INFILL OPPORTUNITIES

Design Research Report
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Infill Opportunities Design Research Report

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Executive Summary

Project Description
Infill Opportunities is an initiative of the Office of the Victorian Government Architect (OVGA) and Monash Architecture Studio (MAS). It explores design strategies for enhancing the outcomes of infill housing redevelopment in the middle suburbs of Melbourne.

The investigation is premised on prior research completed by Monash Architecture Studio (MAS), Swinburne University and RMIT University for the Australian Housing and Urban Research Institute (AHURI) which examined the inputs and processes required for a new development model addressing the dispersion of small-scale infill housing across established suburbs (Newton et al 2011). The AHURI study proposed a model for infill redevelopment over several non-contiguous residential allotments, conceived of and implemented as a coordinated precinct. The proposed model would be both feasible and desirable for a range of government and housing industry stakeholders because it offers a number of innovative finance and delivery opportunities, such as cooperative development and financing. Infill Opportunities expands on this research, focusing on the design aspects of the proposed development model, at scales of 1, 2 and 3 contiguous sites.

This project examines the physical and contextual attributes of typical suburban allotments which impact on the design of infill redevelopments. The spatial relationships, dwelling configurations and siting considerations related to higher density housing are reconsidered specifically for residential land parcels in middle suburban locations. The research demonstrates a range of design strategies for improving the density, quality and performance of small-scale infill housing and identifies the existing planning controls and industry trends incongruous with achieving better redevelopment outcomes.

Research Approach
The project involved four related areas of work:

> Review of existing approaches to infill redevelopment
  Design review of infill redevelopment case studies, standard industry practice and the examination of planning controls and building regulations that impact infill redevelopment outcomes.

> Site and context study in the middle suburbs
  A comparative analysis of social, economic and built contexts in several middle suburban locations in Melbourne and the identification of suitable sites for redevelopment.

> Design-led research
  Iterative development of design strategies and models for improving the quality and performance of infill housing.

> Site specific designs
  Speculative designs on selected 1, 2 and 3 lot amalgamations responding to ‘real world’ site constraints and contexts.
Executive Summary

Summary of Research Findings
The research reveals a number of barriers for enhancing infill housing outcomes within current industry and regulatory contexts and demonstrates the benefits of alternative design approaches. Key findings include:

Strategic locations for infill redevelopment in the middle suburbs
- 7-25km radius from the CBD
- Suburbs developed between 1950-1970’s
- Close proximity to public transport
- Outside of areas with heritage overlays

Identification of suitable lots for redevelopment
- Selection of lots by their width and depth, as opposed to lot area, is a more effective method of determining suitable development sites.
- Common lot sizes in the middle suburbs range from 15-16m in width and 38-43m in depth.

Design Benefits
- Flexible, compact dwelling design
  - The design models provide spacious and flexible housing within a compact envelope while accommodating a diversity of occupations on every level of the dwelling.
- Improved Open Space and Shared Amenity
  - A range of quality private open spaces for smaller dwellings is a significant benefit of the proposed design strategy. Siting and landscape treatments also enhance common open spaces on the site, providing opportunities for interaction and shared use.
- More Effective Site Use and Extended Community Benefits
  - The proposed designs encroach on regulated boundary setbacks, particularly to the street, which enables better site utilisation within the development and potential community benefits, such as the incorporation of local shops or community programmes.
- Adaptable Housing
  - The proposed models are designed for ease of extension and adaptation over time. Vehicle access and parking areas can be converted into generous common open space, shared amenity and shared facilities.
- Construction Techniques
  - The modular dwelling volumes, circulation systems and serving cores enable a range of prefabrication techniques to be employed in the delivery of the development.
- Replicable Design Models
  - The design strategies are transferable to other locations. Importantly, the models are appropriate for expansion onto adjacent lots over time.

Barriers to Improving Infill Housing Design
- Regulated Building Setbacks
  - Current approach to street frontages, setbacks and street character are limiting the potential and restricting optimum use of typical suburban sites. Reducing street setbacks does not impact on amenity of neighbouring properties and increases the possibility of activating a streetscape, facilitating higher levels of community engagement.
- Limited Building Profiles
  - The standard Rescode building profile limits the form of a building particularly at the second storey level. It is possible to build beyond this profile without adversely impacting adjacent properties.
- Excessive overlooking requirements
  - Overlooking within a site should be controlled, but not eliminated. Excessive screening for absolute privacy reduces site permeability, the potential for passive surveillance and positive interaction between residents.
- Market Expectations
  - Growing demand for en suites to all bedrooms and an expectation of double garages integrated with a dwelling structure is a significant challenge for well designed, smaller infill housing proposals. will be required to facilitate behaviour change and take up of unfamiliar housing proposals.
Infill Opportunities Design Research Report

Introduction

Background Research

The compounding pressures of climate change and a rapidly increasing population are shifting the focus of metropolitan planning policies from expanding new development on the urban fringe to more intensive redevelopment within existing urban areas. Higher density housing models for established suburbs are needed to accommodate the sustainable growth of Australian cities.

In Victoria, the suburbs comprise the majority of our built environment. A recent research collaboration between MAS, Swinburne and RMIT Universities (Newton et al 2011) demonstrated that the middle suburbs have potential to accommodate significant increases in population, with very low existing dwelling densities and comparatively high access to public amenity, transport and services. Substantial swaths of the aging residential zones in these areas are in need of physical, technological and environmental upgrade as part of our transition to more sustainable cities, however very few appropriate redevelopment strategies have been realised in these areas. Two principal factors contributing to the lack of effective outcomes are: individual ownership of middle suburban land titles which inhibits the assembly of suitable development sites; and an absence of design expertise within the projects that are completed.

Despite government initiatives for large-scale redevelopment near activity centres and transport nodes, the majority of redevelopment taking place in the middle suburbs is small scale, piecemeal infill housing. A recent review of Victoria’s residential development activity from 2004-2008 (Spatial Economics 2011) indicated that 86 percent of all new housing developments were of 1-2 dwellings, while only 1 percent comprised 20 or more dwellings. Phan et al (2008) revealed that 98 percent of redevelopment completed in the City of Monash in 2002/2006 comprised two to seven dwellings and was widely distributed across the local government area. Significantly, 80 percent of the new housing was more than eight hundred metres from a nominated activity centre indicating that the majority of redevelopment in the middle suburbs is not driven by proximity to transport or activity centres. Rather, it is related to the size of land assets and the age of housing stock. The fragmented pattern of informal infill suggests that small owner/builders redevelop private land holdings only as profitable opportunities arise.

In its current form, piecemeal infill is of inadequate density and quality to contribute to the sustainable regeneration of established suburbs. Generalised requirements for parking, open space, building heights and setbacks restrict the diversity of housing types possible. To maximize profit margins, projects tend to be completed to minimum construction standards with little or no design consideration, which is not a suitable performance level going into the future. On an individual project basis, cost and planning constraints, as well as the duplication of open space and parking requirements, negates the opportunity to provide collective benefits for the broader urban environment. For example, public open space and infrastructure upgrades are not typically delivered through dual occupancy redevelopments.

