

Planning reform, land release and the supply of housing

authored by

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ACRONYMS

ABS	Australian Bureau of Statistics
AURDR	Australian Urban and Regional Development Review
AEG	Audit Expert Group
CBD	Central Business District
DETR	Department of the Environment, Transport and the Regions
DoI	Department of Infrastructure
DPCD	Department of Planning and Community Development
DSE	Department of Sustainability and Environment
GAA	Growth Areas Authority
GST	Goods and Services Tax
HIA	Housing Industry Association
LGA	Local Government Area
MMBW	Melbourne and Metropolitan Board of Works
MMPS	Melbourne Metropolitan Planning Scheme
MSD	Melbourne Statistical Division
NHS	National Housing Strategy
Propnum	Property Number
UGB	Urban Growth Boundaries
UK	United Kingdom
US	United States
VPP	Victoria Planning Provisions
UWS	University of Western Sydney

1 INTRODUCTION

1.1 Background

There is a growing interest in academic and policy circles in the relationship between land use planning policy and housing supply. Housing researchers are interested in the extent to which planning policies and practises may be exacerbating housing affordability questions, while planning academics and practitioners focus on what effect their policies actually have on the characteristics of housing supply. Policies seeking a diversity of built form are underpinned by attempts to reduce energy consumption through smaller house sizes and the design of less car dependent suburbs. Urban Growth Boundaries (UGBs) and increased net housing densities seek to slow the expansion of cities into hinterlands and reduce travel costs. The impact of UGBs on house prices is one of a number of issues that remains contested (Nelson et al 2007; Buxton and Scheurer 2007).

This positioning paper is the first product of a research project which is investigating the links between planning policies and housing outcomes. The project is an investigation into whether changes to land use planning policies and mechanisms impact on the types of housing supplied, particularly in new release areas. It examines details of both planning policy and housing supply in metropolitan Melbourne over a time period covering two significant policy regime shifts. The project examines the impact of changes to the planning system and the changes in strategic planning from 1990 to the present through the use of land transactions records in the Melbourne metropolitan area, merged with subsequent property valuations. This will permit identification of the types and characteristics of newly constructed properties during the period, and significant details about their location in relation to transport and other services. Changes to housing characteristics over time can be seen in the light of changes to planning policy and procedures in order to identify impacts of land regulation. This investigation combines in depth institutional knowledge of the planning system with quantitative methods of analysis to begin building a robust evidence base.

The purpose of this positioning paper is to outline the research project and place it in the context of literature debates and previous research. It is presented in four chapters. The first introduces the project and provides background. The second chapter explores relevant debates in the literature around the impacts of planning policies on built form outcomes and identifies what can be learnt from previous research in this area. The third chapter describes our methodology in some detail, and the final chapter outlines the intended next steps in the research.

1.2 Policy context during study period

The proposed study timeframe is a fruitful one. There was a major overhaul of the planning system in 1996 in Victoria which was intended to improve the efficiency of the land development process, standardise procedures and cut red tape. However, previous research has questioned the effectiveness of these reforms (Buxton et al 2003). Our empirical work will offer a rigorous evidence base by comparing developments on vacant land before and after the 1996 reforms. Differences between municipalities will be assessed. The introduction of the new system was intended to standardise planning provision across the state, so differences between local government areas in the application of planning regulations ought to decrease after the adoption of the new format schemes in the late 1990s.

The planning strategy *Melbourne 2030* (DoI 2002) is another critical reform of metropolitan planning that was the first of a number of similar metropolitan plans in Australian state capital cities, which include Sydney's *City of Cities* (NSW Department of Planning 2005), Perth's *Network City* (Department of Planning and Infrastructure 2004), Brisbane's *South East Queensland's Regional Plan* (Queensland Government 2005) and Adelaide's *South Australia's Strategic Plan* (Government of South Australia 2007). *Melbourne 2030* aimed to create a more compact city through encouraging medium density housing and smaller house lots and by increasing the proportion of development in and around existing urban centres (activity centres), and decreasing the proportion occurring on greenfield sites on the urban fringe. This policy approach is common to most other state strategic plans. The policy goals embedded in these strategic plans are important aspirations from both a planning and housing policy perspective. They attempt to reconcile the achievement of a more compact, environmentally sustainable city, with housing affordability goals. However, there are again doubts as to the efficacy of *Melbourne 2030*. Analysis of the 2006 Census shows that household growth in greenfield development in outer Melbourne actually increased despite the policy (DPCD 2007 p.50).

1.3 Research questions

The key research questions to be addressed in this investigation are:

1. Do changes to land use planning policies and mechanisms impact on the types of housing supplied, particularly in new release areas?
2. Are policies designed to bring about urban consolidation affecting the type of housing being built, and if so in what way?
3. Is there a correlation between planning policies and changes in house prices?
4. To what extent and in what way do government policies impact on decisions on housing supply made by the development industry?

2 PREVIOUS RESEARCH ON PLANNING POLICY AND HOUSING SUPPLY

2.1 Introduction and overview of evidence

The relationships between land use regulation, housing type, land and housing supply, and land and housing price, have been studied extensively in the international literature. The overall findings from this body of research are inconclusive. Few Australian studies exist. There is almost no reliable Australian research on the relationship between a specific regulatory measure such as an urban growth boundary and land price in Australia (Gurran 2008).

In the international literature, uncertainty exists over the size and type of any impacts. Claims of regulatory impacts are often value driven and political, made with little or no empirical support and sometimes at odds with data. Sources of data are variable resulting in measurement difficulties. Data sources include landowner estimates of housing price, developer and planner beliefs about regulatory impacts, land and housing price changes, and qualitative evaluations of governance arrangements. In the context of the present study, which focuses on vacant land and subsequent residential development, Ihlantfeldt's acknowledgement of an important gap in the research literature has a particular significance; as he succinctly points out: 'the effect of regulation on the price of vacant land has received scant attention in empirical studies' (Ihlantfeldt 2007, p.421). Methodological differences between studies abound. Types of regulation studied differ, and these differences affect conclusions and comparability between findings. Cities, city types and urban governance models vary radically between and sometimes within countries making generalised claims impossible.

The choice of variables studied also affect results. A wide range of factors affect the supply and price of developable land and urban housing and complicate claims of causal connections between regulation and land value. Many studies do not control adequately for the impacts of such variables, leading to further difficulties in making causal claims about regulatory impacts on land supply and price. Even many studies that attempt to statistically identify causal relationships generally make qualified conclusions.

