# 11

# Sustainable Precincts: Transforming Australian Cities One Neighbourhood at a Time

Giles Thomson, Peter Newton and Peter Newman

## Introduction

The majority of urban development in Australian cities in recent decades has been delivered in a piecemeal manner, resulting in suboptimal development outcomes in terms of both sustainability and liveability. Considerable attention has recently been given to the capacity of

G. Thomson (✉)
Department for Strategic Sustainable Development,
Blekinge Institute of Technology (BTH), Karlskrona, Sweden
e-mail: Giles.redding.thomson@bth.se

P. Newton
Centre for Urban Transitions, Swinburne University of Technology,
Melbourne, VIC, Australia
e-mail: pnewton@swin.edu.au

P. Newman
Curtin University Sustainability Policy (CUSP) Institute,
Perth, WA, Australia
e-mail: p.newman@curtin.edu.au


P. Newton et al. (eds.), *Decarbonising the Built Environment*,
https://doi.org/10.1007/978-981-13-7940-6_11

Australia's burgeoning cities to continue to support the high quality of life we are accustomed to, while at the same time concerns over the sustainability of Australian cities has come to light. These combined factors highlight the need for more strategic approaches for planning our cities to address future sustainability and liveability needs. In addition, the shifting international policy agenda has highlighted the increasingly urgent need for improved sustainability outcomes as the next section explains.

Australia has recently signed the following high-level international sustainability frameworks: the Sustainable Development Goals (SDGs, September 2015) (United Nations General Assembly 2015), the *New Urban Agenda* (NUA, October 2016) (United Nations 2017) and the Paris Agreement (COP21, December 2015; United Nations 2015).

The need to decarbonise is mandated in all three high-level agreements, foremost of these is the Paris Climate Change Agreement where Australia's commitment is to reduce greenhouse gas emissions across the economy from 26 to 28% below a 2005 benchmark, by 2030. In the absence of federal leadership, several state and territory governments have introduced ambitious greenhouse gas emissions reduction targets including net zero emissions by 2050 in South Australia, ACT, Victoria, NSW, Tasmania and Queensland (ASBEC 2018; Newton & Glackin 2018). The need to translate these goals into effective policy will require coordination between all parts of the economy including industry, agriculture, energy and the built environment.

This chapter considers planning aspects of the built environment and how this sector can best respond to the sustainability agenda. It starts from the premise that comprehensive, as opposed to piecemeal, planning approaches can optimise the scale and performance of built environment outcomes. It offers a high-level discussion of the influence of transport systems on urban form at the city scale (*urban fabrics*); the need for greater attention on *infill* (brownfield and greyfield) development to discourage urban sprawl at city fringe (greenfield) locations; and, finally describes some of the benefits resulting from *precinct-scale planning* approaches. Sustainable precincts are described in terms of 'why' precincts should be considered and 'where' precincts should be located.

As Australia's major cities continue to grow, movement across them has become increasingly dysfunctional. This has led to renewed interest

in the historic way of building Australia's cities before the automobile, where transit such as trams and trains connected higher density walkable centres. The next section introduces the theory of urban fabrics as a way to think about various urban development patterns and the inseparable influence that dominant transport modes play upon urban fabrics and urban performance.

## The Theory of Urban Fabrics

The tram, train and especially the car, which currently dominate urban transport are all essentially products of the nineteenth century and each have produced a different urban fabric around their respective infrastructures (Newman, Kosonen & Kenworthy 2016). While modern versions of these modes are more developed in relation to safety and comfort, they are little changed in the key characteristics (capacity, effective speed), which determine how they accommodate urban travel and also how they shape our cities (Newman & Kenworthy 1999, 2015). In contrast, all of these modes represented a major leap forward over previous transport technologies (walking, horse drawn vehicles) when they were first introduced.

The way that cities are shaped by transport can be explained in terms of the Marchetti Constant relating to the travel time budget in cities (Newman & Kenworthy 2015). This suggests that throughout history, no matter what mode, the average travel time budget for work in a city has been just over an hour. Hence in a walking city the urban fabric is densely packed within a 30 minute walk radius (for the journey there and back); a tram and train-based city could spread further out to 10 or 20 kms at medium densities along corridors and still keep within the travel time budget for most people; then, finally the automobile-based city could spread 40 to 50 kms at much lower densities.