If the design and performance of small infill redevelopments can be improved, the market’s propensity for this scale and type of project offers a potential vehicle for delivering sustainable urban change within existing suburban areas. Newton et al scoped the processes and inputs required to harness the high levels of informal redevelopment activity currently occurring in aging middle suburbs and strategically manage its delivery to achieve significant design, environmental, social and economic benefits. They found that a new development model for precinct scale infill redevelopment was both feasible and desirable to a range of housing providers and stakeholders involved in the residential development industry.

Project Aims

This project draws from the background research undertaken by Newton et al and focuses on the design aspects of the proposed development model. Through a design-led research approach, Infill Opportunities examines the spatial relationships, dwelling configurations and siting considerations for achieving higher density and better quality infill redevelopment outcomes in the middle suburbs of Melbourne.

The research aims to:
- Identify suitable sites for infill redevelopment in the middle suburbs;
- Identify and challenge the planning controls and industry trends hampering more effective design outcomes;
- Develop viable design strategies for better quality, higher density infill redevelopments that can be replicated by industry;
- Develop designs that could support alternative finance models, such as cooperative housing finance;
- Demonstrate the benefits of flexible, adaptable dwelling designs.

Purpose of this Document

This report captures the research approach and findings for the project and provides recommendations for improving infill redevelopment outcomes in the middle suburbs. The structure of the document reflects the scope of the project, comprising four key areas of work and a research findings section that brings together relevant components of investigation:
- Review of existing approaches to infill redevelopment
- Site and context study in the middle suburbs
- Design-led research and development of design strategies
- Site specific designs responding to ‘real-world’ constraints
- Research findings and recommendations.
Defining The Middle Suburbs

There is no single definition for the middle suburbs in Melbourne. The parameters describing the various regions within the metropolitan boundary differ depending on the context in which they are used. For example, the boundary of Melbourne’s statistical areas and local government areas differ. The age of suburbs and patterns of development can distinguish regions within the metropolitan area. More colloquial understandings of the city are also relevant. For example, the property market commonly use a 7km radius to describe “inner city living” which can affect the value of suburban land prices.

To define the “middle suburban” region within which the research would operate, an examination of Melbourne’s metropolitan fabric was undertaken. This process required the collation of several information sources, including metropolitan GIS data, ABS demographic data, dwelling data from the Department of Planning and Community Development and historical information from the State Library of Victoria. Each data source was adapted and analysed on a suburb-by-suburb basis, which informed the ‘typical’ middle suburban case studies areas selected for the design research.

The study spatialised the extent and age of Melbourne’s urban development, which is clearly biased towards the east. Analysis of dwelling densities, population, and land area for the inner, middle and outer regions revealed the significance of intensification strategies for middle suburban locations, where access to transport, employment, education and amenity is relatively high. The middle suburbs comprise 16% of the total urban environment by area, and more than half of Melbourne’s population.
Selection of Study Areas in the Middle Suburbs

Six locations were selected to undertake a comparative analysis of ‘typical’ site attributes and contexts in middle suburban areas. They are dispersed across the metropolitan region to ensure a range of suburban characteristics were represented.

Study Area A – Essendon
Study Area B – Preston
Study Area C – Burwood East
Study Area D – West Footscray
Study Area E – Doncaster
Study Area F – East Brighton

The following criteria formed the basis of their selection.

> 7km - 25km from the CBD
Within a 7-25km radius, some commonalities in allotment size and configuration can be observed. Within a 7km radius of the CBD, there is a predominance of urban housing typologies, such as terraces, which are not representative of the “middle suburbs” and properties are subject to an “inner city living” cost premium. Beyond a 25km radius from the CBD, particularly in the west, there is extensive new (greenfield) development. The contextual concerns around growth area/fringe development were considered outside the scope of the research, which focuses on sustainable redevelopment in established suburbs.

> Age of suburbs
Suburbs that were developed between 1950-1979 are of an age where physical, environmental and technological upgrade is likely to be needed and redevelopment strategies would be most effective. There is extensive post-war development across the 7-25km region from the CBD, making it suitable for replicable design interventions.

> Proximity to transport networks
To maximise opportunities for integrated and sustainable design, the study areas were selected based on their proximity to transport networks. Doncaster is the only outlying area that lacks adequate access to tram or train services, however it is serviced by an extensive bus network.

> Heritage overlays
Locations subject to heritage overlays are beyond the scope of this research and were avoided in the selection of study areas. It is assumed that demolition of existing building stock would be required to achieve better performing, higher density dwellings. The construction and planning complications related to heritage redevelopments would not be representative of typical infill housing scenarios.
Site and Context Comparison

To determine what a ‘typical’ site in the middle suburbs might be, the existing residential allotments in each of the study areas were compared.

Lot Area vs. Length & Width

Initially site area (m$^2$) was used as a measure to compare the existing number and distribution of different sized allotments within each study location. The area ranges were based on the method of residential property analysis in the Melbourne Atlas 2006 (DPCD 2006). Predictably, sites closer to the CBD were generally smaller than sites nearing the periphery of the 25km boundary between the middle and outer suburbs. The majority of allotments in the middle suburbs were between 625–750m$^2$.

While this method of analysis enabled a comparison of lot sizes for each study location, area measurements were found to be not particularly useful as design determinates. A turning point for this research was recognising that ‘typical’ site dimensions (length and width) and orientations were needed to determine the spatial constraints for the proposed design strategies and housing models. Actual site frontages and depths, as well as the extent of solar access, would inform how many dwellings could be achieved, their arrangement on site, the types of building forms vehicular/pedestrian access that could be replicated on common allotments across Melbourne suburbs.

The research team analysed 50 randomly selected sites within each study region. A sample of 50 lots can be considered representative of each context. Irregularly shaped lots (i.e. those which had something other than two sets of nearly parallel sides) were not chosen. The length, width and orientation for all 300 sites were then plotted against each other. While large variances can be observed, the research revealed a clustering of common sites in each location. This example (left) shows that the majority of sites in East Brighton have 15-18m frontages, ranging in depths from 35-48m with a nearly even proportion of sites oriented in north-south and east-west directions.
Infill Opportunities Design Research Report Identifying Strategic Locations for Infill Redevelopment

Site Selections
The pool of 300 allotments sampled across Melbourne’s middle suburbs shows a clustering of sites around 15-16m in width, with a minimum length of 38m up to maximum 43m.

From the sample of sites analysed, 3 different allotment types were selected for use in the design research applications. Each site is within the 'cluster zone' of typical site widths and depths. The assemblies, locations and orientations vary to enable a range of design responses for different contexts and site conditions.
Overview
This section of report outlines pertinent trends within the housing redevelopment industry, as well as the planning and building controls, impacting on infill outcomes in Melbourne’s middle suburbs. Such factors limit both the supply, and demand, for better quality housing design, which has led to a predominance of poor performing dual occupancy redevelopments in these areas. By understanding the pressures currently placed on small scale infill redevelopment, this research proposes viable design improvements that can be readily adopted by industry while also challenging the planning protocols and aspects of domestic building culture that are incongruent with enhancing the quality and performance of infill redevelopments - and hence limit their potential appeal to a wider market.

Current Market Trends
A review of recent infill housing in the selected study areas revealed that the majority of redevelopments completed tended to be large semi-detached unit types with adjacent double garages and small private courtyards. One and two bedroom dwellings can be as small as 130m², however most dwellings were of 220-250m² in area.

