



Mapping urban residential density patterns: Compact city model in Melbourne, Australia

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ABSTRACT

The advocacy of the notion of 'compact city' as a strategy to reduce urban sprawl, to support greater utilisation of existing infrastructure and services in more established areas and to improve connectivity of employment and transit hubs is vigorously debated in urban research. Using the urban residential density as a surrogate measure for urban compactness, this paper empirically examines the cadastre database that contains details of every property in order to capture changes in urban residential density patterns in Melbourne, Australia using geospatial techniques. The paper discusses the realisation of the density aspect of compact city policy implemented in Melbourne 2030 Plan. The policy of densification in pursuit of a more compact city has produced mixed results. The findings of this study indicate that urban densities across the buffer zones around Melbourne CBD are significantly different. The dwindling dwelling counts in the inner suburbs and a rapid densification of the inner outer zone is surprising, with urban development following contrasting patterns to what was anticipated to emerge after such a policy change. Contrary, the dwelling density around the designated Activity Centres between the first two zones are statistically insignificant – questioning the fundamental purpose of the compact city model to increase the residential density around significant economic and transit hubs. The 'hollowing effect' (i.e. a localised reduction in dwelling densities) observed in the analysis around inner suburbs necessitates us to further examine the quality of data input particularly the coding of multi-storey developments and land sub-divisions into the cadastre database.

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Introduction

Land use planning is an integral part of the viability and liveability of a metropolitan area because it affects decisions about where and how we live. Over the last few decades, government agencies and local councils in Australia have been continually developing and adopting land use planning strategies to contain and manage urban growth. Similar approaches such as 'Smart Growth' in United States, and the 'compact city' and 'intensification' in Europe, were devised and adopted to regulate and contain urban sprawl. A 'paradigm shift' in urban policy development can be seen as indicated by drastic changes in policy that has favoured counter-urbanisation over suburbanisation, in Australia. The general purpose of this shift is to reduce urban sprawl and support greater utilisation of existing infrastructure

and services in more established areas, particularly in the inner and middle-ring suburbs. Prior to this shift, suburbanisation was heralded for stimulating economic growth, for generating employment with strong multiplier effects and for the development of infrastructure in urban fringe. Such policies associated with this shift are designed to transform Australian cities so that they are more compact and connected to employment hubs and nodes of social and cultural activities. Burton (2000) argues that the 'compact city' may increase use of public transport as well as encourage the uptake of walking and cycling for transport. This in turn is proposed to reduce car dependence and promote sustainability.

Over the past few decades, the notion of a compact city has become a *cliché* in urban policy debate around the world. Undoubtedly there are many advantages associated with a compact city model. Containment of urban expansion, better access to services and amenities, reduced car dependency and more frequent use of public transport

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are some examples (Burton, 2000; Dieleman, Dijst, & Spit, 1999). However, higher density does not automatically guarantee these benefits, rather they are contingent on the concomitant provision of infrastructure, employment, services and amenities. On the contrary, counter-arguments against the compact city concept (as noted by Burton, 2000) such as depletion of open spaces, overcrowding and an inflated housing market (particularly around high access nodes), deter its adoption as a sustainable urban policy option. These effects are also influenced by other drivers such as housing tenure, dwelling type, land use pattern, cost of housing and access to finance (Randolph, 2006). Heavy investment of public funds has been committed in urban consolidation projects such as inner suburb renewal or urban rejuvenation as evidenced in various dockland developments in Melbourne, Green Square development in Sydney and inner city renewal projects in Brisbane to attract people to live in inner city areas.

