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On the verge: re-thinking street reserves in relation to suburban densification

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ABSTRACT

This paper proposes an alternative strategy for delivering urban infill development in suburban contexts. The paper contends that the combination of upgraded streetscapes and residential densification could result in positive synergies. These include the supply of open space amenity as an incentive for resident groups to support infill development that achieves greater than usual residential densities. The capacity of this approach is tested in a research by design exercise in an Australian greyfield suburb that has high infill development targets and expansive yet typically poorly utilized street reserves.

Introduction

The background to this paper is the need for residential infill development identified in the planning policies of all Australian capital cities – cities which are some of the “lowest density and most car-dependent on the planet” (Dovey and Woodcock 2014, 1). Generally, infill development is being sought to minimize the burden of infrastructure costs, commuting times and the concentration of socio-economic vulnerabilities on the fringes of Australian cities (Kelly, Weldmann, and Walsh 2011a) as well as to maintain and protect both agricultural and biodiverse areas (NSW Government 2010). In 2010 the Western Australian Government set a target that 47% of all new residential development in Perth should be infill development (Western Australian Department of Planning 2010). Despite this being the least ambitious infill target of all Australian capital cities, and Perth already being Australia’s second-most sprawled city, it currently managed only 37% infill development in 2012, slightly above its historical average of 32% (Department of Planning and Western Australian Planning Commission 2012).

This shortfall in Perth can be explained by a variety of factors such as typically piecemeal, unplanned approaches to infill development, resistance from residents groups (otherwise known as the NIMBY¹ factor), a lack of urban design visions for densification that capture the public’s imagination (Dovey and Woodcock 2014, 1), a paucity of political will (Dovey and Woodcock 2014, 68), and finally a shortage of successful benchmark projects and incentives for developers.

Perth's population is projected to increase from 1.8 million to 6.6 million by 2061 (Australian Bureau of Statistics 2013) and this current failure to meet infill targets, if continued, will be compounded over time. At a metropolitan scale, the inability of Perth to meet its infill targets means that it will continue its propensity to sprawl in what is known to be a generally unhealthy, costly, unsustainable and unproductive form (Dodson and Sipe 2008; Newman, Beatley, and Boyer 2009; Western Australian Department of Planning 2010; Kelly, Breadon, and Reichl 2011b).

In the quest for infill development, until now Perth's planning strategies have concentrated mostly on Activity Centres, otherwise known as Transit Oriented Developments (TODs) and on increased residential density along public transit corridors (Western Australian Department of Planning 2010).² While Activity Centres and Activity Corridors are the flagship of the current Western Australian Government infill strategy, a large amount of infill development is occurring through the 'do it yourself' subdivision of backyards. This form of infill development is referred to as ad hoc subdivision or 'background' infill and has been identified as often failing to deliver the sustainability (McManus 2010; Brunner and Cozens 2013) and liveability (Debra Goostrey, in Moodie and Trigger 2015) that urban densification policies tend to promise (Western Australian Department of Planning 2010).

Until now, the potential of upgrading existing streetscapes in Australia's greyfield suburbs as a means of increasing amenity to enable higher density infill development has not been proposed. It is speculated that the provision of streetscapes which deliver a high level of open space amenity can offer a real enticement for suburban residents to support residential infill development at higher densities than are currently being delivered. Throughout Australia only 11% of communities support infill development in their neighbourhood (Kelly, Breadon, and Reichl 2011b). Furthermore, resident groups are well organized and powerful – as one developer puts it: "when you take on the inner suburbs – the wealthy, well-educated suburbs – you are provoking a pretty powerful opponent" (Dovey and Woodcock 2014, 69). By providing a tangible benefit to such a resident group in return for accepting (or even supporting) infill development is one way of unlocking this situation. Indeed, research has shown that suburban residents are willing to trade off paying premium prices for houses adjacent to high amenity parks (Crompton 2005). Given this, it is thought that residents will potentially accept trade-offs such as living at a higher density, or allowing greater residential densification in their proximity, if it allows them access to high amenity streetscapes.