Causal claims are often made about the influence of land scarcity on land price. Regulatory measures are assumed to restrict land supply, and so raise land price, adversely influencing housing and land packages. However, even when regulation restricts land supply, regulatory price impacts may be minimal for a number of reasons, such as a lack of demand or the availability of land in other locations or of denser, more diverse housing types. In addition, a range of factors other than land supply can affect land price. Key variables that can influence land price are transport provision, pricing mechanisms (such as congestion pricing), urban form, particularly whether cities are monocentric or polycentric, land banking, and land release locational factors such as distance of land from city centres, social factors such as income, population and dwelling density, and amenity factors affecting locational decisions (such as coastal or riverine areas).

Further, a range of macroeconomic and market related factors also have affected land price in Australian cities. Colebatch (2003) has pointed to the impact of low interest rates and taxation arrangements on housing demand and property prices. Other criteria, such as the extent, stage and mix of development and broader metropolitan conditions, also influence price. High continuing demand for housing, purchasing power, population and economic growth, flexible lending policies and housing

subsidies such as the first home-buyer grant have underpinned the rise in land and construction prices (DSE 2003). Strong demand for housing has continued in outer urban centres across Australia (DSE 2003) and has been partially driven by Commonwealth taxation policy mechanisms, such as negative gearing and capital gains tax (Productivity Commission 2004). It has proved difficult to separate such impacts from regulatory impacts such as increased local council requirements.

Nevertheless, there is no lack of literature claiming that strong land use regulations reduce land supply and the capacity for new housing construction, and therefore increase price. Brueckner (1990) and Glaeser et al (2005), argue that regulation restricts developer activity. Gordon and Richardson (1989; 1997) assume the validity of a market-based model, claiming that planned interventions into urban form interfere with the capacity of the market to deliver outcomes that maximise efficiency, convenience and responsiveness to user preferences in city building. Braby (1989), while acknowledging market imperfections and political bias, characterises the high-density, public transport-based lifestyle as an 'inferior good' compared to the more desirable ; 'superior good' of low-density living and private mobility. He argues that as incomes keep rising, more consumers will opt for the latter.

Birrell and Healy (2003), Birrell et al (2005), and the Housing Industry Association (HIA) (2008), addressing the introduction of an UGB in Melbourne, argued that supply constraints caused by a rigid UGB contributed to price increases for broad hectare land inside the UGB by causing developers to compete for remaining land parcels. Early in 2003, the Urban Development Institute, the HIA and other development groups and commentators claimed that the introduction of the Melbourne UGB in 2002 led to a 30 per cent increase in the price of land on the urban fringe (Millar 2004; Ketchell 2003). Moran (2006, p.4) claimed, but did not substantiate, a causal connection between regulatory planning systems, government induced land shortages, and land price increases in Australia:

Invariably [Australian planning systems] reduce the quantity of land that is available for conversion into housing ... If Australia were applying the liberal systems to development that prevail in Texas for example, a house/land package price would at least halve. Australia's ration-induced high prices for new developments on the periphery lift prices throughout the city.

No evidence was provided for these claims. Many such studies also are characterised by a simplistic comparison between regulation and price that does not provide a realistic comparative base. Few researchers, or members of the public, would argue that housing construction should be totally unregulated, yet comparisons are often made between various, often undefined, regulatory systems and an ideal market economy. The broader benefits of regulation are often excluded from these studies. Such benefits might include the potential for lower household and transport energy costs, for example, and claimed additional social benefits. Conversely, the costs of not regulating are not considered or explained as 'market failure' that can be addressed by appropriate assignment of property rights and market based mechanisms.

There is variability of results for studies on the impacts of regulation on price, as Quigley and Rosenthal (2005) point out, with many studies finding price impacts and others little or no impacts. In addition to identifying methodological differences to explain variable results, Quigley and Rosenthal also point out that a statistical association that might infer a housing price impact from regulation might really show that wealthier households select living environments protected by regulation. The literature on consumer choice of housing location contains a debate between advocates of the primacy of individual decision-making, and those who explain residential migration trends as 'located in the social relations and the social processes

of the wider society, and not in the motivations and aspirations of the individual migrant' Fielding (1982, p.20). Advocates of both positions agree that people move to areas with attractive environments and to areas with high standards of infrastructure and services, such as health services and transport. Alternatively, they might move because of employment opportunities. As Ihlanfeldt (2007, p.421) points out, another impact of regulation is that it 'may also yield an amenity effect'. The detailed literature on the claimed relationships between regulatory containment programs, such as the use of various types of urban growth boundaries, and land supply and price, is examined below.

Before addressing regulatory interventions, however, we first examine the importance of location to land values and house prices. Location is an important variable driving these magnitudes and can confound relationships between regulations, on the one hand, and land values/house prices on the other. Part of the complexity of relationships involving land values and house prices, and their determinants, is attributable to the role of locational characteristics.

2.1.1 Location

A number of researchers have pointed to the importance of location as an element that influences the complex relationships between land supply and land prices. Grimes and Liang (2009) point out the impact on land price of distance from a functioning city centre. In New Zealand, Australia and many European countries, land values fall with distance from city centres, but in the United States values generally rise because of the depressed state of inner city locations. Monocentric and polycentric cities can exert different influences on land price as Grimes and Liang (2009) also point out. Land supply is the sum of land available in greenfield sites on the urban fringe, brownfield and redevelopment sites in established urban areas, regional urban areas in actual or potentially networked cities and townships, multiplied by density. Large areas are available for urban habitation in American and some northern cities in the United Kingdom, but are not included in calculations of land supply because of locational preferences of white, middle-income residents. In Australian cities, most intensification is occurring in inner-urban locations. Yet large areas of land around established outer metropolitan activity centres with comparatively high quality public transport are not being redeveloped, and greenfield residential densities on the urban fringe are among the world's lowest. These differences in international city types reinforce the difficulty in making generalised conclusions about the causal relationship between land supply and price.

