are multiple land uses in a single parcel (e.g., a building with a shop on the ground floor, and apartments above) a single land use was selected based on the following priority: retail, commercial, community, recreation (excluding public open space), residential, and other. Land use classes were based on classes used by the Western Australia Ministry for Planning [24]. The priority was determined by researchers who considered the likelihood of the land use being treated as a destination to walk to and was based on previous analyses by Christian and colleagues.[11]

Land use mix for a given SA1 area was calculated using an entropy formula,[16] which produces a value between 0 and 1. A score of 0 means that the SA1 contained a single land use. In contrast a land use mix score of 1, means that the SA1 contained an equal area of all land uses.

Bringing the data together to form the Transport Walkability Index

Each of the values for the input datasets (Residential Density, Street Connectivity and Land Use Mix) were normalised (via z-scores), and all the values were then brought into the range 0-1. The final Transport Walkability Index was calculated by summing the z-scores for dwelling density, street connectivity, and land use mix (this method has been adapted to the data available in Melbourne, however it follows a similar method as previous studies presented by Christian and colleagues[11] and Frank and colleagues.[16].

For ease of interpretation, the Transport Walkability Index scores have been scaled so they can be interpreted as deciles for visualisation and analysis, rather than using the sum of the z-scores. The individual index scores are still provided for research purposes within the output, and can still be interrogated within a GIS platform.

Figure 2a: Highly connected

(Data sourced from VicMap Transport, 2012)

Figure 2b: Low connectivity

MAPPING THE TRANSPORT WALKABILITY INDEX

Maps provide the ability to visualise the Transport Walkability Index in a geographic context. The following series of walkability maps illustrate the results of the index across Metropolitan Melbourne. Levels of transport walkability are presented as 'deciles of walkability' with the more walkable areas indicated in shades of green, with the most walkable areas in darkest green. Low walkable areas, on the other hand, are shown in shades of orange (i.e., less walkable) to red (i.e., least walkable). As can be seen, most of the outer areas generally exhibit low transport walkability, while inner Melbourne is generally shown in shades of green indicating much higher transport walkability.

Within the map it is possible to detect anomalies in which the map deviates from expected results. For example the Docklands located on the edge of the Melbourne CBD has been developed as a shopping and entertainment precinct. However, the statistical area to the west of the Docklands is scored within the third least walkable areas in Metropolitan Melbourne. This score is the result of a number of factors including the road network which is relatively linear and does not contain many intersections, the relatively low land use mix (at the time of data collection), and the large geographic area. It is understood that this area is undergoing rapid change and development and we will monitor progress overtime, when we update the Transport Walkability Index in the future.