It is generally recognized that streetscapes can play a variety of important roles in our suburbs. Streetscapes, in particular, can provide a setting for social interaction, play and passive recreation for people of all ages (Ben-Joseph 2007, 505) which enhances both individual and community health and wellbeing. Streetscapes also have the potential to provide ecosystem services such as supporting biodiversity, reducing ambient temperature, improving air quality and assisting with urban water management. Despite this, street verges in Perth's greyfield suburbs are generally barren and under-utilized. This in part reflects that verges are often an overlooked public resource³ (Thompson and Meenachi-Sunderam 2007, 1); we tend to not see these 'leftover' landscapes as they are outside our day-to-day experience of the city and its buildings, streets and parks (Bolleter 2015).

The following sections of this paper explore, through discussion and a research by design exercise (Swaffield and Deming 2011), the potential synergies of residential infill development occurring being correlated with upgraded streetscapes.

The study area

The focus for this research by design exercise is the Perth Local Government Area (LGA) of Bayswater, which is situated 6 km north east of city's centre (Figure 1). Located in the middle ring of Perth's suburban spread, the study area constitutes under-utilized property assets, infrastructure and services (Newton et al. 2011) which is a characteristic shared with other greyfield⁴ suburbs around the nation. Notwithstanding variations in community socio-economic structure, this ensures that the findings proposed in this research paper should be reasonably generalizable to greyfield suburbs in Australia and around the world.

Reflecting the requirements of Perth's overarching planning document, Bayswater has an ambitious infill development target which seeks a further 8500 dwellings by 2031 (Western Australian Department of Planning 2010). While a Town Planning Scheme has been approved by the City of Bayswater which defines areas for urban infill, no accompanying plan exists for how streetscapes, and public open space more generally, will be upgraded to provide amenity and ecosystem services to this burgeoning population. This is an issue because to date infill development in the study area is resulting in the truncating of once expansive private gardens which have historically delivered both amenity and ecosystem services (Hall 2010). This situation is reflected in the fact that 11.9% of Bayswater's vegetation cover was

Figure 1. The study area of Bayswater (in solid outline) within its Central Sub Region context – the Central Sub Region is the region where most urban infill is planned to occur.

cleared between 2001–2004 alone (McManus 2010), through the incremental subdivision and infilling of once generous residential blocks.

The potential of upgraded streetscapes to incentivize density

Research concerning the nature and function of Perth's public open space has focused primarily on parks (Australian Institute of Landscape Architects 2012; Hedgecock 2012; Centre for Sport and Recreation Research 2013; Centre for the Built Environment and Health 2013; Bolleter and Ramalho 2014). However, according to GIS analysis of the study area, verges comprise approximately nine times the area of land bound up in parks (Figure 2).⁵ By extension, verges presumably offer a greater potential source for amenity and ecosystem services

Figure 2. Verges plan. According to GIS analysis of the area, verges (in darker shading) comprise roughly nine times the area of land bound up in parks.

provision than parks do, and are certainly more convenient to access for adjacent residents. The enormous land area bound up in verges can be explained by generous road reserves set out in Perth's 1955 inaugural metropolitan plan (Stephenson and Hepburn 1955). In Bayswater's 'Access Ways,'⁶ which are considered minor 'tributaries' within the road network (Western Australian Planning Commission 1998), this constitutes a typically 20.2 m wide road reserve that contains wide verges (6.5 m on each side of the road) and a generous roadway (7.2 m). This streetscape is determined partly by infrastructural requirements, gas, water and sewerage pipes being set out horizontally beneath the verge (Thompson and Meenachi-Sunderam 2007), and the requirements of service vehicles such as garbage trucks.⁷ The width of the street section also became a convention because it measured one chain wide, the then standard measurement of distance, and as such was a convenient corridor to survey (Seddon 1994, 27).