En suites to main bedrooms are a “must have” selling point and, interestingly, it appears that some redevelopments are beginning to provide one bathroom per bedroom. Dwelling size tends to be measured and marketed in terms of the “number of bedrooms” provided however bedrooms are generally reducing in size. The minimum room dimensions along with restrictive internal planning and limited egress points inhibit opportunities for flexible occupations or multiple uses. In short, current infill housing designs are only suitable for domestic purposes for a limited number of household types. Future adaptation of the building structure is likely to be difficult which is unsatisfactory from a sustainability standpoint and an unappealing investment option for a number of households, such as young families.

Australia’s perceived aspiration for spacious homes and personal car transport is manifest in the infill redevelopment market. Developments will often sacrifice private open space amenity, solar access and natural ventilation opportunities to ensure the dwelling is as large as possible and garages are integrated with the dwelling structure. An extensive examination of market demand for various infill housing types is outside the scope of this research, however the following summary provides some indication of the recurring attributes in common housing models delivered through standard industry redevelopments (refer overleaf for more detail).

Dual and Triple Occupancies
- Typically large, single storey, detached or semi-detached units.
- Limited useful private open space or vegetated gardens.
- Front yards are often unfenced / low-fenced and lack other privacy treatments, limiting more effective use due to public exposure.
- Extensive paved areas for car access or garage doors dominate the street frontage.
- Little to no engagement with the streetscape otherwise.
- Reasonable access to light and air, but generally poor solar orientation
- Restrictive internal design and room sizes allowing singular occupations and uses only

Multi-lot redevelopments (6 or more units on 2 or more lots)
- Typically one and two storey semi-detached units or townhouses.
- Limited useful private open space or vegetated gardens.
- Extensive paved areas for car access, common areas dominated by vehicle movement and parking.
- Variable access to light and air with openings often abutting neighbouring walls and fences.
- Generally poor orientation
- Little to no engagement with the streetscape
- Restrictive internal design and room sizes only allowing singular occupations and uses

Terrace types
- Dwellings are usually single storey, sometimes double storey, provided in runs of 2 or 3, depending on lot dimensions.
- Generous private open space to rear, due to typical suburban block lengths.
- Reduced extent of driveways, however garages often dominate the streetscape due to narrow width of allotments.
- Where parking is to the rear, reduced setbacks assist engagement with the street, however privacy treatments for the occupants is often lacking.
- Poor access to light and air, poor orientation due to issues of overlooking.
- Restrictive internal design and room sizes only allowing singular occupations and uses
Infill Opportunities Design Research Report

**Standard Industry Practice and Market Trends**

**Case Study 01**
53 Price Street, Essendon
- Number of Lots: Single Lot
- Number of Dwellings: Double Occupancy
- Site Area: 638m²
- Built Footprint: 371m² - 51%
- Driveway: 159m² - 25%
- Private Open Space: 98m² - 15%
- Dwelling Floor Area: 2 X 205m²

**Case Study 02**
74 Nimmo Street, Essendon
- Number of Lots: Single Lot
- Number of Dwellings: Triple Occupancy
- Site Area: 1044m²
- Built Footprint: 508m² - 49%
- Driveway: 262m² - 25%
- Private Open Space: 124m² - 12%
- Dwelling Floor Area: 2 X 327m²

**Case Study 03**
64 Price Street, Essendon
- Number of Lots: Single Lot
- Number of Dwellings: Double Terrace
- Site Area: 685m²
- Built Footprint: 328m² - 48%
- Driveway: 49m² - 7%
- Private Open Space: 230m² - 34%
- Dwelling Floor Area: 2 X 134m²

**Case Study 04**
40 Beaver Street, Essendon
- Number of Lots: Single Lot
- Number of Dwellings: Triple Terrace
- Site Area: 860m²
- Built Footprint: 338m² - 40%
- Driveway: 20m² - 2%
- Private Open Space: 238m² - 27%
- Dwelling Floor Area: 3 X 184m²

**Legend**
- garage entry
- pedestrian entry
- sidewalk cross over
- driveway
- secluded outdoor space
- non-secluded outdoor space

North point for aerial photos only

Scale 1:500

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Infill Opportunities  Monash Architecture Studio  Monash University  November 2011
Case Study 05:
48 Hewitt St, Reservoir
Number of Dwellings: Four Unit Occupancy
Number of Lots: Double Lot
Site Area: 1485m²
Built Footprint: 757m² - 51%
Driveway: 357m² - 23%
Private Open Space: 239m² - 16%
Dwelling Floor Area: 4 X 189m²

Case Study 06:
49-51 Copper Street, Eastwood
Number of Dwellings: Six Unit Occupancy
Number of Lots: Double Lot
Site Area: 1578m²
Built Footprint: 328m² - 48%
Driveway: 557m² - 25%
Private Open Space: 220m² - 14%
Dwelling Floor Area: 3 X 172m² + 3 X 133m²

Case Study 07:
62-64 Waverley Road, Chadderton
Number of Dwellings: Eight Unit Occupancy
Number of Lots: Double Lot (equivalent to 3 x 15m)
Site Area: 860m²
Built Footprint: 1056m² - 47%
Driveway: 262m² - 25%
Private Open Space: 124m² - 12%
Dwelling Floor Area: 8 X 132m²

Legend
- garage entry
- pedestrian entry
- sidewalk cross-over
- driveway
- secluded outdoor space
- non-secluded outdoor space

Scale 1:500
Infill Opportunities Design Research Report Standard Industry Practice and Market Trends

Standard Industry Practices

Infill redevelopment is often more expensive to deliver than conventional detached housing. This is due to a range of standard practices, delivery processes and regulatory conditions within the domestic building industry however the increased complexity of construction involved in multi-unit redevelopments is a significant contributory factor. For example, multi-storey construction and shared party walls attract higher costs due to vertical circulation solutions (liffs and stairs) as well as the additional fire separation required between dwellings.

To maintain competitive price points and avoid unnecessary economic risk, infill housing is usually completed with the most cost effective building methods, to minimum construction standards. In Victoria, the domestic residential industry is geared towards cottage building techniques: typically lightweight framing on concrete slabs, brick veneer or compressed sheet cladding and metal sheet roofing systems. Housing types and construction techniques are standardised for efficient coordination of trades and labour. This risk adverse approach impedes potential construction innovations in this building sector and leads to limited diversity of dwellings offered to the market. Sustainable design initiatives are also generally provided to minimum regulatory requirements. Additional equipment or enhancements to building performance are in fact readily available but usually attract unaffordable cost imposts, unaffordable for many prospective purchasers.

A significant consequence of the highly constrained economic environment surrounding infill redevelopment is the lack of adequate design inputs for this scale and type of project. Cost neutral benefits, such as appropriate building orientation for optimised passive design and spatial solutions that facilitate a range of social sustainability outcomes, are often omitted from infill redevelopments through ill-considered siting and building design. To deliver good quality, higher density environments, this form of redevelopment requires greater design attention to ensure the necessary supporting infrastructure, private amenity and public urban space upgrades are also achieved.

This research project explores on the contribution of design for improving the quality and performance of infill redevelopment and proposes models that could be readily adopted within current industry practices. The potential benefits achieved through higher levels of design input are discussed in more detail in the Design Strategies section of this report.