Current transport systems have gone backwards in recent years as traffic has slowed down and hence there is a revival of people choosing to live in dense, centrally located and well serviced walking fabric as well as in medium density corridors with good transit systems that can actually go faster than traffic (Newman & Kenworthy 2015). This change has

happened because cars on a freeway lane can only move around 2500 passengers per lane per hour whereas rail-based solutions can handle ten times the volume of passengers per hour in the same space (Table 11.1). The traffic is not just reducing the speeds of those in cars but any other vehicles (trucks, buses, trams, bicycles) caught up in the congestion. Thus urban efficiency as a whole has declined, notwithstanding the apparent improvement in personal mobility, suggesting that there is a need to regenerate cities using more efficient urban fabric as well as new technologies that can support this (Glazebrook & Newman 2018).

The theory of urban fabrics was developed by Newman, Kosonen and Kenworthy (2016) to help planners see that there are three main city types, not just one (automobile fabric), as has been suggested by modernist city planners since the 1940s. Urban fabric is shorthand for describing the urban environment (or urban morphology) that results from the different types of underlying infrastructure within a city as set out above. Urban fabric includes transport infrastructure, such as road or rail technology, building setbacks, road patterns and widths, which in turn shape the form of the more localised infrastructure of buildings, open space and utilities. The theory enables planners to create strategies for managing the different fabrics to highlight how some urban fabrics have inherently more sustainable properties that need to be optimised and extended to other parts of the city through infill strategies.

The three dominant city types from history that form the basis of urban fabric theory—walking cities, transit cities and automobile

**Table 11.1** Calculations of transport patronage capacity per hour per kilometre of lane space

| Transport mode | People per hour per km of lane space | Multiples of car capacity in a suburban street |
|---|---|---|
| Car in suburban street | 1000 | 1 |
| Car in freeway lane | 2500 | 2.5 |
| Bus in traffic | 5000 | 5 |
| Bus in freeway lane (BRT) | 10,000 | 10 |
| Light rail | 10,000–20,000 | 10–20 |
| Heavy rail | 50,000 | 50 |

*Source* Based on data extracted from Newman and Kenworthy (1999, 2015)

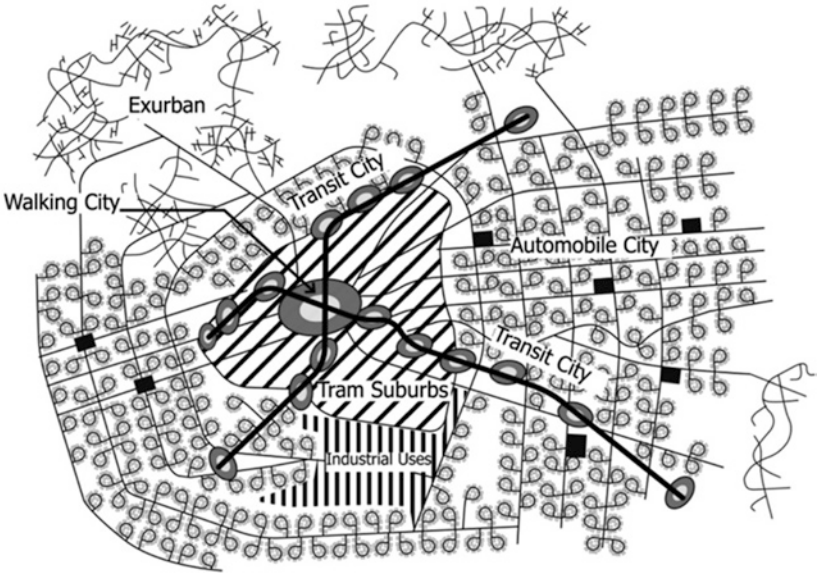


**Fig. 11.1** Automobile city, transit city and walking city: a mix of three city types (*Source* Newman and Kenworthy 2015)

cities—are obvious in most cities today depending on the age when the city was developed. Figure 11.1 shows a typical Australian city with its various fabrics, now dominated by automobile fabric in the past 60 years or so.