The verges themselves assume a variety of guises. Perhaps because landscaping can add up to 15% of a home's worth (Bormann, Balmori, and Geballe 2001, 11) manicured turf verges proliferate in some street sections (Figure 3). These require substantial inputs of water and fertilizer and are a drain on resources which are being rapidly depleted in Perth (ARUP and Curtin University Sustainability Policy Institute 2013, 23). In contrast, the majority of verges have been allowed to 'go to seed,' and appear half dead in Perth's relentlessly dry and hot

Figure 3. A manicured verge functions symbolically as a verdant 'moat' between the public street and the private garden.

Figure 4. Most verges are allowed to 'go to seed,' and lie half dead in Perth's relentlessly dry and hot summer months.

summer months (Figure 4). Regardless of their level of maintenance, verges are generally traversed by concrete driveway crossovers, which are steadily proliferating due to infill development occurring in the adjacent private lots.

The fact that these streetscapes are not generally considered as open space in which people may choose to spend their time results from the situation in which, up until recently, residents have had a substantial allocation of private open space and therefore have not needed the streetscapes to provide open space amenity. According to the calculation in this paper, areas of Bayswater that are still at a low residential density of R12 (12 dwellings per hectare) afford an impressive 206 m² of private open space per resident.⁸ At a density of R25, the zoned density of a significant amount of the study area, and given the building types that the market is currently producing, this will result in a compression of private open space of approximately 50 m² per person.⁹ Despite this situation there has been no systematic upgrade of streetscapes to compensate for the loss of private outdoor space. To aggravate this issue further, the remnant private open space on subdivided lots is not only reduced in area but also in the amenity it provides, a result of much of it being driveway space. The loss of the iconic Australian backyard is described in detail by others (Hall 2010), and designers have answered with dwelling typologies which provide more usable private open space (London and Anderson 2008).¹⁰ However, there has been a relative absence of plans for how streetscapes could also be reconsidered to afford amenity to residents living at higher densities.¹¹

This is in part because while the public domain generally can “share the ability to provide biodiversity, aesthetic pleasure and a beneficial microclimate ... it cannot replace the backyard” (Hall 2010). Tony Hall attributes this to the fact that the public domain and front gardens are public and semi-public, respectively, and thus cannot “offer the same privacy and degree of security of the backyard” (2010, 25). Indeed, as Bormann explains “in the front yard, a social obligation could arise at any moment, but in the backyard, you can set up a hammock, lie down, close your eyes, and relax. The backyard is yours alone” (Bormann, Balmori, and Geballe 2001, 11). Thompson and Meenachi-Sunderam (2007) also identify the blurring of public and private space which is manifested in verges landscapes as having adverse implications for their usability by adjacent residents. In this way of thinking the verge serves as a “barrier, a kind of verdant moat separating the household from the threats and temptations of the city ... a transition from the public street to the very private house” (Bormann, Balmori, and Geballe 2001, 11) – a symbolic rather than useful space.

While there is truth in all of these assertions, given that private open space is being squeezed to such an extent, it is thought that a shift will occur whereby residents will, to a degree, accept the lack of privacy inherent in the public domain for the amenity it can offer. This concept is referred to as the ‘compensation hypothesis’ which proposes that residents will compensate poor access to private green space by using public green spaces (Byrne, Sipe, and Searle 2010, 164). Evidence of this occurring has been found in a survey of West Australian adults (most of whom live in Perth) which revealed 33% of all physical activities (such as walking, gardening, cycling etc.) occurred in the street or on the footpath (Physical Activity Taskforce 2009, 30), while less than the percentage of recreation conducted at home (55%) it is still a sizeable amount, and significantly more than that which is occurring in parks (14%) (Physical Activity Taskforce 2009, 31). Evidently people will recreate in the public domain, even if they do not occupy it for substantial lengths of time.

Research by design

To engage with this problematic situation three scenarios have been developed by which the study area's 'Access Way' streetscapes could be upgraded in order to provide both open space amenity and ecosystem services for adjacent residents living at R25 (the typical zoning density), but which could also incentivize higher residential densities. These upgrades could be targeted to provide an enhanced walking environment, shared facilities for informal recreation, shared precinct scale service infrastructure, formalized car parking, and areas for the cultivation of fruit and vegetables, as well as moderating climatic extremes (Barnett 2013), cleaning air (Brack 2002) and providing flood mitigation and storm water attenuation (Wong 2006).

