

Living on the Edge: transport sustainability in Perth's Liveable Neighbourhoods

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This thesis is presented for the degree of Doctor of Philosophy of Murdoch University

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I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution

.....:

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# *Abstract*

Following World War Two, land use and transport policy and practice in most major Australian cities was modelled on the US experience. As such, these cities have become characterised by urban sprawl (indicated by segregated zoning and low development densities) and car dependence. In Perth, Western Australia, these characteristics are particularly evident despite, or perhaps because, the city has a strong regional planning system unlike most American cities.

Car dependence and sprawl are in turn linked to dependence on fossil fuels for transport energy. Increasingly, too, links are being found between conventional planning outcomes and public health. For example, research has linked car dependence with a variety of health conditions including respiratory illness, overweight and obesity. Moreover, research is increasingly linking sprawl and car dependence with social justice issues because people on limited income and with decreased mobility struggle to undertake their life's work.

In response to these concerns the Western Australian planning system introduced Liveable Neighbourhoods, a new design code, which was meant to reduce car dependence and sprawl. This code has its roots in New Urbanism and appears to have been taken up more rapidly in Perth than elsewhere. No large-scale evaluation of New Urbanism has previously been conducted anywhere.

This thesis reports on an extensive literature review, travel survey (n=211), perceptual study (n=992) and environmental study, which together sought to evaluate whether the Liveable Neighbourhoods (LN) design code is contributing to a sustainable transport

agenda. In total, 46 neighbourhoods (11 LNs and 35 CNs) were compared. The research found that despite residents of Liveable Neighbourhoods driving less and walking more than residents of conventional neighbourhoods (CNs) (a switch of 9% with some associated health advantages), there was little else to indicate that LN is achieving its goals as transport VKT and fuel use was identical due to regional transport requirements diminishing any local walkability advantages.

There was strong supportive evidence that LNs were not significantly different to CNs. For example, there were few differences in perception of opportunity for more sustainable travel and residents of CNs actually had better access, on average, to key destinations, including shops (i.e. the average distance to key destinations was 2.2 kilometres compared with 2.5 kilometres in LNs). Also, residential lot densities were well below what were intended by LN and in both LNs and CNs the time for public transport to get people to work was over 90 minutes compared with around 30 minutes by car.

The results reveal that there must be significant revisions to the LN code and how it is applied, because there is no evidence that new neighbourhoods are improving regional transport sustainability. In particular, residential densities and land use mix appear to be too low to encourage community self-sufficiency, indicated by few neighbourhoods being anchored by key destinations. These matters are not mandated in the LN guidelines making them powerless to bring significant change. More generally, the thesis questions the extent to which New Urbanism can promote a sustainable transport agenda wherever it is applied unless it mandates real changes in land use and transit not just local walkability.

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# *List of acronyms*

<b>AAA</b>	Automobile Association of Australia
<b>ABARE</b>	Australian Bureau of Agricultural and Resource Economics
<b>Au</b>	Australia (typically used in a reference to Australian dollars)
<b>BMI</b>	Body Mass Index
<b>BP</b>	British Petroleum
<b>CBD</b>	Central Business District
<b>CCD</b>	Census Collection District
<b>CDC</b>	Centers for Disease Control and Prevention (United States of America)
<b>CN</b>	Conventional neighbourhoods
<b>CPTED</b>	Crime Prevention Through Environmental Design
<b>DPI</b>	Department for Planning and Infrastructure
<b>ECan</b>	Environment Canterbury (Canterbury Regional Council, New Zealand)
<b>ha</b>	Hectares
<b>ISTP</b>	Institute for Sustainability and Technology Policy
<b>km</b>	Kilometres
<b>LN</b>	Liveable Neighbourhoods
<b>MfE</b>	Ministry for the Environment (New Zealand)
<b>NHS</b>	National Health Service (United Kingdom)

**OPEC**..... Organization of Petroleum Exporting Countries

**PATF**..... Premier’s Physical Activity Task Force (Western Australia)

**PATREC**..... Planning and Transport Research Centre (Western Australia)

**PM**..... Particulate Matter

**POD**..... People-Oriented Development

**PT**..... Public Transport

**RA**..... Residents’ Association

**RESIDE**..... RESIDential Environments Project (University of Western  
Australia)

**TOD**..... Transit-Oriented Development

**TSH**..... Transport Sustainability and Health (study)

**UK**..... The United Kingdom

**US**..... The United States of America (also used to reference United  
States dollars)

**UWA**..... University of Western Australia

**WAPC**..... Western Australian Planning Commission

**WCTRS and ITPS**.... World Conference on Transport Research Society and Institute  
for Transport Policy Studies

**WHO**..... World Health Organization

**WWII**..... World War Two

# *Key concepts*

## **Access**

For the purposes of this study, access refers to the ease with which a person can get to a select physical destination (Litman, 2003). Access varies as a function of the mode of choice and all manner of trip conditions. For example, poor infrastructure between a home and a local shop may drastically affect accessibility, even if the distance is short. Even small changes to land use and infrastructure can alter how easy it is to access destinations by one or more modes.