Glaeser and Ward (2009) contend that land use regulations in Greater Boston may lead to minor increases in construction costs when researchers do not control for density and demographic changes, but not when these factors are included because of the availability of land supplies in a wide number of locations. They also point to the difficulty in proving the causal effects of regulations on a decline in housing construction. Increases in minimum lot size led to a reduction in single-family home construction, but uncertainty remained over the extent to which building relocated to less regulated locations. Ihlanfeldt (2007) also found that although greater regulation led to small increases in housing prices, primarily through construction costs, the effect was even smaller where a large number of jurisdictions existed because households have a wider choice with respect to where they live. Ihlanfeldt (2007) also found that amenity affected price and that amenity was related to larger average lot sizes, houses and higher prices. These findings are consistent with the expectation that mandated higher average residential densities along with lot and housing diversity will lower housing costs. At the same time, total land values in a subdivision can increase as a greater number of lots are fitted in, and there is also a potential

range of other environmental and social benefits that can stem from higher outer urban densities.

Glaeser and Ward (2009) also found that the least total number of houses occurred in areas with the greatest supply of land as developers had no incentive to use land sparingly. These areas invariably occur on the extending urban fringe. This result that land scarcity drives increased efficiency of land use is a consistent finding in the literature. Ihlanfeldt (2007) found that restrictive land use regulation reduces the affordability of single-family houses. The regulation most affecting single housing supply and price in American jurisdictions was higher minimum lot sizes which, as expected, reduced the number of houses on a given area of land and resulted in larger more expensive houses. Lewis and Nieman (2000) compared residential development policies and growth controls in 297 municipalities in three regions in California by surveying municipal planners. They found that Central Valley planners, where a large amount of agricultural land was available, were much less likely to regard residential land supply as a growth constraint compared to planners in built up areas such as the San Francisco Bay area.

In general, development companies determine density in outer urban areas of Australian cities, with results that are similar to those in the US. High density development is being concentrated in inner Australian urban areas with the highest existing densities, while new outer development is mainly low density housing. Such locational differences are not as evident in the outer areas of most European cities where new housing is constructed generally at net densities of between 25–60 dwellings per hectare, though there is evidence of increased detached housing rates and lower densities being constructed on the fringes of some Mediterranean cities, and also on the edges of many cities in developing countries. This finding also points to a consistent lack of anticipatory policies for land consumption in outer urban areas, and the failure to use regulatory tools to prevent cost shifting from developers and governments to housing consumers over issues such as transport and other recurrent household costs.

2.1.2 *Demand and supply*

The interactions between governments, development companies and consumers exert constantly changing impacts on the relationships between the demand for and supply of land. Some researchers have proposed that land use planning and building regulations are responsible for some rigidity in the development process, causing housing supply to be unresponsive to changing market circumstances (Evans 2004; Ihlanfeldt 2004; Barker 2004). Buxton and Scheurer (2007), in contrast, have argued that development companies limit the supply of housing through land banking and controlled land releases, so raising land prices, reducing affordability, lot diversity, and environmental sustainability, while raising lot and dwelling size. Buxton and Scheurer (2007) contend that producer control over land markets and housing construction raises prices through the inefficient consumption of land and restrictions of consumer choice. They argue that another critical factor in land price is not the amount of future urban land designated by governments for development, but the rate at which land is released onto the market, and that this rate is determined in Australia by a limited number of seven or eight major development companies.

Consumers are often regarded as conservative in their preferences of housing design. However, as Ball (1999) points out, few house builders have attempted to convince consumers to select new and improved products. The theory of individual preferences driving migration to outer urban areas ignores the influence of speculators and the producers of housing on consumer choice. The lack of meaningful consumer experience with housing alternatives limits choice in outer suburbs. *Green Cities*

(AURDR 1995, p.127) argued that patterns of conventional subdivision and housing design developed by the producers of housing

has determined a generation's expectations of subdivision layout and housing type rigidly designed for a certain block size, and has reinforced conservative attitudes by the development industry of what will sell. Market choice is locked into a conservative and mutually reinforcing set of seller and buyer expectations.

Home owners in the UK buy and sell their properties significantly more frequently than most of their continental European counterparts, leading to greater value being placed on the future saleability of the dwelling. On the other hand, British consumers rarely experiment with customised design options or building components for their homes, choosing instead to purchase standardised products offered by the industry. Mortgage lenders tend to support the consumer focus on future saleability and are thus cautious about lending for dwellings whose design features or components appear too expensive.

Ball (1999) analyses reasons why the house building industry in Britain has been comparatively slow in an international context to implement operational innovations and productivity reforms. There are widespread tendencies within the industry, he argues, to maintain traditional designs and production methods, to focus on the most profitable market segments, and to adjust their land banking strategies and interactions with planning authorities accordingly. These tendencies are adaptive, opportunistic responses to the specific market conditions in the UK. It could be argued that they stifle innovation through a relative absence of long-term, strategic thinking, with the additional effects of low productivity and a neglect of professional training. Nonetheless, such conditions prevail, not least because individual firms have little incentive or reason to expect success as they try to break out of this pattern.

The price elasticity of demand, (i.e., housing consumers substitution of one location or housing product for another in response to change in relative prices), is the single most influential factor on house price formation, especially at the metropolitan scale according to Nelson et al (2002). The price elasticity of demand helps determine whether a housing supply constraint binds. The price elasticity of supply (i.e. response of housing supply to increases in relative price for an area or housing type) in turn determines the extent to which an increase in demand will be translated into house price inflation (Dawkins and Nelson 2002).

House price inflation can be triggered by a supply side driven contraction that leaves a shortfall relative to an unchanged demand for housing. Alternatively there can be a steady supply of housing but demand driven house price inflation, as increases in income or reductions in interest rates stimulate the demand for housing. Dawkins and Nelson (2002) comment that studies of house price formation using hedonic techniques are limited in their ability to distinguish between demand and supply side driven inflation, and are therefore of limited help in providing explanations of house price fluctuations and the role that might be played by the production decisions of the housing industry, or regulatory interventions.

Since housing producers are likely to vary the type and style of housing to economise on regulatory costs, we should not draw conclusions about the effect of urban containment policies without examining the dynamics of the entire housing market (Dawkins and Nelson 2002, p.10).

Ball (1999) comments that the house building industry in the UK is characterised by low supply elasticities exacerbated by the low level of innovation in the sector. Since productivity gains aimed at reducing or diversifying the labour input of house construction have failed to eventuate at a sufficient rate, upswings in the house building cycle are regularly accompanied by skills shortages and skyrocketing costs for the services of tradespeople. This constraint on supply responsiveness drives up the cost of housing production further at just the time in the cycle when demand is greatest. As a result, the peaks and troughs of the cycles are accentuated, which leads to greater volatility in the market environment, and hence greater uncertainty within the industry about rates of profit. House builders seek a premium above and beyond normal rates of return in order to maintain sufficient reserves to withstand a downturn. The vulnerability of the house building industry is further exposed by the relatively easy entry and exit of players, inevitable competition from the existing housing stock, as well as the capital intensive nature of their operations (Ball 2003). The consequence is upward pressure on housing costs.