The procedure by which the enhancing and intensification of streetscapes could be conducted is as follows. It is considered that upon the achievement of a consensus from the residents of a particular street section¹² the lots fronting the street would be rezoned at a higher density (~R40–R80) producing increased land taxes and rates, and once they are developed, developer contributions.¹³ Once enough developer contributions have been collected from such coordinated developments the contributions would be directed to reconfiguring road alignments, carrying out infrastructural improvements and implementing upgraded landscape treatments to the street section. In principle this is nothing new – in New South Wales, developers are mandated to provide financial contributions to councils for increased local open space requirements generated by new residential infill development (Searle 2011, 202). Once the aforementioned streetscape upgrades have been implemented new residents will presumably be attracted to the densified street section. Subsequently, the increased stamp duty revenue, resulting from the expanded number of dwellings (Pracsys 2012), could then be directed towards the ongoing maintenance of the streetscape at a high level. Crucial to the maintenance of the upgraded streetscape will also be a significant degree of involvement by the street section residents. In an ideal situation the effort that residents have historically dedicated to their backyards could, in the relative absence of such backyards, be translated to the streetscape.¹⁴ In brief, the upgrade of the streetscape aims to create a flexible, organizing structure for stimulating community participation; the upgraded streetscape is not intended to be the 'end' in itself.

The decision to pitch the proposed density at R40–R80, in a coordinated street section precinct, is that it avoids 'middle ground' densities of R25–R40¹⁵ which can, if poorly designed, be the 'worst of both worlds' – on the one hand this, often uncoordinated, densification negatively impacts on the liveability of once spacious 'leafy, green' suburbs – at the same time, it is not dense or coordinated enough to produce the collective benefits of urban density (Bolleter and Weller 2013, 56).

However, the question about exactly what density is required to yield urban amenity is a vexed one (Public Transport users Association 2015). Of course this question goes to what sort of amenity exactly is being proposed. It would be considered that by increasing residential density to R40–R80 – three to six times un-subdivided suburban density – then the upgraded street sections should be able to yield benefits in terms of the provision of car share initiatives (Royal Automobile Club 2015), storm water treatment infrastructure, a communal productive garden and composting and generally high quality shared spaces and facilities (Newton et al. 2011, 30), as well as reducing automobile dependence (Newman and Kenworthy 2006, 1), and water, basic raw materials and energy usage typically associated

Figure 5. While the selection of particular street sections for reconfiguration would be dependent on the consensus of its adjacent residents, in our proposal only streets within a 5-minute cycle-able catchment of public transport nodes would be candidates for this process, reflecting the ideal of correlating density with public transport expressed by Perth’s overarching plan. This zone presents a significant opportunity for urban infill – indeed there are some 912 linear km of residential ‘Access Way’ roads in this area shown. If the housing density along was increased only along proportion of these roads it could still make a substantial contribution to the urban infill target for the Central Sub Region of 122,000 dwellings by 2031.

with suburban density development (ARUP and Curtin University Sustainability Policy Institute 2013). Beyond the feasibility of providing urban amenity, a question remains as to the intricate trade-offs residents will be willing to make between the provision of urban amenity and projected increases in density. Ultimately this conundrum would need to be tackled through a ‘needs based’ assessment which considers the ‘socio-demographic’ characteristics (Sipe and Byrne 2010, 23) of the street scape communities.

While the choice of particular street sections for densification and upgrade would rely on the consensus of its residents, in this proposal only streets within relative proximity to public transport nodes would be candidates, reflecting the ideal of correlating density with public transport expressed by Perth’s overarching plan (Western Australian Department of Planning 2010). In this case ‘relative proximity’ is taken to mean a 5-minute cycle or less than 20-minute walk (Figure 5). It is envisaged that to initiate this ‘organic’ process an upgraded and densified streetscape demonstration project should be constructed with the involvement of both the local state governments. This exemplar project could provide residents from other streets with a model to replicate or respond to. As Kim Dovey explains with respect to ‘selling’ urban

infill: “The first things that roll out have to be great, not reasonable ... You have to sell off that image that you are building – this is where we are going and this is putting it on the map ... Getting it right in the early stages is critical in overcoming that stigma and the poor image and identity” (Dovey and Woodcock 2014, 61).