Extant Planning Controls

The limited range of infill housing delivered by the domestic building industry can, in part, be attributed to complicated planning processes and extant planning controls currently in place in Victoria. The spatial design and architectural form of infill redevelopments are highly constrained by generalised planning requirements for parking, open space, building height limits and setbacks. Approval decisions are not architecturally driven, and potential dispensations for context specific design responses are rarely assessed from a spatial point of view.

The below discusses some of the most prevalent design and delivery impacts arising from current planning regulations and processes.

State level planning system administered by local municipalities

The lack of consistency within the current planning regime is a significant barrier for effective delivery of infill redevelopments. Regulations set at state level can be customised by each municipality, which results in a highly uncertain approval process for domestic builders. Such confusion often leads to prolonged development delays. The cost of “holding” latent sites while the planning process is resolved is an avoidable situation for smaller-scale builders undertaking infill projects in the middle suburbs. The flow-on effect is an informal, self-imposed standardisation within the building industry itself. Building forms and siting strategies are replicated to avoid the risk of planning permits becoming “stuck” in the system, impacting on the diversity offered by the infill housing sector.

“As of Right” Development

Currently, no planning mechanisms exist to streamline the approval process for infill redevelopment. Most municipalities do not require a planning permit for a single dwelling on allotments greater than 300m2 however multi-unit redevelopments and land subdivisions must undergo assessment. The market’s propensity for small infill projects (refer Background Research), as well as the design and delivery advantages presented by this scale work in middle suburban contexts, warrants the development of a new planning instrument that can facilitate better quality redevelopment outcomes and more efficient delivery of the work.

Building Heights and Setbacks

The low density development form constituting the middle suburbs is perpetuated by blanket controls around building heights and setbacks. It is recognised that aspects of the suburban context warrant preservation in this manner, however a “one size fits all” approach is counter-productive for intensification efforts and restricts the diversity of redevelopment options. The repetition of building easements on each boundary of a suburban allotment represents significant challenges for achieving even the most modest of density increases.

This research project has particularly focused on the design benefits that can be delivered with the adjustment of standard street setbacks. Reducing street setbacks does not impact on the amenity of neighbouring properties and, in most middle suburban contexts, generous nature strips provide adequate noise protection from vehicular street traffic. Through considerate siting and treatment of the street interface, substantial amounts of land can be “reclaimed” for collective use by residents and the surrounding community, encouraging interaction and a mix of programmes. This might include provision of bus shelters, small shops, local businesses, recreation facilities and community programmes.

The standard Rescode profile for setbacks on side boundaries particularly limits building mass at the second storey level. It is often possible to build beyond the mandated profile without impacting on the amenity of adjacent properties, however this varies from site to site and successful design solutions would rely on specific buttorm configurations. The design models proposed by this project largely adhere to the current regulations, with some minor encroachments required on the 2- and 3- lot developments.

Overlooking within the site

A small degree of internal overlooking between neighbours within multi-unit developments is inevitable. Excessive screening for absolute privacy is not recommended as it decreases visual permeability through the site and limits possibilities for shared space. With appropriate design strategies, such as the placement and treatment of garden elements, undesirable levels of overlooking can be controlled while maintaining positive design attributes, including passive surveillance and community interaction.

Carparking

Multi-unit parking requirements are another significant barrier for infill redevelopments. Planning controls impose 1-2 car parks per dwelling, plus an additional 20% for visitor parking, depending on the scale of redevelopment and number of bedrooms per dwelling. There is no allowance for shared parking arrangements and performance criteria for permeable ground treatments are not coupled with parking controls. For small scale infill redevelopments, vehicle access and parking constitute a substantial proportion of the site. Typical infill projects forego the majority of open space opportunities in lieu of concrete driveways and annexes. In a context that is seeking to reduce car dependency and mitigate the impact the built environment, the extent and location of parking required by planning regulations is in need of re-examination.

Summary

The majority of small scale infill redevelopments are dual occupancy projects, often on sites around 300m2 (post strata titling). Dwelling density and diversity is limited and projects are typically delivered to minimum construction standards. The combination of economic and regulatory pressures on small scale infill projects adversely affects redevelopment outcomes. The sheer volume of infill housing taking place in the middle suburbs means that these issues also impact larger urban concerns.

To improve the quality of infill outcomes, a thorough review of planning processes, regulatory controls and industry practices will be required, and a new planning instrument supporting innovative infill design solution put in place. Rather than defensive controls driven by a fear of unappealing redevelopment outcomes, planning controls and processes should be a proactive agent for facilitating high quality architecture and urban design contributions for this scale and type of work.
Infill Opportunities Design Research Report Design Strategies

Design Objectives

drawing from the examination of standard industry practices, regulatory constraints and location studies, the following design objectives were developed to enhance the quality and performance of the infill redevelopments proposed in each case study location.

> 3-for-1 dwelling replacement
- The majority of infill projects taking place in the middle suburbs are dual occupancy redevelopments. This project sought to achieve a modest increase in density outcomes, targeting a 3-for-1 dwelling replacement for each of the sites selected.

> 1:1 parking
- The proposed design models allow for 1 on-site carpark per dwelling. This allowance is considered a necessary provision for adequate mobility and access to amenity in current suburban contexts. The parking strategies have been developed to enable future adaptation upon the arrival of improved public transport connections or potential car-sharing arrangements.

> Optimised Passive Design Strategies
- The design, construction and siting of dwellings should maximise opportunities for solar thermal gains, natural lighting and natural ventilation.

> Ground Floor Access to All Dwellings
- All dwellings are designed to be visible and can be adapted for universal accessibility.

> Viable construction techniques with potential for innovation
- The proposed design models can be constructed using conventional domestic building techniques. The dimensions and arrangement of volumes, services and vertical circulation systems also accommodate prefabricated delivery methods.

> Preserve key aspects of suburban character and amenity
- Through a considerate design approach, medium density redevelopments can be integrated into existing suburban contexts, maintaining the existing character and amenity valued by their residents. For example, the form and distribution of new building volumes should ensure sunlight penetration to adjoining properties while maintaining privacy between neighbours. Increased vehicle access and parking should be developed in such a way that no additional cross-overs are necessary.

‘First Principles’ Design Method

The ensuing design strategies and housing models were generated from a ‘first principles’ design approach. Rather than adopting and working within the parameters of familiar housing types or market standards, this project reconsidered the occupational requirements, siting, amenity and regulatory constraints for infill housing on 1, 2 and 3 lot assemblies and proposed a series of design alternatives for improving the quality, diversity and performance of typical redevelopment outcomes.

Simply stated, the models were developed from the inside out, beginning with an examination of what makes a flexible room. The dwelling forms evolved as consideration was given to the assembly of flexible internal spaces, their relationship to a range of open spaces and the ability to provide independent entry points. The models anticipate the changing occupation of a dwelling over time and have been designed for easy expansion and adaptation. Finally, the distribution of building volumes on the site and design of common spaces were configured to maximise the collective benefits offered by multi-unit redevelopments in a suburban context.