Housing supply is a risky business. Production and land purchase decisions have to be made on the basis of forecasts of highly uncertain prospects. ... It is also extremely difficult to forecast how long market upswings last and the extent to which they are dampened or exacerbated by business cycle effects. ... Price behaviour in the housing market may be irrational in the sense that forecasts of future market performance are based on recent experience—ie. adaptive expectations. ... This may help to explain why the ending of the upswing phases of market cycles tends to come as a shock event, which radically alters subsequent behaviour and house builder performance. ... Housing market cycles can be the opportunity for spectacular profit-making, but equally spectacular loss-making during downswings (Ball 2003, p.902).

2.2 Governance, land use regulation and urban growth management

2.2.1 Regulatory type

A wide range of land use regulatory tools are used internationally to influence or control development. The most common is the use of tools such as zones, policies and legislation, and related plans, maps and ordinances, to specify land uses, control subdivision and locate development. More specific controls, such as density requirements; housing size, height and types; affordable housing and diversity requirements; growth management controls, such as growth boundaries; and environmental controls, such as building and subdivision design and performance measures, integrated land use and transport requirements, and landscape and biodiversity protection measures are less common. Such environmental controls apply more in some European countries than in America. The use of even stronger regulatory factors, such as the regulatory or pricing tools designed to force land release, public authority land development, and betterment taxes are even less frequently used.

Regulatory controls can be strongly or weakly related to other policy tools, and form part of an integrated package designed to promote a desired outcome. For example, a regulated boundary to growth is sometimes linked in the US to the purchase or transfer of development rights from non-urban land, or in the UK to land purchase. This linking of regulatory, market and purchasing tools is rare in Australia. The type of regulatory factor examined will be expected to influence results gained in studies of impacts on housing type, land supply, and land and housing prices. Quigley and

Rosenthal (2005, p.84) point out that regulatory restrictions on development are generally weak and indirect, thus avoiding 'true growth management' measures.

2.2.2 Integrated governance

An important factor underlying the type and strength of regulation is the comparative dominance of local jurisdictions compared to the existence of metropolitan wide governance. The fragmentation among local government organisations has often been proposed as an important cause of the spread of suburbs into peri-urban areas in the US. It has led to difficulties in achieving regional environmental management because local councils have little incentive to deal with environmental problems that have their source outside their boundaries, or that affect multiple jurisdictions (Mattingly 1999). In the US, about 83,000 local government bodies form a 'crazy quilt' of municipalities, towns and townships (van der Veer 1994). Daniels (1999, p.45) identifies fragmented and overlapping governments, authorities and special districts as the main obstacle hindering 'co-ordinated, long term and effective growth management in the metro fringe'. For example, by 1996, 20 million people lived in a greater New York that included 31 counties and 2,000 governments within a hundred mile reach. The boundaries of older cities have been frozen since the 1930s, while municipalities on the outskirts of cities were able to annex land, attract development and expand. Competition for growth between municipalities on the ever-expanding urban fringe and inner city cores was therefore established and jurisdictional fragmentation provided both the incentive and the means for constant expansion.

Internationally, limited municipal power in sectors such as transport, water, energy, solid and liquid waste management and land use planning often result in uncertainty (Allen 2003), confusion, and inconsistent and ineffective policy arrangements. The lack of effective regional planning worsens these effects in Australia. Local government in Australia does not control transport systems or natural resource management, and only obliquely affects infrastructure and social policy. The city of Brisbane is the exception to the rule as it has jurisdiction over most of the Brisbane metropolitan area. In comparison, the Melbourne metropolitan area contains 30 municipalities.

Institutional fragmentation also occurs over time within sectors. Until 1985, one metropolitan planning body, the Melbourne and Metropolitan Board of Works (MMBW), was responsible for most of Melbourne's physical planning. The MMBW was an integrated planning authority responsible for planning for strategic and statutory land use, sewerage, drainage, water supply and the provisions of regional open space. It administered one planning scheme for the Melbourne Statistical Division (MSD), an area that included the metropolitan area, the designated urban growth corridors, and a large area of non-urban land extending over 5,029 square kilometres in an arc around Melbourne. Metropolitan councils administered delegated authority over some permits and were represented on the MMBW. Thus, land use planning was related to other forms of physical planning over a designated area by the one integrated authority. But, from 1985, the MMBW was progressively broken up, its planning functions transferred to the Ministry for Planning and Environment, and after 1990, its other functions dispersed into a number of corporatised authorities or government agencies. From 1996, a new planning system influenced by neo-liberalist notions of deregulation was introduced to replace the previous more regulatory system (Buxton, Goodman and Budge 2003).

Government policies, such as housing subsidies, taxation policies and interest rates, influence demand and affect prices. Where regulations and conditions stipulated by the planning system are so stringent that they impose prohibitive additional costs on housing production, the result may be that housing production is effectively reduced to

a level where it fails to meet demand, driving up property values. Such stringency may be associated with a shortage of suitable development sites, or with planning requirements such as design parameters or the prescribed mix of housing types and lot sizes. In some US cases, authorities place ordinances to inhibit development unless it occurs concurrently with infrastructure provision, at times resulting in a similar effect of suppressing housing production (Nelson et al 2002).

On the other hand, where planning system controls on development are lax, developers may perceive the supply of new housing as a significant commercial risk, associated with possible over-production of dwellings and resulting drops in property values. Such a market environment may lead to uncertainty about profit margins and consequently, excessive caution in taking up any residential development activity at all (Bramley 1996). Where development does proceed in such conditions, it often occurs in a spatially haphazard and non-contiguous manner that reduces the functional coherence of the urbanised region and the efficiency of publicly provided infrastructure. By the same logic, a lack of effective growth management may also exacerbate the effects of land speculation on short-term housing prices and on the long-term viability of the development industry at large (Nelson et al 2002).