Despite attempts to turn the rhetoric of the compact city model into reality, the implications of recent urban policy change implemented through urban development plans such as 'Melbourne 2030', 'Melbourne@5million' (Department of Planning & Community Development (DPCD), 2008a, 2008b), 'Sustainable Sydney 2030' and the 'South East Queensland (SEQ) Regional Plan' on urban form are yet to be thoroughly scrutinised. In addition, some of the planning constructs upon which the proposed policy shifts to a higher density living have been based (such as compact cities), are neither adequately understood nor statistically tested. Forster's (2006, p. 180) comment on the metropolitan planning strategies in Australia also suggest over-optimism for the future of Australian cities that sits dangerously at odds with the picture of increasing geographical complexity since the early 1990s. This is despite the wider use of these constructs in the pursuit of sustainable urban growth. Often, these constructs are generically defined for the purpose of strategic planning. We argue that the compact city policy need to be empirically examined at a micro-geographic level (i.e. the land parcel/block) so that the local effects of urban policy change on residential dwelling density can be better understood. The potential implications of the pursuit of sustainable urban form in recent years such as through mixed land use, higher population and dwelling density of inner suburbs, more diversified supply of housing in the local housing market and creation of social ecologies, can then be evaluated to inform future decisions. Targeted research on this topic has barely begun and this deficit underpins the impetus of this paper.

In order to explore the spatial characteristics of urban form and growth, this paper attempts to evaluate the change in residential dwelling densities before and after the implementation of the 'Melbourne 2030' Plan – a government planning framework pursued for the metropolitan capital city in the state of Victoria, Australia. Other reflections of compactness, such as employment density or land use mix, however, are not taken into account, which means its use is limited to the residential aspect of the notion of a compact city. In this study we will examine the research hypothesis that the current compact city model is likely to increase the residential dwelling density in inner suburbs and around the major Activity Centres because the

compact city policy encourages the development of multi-level/unit constructions in these areas.

To capture the change in urban density, two main sets of techniques are employed. First, a buffer analysis is applied to compute zonal statistics and test the difference in residential densities around the Melbourne central business district (CBD) and the Activity Centres designated in the plan. Second, at a metropolitan scale, a 'spatial autocorrelation' measure (i.e. Moran's I) is used to calculate the degree of spatial clustering of dwellings. To avoid geographic bias such as diversifying size and irregular shapes of suburbs or postcodes, the spatial analysis applied in this study uses a 1 km by 1 km grid to explore the changes in urban residential density patterns in Melbourne. This represents the spatial variability and the degree of densification within the Urban Growth Boundary (UGB).

The concept of compact city

The concept of compact city has been widely adopted as a planning tool in developed countries. Jenks, Burton, and Williams (1998) state that the compact city hypothesis combines various concepts of urban planning. Compactness can be defined as high-density or monocentric development (Gordon & Richardson, 1997), while for Ewing (1997) it means concentration of employment and housing and a greater diversity of land uses. Arguably compactness has been seen as a mechanism for controlling and regulating urban sprawl by promoting a relatively high-density, mixed land-use city structure, supported by a more efficient public transport system and increased opportunities for walking and cycling. The land use policy changes built around the concept of the compact city include the following:

- Intensification, consolidation or densification, particularly around inner suburbs.
- In-fill development and redevelopment of brownfield land.
- More intensive use of urban land.
- Sub-divisions and conversions of existing development.
- Re-zoning and greater mixing of land uses.
- Greater dwelling density and re-urbanisation.
- Higher degrees of accessibility.

Compactness has been conceptualised and measured in different forms. A range of methods have been proposed to quantify compactness of cities. Bertaud and Malpezzi (1999), for example, proposed a compactness index called *rho*, that determines the ratio between the average distance from home to central business district (CBD) and its counterpart in a modelled cylindrical city with equal distribution of development. More recently, Galster, Hanson, and Ratcliff (2001) defined compactness as the degree to which development is clustered to minimise the amount of land developed per square mile. Tsai (2005) applied a range of techniques (i.e. Gini, Geary and Moran and adjusted Geary indices) and evaluated their suitability to measure aspects of compactness on one end of the spectrum and urban sprawl on the other for a number of cities. Summarising the positive and negative effects of urban compactness in terms of social equity, Burton (2000) found that urban

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