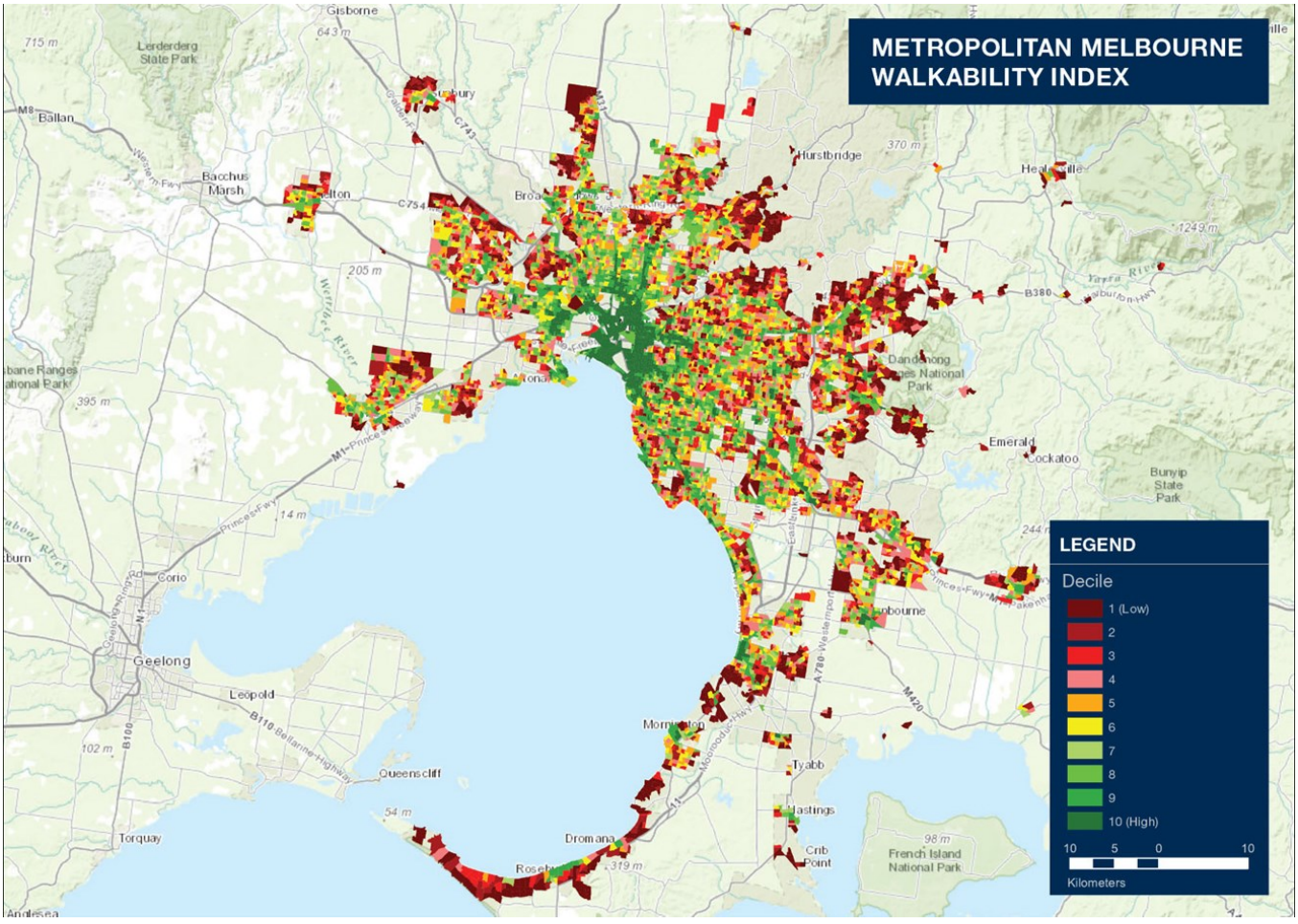

Figure 3: Metropolitan Melbourne Transport Walkability Index

CHALLENGES AND RECOMMENDATIONS

When developing the Transport Walkability Index a number of challenges and limitations were faced. Here we list some of the most important challenges and some recommendations on how to overcome them in the future.

First, the quality of the output rests on the quality and completeness of each of the input data layers. The datasets used in the analysis originate from data collections undertaken in 2010, 2011, and 2012 and this will impact the results. We strongly recommend that agencies make the relevant data readily available for use as developed as this will enable the production of the most up-to-date maps possible.

Finally, the Transport Walkability Index we have developed includes only three variables: street connectivity, mixed land use and density. A number of other variables could be added: for example, traffic exposure, access to footpaths and access to public transport are also important. Future iterations of the Transport Walkability Index could be validated to include other environmental characteristics known to be associated with whether or not residents walk.

NEXT STEPS

Translating the results of research into policy and practice is the key driver for developing the walkability index. We look forward to local and state government feedback in this next phase. However, in the meantime, the results of the study are currently being formatted into Local Government Areas and will shortly be distributed through Community Indicators Victoria (www.communityindicators.net.au).

ACKNOWLEDGMENTS

Our industry partners for the Place Health and Liveability Program, the Department of Health NW Region and the NW Regional Management Forum are acknowledged. In particular, the assistance of the former Chair of the NW RMF, Mr Jim Betts, in facilitating access to the data used in this project is gratefully acknowledged. This project is an off-shoot of other walkability projects funded by the Australian Urban Research Infrastructure Network and this funding is gratefully acknowledged, together with the technical and leadership AURIN teams members, (particularly Professor Bob Stimson, Associate Professor Chris Pettit, Dr Martin Tomko, Gus Macaulay and Dr William Voorsluys for their assistance with this project). Details of this project can be found on the AURIN website http://docs.aurin.org.au/help/analysing-your-data/walkability-tools/. MD, SM and RB are supported by Community Indicators Victoria, which is funded by VicHealth. BGC by a National Health and Medicine Research Council (NHMRC) Principal Research Fellowship (#1004900) and VicHealth. HB is supported by the NHMRC CRE in Healthy Liveability Communities (#1061404). In addition, this project would not be possible without the support of the GIS team at the UWA Centre for the Built Environment and Health (CBEH). The CBEH's RESIDE study team have contributed to intellectual capital that underpins this project and this expertise and contribution is gratefully acknowledged. In particular, the advice and support provided by Dr Bryan Boruff and Mr Nick Middleton (NJM Spatial) are gratefully acknowledged.

Finally, the walkability index is comprised of three main datasets and we would like to acknowledge each of the data custodians: the Office of the Valuer General for the Land Use data, Victorian Government for the Roads layer and the Australian Bureau of Statistics (ABS) for the residential density.