2.2.3 Planning regulations and uncertainty

Control of housing development is subject to a regulatory regime in the UK that leaves considerable uncertainty about whether or not planning approval is ultimately granted. This system allows for greater scrutiny of development proposals regarding their compliance with policy objectives than in many other countries. But it can also deter smaller developers from entering the market, as these frequently do not have the resources to carry the associated risks of refusal or delays (Gurran et al 2008). This can lead to a concentration of the industry to a small number of large players, and restrict the choice of housing products available to consumers (Evans 2004). 'The more uncertain and expensive it is to secure planning approval, the more likely it is that a few large companies will dominate the process' (Gurran et al 2008, p.40).

Morrison (2009) argues that uncertainty in the planning regime also extends to the status of the green belts, which cover some 16,700 sq km or 13 per cent of England's surface area. While planning legislation allows for alterations to green belt demarcations in 'exceptional circumstances', diverging interpretations are offered by stakeholders with competing interests as to what constitutes exceptional circumstances (Amati and Yokohari 2006). The Barker reviews (Barker 2004) into the impact of growth restraint mechanisms on economic competitiveness and housing affordability in south-east England represent the 'most recent and forceful criticism' of the use of green belts in the UK (Amati 2008, p.11).

The experience of regulatory uncertainty and vagueness in planning practice can be mitigated by a policy framework that states its objectives and procedures as clearly and unambiguously as possible, and applies them consistently (Gurran et al 2008). Otherwise there is a tendency for developers to put resources into activities not directly related to the production of housing but adding to its cost, such as public relations material and events, lobbying efforts with authorities, consultants' reports and legal services. Such activities are variously described as 'premium seeking expenditure' (Evans 2004) or 'rent-seeking' (Ball 1999). Ball (1999) also suggests that planning permits for greenfield sites should be auctioned through public authorities in an open tender process, rather than granted on a discretionary basis, as is current standard practice in the UK. In the Netherlands and other European countries, public authorities have historically assumed a greater role in the development process, particularly through active land banking policies and the provision of services and infrastructure by government agencies (Lawson and Milligan 2008).

2.2.4 Urban Growth Boundaries

Urban Growth Boundaries (UGBs) often influence land markets by restricting land purchasers to land within UGBs (Gustafson et al 1982). They can be expected to 'increase the demand for urban land, reduce the demand for rural land, and segment land on the urban fringe into urban and rural submarkets' (Nelson 1985, p.400). The key variables in studies of UGB impacts on price are land supply, residential density and the rate of land release. These variables are interconnected. Many claims about the impacts of UGBs do not accurately control for the impacts of such variables. Whitelaw (1980) proposes that a UGB will depress the value of land outside the growth boundary, and raise the value of land within the UGB because of an increased demand for urban land. If containment programs, such as UGBs, limit the supply of developable land then they might be expected to affect land prices (Dawkins and Nelson 2002; Jun 2006).

Nelson (2000, p.46) summarises the potential effects of containment policies as follows:

Urban containment policies change housing costs for two reasons. First, land prices change when land supply is altered. Second, if urban containment increases the value of the amenity package associated with a house, then that, too, will cause a change in house prices.

Jun (2006, p.239) concluded that 'although the evidence is not overwhelming, there are many empirical studies indicating that UGBs and other means of urban containment lead to higher land prices by limiting the supply of developable land'. Nelson, Dawkins and Sanchez (2007, p.92) conclude that 'numerous studies have shown that land use regulation in general and growth management in particular increase housing prices chiefly by constraining the supply of new housing'. Grimes and Liang (2009) claim that considerable evidence exists in the United States that UGBs can have major effects on the patterns and dynamics of new housing supply and on land prices.

However, other sources of land supply can control price increases just as factors other than land supply can act to increase land price. The influence of land supply should be assessed against the influence of other policy measures, economic factors, amenity factors, infrastructure provision and consumer preferences, as shown above. Gurran et al (2008) contend that, in practice, it is impossible to separate the impact associated with planning regulation on housing costs from the influence exercised on housing costs by the additional amenity achieved by these initiatives and regulations. This is the case both in central and peripheral locations. Amenity gains in central locations through planning interventions include easy accessibility to urban facilities and services by a diversity of transport modes, while amenity gains in peripheral locations include proximity to protected natural and rural environments. The price impact from these planning objectives can be mitigated, however, if such amenity gains are broadly replicated across a regional market, rather than being subject to scarcity effects (Gurran et al 2008), a view also supported by Yates (2001). Thus, urban containment policies, such as outer urban growth management and/or urban consolidation around public transport and walkable activity centres, need not excessively inflate house prices if supply is deliberately increased in such preferred locations (Dawkins and Nelson 2002).

The type of UGB also influences land supply. UGBs may be either flexible, to manage orderly sequential development and infrastructure provision, or inflexible, to protect non-urban land from urbanisation. The Melbourne UGB is flexible where it adjoins nominated urban growth corridors, and inflexible elsewhere. UGBs may apply a strict demarcation between urban and rural land (a 'hard edge') or a graduated demarcation (a 'soft edge') through, for example, rural residential subdivision separating urban and rural land uses. The Portland UGB and others like it manage growth through orderly land release while promoting urban intensification and public transport use (Johnson 2001). This type of UGB will be varied to accommodate future demand. In contrast, the London UGB is an example of an inflexible boundary. In an early study, Nelson (1985) investigated the potential impact of the introduction of UGBs on the price of urban land in metropolitan areas, and found differential results. Citing both Knaap's (1982) finding that the Portland UGB in Oregon did influence land values, and the finding by Beaton et al (1977) that the Salem UGB in the same state had no influence, Nelson concluded that UGBs create an additional demand for urban land, and that land supply should begin to be restricted within four years of the implementation of the UGB in cities with a 20-year supply of urban land. However, in their later study, Nelson et al (2007) argue that the urban containment program in Portland, Oregon, has been shown by both Knaap and Nelson (1992) and Downs (2002) to have no price effect or even lower prices than models would expect (Phillips and Goodstein 2001). Nelson et al (2007, p.101) suggest that:

The difference may be that unlike elsewhere, Oregon's planning laws require pro-active and enforceable efforts to inflate the supply of land suitable for development in the face of market demand. This has been done through higher-density zoning, expedited development review, and expansion of the Urban Growth Boundary.