## Rediscovering Walking and Transit Urban Fabrics

Many modern cities are now attempting to reclaim the fine-grained street patterns associated with walkability (Gehl 2010) but often don't have the tools to do so, as modernist planning manuals rarely focus on pedestrian needs. However, this is slowly changing; for example, the new (US) National Association of City Transportation Officials (NACTO 2012, 2016) manuals and the work of Jan Gehl emphasise the importance of human-centred urban design (Gehl 1987, 2010) and

the importance of pedestrian prioritisation to make successful urban environments.

Transit city fabric has had a considerable revival in recent decades and is the preferred location—along with walking city fabric—for knowledge economy jobs such as education, hospitals and health professionals, and consulting services, with the highly spatially confined jobs associated with financial services, government and high-end services keeping to the old walking cities (Newman & Kenworthy 2015).

There has been a slowdown in the building of automobile fabric as walking and transit fabric have been rediscovered, leading to the phenomenon of 'peak car use' (Newman & Kenworthy 2015). This is important for low carbon living and in particular the value of urban precinct regeneration as they will be far more popular and lower in carbon if they are more like walking or transit fabric and in areas where the infrastructure supports this. The variations in urban density versus per capita consumption of energy use and corresponding emissions show this very clearly (see Fig. 11.2).

However, decarbonising cities is not as straightforward as simply substituting cars with electric vehicles, because as major Australian cities continue to grow, there are other real issues associated with the dominance of automobile urban fabric, especially where it extinguishes the best features of walking and transit fabric (Newman, Kosonen & Kenworthy 2016). The low-density automobile city is the most resource-consumptive type of urban fabric, due to its inefficient use of land and associated increases in basic raw materials for building longer roads, pipes and wires to service an increasingly dispersed population (Thomson, Newton & Newman 2016). In addition, low densities have economic and social outcomes that are significantly worse than other city types (Glaeser 2011). It is this recognition of the economic agglomeration benefits and greater social qualities that is driving the previously mentioned strong re-urbanisation of Australia's cities. This demand is being led by the 'creative classes' who value the role of people and place as well as proximity to workplaces that can all be found in greater proportions in denser, walking and transit-oriented, urban environments (Florida 2014).

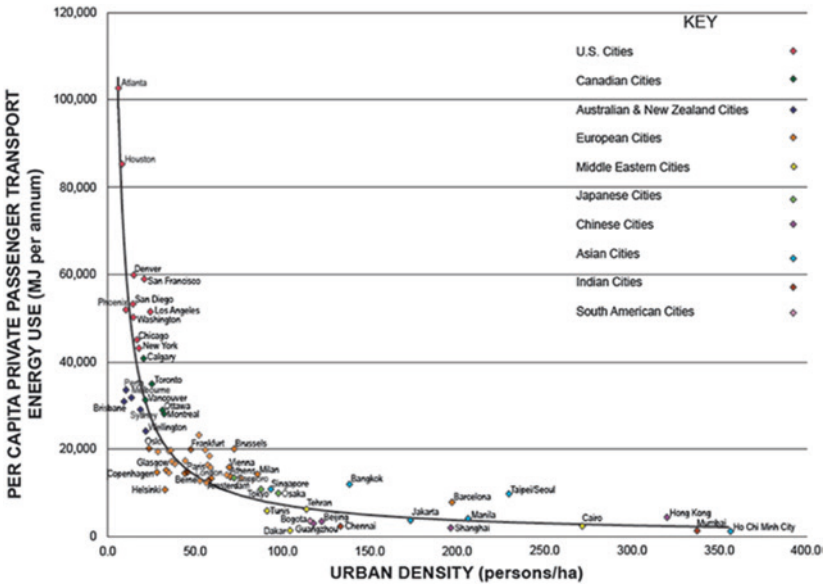


**Fig. 11.2** Urban density and transport fuels in global cities (*Source* Newman and Kenworthy 1999)

The creative classes are attracted to vibrant locations near transit and often in more central locations, rarely will urban fringe locations offer these qualities, thus highlighting the importance of urban regeneration in existing inner and middle suburban areas rather than outer areas.