This method of working revealed the significant contribution of design thinking and knowledge to infill redevelopment outcomes. Through a speculative design process and ‘on-site’ testing, the research identified several areas in which the quality and diversity of infill housing could be improved. The ‘first principles’ design approach enabled the research to challenge extant industry standards and regulatory constraints that impede the delivery of innovative infill housing models.

Design Strategies

Three key design strategies were developed to achieve the objectives and aspirations for the project:

> Flexible Rooms, Compact Plan
- Generous rooms sizes with indeterminate uses can accommodate a range of potential occupations.
- A ‘loose fit’ approach for ease of partitioning and adaptation of spaces over time.
- Compact service cores facilitate independent occupations of different dwelling zones.
- The arrangement of cores and flexible rooms ensure a compact dwelling footprint is achieved.

> Housing designs that anticipate growth and changing occupations
- Assembly of flexible room modules for a diversity of dwelling types, sizes and occupations. Additional modules can easily be incorporated as occupants’ needs change.
- Compact cores enable efficient extension of services and vertical circulation to additional levels. Covered open spaces can be ‘infilled’ as necessary.
- A variety of private open spaces related to internal spaces on each level for flexible occupation and adaptive use.

> Maximise Shared Uses and Collective Benefits
- Subdivision of the site incorporates dedicated shared space and facilities.
- Parking areas are designed for future adaptation as green open space.
- Siting and building forms ensure open space amenity and solar access is maintained to neighbouring properties.
- Dwelling designs and siting strategies offer potential to increase public amenity, such as local shops, businesses and improved streetscapes.
- Redevelopment models support potential collective finance and development opportunities (e.g terminating cooperatives).

This section of the report provides an insight into the design principles and strategies which underpin the proposed infill housing models.
Flexible Rooms, Compact Plan

Design for flexibility within the dwelling began with a reconsideration of the basic spatial unit of the house - the room.

Domestic use of spaces in typical project homes is highly predetermined by sequences of access, provision of servicing, and spatial dimensions. Conventional room sizes, internal layouts, built-in joinery and the location of openings in project housing does not allow for flexible occupation. For example, small bedrooms are only suitable for use as private sleeping spaces and are difficult to adapt for other purposes. The location of entry doors, common living spaces and circulation systems impedes opportunities for independent uses and separate zoning of areas within the house.

Additionally, the size of infill housing currently delivered by industry is typically very large, which hampers the possibility of achieving higher densities through this type of redevelopments. It is standard practice to provide several bathrooms in a dwelling; wet areas, including ensuites, laundries and separated WC’s, can commonly reach up to six or seven rooms. This is considered an unnecessary inefficiency that does very little for the flexible occupation of the dwelling while incurring additional construction costs for the extra fixtures, servicing, doors, and walls.

This project sought to explore viable design alternatives that could provide for a wide range of living, working and care arrangements within the dwelling. Through careful planning and the consolidation of efficient service cores, the design research proposes infill models that comprise generous, flexible rooms while ensuring a compact dwelling plan. The models take on a “loose fit” approach to the partitioning and fitout of internal spaces, allowing prospective occupants to easily subdivide and adapt the dwelling to their individual needs over time (refer page opposite).

> Flexible Room 1
The proportions of this model and the relationship to the service core and entry points allows for several occupations requiring larger, open plan spaces, such as a main family room, home office or small shop. It can be partitioning at various points along its length to accommodate smaller, separated occupations such as a small semi-independent ground floor unit or bedsit.

> Flexible Room 2
The slightly larger proportions of this model permits both lineal and transverse partitioning enabling a quadrant of related uses. For example, children’s bedrooms and a play space might be configured together with access to suitable storage and a “messy” wet area beside the core. Alternatively, this space could be used as a generous one bedroom apartment. With secured independent entry points to the dwelling, opportunities exist to lease different areas and levels of the house.

> Compact Core
A range of core configurations have been developed comprising different combinations of bathrooms, storage, kitchens, kitchenettes and laundry facilities. Cores can also expand if, for example, larger kitchens are required. Vertical circulation is integrated into the compact core volume, which can efficiently extend servicing and stair access to every floor. Importantly, the cores can be adapted to accommodate a universally accessible bathroom and domestic lift, enabling all ambulatory modes to inhabit each level of the dwelling.
Infill Opportunities Design Research Report

Design Strategies

Typical two storey townhouse – Rooms shown in isolation

Proposed Design Model – Flexible Room 1

Proposed Design Model – Flexible Room 2

1. Bedroom
2. Living + Dining
3. Kitchen
4. Kitchenette
5. Bathroom
6. Storage
7. Study
8. Kid’s bedroom
9. Playroom
10. Wash stand
11. Office
12. Accessible entry

Scale 1:150
Room and core assembly possibilities to form a variety of household types.
Infill Opportunities Design Research Report Design Strategies

Housing Designs that Anticipate Growth and Changing Occupations

Assembly of Flexible Room Modules
The form of the dwellings evolved through the development and assembly of the flexible room modules, producing a diversity of dwelling types, sizes and possible occupations. The simple stacking of two volumes provides the basic dwelling model comprising two flexible rooms and three types of private open space configured around the compact vertical circulation and services core. From this basis, a variety of house types can be developed through the potential addition of a third level volume and the considered internal design, partitioning and zoning of separate household occupations (refer page opposite).

Variety of Private Open Spaces
An important component for high quality infill redvelopments is the inclusion of generous, usable private open spaces that have a strong relationship with the internal spaces of the dwelling. Three types of open space are proposed in base model: a garden space at ground level, providing opportunities for landscaping, tree cover and productive gardens; a covered open space which could potentially serve a number of purposes including the extension of living activities, an accessible carpark or temporary “drop-off” area, a separate play space for children, work shed or studio; and finally an upper level terrace facilitating independent occupations within the house.

The covered open space is an integral component of the model, offering a number of flexible avenues for adapting the dwelling to suit different household needs. By simply enclosing the space and incorporating it into the main dwelling, the ground floor module can accommodate a universally accessible one-bedroom unit. Alternatively the space could be used by a semi-independent teenager or converted into a bedsit for a live-in carer.

The design model also provides for potential roof terraces. This option does not form part of the basic dwelling module due to construction cost and affordability considerations. However, should a dwelling extend to 3 levels, additional open space can be dedicated for this purpose.

Compact, Extendable Service Core
The vertical circulation and service cores have been configured to work over three levels. With independent entries to the dwelling, a range of wet area services can be customised for flexible use or separate occupation of each level.

Construction Viability and Potential Innovation
The design model has been developed for viable delivery by conventional domestic building methods. For example, the modules are sized for standard joist/beam spans. Shared party walls are simplified for ease of fire rating and structural masonry walls are located to optimize thermal gains. The design also anticipates prefabrication of, either, separate building elements such as stair or roof assemblies, or potential off-site manufacture or flat-packed partial pre-assembly of full unit modules.
Maximise Shared Uses and Collective Benefits

As discussed in previous sections of the report, infill redevelopments delivered through standard industry practice fail to address the shared amenity necessary to support higher density environments. This design project endeavours to maximise opportunities for collective benefits within the redevelopment. This might include on-site enhancements, such as high quality shared open spaces and facilities for the residents, or comprise improvements for the public realm, such as upgrading streetscapes, providing bus shelters or a local shop.