Dawkins and Nelson (2002) note that while urban containment tools such as UGB are employed in the US to accommodate suburban growth in an orderly sequential way, their role in countries such as England or South Korea is a very different one: here, the main goals are the containment of dominant cities and the decentralisation of population and jobs away from them. Hall et al (1973) argued that urban containment policies in England led to large increases in the cost of residential land in land-and-house packages during the 1960s, with developers responding to this pressure by increasing density, thus accommodating a greater number of larger dwellings on smaller lots. Lee (1999) reports that Seoul's greenbelt, instigated in 1971, did not prevent a doubling of the population (and a close to doubling in density) over the following 20 years, and argues that the greenbelt policy generated net social gains during its early years, because of protection of non-urban land and greater accessibility within the urban area, but in later years produced net social cost, because of congestion (Dawkins and Nelson 2002).

The operation of development companies can also influence land supply and land prices. Governments may designate sufficient land for urban use in outer urban, existing metropolitan or regional areas, but development companies often control the timing or amount of land released. In many countries, long time lags can occur in zoning land for urban use and issuing development approvals, and these may increase if governments hand control of this process to development companies. Nelson (2002) has pointed to the potential for containment policies to limit the number of development companies, reducing competitiveness and the diversity of housing products. Reduced competition can therefore increase the control of the process of land releases by a few powerful companies, leading to cartel effects.

2.2.5 Land supply

Metropolitan land supply is the sum of land available for development on designated greenfield sites, redevelopment in the existing metropolitan area, multiplied by urban density. In addition, metropolitan land supply is often augmented by a regional approach that provides land for dwelling construction in satellite towns or regional centres used by commuting users of metropolitan services on a network or similar city model.

In their review of the price impacts of UGBs, Nelson et al (2007, p.93) conclude that urban containment does not limit land supply 'in the large majority of situations where urban containment is applied', reinforcing the same findings by Nelson and Dawkins (2004) and Pendall (2000). In these American studies, land supply increased because urban containment programs were accompanied by policies that increased density, leading to more housing in the same market. Urban containment also slowed outer urban growth and increased inner urban development. Importantly, many cities accompanied urban containment with proactive affordable housing policies such as inclusionary zoning, affordable housing programs, and mandated increases in minimum density targets. Nelson et al (2007) also point to other factors that can limit the impact of UGBs on land prices—making available additional land on the urban fringe, requiring higher densities on the fringe, and expedited development.

Glaeser and Ward's (2009) analysis of land supply in Greater Boston provides a useful comparison to the provision of urban land in Australian cities. They showed that declining levels of housing construction in Greater Boston were not caused by any lack of land, and that low levels of construction were often associated with high prices and low density levels. The least construction occurred in areas of most land and lot sizes that actually rose between 1990 and 1998, a trend not consistent with land shortages. Local government controls the availability of urban land in areas around many US cities, in contrast to the Australian practice of state governments designating the future direction of growth. Even where strong regulatory controls, such as UGBs, do not apply, debate still occurs over land supply, price and the amount of housing construction.

UGBs are one regulatory impact studied for their impacts on price. However, these studies have also produced conflicting results. These variable results are due in part to the type of regulatory measure used and where the same type of measure is studied to differing circumstances in its use. There is almost no reliable Australian research on the relationship between UGBs and land price (Gurran 2008). Land supply and price also can be affected by models of urban form. Distance from a city centre may affect price in a monocentric city in different ways than a polycentric city. A network city model linked to high densities can affect land supply in ways not experienced in Australian cities. Similarly, comparisons between the effects of UGBs in American cities with depressed urban inner cores, and Australian cities with vibrant inner areas, can be misleading.

Australian state governments generally do not restrict outer urban land supply. Following the introduction in 2002 of the Melbourne metropolitan strategic plan, *Melbourne 2030*, the Victorian Government extended the 2002 UGB around nominated urban growth corridors. In 2003, the government guaranteed to maintain a 15-year supply of land in urban growth corridors (Delahunty 2003). In December 2003, the size of the growth corridors was increased by 1610 hectares, in November 2005 by 11,132 hectares, and in December 2008 it included 41,000 hectares in an investigation of which 26,000 hectares was added to the urban areas inside the UGB. In March, 2008, the government announced the accelerated development of 90,000

residential lots in the existing urban growth areas and the development of simplified planning measures including the creation of an urban growth zone.

Planned new corridor dwellings therefore have risen from 180,000 in 2004, 225,000 in 2005 at a net residential density of 11 dwellings per hectare, to 284,000 in 2008 at 12.5 net dwellings per hectare. Nevertheless, despite such a large area designed future urban, the amount of zoned urban land available for release onto the market in Melbourne's growth corridors in 2008 was eight years supply (DPCD 2008). The Victorian Government has rejected claims that the UGB caused an immediate increase in the price of residential land in the growth corridors (DSE 2003, p.21). The interim *Melbourne 2030* Audit Analysis (DPCD 2007) confirmed these findings on land price when tracking new house and land prices for Melbourne. Its analysis shows that this price has remained 'relatively stable following the spike when the Goods and Services Tax (GST) was introduced in 2000 (DPCD 2007, p.42), and the final audit (AEG 2008) confirms this position. Even assuming that the recently increased rate of population growth is maintained, greenfield land supply in corridors exceeds that of 2002.

2.2.6 Growth management in Australian cities

Development practices have been understudied in Australia, with little detailed investigation into subdivision and building design or the impacts of governance practices. There has been little empirical evidence produced to date demonstrating that regulatory policies have affected urban density, subdivision design, building practice and subdivision and building approvals processes in Australian cities.

The difference between designated land supply and land release is an important concept in understanding the amount of zoned land available for development at any given time. Australian state governments control the direction of development and its sequencing, designating future greenfield areas for urban purposes and including them inside metropolitan areas by extending growth boundaries. Governments also zone land and use other regulatory tools to enable urban development to occur in nominated urban corridors. The land development industry determines the amount of land released onto the market and its timing, housing type, lot size and subdivision design, and initiates the process for rezoning land for urban uses and gaining development approvals. Developers thus exercise primary control of the actual development process and councils generally act as the approvals authority. Metropolitan councils and state governments generally have acted in a reactive manner in approving greenfield development applications (Buxton and Scheurer 2005). In Melbourne, the process of land release is controlled primarily by six or so large development companies that own or otherwise control most of the greenfield land inside the UGB (DSE 2003; AEG 2008) and the rural land adjacent to the UGB. The control of large areas of land by so few development companies has led to claims of land banking and price control (Millar et al 2007).