The following scenarios deliberately stake out a range of possibilities. The initial scenario outlines the likely effects infill development will have on a streetscape which is not systematically upgraded – this forms a point of comparison for the subsequent scenarios. The second scenario (Woonerf streetscape) seeks to provide greater amenity and ecosystem service provision in the streetscape itself through a reduction of the influence of cars. The third (Carport streetscape) explores the ability of streetscapes to provide formalized car parking in order to reduce the large amount of land required to park cars in private infill development lots, a situation which results in an accompanying reduction in amenity and ecosystem services. The intention of these divergent scenarios is to cater to the varying requirements of ‘street section’ communities. Importantly, allowing for “local initiatives and diverse design solutions” is argued to have an increased likelihood of enlisting residents’ commitment to ongoing maintenance (Ben-Joseph 2007, 505). The scenarios have been visualized in a manner that is intended to be able to be understood by a lay-person. This addresses the situation in which one of the major obstructions to ‘transformational change’ in our suburbs has been “lack of design vision (and visuals) that capture the public imagination for alternative urban futures” (Dovey and Woodcock 2014, 1).

Scenario 1: business as usual streetscape

This initial scenario outlines the effects that infill development (at ~R25) has on the adjacent streetscape. In a typical study area¹⁶ street prior to infill development occurring to any significant degree, typically 33% of the streetscape area is dedicated to turf, 41% to road surface and 18% to driveways (Figure 6). After ‘Business as usual’ (BAU) infill development

Figure 6. Typical street section prior to densification. In a typical stud- area street prior to infill development occurring to any significant degree we typically find 33% of the streetscape area being dedicated to turf, 41% to road surface and 18% to driveways.

Figure 7. Typical street section after BAU densification. After ‘Business as usual’ (BAU) infill development has taken place these figures change with the turf areas decreasing by 2% and the driveway areas increasing by 2.6%. The number of street trees is also reduced to allow for greater numbers of driveway crossovers. While these surface area changes are not alarming increases the psychological effect of the street scape being dissected by an ever increasing number of driveways is significant.

has taken place these figures change, with the turf areas decreasing by 2% and the driveway areas increasing by 2.6% (Figure 7). The number of street trees is also reduced to allow for greater numbers of driveway crossovers. While these surface area changes are not alarming increases in themselves, the perceived visual effect of the streetscape being dissected by an ever increasing number of concrete hardstand driveways is significant. Furthermore, when these figures are reflected across entire suburbs, or indeed a city, they are not insubstantial. Beyond these incremental changes in surface areas, the streetscapes are generally not upgraded in any way to accommodate for the diminishing areas of open space available to adjacent residents. Rather, the streetscapes become incrementally hotter (Coutts, Beringer, and Tapper 2007, 478), less vegetated and increasingly car dominated. Arguably, this gives residents reasonable grounds for resisting infill development in their suburbs, and their street in particular.

Scenario 2: Woonerf streetscape

Responding to the issues perpetuated by a BAU model of infill development, this scenario involves the ‘Woonerfing’ of a suburban street section to create a pedestrianized space and simultaneously to reduce the speed and impact of cars, provide shared facilities for residents such as a playground, communal productive garden and composting, street furniture, barbecues, a small workshop, and allow for greater ecosystem services provision through increased permeable and planted surfaces, and trees. This situation is allowed by reconfiguring the roadway so that it ‘meanders’, creating usable area of POS either side rather than merely bisecting the road reserve directly down the middle (Figures 8, 9 and 10).