In the proposed design models, shared spaces and amenity is initially addressed through the subdivision strategy for each of the case study sites. A 3-for-1 dwelling replacement was targeted as a redevelopment density in each location; to incorporate adequate shared space and common facilities, a 4-to-1 subdivision ratio was employed. Thus, the shared zone on the site is allocated equal space to each of the private dwellings (refer diagram to far left). The shared zone does not include the driveway, but rather provides a dedicated area for common uses. It can be located at any point along the site in response to the existing context. For example, existing vegetation in the back yard of a neighbouring property might be augmented by adjacent planting and tree cover provided in this shared zone. Alternatively, the break in building masses for the proposed redevelopment could be located to ensure solar access is maintained to adjoining properties.

The shared zone has been considered for both immediate and long term uses. While the middle suburbs remain a car dependent environment, it is proposed the shared zone is used for collective parking, providing space for 1 car park per dwelling. It is anticipated that the extent of personal cars will decrease as fuel prices increase and car sharing arrangements become more common. In the latter scenario, the shared zone would be transformed to provide generous shared open space amenity and common facilities for residents. These types of enhancements serve a number of purposes in higher density environments. For example, facilities and equipment could be “pooled” offering cost savings to residents and encouraging social interaction. Workshops and recreation facilities along with tools and equipment might be shared by a community rather than duplicated by individual households. Other advantages include informal child minding arrangements in common spaces or a guest unit that is shared/leased by the residents.

This example illustrates the first evolution of the site with a shared parking area (above left) that is transformed into a shared productive garden with an outdoor kitchen and tool shed (bottom left). The existing permeable driveway is allowed to be grown over with grass which enables the shared open space to expand to the fence line. Without vehicle access the boundary fence can be inhabited with storage, bike parks and extensive planting. The maturing trees begin to provide shade cover for an area that will be frequently used by residents and guests.
Infill Opportunities Design Research Report  
**Design Strategies**

- Shared open space and facilities, providing for communal use as determined by the cooperative
- Driveway / garden lane with planting and permeable paving
- Narrow frontage with minimal street setback: possibility for commercial occupation providing local public amenity (e.g. milk bar)
- Private roof terrace
- Private garden
- Higher volume (including possible 3rd storey addition) set in middle of lot to reduce overshadowing and overlooking of neighbours
- Vertical circulation provided in core to allow access to roof terraces or additional upper floors
Infill Opportunities Design Research Report

Design Case Studies

Selected Sites for Design Case Studies

Following the identification of suburban regions with strategic relevance for infill development, six study areas were selected within these regions and analysis of the variance of lot dimensions within the areas was undertaken. From this a set of guide dimensions were established that would enable design testing to have broad relevance within the kind of suburban fabric in question. It then remained to choose specific real sites with compatible dimensions for design testing.

The design research sought to investigate particular opportunities associated with sites of 1, 2, and 3 contiguous lots, and to formulate a design model for each of these. Individual sites were chosen for each lot amalgamation scenario.

As the analysis of lot dimensions through scatter graph plotting made apparent, attempting to identify a single most typical condition to design for would be counter-productive, as within certain thresholds a range of conditions are common. For this reason, the selection of particular sites on which to base design case study work sought to encompass a reasonable degree of difference and variety, whilst avoiding the inclusion of eccentric or “outlier” conditions.

The three sites were thus selected from suburbs with quite dissimilar characteristics of streetscape, housing stock, urban form, and redevelopment trends; the chosen suburbs being Essendon, Preston, and Burwood East. Refer to the Context Analysis section accompanying each design model for a description of their respective characteristics.

Lastly, the three selected sites encompass a variety of solar orientations. Both the double lot Preston site and the triple lot Burwood East site are oriented North-South, with Preston being on the Northern side of the street and Burwood East on the Southern side. In contrast, the Essendon site has an East-West orientation (in which case both sides of the street are equal).
Infill Opportunities Design Research Report

Design Case Studies

Single Lot Model Essendon

Location, Subdivision and Design Diagrams

Lot configurations

Subdivision diagram - private and shared space

Design Model: L-House

L-HOUSE TYPE

<table>
<thead>
<tr>
<th>Project Data</th>
<th>1 lot</th>
<th>2 lots</th>
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<tbody>
<tr>
<td>Site Area</td>
<td>698m²</td>
<td>1,422m²</td>
</tr>
<tr>
<td>Number of lots</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Dwellings</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Cars</td>
<td>3 + visitor</td>
<td>6 + visitor</td>
</tr>
<tr>
<td>Density</td>
<td>42 dwellings per hectare</td>
<td></td>
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<tr>
<td>Building Footprint</td>
<td>160m²</td>
<td>200m²</td>
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<tr>
<td>Floor Area</td>
<td>306 - 554m²</td>
<td>612 - 1108m²</td>
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<tr>
<td>Open Space</td>
<td>533m²</td>
<td>1092m²</td>
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<tr>
<td>Site Coverage</td>
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<td>23%</td>
</tr>
<tr>
<td>Floor Area Ratio</td>
<td>0.44 - 0.79</td>
<td></td>
</tr>
</tbody>
</table>

Design Description

3 for 1 dwelling replacement
1:1 car parking
Subdivision allows for effective shared space and facilities
Flexible & diverse housing types
Site and dwellings accommodate future change and growth
Building model optimises passive design opportunities
Ground floor access to all dwellings
Building mass and height contained to centre of the site
Design responds to the surrounding context
Building regulations are maintained
Of the six suburbs picked up in the study areas identified, Essendon appears to be undergoing the most redevelopment. Detached single storey houses are intermixed with a great variety of vernacular infill types, from familiar dual occupancy types to six unit occupancies and walk-up “six-pack” apartment blocks. There is roughly equal proportion of single storey to double storey, although three storey construction is yet to be seen. Corner sites in particular are thoroughly exploited, sometimes enabling up to four semi-detached houses to be accommodated on a single lot.

Street setbacks are generally 5-12m, with lesser setbacks at corners. Front yards are usually very visible to the street, with low permeable fences or no fence at all. Lots tend to be slightly longer and wider than the other areas sampled.
Single Lot Model Essendon Siting
Infill Opportunities Design Research Report

**Design Case Studies**

**Single Lot Model Essendon Site Layout**

**Block configuration**

**Date** Nov 2011

**Scale 1:250**
Single Lot Model Essendon Dwelling Plan: Couple with Home Office, Study or Guest Suite

**KEY**

- Ground Floor:
  1. Shared Office / Shop front
  2. Kitchenette
  3. Bathroom
  4. Store
  5. Covered open space
  6. Open space

- First Floor:
  7. Bedroom
  8. Bathroom
  9. Kitchen
  10. Living
  11. Deck

**Design Model:** Couple with home office, study or guest suite
Single Lot Model Essendon **Dwelling Plan: Dividable House with Shared Laundry**
Infill Opportunities Design Research Report

**Design Case Studies**

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### Design Model: Large Family

**KEY**

- **Internal Floor Area:** 156m²
- **Scale:** 1:100

#### Ground Floor
1. Main Living / Dining
2. Kitchen
3. WC
4. Store
5. Covered open space
6. Open space

#### First Floor
7. Bedroom
8. Bathroom
9. Living / Rumpus
10. Deck

#### Second Floor
11. Master Bedroom
12. Bathroom
13. Living / Study
14. Deck

---

Single Lot Model Essendon

**Dwelling Plan: Large Family**
Infill Opportunities Design Research Report: Design Case Studies

Double Lot Model Preston Location, Subdivision and Design Diagrams

**MANSION TYPE**

**Project Data**

- Site Area: 1262 m²
- Number of lots: 2
- Dwellings: 6 - 7
- Cars: 6 + visitor parking options
- Density: 48.55 dwellings per hectare
- Building Footprint: 345 m²
- Floor Area: 575 - 952 m²
- Open Space: 910 m²
- Site Coverage: 27%
- Floor Area Ratio: 0.46 - 0.75

**Design Description**

- Potential to achieve up to 7 dwellings on 2 sites.
- "Mansion" typology with individual access points.
- Dwellings can be universally accessible.
- Subdivision allows for effective shared space and facilities.
- Building model optimizes passive design opportunities.
- Building mass, height and setbacks respond to the existing context.
- Some building regulations would need challenging.