## **Alternative modes/active modes**

Alternative modes are modes other than the private motor vehicle. These include the various forms of public transport, such as trains, buses and ferries, and ‘active modes’, such as walking and cycling. Skateboards, foot-powered scooters and the like may also be considered active modes. As the thesis is focused on the urban passenger and individual transport task, aircraft are not mentioned in any discussions and neither is freight.

## **Car dependence**

Newman and Kenworthy (1989; 1999) are credited with conceptualising automobile (or car) dependence. Car dependence characterises cities where transport planning has been focused on imperatives for drivers and over time, alternative modes have lost their competitiveness. People therefore come to rely on motor vehicles to conduct much of their travel because there are few, if any, suitable alternatives (Newman, 2006). Newman and Kenworthy (1999) suggest a density threshold of 20-30 persons per

hectare below which car dependence can be assumed. This is because it becomes difficult to serve people with a quality public transport system below this threshold (discussed more in Chapter 6) and distances between homes, services and places of employment become too great to walk or cycle. Intuitively, car dependence is linked to sprawl because low density development and segregation of land uses reduce the attractiveness and efficiency of public transport, walking and cycling (Hotlzclaw, 1990; Kenworthy and Laube, 2005; Newman and Kenworthy, 1999).

Litman (1999; 2002) adds to understanding of the characteristics of a city that make it car dependent and dispels some of the vagaries associated with the term. Litman's (2002) argument is that car dependence is the product of a range of measurable variables, such as vehicle ownership and use, and frequency of trips. In the literature review presented in this thesis (Chapters 1-7) it is explained how many areas of Perth are car dependent. Such car dependency served as a backdrop against which the Liveable Neighbourhoods policy was developed.

### **Car preference**

Car preference refers to people's choice to drive. It is distinct from car dependence, which implies that use of the car is necessary. For example, preferential rather than necessary use of a car would be a person's decision to drive two hundred metres to local shops when they could easily and efficiently conduct the trip by walking. The distinction between preference and dependence is further developed in Chapter 3.

### **Fossil fuel dependence**

Fossil fuel dependence is related to car dependence. The motor vehicle fleet presently relies almost exclusively on oil for transport energy (the implications of which are

discussed in Chapter 5). Accordingly, changes to demand for and supply of oil can have far-reaching consequences for transport systems<sup>1</sup>.

### **Greenfield development**

This refers to development of land that was previously farmland, vegetated or otherwise ‘green’. It is distinct from *brownfield* development, which refers to recycling of land that previously served some other urban function (for example, conversion of disused light industrial land to housing). Conventional greenfield development, which usually occurs on the fringe of cities, perpetuates sprawl.

### **Local travel**

‘Local travel’ is a subjective concept, however, for the purposes of this study, it may be defined as a short trip made within a person’s own neighbourhood. It can be easier to conceive local travel to be a trip made within a walkable neighbourhood (see below) as this gives a measure of distance.

### **Mobility**

How mobile a person is, in the context of this study, is how able they are to conduct their life’s work. Mobility at the personal level is influenced by physiology. A disability, for example, may render some people unable to walk or cycle. It is also influenced by the availability of different modes of transport. The availability of a car, for example, will almost certainly make a person more mobile than if they were to rely on walking, cycling and public transport. Mobility is distinct from access.

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<sup>1</sup> A change in demand may be instigated by significant increases in vehicle ownership and VKT (such as is occurring in China) and a change in supply may occur if the Organization of Petroleum Exporting Countries (OPEC) shifts production levels.

## **Permeability/connectivity**

These terms are often used interchangeably. They refer to the ratio of the network to the straight-line (or Euclidean) distance of a trip. These values will almost always differ as routes rarely directly link an origin with a destination<sup>2</sup>. A ratio close to 1:1 represents good permeability/connectivity.

## **Sprawl**

Sprawl refers to a state of decentralised urban development and often characterises cities where there are few geographical barriers to outwards growth, significant investment in road infrastructure and piecemeal urban growth over time. There are four widely accepted measures of sprawl, which together can be organised into an index (Ewing *et al.*, 2002). These measures are low densities, segregated land uses, and a lack of network permeability and urban vitality.

## **Walkable neighbourhoods**

Public health academics concerned about achieving recommended levels of walking define a walkable distance as 1.5 or 1.6 kilometres (McCormack *et al.*, 2007) corresponding to a brisk 15 minutes of walking time (Saelens *et al.*, 2003a). Other research has found, based on participant feedback, that walkable neighbourhoods may actually be closer to 1 kilometre in diameter (Moudon *et al.*, 2006).

Holtzclaw (1994) used buffers of around 400 metres to define walkable catchments. The Liveable Neighbourhoods guidelines themselves refer to a 400-metre neighbourhood radius being the target for new neighbourhoods (Western Australian

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<sup>2</sup> A good example of the contrast between network and straight-line distance is given in Chapter 2.



Planning Commission, 2004). Accordingly, the Transport Sustainability and Health study was interested in two buffers: one at 400 metres and a second at 1.5 kilometres.



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