Figure 8. The Woonerfing of a suburban street section to create a pedestrianized space and simultaneously reduce the speed and impact of cars, provide shared facilities for residents, and allow for greater ecosystem services provision through increased permeable and planted surfaces, and trees. This situation is allowed by reconfiguring the roadway so that it 'meanders' creating usable area of public open space either side rather than merely bisecting the road reserve directly down the middle. A number of the building types shown in these visualizations are loosely based on those featured in 'Take 7 Housing Australia: How architects can make a difference' (London and Anderson 2008).

Figure 9. See caption to Figure 8. Key: 1. Meandering roadway; 2. Community garden and communal composting; 3. Permeable driveway crossovers; 4. Playground; 5. Typically R40-80 infill dwellings; 6. Car share parking bays; 7. Household parking on private lots.

Figure 10. See caption to Figure 8.

Arguably, this proposition is nothing new. The shared street (Woonerf) concept has been adopted in guidelines and regulations, originally in the Netherlands (1976) and also in many other countries: Germany (1976), England (1977), Sweden and Denmark (1977), France (1979), Japan (1979), Israel (1981) and Switzerland (1982) (Ben-Joseph 2007, 506). What is novel is the correlation of these streetscape upgrades with higher density infill development than might otherwise be achieved in current planning. Evidence that such streetscape upgrades could act as an incentive to adjacent residents to accept, or indeed support, infill development can be found in a Perth study that looked at the correlation between street trees and property values. The study found that street trees adjacent to a house produced ‘positive and sizeable effects’ on the house’s sale price. They concluded that the marginal implicit price of a broad-leaved tree on the street verge is approximately AU\$17,000 which corresponds to approximately a 4.3% increase in the median value of the property (Pandit et al. 2013, 140). It can be presumed that further street tree planting, and by extension streetscape upgrades such as that described in the Woonerf streetscape scenario, will uplift property values and give residents a ‘hip-pocket’ reason to support infill development, even if they cannot be convinced with more altruistic environmental or societal arguments.

Scenario 3: carport streetscape

Some of the primary reasons given as to why residents oppose infill development in their street is because of a perceived increase in car-parking hassles and cars ‘littering’ previously quiet residential streets (Prospect Residents Association Inc 2013, 4) and safety concerns associated with increased traffic (City of Stirling 2014, 9). This scenario outlines how a streetscape section could be upgraded in a manner that formally incorporates car parking requirements, and in so doing, reduces this community disincentive to support infill development.¹⁷ Furthermore, it frees up an area within private lots for open space, recreation and ecosystem services (Figure 11). Currently, calculated by this study, the desire to park private cars within a garage physically connected to an R25 infill dwelling results in 23% of private lot areas being lost to the parking and movement of cars. Through providing designed carports within public verges, which protect cars from the elements (and potentially theft) this substantial land area freed up could allow building types such as courtyard houses (Figures 12 and 13) which tend to create less residual

Figure 11. Carport streetscape. This scenario outlines how a streetscape section could be upgraded in a manner which formally incorporates car parking requirements, and in so doing reduces this community disincentive to support infill development, and frees up area within private lots for building types which maximize open space, recreation and ecosystem services - such as the courtyard housing types pictured.

space than conventional semi-detached infill dwellings, and potentially allow for the maintenance of mature trees which are crucial to a suburb's liveability and ecological performance. As visualized, the remaining area of the street reserve would be rendered

Figure 12. See caption to Figure 11. Key: 1. Shared vehicular pedestrian space; 2. Carports associated with adjacent dwellings; 3. Courtyard dwellings allowing mature tree planting; 4. Un-used parking bays repurposed for other uses; 5. Car-share parking bays.

Figure 13. See caption to Figure 11.

as a shared zone and incorporate both vehicular, recreational and some social needs. Indeed, one of the major facets of suburbs that impede spontaneous social encounters is residents' desire to being able to drive directly into a lock up garage adjoining their home. Conversely, by placing this parking on the public street this scenario maximizes potentials for interaction between residents, admittedly at the cost of some personal privacy.