Lot configurations  
Subdivision diagram - private and shared space  
Design Model
This area of Preston predominantly characterised by detached houses on single lots with a greater variety of building types are only found around arterial roads. Some infill has occurred, predominantly in the form of double occupancies appear. Interestingly, a symmetrical duplex type built across two lots occurs frequently in this area.

Union street has a variety of street edge treatments, from completely unfenced to high brick wall, with building setback ranging from 5.5 to 9.5 metres. Lots in this area tend to be somewhat narrower and shorter than in the other study areas sampled.
Double Lot Model Preston Site Layout

6 Dwelling Option

7 Dwelling Option

Block configuration
**Infill Opportunities Design Research Report**

**Design Case Studies**

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**Double Lot Model Preston**

** Dwelling Plan: Accessible Unit **

**KEY**

- **Internal Floor Area:** 79m²
- **Ground Floor**
  1. Living
  2. Kitchen / Dining
  3. Bathroom
  4. Laundry / Store
  5. Guest Room / Short-stay carer
  6. Bedroom
  7. Covered Open Space
  8. Open Space

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**Design Model: Accessible Unit**

(1.5 bedrooms)
Infill Opportunities Design Research Report **Design Case Studies**

**Design Model: Couple with Home Office plus Independent Studio**

**KEY**

- Internal Floor Area: 134m²
- **Ground Floor**
  1. Independent Studio / Bedsit
  2. Kitchenette
  3. Bathroom
  4. Open space
- **First Floor**
  5. Living / Dining
  6. Bathroom
  7. Kitchen
  8. Study
  9. Bedroom
  10. Deck
- **Second Floor**
  11. Studio
  12. Deck

**Ground Floor**

- 1. Independent Studio / Bedsit
- 2. Kitchenette
- 3. Bathroom
- 4. Open space

**First Floor**

- 5. Living / Dining
- 6. Bathroom
- 7. Kitchen
- 8. Study
- 9. Bedroom
- 10. Deck

**Second Floor**

- 11. Studio
- 12. Deck

**Double Lot Model Preston Dwelling Plan: Couple with Home Office plus Independent Ground Floor Studio**
Infill Opportunities Design Research Report Design Case Studies

Triple Lot Model Burwood East Location, Subdivision and Design Diagrams

CLUSTER TYPE

Project Data
- Site Area: 1751m²
- Number of lots: 3
- Dwellings: 9
- Cars: 9 + visitor parking options
- Density: 51 dwellings per hectare
- Building Footprint: 533m²
- Floor Area: 924 - 1509m²
- Open Space: 1218m²
- Site Coverage: 30%
- Floor Area Ratio: 0.53 - 0.86

Design Description
- Potential to achieve up to 7 dwellings on 2 sites
- "Mansion" typology with individual access points
- Dwellings can be universally accessible
- Subdivision allows for effective shared space and facilities
- Building model optimises passive design opportunities
- Building mass, height and setbacks respond to the existing context
- Some building regulations would be need challenging
Little infill seems to have occurred in the area, with redevelopment usually limited to occasional replacement of a single detached house with a new, larger single detached house. A few instances of multi-lot amalgamation can be found however, where two or more lots have been joined and redeveloped with elementary low-rise units.

There is great variety of street edge treatment, ranging from entirely unfenced to high brick walls, with buildings built hard to the front boundary at some corner sites. Otherwise setbacks tend to be from 5 to 12 metres. Lots in this area are slightly shorter than in the other suburbs sampled.
Triple Lot Model Burwood East Siting
Infill Opportunities Design Research Report

**Design Case Studies**

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**Triple Lot Model Burwood East Site Layout**

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Block configuration
Infill Opportunities Design Research Report Design Case Studies

Triple Lot Model Burwood East Section

Rescode Setback

Scale 1:200

Date Nov 2011  Scale 1:200
Infill Opportunities Design Research Report Design Case Studies

Triple Lot Model Burwood East Dwelling Plan: Ground Floor Office or Shop plus First Floor Studio Apartment

KEY
- Internal Floor Area: 107m²
- Ground Floor:
  1. Shared Office / Shop front
  2. Kitchen
  3. WC
  4. Store
  5. Covered open space
  6. Open space
- First Floor:
  7. Guest / Studio Apartment
  8. Bathroom
  9. Kitchenette
  10. Store
  11. Deck

Date: Nov 2011
Scale: 1:100
Infill Opportunities Design Research Report Design Visualisations

Landscape Turnover Strategy

In standard industry practice, residential infill developments often give over a substantial portion of site area to the exclusive use of vehicle access. Often fully concreted, vehicle access and parking represents a significant loss of amenity that requires reconsideration; enjoyable open space is a crucial component to the success of higher density environments. The privileging of vehicle access over other programmes in contemporary residential developments also seems short-sighted in light of the anticipated increases in fuel prices and ensuing decreases in personal car ownership expected for the future.

In the short term, provision for vehicle access will remain a necessary component of middle suburban redevelopments. However, it is assumed that public transport services will improve and car sharing arrangements will become more common as strategic intensification policies are realised in these areas. The models presented here are designed in such a way as to enable vehicle traffic areas to be adapted for other uses at a later date. These uses may entail such things as recreation facilities, extra-domestic functions such as workshops, productive gardens, commercial facilities open to the broader public, or simply green open space.

Using the Essendon scheme as an example, the following three plans illustrate how a staged turnover of open space may occur as parking provision decreases over time.

Stage One
It is proposed the shared zone is used for collective parking; providing space for 1 car park per dwelling. Furthermore the entire laneway is kept clear to enable vehicle access and parking within the individual dwelling lots.

Stage Two
The segment of the driveway between the shared parking areas is closed to vehicle access and becomes a garden laneway with grass and planting allowed to cover much of the permeable paved ground. This enables informal appropriation of the lane for outdoor uses by the residents.

Stage Three
Parking provision is limited to two small bays at either end of the site, sufficient for a flexi-car or other shared transport arrangement. The shared zone is transformed to provide generous shared open space amenity and common facilities for residents. The Western yard becomes a shared productive garden with an outdoor kitchen and tool shed, while the Eastern yard is given over to recreational activities. Without vehicle access the boundary fence can be inhabited with storage, bike parks and extensive planting. The maturing trees begin to provide shade cover for an area that will be frequently used by residents and guests.