## Urban Regeneration

This section looks at greenfields (outer peri-urban areas), brownfields (inner ex-industrial areas) and greyfields (established, ageing middle-ring suburban residential areas) and why urban regeneration needs to focus upon infill (greyfields plus brownfield) areas with a different model based on urban precincts.

Greenfields are those previously undeveloped sites, typically on the fringe of existing settlements. Greenfield development usually has the

least constraints and the business models of most Australian bulk project home builders are geared towards greenfield development. But they have high government costs resulting from the provision of infrastructure services such as road, sewerage and other utilities (Trubka, Newman & Bilsborough 2010a, 2010c) and high societal costs due to fuel consumption, commute times and greenhouse gas emissions related to long travel distances that are due to low-density localities that are not well serviced by public transport (Dodson & Sipe 2006; Newton, Pears et al. 2012; OECD 2012; Trubka, Newman & Bilsborough 2010b).

The increasing geographical spread of urban areas into greenfields is known as 'urban sprawl' (OECD 2018; UN-Habitat 2011), sprawl negatively impacts upon the city fringe agricultural and ecological land that it displaces. As observed by Newton and Thomson (2016) sprawl has been a consistent challenge for urban planners in Australia's cities since the mid-1950s, and remains so, given that the dominant mode of new housing development continues to be detached low-density (78% of all residential stock in 1971, 74% in 2011). All of Australia's metropolitan planning agencies have now established targets for 'infill' housing development (i.e. new housing built on previously developed land, including both brownfield sites and greyfield sites), and many of Australia's major cities are now experiencing strong re-urbanisation. Australia's five largest capital cities have infill targets ranging from 47% in Perth to 85% in Adelaide, with Sydney and Melbourne at 70% (Newton, Meyer & Glackin 2017). However, much new development is resulting in suboptimal outcomes following the piecemeal redevelopment approach of 'knock down, rebuild' involving the demolition of an older structure and replacement with either a new detached dwelling or townhouses that can be accommodated within current restrictive residential zoning (Newton & Glackin 2015; Newton, Meyer & Glackin 2017; Newton & Thomson 2016). As a result, most of Australia's major cities are failing to achieve the infill targets for new housing established in their strategic plans with the majority of dwelling construction projects continuing to occur on greenfield sites in the outer suburbs (Newton & Glackin 2018; Newton, Murray et al. 2012). Suboptimal infill effectively increases the development footprint through built form,

car parking and vehicle infrastructure, while only increasing densities slightly. The result has been the widespread erosion of those positive suburban qualities such as backyards, tree canopy and biodiversity (Hall 2007; Thomson & Newman 2017; Thomson, Newton & Newman 2016). There is a need for better models of infill development and this chapter suggests that urban precincts in well serviced, established middle suburban areas should be the focus of this.

The best urban regeneration outcomes result from a more complete recreation of an entire infill site at the block or precinct scale. This is because larger land parcels permit more integrated solutions to support distributed urban infrastructures such as energy, water and waste, while also optimising community facilities and shared open space arrangements (Newton et al. 2011). Urban regeneration may occur on infill sites in either brownfield or greyfield locations (Newton & Glackin 2014). Greyfields, unlike brownfields, usually have no need for site remediation. Greyfields in the Australian context have been defined as those ageing but *occupied* tracts of inner- and middle-ring suburbia that are physically, technologically and environmentally failing and which represent under-capitalised real estate assets (Newton 2010). They are predominantly located in the middle suburbs and as such provide greater access to employment, public transport and services than typical greenfield locations (Newton & Thomson 2016). There is significant potential for amalgamation of land parcels in greyfield locations to achieve precinct-scale lot consolidation. However, difficulties with site assembly, restrictive local planning schemes and NIMBY resistance represent considerable barriers, yet promising models have been proposed, some involving state and municipal government agencies as facilitators to engage with and build support amongst local communities (Newton, Meyer & Glackin 2017; Newton, Murray et al. 2012). Large infill parcels (i.e. brownfield or greyfield precincts) permit higher order urban regeneration responses. Larger sites offer the scale and flexibility to comprehensively plan sustainability and liveability enhancing opportunities, such as public transport, open space, distributed energy and integrated water infrastructures. Precincts and the opportunities they present are described in greater detail in the following section.