REFERENCES

1. State of Victoria. Plan Melbourne - Metropolitan Planning Strategy. In: Department of Transport Planning and Local Infrastructure, ed. Treasury Place, Melbourne: Victorian Government; 2014.
2. Transportation Research Board. *Does the built environment influence physical activity? Examining the evidence.* Washington, DC: TRB; 2005.
3. Giles-Corti B, Foster S, Shilton T, Falconer R. The co-benefits for health of investing in active transportation. *New South Wales Public Health Bulletin.* 2010;21:122-127.
4. Frank LD, Andresen MA, Schmid TL. Obesity relationships with community design, physical activity, and time spent in cars. *Am J Prev Med.* Aug 2004;27(2):87-96.
5. Leyden KM. Social capital and the built environment: the importance of walkable neighbourhoods. *American Journal of Public Health.* 2003;93(9):1546-1551.
6. Wood L, Frank LD, Giles-Corti B. Sense of community and its relationship with walking and neighborhood design. *Soc Sci Med.* 2010;70 (9):1381-1390.
7. Litman T. Transportation and public health. *Annu Rev Public Health.* 2013;34:217-233.
8. Heart Foundation of Australia. *Good for business. The benefits of making streets more walking and cycling friendly. Discussion Paper.* Adelaide: Heart Foundation of Australia,; 2011.
9. Frank LD, Greenwald MJ, Winkelman S, Chapman J, Kavage S. Carbonless footprints: promoting health and climate stabilization through active transportation. *Prev Med.* Jan 2010;50 Suppl 1:S99-105.
10. Ewing R, Cervero R. Travel and the Built Environment. A meta-analysis. *J Am Planning Assoc.* 2010;76(3):265-294.
11. Christian HE, Bull FC, Middleton NJ, et al. How important is the land use mix measure in understanding walking behaviour? Results from the RESIDE study. *Int J Behav Nutr Phys Act.* 2011;8:55.
12. Knuiman MW, Christian HE, Divitini ML, et al. A Longitudinal Analysis of the Influence of the Neighborhood Built Environment on Walking for Transportation: The RESIDE Study. *Am J Epidemiol.* Sep 1 2014;180(5):453-461.
13. Witten K, Blakely T, Bagheri N, et al. Neighborhood built environment and transport and leisure physical activity: findings using objective exposure and outcome measures in New Zealand. *Environ Health Perspect.* Jul 2012;120(7):971-977.
14. Kerr J, Sallis JF, Owen N, et al. Advancing science and policy through a coordinated international study of physical activity and built environments: IPEN adult methods. *J Phys Act Health.* May 2013;10(4):581-601.
15. Frank L. *How land use and transportation systems impact public health: a literature review of the relationship between physical activity and built form.* Atlanta: Centers for Disease Control and Prevention; 2000.
16. Frank LD, Schmid TL, Sallis JF, Chapman J, Saelens BE. Linking objectively measured physical activity with objectively measured urban form: findings from SMARTRAQ. *Am J Prev Med.* 2005;28(2 Suppl 2):117-125.
17. Leslie E, Coffee N, Frank L, Owen N, Bauman A, Hugo G. Walkability of local communities: using geographic information systems to objectively assess relevant environmental attributes. *Health Place.* Mar 2007;13(1):111-122.
18. Learnihan V, Van Niel KP, Giles-Corti B, Knuiman M. Effect of Scale on the Links between Walking and Urban Design. *Geographical Research.* May 2011;49(2):183-191.
19. Adams R. *Transforming Australian Cities. For a more financially viable and sustainable future. Transportation and urban design.* Melbourne: City of Melbourne and Places Victoria; 2010.
20. Talen E. The walkable neighborhood: A literature review. *Int J Sustainable Land Use and Urban Planning.* 2013;1(1):42-63.
21. Talen E. The walkable neighborhood: A literature review. Int J Sustainable Land Use and Urban Planning. 2013;1(1):42-63.
22. State Government of Victoria. VicMap Transport; 2012.
23. Valuer General Victoria. Property Sales and Valuations (PSV). Melbourne; 2010.
24. Ministry for Planning Western Australia. Commercial Land Use Survey 1997: Perth Metropolitan Region. W.A.P. Commission: Perth; 2000.

McCaughey VicHealth Community Wellbeing Unit

Centre for Health Equity
Melbourne School of Population and Global Health

Level 5, 207 Bouverie Street
University of Melbourne, Victoria 3010 Australia
T: +61 3 8344 9101
E: info-mccaughey@unimelb.edu.au

www.mccaugheycentre.unimelb.edu.au