The implementation of the three phases needn't happen sequentially of course. Depending on the needs and priorities of its members, the cooperative may elect to reduce parking provision and the outset and begin at phase two or three.
Landscape Turnover: **Stage One**

LEGEND

- a - shared recreation space
- b - shared parking area
- c - laneway
- d - private garden
- e - private shaded patio
Landscape Turnover: **Stage Two**

**LEGEND**
- a - shared recreation space
- b - shared parking area
- c - garden lane
- d - private garden
- e - private shaded patio
- f - storage, water tanks, garden beds
- g - possible home office / non-residential use
Infill Opportunities Design Research Report Design Visualisations

LEGEND
a - shared recreation space
b - shared parking area (flex-car)
c - garden lane
d - private garden
e - private shaded patio
f - storage, water tanks, garden beds
g - possible home office / non-residential use
h - communal vegetable garden
i - bus stop

Landscape Turnover: Stage Three
Internal Site View Stage One: Vehicle Parking
The shared zone between dwellings is occupied by resident vehicles in the short term. The driveway is softened with permeable ground treatments and planting. Landscaping and vegetation throughout the site ensures vehicle spaces can also be enjoyed as shared open space amenity.

Internal Site View Stage Three: Shared Open Space Amenity
The shared zone between dwellings evolves in the longer term. With reduced parking requirements, the common area is occupied by pedestrian-level activity and shared resident facilities. The fence line can be populated by work sheds, BBQ's, site storage or recreation, enabling the shared space to expand across the redundant driveway. The permeable ground surface is allowed to ‘over-grow’, while trees and planting mature to provide generous green open space amenity.
Street View Stage One: Private Residence
The proposed infill models are designed to knit into the existing suburban fabric. Building masses respond to the height and pattern of the surrounding development. Reduced street setbacks enable better utilisation of the site, privacy treatments and building openings ensure the existing amenity is maintained.

Street View Stage Three: Potential Shop Front
As middle suburban contexts transform to higher density environments, additional supporting amenity and services will be necessary. The siting and design of the proposed infill models provides potential for street front dwellings to be converted into public and semi-public uses. This might include programmes such as local shops and offices, community rooms or childcare facilities. Reduced setbacks at the front boundary enable better engagement with the street and encourage social interaction. Redevelopments might also incorporate public infrastructure upgrades such as new bus shelters and improvements to footpaths and nature strips.
Research Findings
The design strategies and models proposed by this research were generated from a 'first principles' approach. Rather than adopting and working within the parameters of familiar housing types or market standards, this project reconsidered the occupational requirements, siting, amenity and regulatory constraints for infill housing on 1, 2 and 3 lot assemblies in and proposed a series of design alternatives for improving the quality, diversity and performance of typical redevelopment outcomes.

This method of working revealed the significant contribution of design thinking and knowledge to infill redevelopment outcomes. Through a speculative design process and 'on-site' testing, the research identified several areas in which the quality and diversity of infill housing could be improved. The research demonstrates how the compounding economic and regulatory pressures on small scale infill projects adversely affect redevelopment outcomes. The design models challenge planning encumbrances that conflict with contemporary urban needs and approaches to high quality, sustainable infill redevelopment.

Strategic Location for Infill Redevelopment
Definitions for the middle suburbs vary depending on the context in which they are used. To identify suitable areas for proposed infill redevelopment in Melbourne, this research developed 4 simple selection criteria:

- 7km - 25km from the CBD
- Suburbs developed between 1950-1979
- Good proximity to public transport networks
- Exclusion of areas with heritage overlays

Upon a detailed examination of sites within these strategic areas, it was found that the most effective way to isolate suitable allotments for redevelopment was to determine the width, depth and orientation as opposed to the site area. In the 6 suburbs reviewed, there was a clustering of common site profiles ranging from 15-16m wide and 38-43m deep.

Design Benefits
- Flexible, compact dwelling design
  The design models provide spacious and flexible housing within a compact envelope. The size and arrangement of rooms, their relationship to service areas and access to a range of open spaces enables a diversity of occupations on every level of the dwelling. The incorporation of multiple entry points enables independent use of separate areas within the one dwelling by unrelated households.

- Improved Open Space and Shared Amenity
  The proposed dwelling designs provide a range of quality private open spaces for smaller dwellings, which standard infill redevelopments fail to achieve. The siting strategy and landscape treatments convert the typical concrete driveway and parking areas into desirable common open spaces with opportunities for interaction and shared use. The development models anticipate reductions in car dependency and allow for future adaptation of vehicle spaces for further enhancement of shared amenity and facilities.

- More Effective Site Use and Extended Community Benefits
  In addition to the above siting strategies, the design models challenge extant planning regulations which result in inefficient utilisation of the site. Standard boundary setbacks, particularly to the street, are encroached upon without reducing amenity for neighbouring properties. This also enables extended community benefits, such as the potential incorporation of local shops, businesses and community programmes into the redevelopment.

- Adaptable Housing
  It is recognised that prospective purchasers of smaller dwellings are likely to have future need to expand and alter the use of their home. The proposed models are designed for ease of extension and adaptation over time.

- Construction Techniques
  The modular dwelling volumes, circulation systems and serving cores enable a range of prefabrication techniques to be employed in the delivery of the development. The benefit of such an approach is not only to facilitate efficient construction, but also to allow for viable customisation of appropriate building elements, fixtures and equipment.

- Replicable Design Models
  The proposed design models have been developed for sites that are commonly found in the middle suburbs. The design strategies are therefore transferable to other locations. Importantly, the models can also be expanded onto adjacent lots over time, should the sites become available.
Barriers to Improving Infill Housing Design

Regulated Building Setbacks
Current approach to street frontages, setbacks and street character are limiting the potential and restricting optimum use of typical suburban sites. Reducing street setbacks does not impact on amenity of neighbouring properties and, in most middle-suburban cases, generous nature strips provide adequate protection from vehicle traffic. Reducing setbacks increases the possibility of activating a streetscape and community engagement.

Limited Building Profiles
The standard Rescode building profile limits the form of a building particularly at the second storey level. It is possible to build beyond this profile without adversely impacting adjacent properties, however this would require site specific design input for each proposed redevelopment.

Excessive overlooking requirements
Overlooking within a site should be controlled, but not eliminated. Excessive screening for absolute privacy reduces site permeability, the potential for passive surveillance and positive interaction between residents.

Market Expectations
Growing demand for en suites to all bedrooms and an expectation of double garages integrated with a dwelling structure (rather than, say, detached carports or collectivised parking in a landscaped areas) is a significant concern for the future viability of alternative, more compact design models. Demonstration of the livability and performance benefits of well designed, smaller infill housing will be required to facilitate behaviour change and take up of unfamiliar housing proposals.

Further Research
The proposed design models can be extended onto adjacent sites or transferred to other locations within the middle suburbs. Further research examining strategies for the replication and extension of the design models would be beneficial. The extent of infill redevelopment currently taking place in the middle suburbs has implication on broader urban concerns and morphologies. Investigating the requirements and consequences of infill redevelopment at a larger precinct scale would be recommended.
Infill Opportunities Design Research Report  Bibliography


State Library of Victoria (2011) Historical information regarding the age of suburbs, cited July 2011