## Precincts—A Neighbourhood Scale for Planning

Precincts are unified areas of urban land with a clearly defined geographic boundary (Huang, Xing & Pullen 2017). A precinct, with the exception of institutional precincts, will contain private and public land with shared infrastructure. At the larger scale, precincts may be described as synonymous with neighbourhood or district. Precinct size can vary considerably. For example, a precinct may be quite small, such as the internationally well-known sustainable precinct BedZED in London (1.7ha); compared to Hammarby Sjöstad in Stockholm (250ha). Efficiencies tend to have physical thresholds. Therefore, the size of the land parcel available or the desired technology will influence the approach to urban design from an eco-efficiency perspective. For example, the minimum size for economies of scale (to reduce cost per unit) or maximum size for physical efficiency (such as 'pedsheds' for transport or district heating networks for heating buildings). Distributed technologies require a clustering of participating properties to enable planning at precinct scale.

In this situation, defining a boundary is perhaps more important than the scale of a precinct.

A well-defined geographic boundary for a precinct, with a clear governance structure can allow for the precinct to be managed and monitored at the local level, potentially permitting it to trial new distributed localised infrastructures such as renewable energy as well as building efficiencies managed through smart technology and new shared urban transport systems.

## Sustainable Precincts

Large sustainable precincts typically function as 'urban villages' in that they are optimise land with medium to high-density development; mixed-use zoning (residential uses mixed with retail, services and employment to reduce daily travel needs); and, the integration of high quality

urban greenery and social infrastructure to create a 'village' feel in a city context (to enhance quality of life) (UNEP 2016).

The sustainability advantages of precinct-scale regeneration are numerous and have been identified by Newton et al. (2011) as including:

- Accessibility: where mixing dwelling types with other land uses reduces travel time and encourages active transport modes such as walking and cycling
- Energy: carbon neutrality or zero carbon status is enabled with the introduction of distributed (renewable) energy and storage and microgeneration technologies as new elements of hybrid buildings or precincts, capable of generating energy for local use as well as for the national grid (Newton & Tucker 2011)
- Water: integrated urban water systems involving water-sensitive urban design at the precinct scale, with an appropriate mix of technologies for local water capture, storage, treatment and end use (Kenway & Tjandraatmadja 2009)
- Waste: precinct-scale redevelopment can optimise reuse of demolished stock and minimise the waste stream from new construction, as well as automate waste disposal and maximise recycling from occupied dwellings, including food waste (Crocker & Lehmann 2013)
- Green infrastructure: where greenspace can be maintained or enhanced rather than lost as a result of redevelopment due to the capacity of precinct-scale urban design to accommodate innovative dwelling, green space and streetscape typologies.

These objectives need to be reflected in contemporary precinct design processes and be subject to performance assessment—a critical deficit in contemporary urban development that mitigates against transition to sustainable low carbon cities (see Newton chapter, this volume).

While every site will require a different response, adhering to the key principles of well designed, precinct scale, medium to high-density urban fabric linked active transport and transit-oriented development with green space and social infrastructure, will put in place

robust infrastructural elements to maximise urban liveability, sustainability and desirability in Australian cities. In this sense, the principles run counter to some conventional planning approaches, born out of a post-WWII industrial modernism that specify single-use zoning, massive road construction and urban disinvestment to propagate 'suburban' monocultures. Suburban monocultures are typified by dormitory suburbs, bland shopping centres where ebb and flow activity is dependent upon opening hours, and car dependency. Well-designed, well-located mixed-use, medium density precincts can regenerate the urban fabric by creating urban villages. In a number of respects, this approach represents a return to traditional patterns of living seen in the early years of European settlement in Australia the remnants of which are still apparent in most Australian cities and particularly so in pre-WWII neighbourhoods, but with an overlay of high performance, life-enhancing, sustainable infrastructure. An example is the recent precinct scale, greyfield, urban regeneration White Gum Valley (WGV) project in Fremantle which has shown it can meet the objectives of the Paris Agreement as well as the UN Sustainable Development Goals (Wiktorowicz et al. 2018).