Australian state governments have to varying extents adopted contradictory policy objectives. All states have adopted containment policies, including the use of UGBs, although only Victoria has legislated its boundary. Yet all governments progressively extend their UGBs creating, in effect, unlimited supplies of urban land on the metropolitan fringe. Buxton and Scheurer (2005) have pointed to the impacts of a constantly expanding UGB: continued land speculation on the non-urban borders of the UGB that drives up rural land prices; and undermining the intent of regulatory urban containment policies that seek to redirect development to established metropolitan areas and increase outer urban land use efficiency. They point to the existence of two types of development companies that build almost exclusively to either growth or established area housing markets and argue that outer urban

developers will be reluctant to change building practices from ‘a formula of detached housing construction in urban corridors’ while outer urban land supply is, in effect, unlimited (Buxton and Scheurer 2005, p.49).

There is a contradiction also between planning and housing taxation policies in Australian cities (Gurran et al 2008). Planning policies intending to contain urban dispersal, and encourage the construction of smaller dwellings and more compact urban arrangements, are at odds with taxation policies that encourage household investment in residential homes as repositories of private wealth, as these tend to generate a dominant market of larger, higher-quality houses or units (Evans 2004). A similar effect has allegedly resulted from the provision of tax relief on mortgages in the Netherlands and the United Kingdom, leading to subsequent reforms or abolishment of such policies (Lawson and Milligan 2008). Infrastructure provision, such as the building of freeways to outer urban areas, can also contradict urban consolidation policies.

Melbourne

There has been little investigation of the impacts of Victorian Government regulation of land development on housing, particularly in outer suburbs. There are four types of state and local land use planning policies and mechanisms in Victoria—strategic policy, the land use planning system; legislation and other regulatory statutory tools, and underlying institutional arrangements. These will be considered in turn.

Melbourne has a long history of strategic planning. The Melbourne and Metropolitan Board of Works (MMBW) first outlined the future strategic shape of Melbourne in the 1971 *Planning Policies for the Melbourne Metropolitan Region* (MMBW 1971). It proposed seven urban growth corridors separated by permanent green wedges, or non-urban areas, in a plan which has defined the direction of urban growth and the shape of Melbourne for over 30 years. All future urban development was to be confined to the growth corridors which would not be wider than 6–10 kilometres. Physical and economic constraints on development were identified and these helped to define the features to be protected in the non-urban zones, or green wedges. Both the 1987 metropolitan policy, *Shaping Melbourne's Future* (Government of Victoria 1987), and the 2002 policy, *Melbourne 2030* (Dol 2002), continued the policy of concentrating outer urban development in defined linear growth corridors and protecting non-urban areas from urban related development.

The 2002 Melbourne strategic plan, *Melbourne 2030*, followed an urban containment policy widely adopted throughout developed countries with the exception of many cities in the US. This policy included a dual containment policy through a strategic integration of growth limitation on the urban fringe and an increase in density in the established metropolitan area. It proposed to achieve this integration by redirecting about 20 per cent of business-as-usual outer urban growth to the established metropolitan area primarily to mixed use activity centres. This involved reducing the 2001 proportion of residential dwellings being constructed in urban growth corridors from 38 to 31 per cent, while increasing the proportion in activity centres from 24 to 41 per cent. As an indication of the failure of the policy, 48.3 per cent of household growth between 2001 and 2006 occurred in urban corridors while only a marginal increase in activity centre dwellings occurred (DPCD 2007). The strategy also proposed to increase residential density in outer urban growth areas to 15 lots per hectare. The current density is 12.5 lots per hectare net residential density (AEG 2008).

Until 1988, Melbourne's land use planning system consisted of one standardised planning scheme, the Melbourne Metropolitan Planning Scheme (MMPS), developed and administered by the metropolitan planning authority, the MMBW. Local councils exercised some delegated controls over approvals and a few fringe area metropolitan councils located outside the area affected by the MMPS operated their own planning schemes. Urban growth corridors were eventually located in some of these municipalities and the councils became incorporated into an expanded metropolitan area. After 1988, the MMPS was broken up into local planning schemes and administered by councils until the introduction in 1996 by the Kennett Government of a standardised state-wide planning system, the Victoria Planning Provisions (VPP), and the accompanying new format planning schemes that followed in the late 1990s. From 1988 until the introduction of the new format schemes, the government retained control over strategic policy and the approval of amendments to planning schemes while all councils administered their local planning schemes. In the late 1980s, the Victorian Government completed detailed strategic plans for the three priority urban growth corridors. These plans were incorporated into local planning schemes through appropriate zones and used to determine the location of uses.

The Victorian Government altered the range of statutory tools to regulate land use in the VPP. These regulatory provisions are facilitative, with the government acting in Stoker and Young's (1993) terminology as a 'strategic enabler'. Between the late 1990s and 2007, the government and councils continued to develop detailed strategic plans (or structure or outline development plans) for corridors. These specify preferred land uses, in particular, future zoning, density, transport, servicing, and infrastructure requirements and the provision of facilities. These plans can be incorporated into planning schemes, and where this has occurred, the plans are both policy and statutory documents.

In general, the more permissive planning era from the middle and late 1990s reduced significantly the type and amount of regulatory strategic planning in designed urban growth corridors, but did not alter significantly the process of development approval. Regulated corridor master plans, before the introduction of the VPP, controlled land development by designating the locations and types of future land uses, and through other techniques, such as raising minimum average residential densities. The VPP changed the name of zones and introduced some new regulatory controls such as overlay provisions. However, designed future urban land continued to be located in a holding zone which gave control over the design, location, density and environmental performance of development to councils. After the introduction of the VPP, councils have exercised significantly less statutory and strategic control over development, though more recently they have attempted to increase their involvement in strategic planning. However, in 2007, the government established the Growth Areas Authority (GAA) which took over control of the strategic planning process, including zoning, variations to the UGB and decision-making processes for the outer urban growth areas. The government also announced that it would drastically reduce the number of statutory controls and introduce a primary development zone, the Urban Growth Zone.

A number of additional legislative and other regulatory tools have been used to control development. Two key regulatory provisions were density controls and the use of a UGB. In 1991, the government introduced a Ministerial Direction under Section 12 2(a) of the *Planning and Environment Act* as part of the framework corridor plans to require that subdivision plans in rezoning applications for all land zoned Reserved Living and Corridor in the Berwick-Pakenham (South-East) and the Werribee (Western) growth corridors achieve an average 15 lots per hectare gross residential density. Land zoned residential was not affected, allowing development companies four to five years in which to alter their subdivision and housing practices. The Kennett

Government removed this provision in 2003, regarding it as inconsistent with its promotion of a neo-liberal planning regime.