Conclusion

In 1910, landscape architect Frederick Law Olmsted declared:

There has been a decided tendency on the part of official street planners to insist with quite needless and undesirable rigidity upon certain fixed standards of width and arrangement in regard to purely local streets ... (Ben-Joseph 2007, 504)

Yet despite this call, since the 1930s in countries such as North America, the UK, Canada and New Zealand, suburban street profiles (and often layouts) have changed very little (Ben-Joseph 2007, 504). Given that the density of traditional suburbs is changing dramatically,¹⁸ this study re-iterates Olmsted's point and extends it by saying it is timely that we reconsider what a streetscape could offer.

This paper has visualized upgraded streetscapes which could achieve synergies with increased residential densities. These synergies include the potential garnering of community support for infill development, and the supplying of open space amenity and ecosystem services for residents living at higher than suburban densities. While this paper has focused on the potential of this process in the case study city of Perth, the potential application is much broader. Community resistance to suburban infill development occurs around the world, including Finland (Arvola and Pennanen 2014, 5), North America (Cuff and Dahl 2009; Wheeler 2001, 11), Canada (Punter 2003) and the UK (West Lothian Council 2013, 5). With appropriate local variations, the described process could be employed to unlock community resistance to infill development in many of these settings.

The small number of infill development strategies advocated for in conventional transport oriented development, around the Western world, engenders a situation in which, if any of these strategies were to be unsuccessful, suburban cities will continue their propensity to sprawl in what is regarded as a typically unhealthy, costly, unsustainable

and unproductive urban form (Dodson and Sipe 2008; Newman, Beatley, and Boyer 2009; Western Australian Department of Planning 2010; Kelly, Breadon, and Reichl 2011b). To avoid this situation this research provides an additional yet complementary infill development strategy – one in which the vast majority of people who do not support infill development in their neighbourhood (Kelly, Breadon, and Reichl 2011b) are given a reason to change their mind.

Notes

1. NIMBY is an acronym 'not in my back yard'.
2. In fact much of the infill development that has been achieved in recent years is through opportunistic subdivision of individual lots resulting in the loss of the Australian backyard and its replacement with typically unusable residual spaces (Hall 2010).
3. Verges are legally the property of local governments and as such they can be considered as public open space (POS) (Thompson and Meenachi-Sunderam 2007, 1).
4. North American New Urbanism uses the term 'greyfield' to refer to failing retail and commercial shopping sites; this is not the definition to which this paper refers.
5. There are studies on the function of verges in Perth; however, they are more from a valuation than design perspective (Pandit et al. 2013, 134–142).
6. Otherwise known as 'local roads' these typically do not carry more than 800 vehicles per day and do not carry buses.
7. At least 12 government agencies and private companies have legal powers to do works in streets which significantly complicates efforts to reconfigure streetscapes (Mobbs 2012).
8. This is calculated as a typically 530 m² of garden space, front and back, divided by 2.56 people which is the current statistic average number of people per household (Australian Bureau of Statistics 2011).
9. The current housing types being delivered are the battle axing of large lots and the demolition of the old front house and replacement with a 3–6 strata unit development.
10. The housing typologies shown in the following visualizations of reconfigured streetscapes relate principally to those in this publication. These typologies, in part, attempt to also maximize the usability and amenity of private open space.
11. The 'Suburban Lineal Park' proposal by Neeson Murcutt is notable exception to this (London and Anderson 2008, 100).
12. A typical street section, within the study area, contains approximately 60 residents prior to infill development occurring. It is thought this represents a micro- community that is not so large that a consensus decision cannot be achieved.
13. The advantage of concentrating development within a particular street section is that a number of otherwise dispersed "projects could be assembled and strategically managed to achieve more cost effective built outcomes" due to the increased operational scale (Murray, 2013, 293).
14. There is some evidence that this is beginning to occur in some of the denser areas of Australian cities (Mobbs 2012).
15. Such residential densities are typical of urban infill development in Perth's greyfield suburbs.
16. This mapping is based on a section of Hotham St between Bowden St and Hobart St in the Local Government Area of Bayswater.
17. The author is indebted to Geoffrey London for this idea.
18. Infill development in Australian suburbs generally results in at least a doubling of the residential density from R12 to R25.

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