## Conclusion

Actively thinking about *urban fabrics* and *urban regeneration* will assist the conscious delivery of the type of Australian cities we want, by choice not chance. Such thinking is necessary in order to enable the urban sustainability transition that Australia needs to successfully achieve its sustainability and liveability goals (SDGs, Paris, NUA). Delivering sustainable precincts comprising *transit* and *walking urban fabrics*, ideally in *infill* urban regeneration areas, and supported by distributed infrastructure, can help us meet these various international and national agendas, one neighbourhood at a time. Getting these big moves right will put in place beneficial urban structures to support attractive, sustainable and liveable places, for current and future generations of urban residents.

## References

ASBEC 2018, *Built to perform, an industry led pathway to a zero carbon ready building code*, Australian Sustainable Built Environment Council & Climate Works Australia, Melbourne, Australia.

Crocker, R & Lehmann, S (eds) 2013, *Motivating change: sustainable design and behaviour in the built environment*, Routledge/Earthscan, London.

Dodson, J & Sipe, N 2006, 'Suburban shocks: assessing locational vulnerability to rising household fuel and mortgage interest costs', in C Grainger (ed.), *29th Australasian Transportation Research Forum*, 27–29 September, Gold Coast, Queensland.

Florida, R 2014, 'The creative class and economic development', *Economic Development Quarterly*, vol. 28, no. 3, pp. 196–205, https://doi.org/10.1177/0891242414541693.

Gehl, J 1987, *Life between buildings: using public space*, Van Nostrand Reinhold, Cambridge, MA.

Gehl, J 2010, *Cities for people*, Island Press, Washington DC.

Glaeser, E 2011, *Triumph of the city*, Pan Macmillan, London, UK.

Glazebrook, G & Newman, P 2018, 'The city of the future', *Urban Planning*, vol. 3, no. 2, pp. 1–20, https://doi.org/10.17645/up.v3i2.1247.

Hall, T 2007, *Where have all the gardens gone? An investigation into the disappearance of back yards in the newer Australian suburb*, *Urban Research Program, Research Paper 13*. Brisbane, Australia.

Huang, B, Xing, K & Pullen, S 2017, 'Carbon assessment for urban precincts: integrated model and case studies', *Energy and Buildings*, vol. 153, pp. 111–125, https://doi.org/10.1016/j.enbuild.2017.07.087.

Kenway, S & Tjandraatmadja, G 2009, 'Technological innovation in the provision of sustainable urban water services', in P Newton, K Hampson & R Drogemuller (eds), *Technology, design and process innovation in the built environment*, Spon Press, London, UK.

NACTO 2012, *NACTO urban street design guide: overview*, National Association of City Transportation Officials (US), Island Press, Washington DC.

NACTO 2016, *Global street design guide*, National Association of City Transportation Officials (US), Island Press, Washington DC.

Newman, P & Kenworthy, J 1999, *Sustainability and cities: overcoming automobile dependence*, Island Press, Washington DC.

Newman, P & Kenworthy, J 2015, *The end of automobile dependence: how cities are moving beyond car-based planning*, Island Press, Washington DC.

Newman, P, Kosonen, L & Kenworthy, J 2016, 'The theory of urban fabrics: planning the walking, transit and automobile cities for reduced automobile dependence', *Town Planning Reviews*, vol. 87, no. 4, pp. 429–458, https://doi.org/10.3828/tpr.2016.28.

Newton, P 2010, 'Beyond greenfields and brownfields: the challenge of regenerating Australia's greyfield suburbs', *Built Environment*, vol. 36, pp. 1–53.

Newton, P & Glackin, S 2014, 'Understanding infill: towards new policy and practice for urban regeneration in the established suburbs of Australia's cities', *Urban Policy and Research*, vol. 32, no. 2, pp. 121–143.

Newton, P & Glackin, S 2015, 'Regenerating cities: creating the opportunity for greyfield precinct infill development', in C Legacy & R Leshinsky (eds), *Instruments of planning: tensions and challenges for delivering more equitable and sustainable cities*, Routledge, London, UK.

Newton, P & Glackin, S 2018, 'Greyfield regeneration: a precinct approach for urban renewal in the established suburbs of Australia's cities', in K Ruming (ed.), *Urban regeneration and Australian cities: policies, processes and projects of contemporary urban change*, Ashgate, London.

Newton, P, Meyer, D & Glackin, S 2017, 'Becoming urban: exploring the transformative capacity for a suburban-to-urban transition in Australia's low-density cities', https://doi.org/10.3390/su9101718.

Newton, P, Murray, S, Wakefield, R, Murphy, C, Khor, L & Morgan, T 2011, *Towards a new development model for housing regeneration in greyfield residential precincts*, AHURI Final Report No. 171, Australian Housing and Urban Research Institute Limited, Melbourne, <https://www.ahuri.edu.au/research/final-reports/171>.

Newton, P, Murray, S, Wakefield, R, Murphy, C, Khor, L-A & Morgan, T 2012, *How do we regenerate middle suburban 'greyfield' areas?*, AHURI Research & Policy Bulletin No. 150, Australian Housing and Urban Research Institute Limited, Melbourne, Australia, <https://www.ahuri.edu.au/research/research-and-policy-bulletins/150>.

Newton, P, Pears, A, Whiteman, J & Astle, R 2012, 'The energy and carbon footprints of urban housing and transport: current trends and future prospects', in R Tomlinson (ed.), *Australia's unintended cities: the impact of housing on urban development*, CSIRO Publishing, Melbourne, pp. 153–189.

Newton, P & Thomson, G 2016, 'Urban regeneration in Australia', in P Roberts, H Sykes, & R Granger (eds), *Urban regeneration*, 2nd edn, Sage, London, UK.

Newton, PW & Tucker, SN 2011, 'Pathways to decarbonizing the housing sector: a scenario analysis', *Building Research & Information,* vol. 39, no. 1, pp. 34–50, https://doi.org/10.1080/09613218.2010.531085.

OECD 2012, *Compact city policies: a comparative assessment*, OECD Green Growth Studies, Paris.

OECD 2018, *Rethinking urban sprawl. Moving towards sustainable cities*, OECD, Paris.

Thomson, G & Newman, P 2017, 'Sustainable infill development', in S Rowley, R Ong & A James (eds), *Perth's infill housing future: delivering innovative and sustainable housing*, Curtin University, Perth, Western Australia, pp. 177–194.

Thomson, G, Newton, P & Newman, P 2016, 'Urban regeneration and urban fabrics in Australian cities', *Urban Regeneration and Renewal*, vol. 10, no. 2, pp. 169–190.

Trubka, R, Newman, P & Bilsborough, D 2010a, 'The costs of urban sprawl (1) – infrastructure and transportation', *Environment Design Guide*, vol. 83, pp. 1–6.

Trubka, R, Newman, P & Bilsborough, D 2010b, 'The costs of urban sprawl (2) – predicting transport greenhouse gases from urban form parameters', *Environment Design Guide*, vol. 84, pp. 1–16.

Trubka, R, Newman, P & Bilsborough, D 2010c, 'The costs of urban sprawl (3) – physical activity links to healthcare costs and productivity', *Environment Design Guide*, vol. 85, pp. 1–13.

UN-Habitat 2011, *Cities and climate change. Global report on human settlements*, Earthscan, https://doi.org/10.1787/9789264091375-en.

UNEP 2016, 'The ABC for sustainable cities', <http://www.efcanet.org/Portals/EFCA/EFCA%20files/PDF/ABC%20for%20sustainable%20cities_2016.pdf>.

United Nations 2015, *Adoption of the Paris agreement*, *framework convention on climate change*, Paris, France, <http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>.

United Nations 2017, *New urban agenda*, Quito, Ecuador, Doi: 978-92-1-132757-1.

United Nations General Assembly 2015, *Transforming our world: the 2030 agenda for sustainable development*, New York, https://doi.org/10.1007/s13398-014-0173-7.2.

Wiktorowicz, J, Babaeff, T, Breadsell, J, Byrne, J, Eggleston, J & Newman, P 2018, 'WGV: an Australian urban precinct case study to demonstrate the 1.5 °C agenda including multiple SDGs', *Urban Planning*, vol. 3, no. 2, p. 64, https://doi.org/10.17645/up.v3i2.1245.