An UGB therefore has existed on the fringes of Melbourne since 1971, as part of Melbourne's strategic plan, and informally since 1954. However, in implementing *Melbourne 2030*, the government passed the *Planning and Environment (Metropolitan Green Wedge Protection) Act* in May 2003. This defined a UGB and green wedges, and requires parliamentary ratification for any change to the UGB and subdivision controls in a total of 17 fringe area planning schemes. Prior ministerial approval is also required before councils can initiate planning scheme amendments.

2.3 Urban consolidation

2.3.1 Urban consolidation internationally

Urban consolidation, as mentioned above, is a widely adopted tool to alter the form of housing and urban form generally. Urban consolidation may involve increasing urban densities generally, or intensifying development in specified locations in a metropolitan area, such as inner and outer urban areas, or mixed use activity centres. There are also many types of urban intensification, such as low, medium or high rise development, apartments, townhouses and attached dwellings. Methods of calculating intensification also vary. European experience with urban growth varies with some cities exhibiting low density sprawl on the urban fringe while others continue to expand with high fringe densities.

Madrid, the Spanish capital, provides an interesting example of densification on the urban fringe. Madrid's housing production remains predominantly apartment-based despite having forms of housing production based largely on greenfield development, produced by a highly corporatised development industry and with relatively permissive land use controls. Home to 6.25 million inhabitants (in 2008), Madrid entered a severe residential property crisis during the global economic downturn in 2008–09, with a concurrent downturn in real estate prices (Vergés 2009a). This situation arrived at the end of a decade of the use of a permissive land use planning regime, partially originating in a historic weakness of metropolitan strategic planning in Madrid, partially as a consequence of regional legislation passed in 2001 that turned its back on previous attempts at growth management and explicitly considered all metro-regional land as developable in principle (Gutiérrez 2009).

Between 2001 and 2008, housing production boomed: more than 400,000 housing units were added in metropolitan Madrid, with a further 600,000 under construction or with planning approval (Gutiérrez 2009). This is equivalent to an expansion of the housing stock by more than 20 per cent in only eight years during which time the population grew by 15 per cent (Massot 2007). Housing production reached a peak of over 20 new dwelling units per 1,000 population in 2006 (Vergés 2009a), representing an annual growth rate of more than 3 per cent. Both figures are the highest in a sample of six leading Western European nations (Massot 2007).

The growth in housing stock translated into an expansion of the urban area. During the 1990s, a steady population shift occurred towards the periphery, with the core city losing 2.4 per cent of its population over the decade and the metropolitan area as a whole gained 9.6 per cent (Vergés 2003). While the shrinkage of the core city appears to have been arrested and (to a modest extent) reversed during the 2000s, most growth continued to eventuate on greenfield land at the urban fringe. Remarkably, from an Australian perspective, the form of this growth is predominantly in six to ten storey apartment buildings at typical gross densities of 30–35 dwellings per hectare (Palisse et al 2006) delivered by private sector developers and marketed almost

exclusively to owner occupiers. This is in line with national trends. Only 29 per cent of the housing stock across Spain is single-family houses, and this figure is likely to already include terraced houses and duplexes. A high 82 per cent of households in Madrid were owners or purchasers of their dwellings in 2001, the highest home ownership rate in the European Union (Massot 2007).

Most greenfield areas of Madrid are classic dormitory suburbs, not integrated and in many cases at considerable distance from employment (Gutiérrez 2009). The focus on market-priced owner occupation has created widespread negative equity and a mortgage burden whose share of household income has risen substantially since the early 2000s, negatively affecting households' purchasing power for expenses other than housing (Vergés 2009b). Simultaneously, Spain's owner-occupation-dominated housing market with a shortage of small apartments offers few viable pathways for households to downsize in dwelling size or standard, or in tenure form, as their incomes are under stress from the crisis (Massot 2007).

While the experience across Europe varies, there are a number of other examples of recent attempts at urban consolidation in middle or outer ring suburbs that have resulted in higher density, mixed use and transit oriented developments. Recent developments in the growth corridors of Hamburg, for example, are building housing at densities some three times the current Melbourne greenfield average (Buxton and Schuerer 2005, p.108). New development on the fringes of German cities varies from attached and duplex 2–3 story housing at a density of about 25 dwellings per hectare to 6–8 story apartment blocks up to 120 dwellings per hectare. The UK Government, influenced by these densities, has stated the desirability of raising the density of outer urban development from 25 to between 30–50 lots per hectare. The UK Green Paper on urban development (DETR 2000, p.43) argued that 'we also build at very low densities, and in the past have squandered land'. Continental European outer urban densities are even higher than UK levels as are the densities of new middle class suburbs in Asian cities, and those on the edges of cities in almost all other countries.

2.3.2 Urban consolidation in Australian cities

In Australia, Australian Bureau of Statistics (ABS) figures underestimate the amount of intensification by counting detached multiple dwellings on the same lot as detached houses. Australian governments have adopted a differential approach to the potential of density to increase land supply by simultaneously promoting higher inner urban densities and low outer urban densities. The Audit Expert Group (2008, p.44), reviewing the implementation of *Melbourne 2030*, points out that lower priced housing in outer urban areas does not necessarily equate to affordable housing. Despite the increase in net densities from 10 to 12.2 dwellings per hectare, 'there is an urgent need to increase average residential densities in Growth Areas', it says, through state government mandating increased minimum average lot yields or requiring a fixed proportion of medium density housing.

In Australia, urban consolidation policies have guided the strategic planning frameworks of most states and territories since the 1990s (Yates 2001; Gleeson et al 2004; Buxton and Tieman 2005) and now allow for assessing changes to urban growth and housing production under such frameworks.

There is a consensus that the apparently unsustainable car dependent, 'sprawling' morphology of capital cities requires redress by directing activities and investment into regional centres, increasing densities, improving alternatives to the motor car, providing open space and protecting natural resources (Gleeson et al 2004, p.363).

Buxton and Tieman (2005) distinguish three main policy approaches to urban consolidation, ranging from planned redevelopment of strategically located sites or activity centres in the existing urban area, the incremental, dispersed intensification of existing neighbourhoods, and the application of higher density targets or mandates for greenfield growth areas. They argue that consolidation trends in Victoria during the 1990s mostly followed the second approach, facilitated by market oriented deregulation of the planning system under the Kennett Government. A change of government in Victoria in 1999, partially driven by public discontent with the outcomes of such liberalisation of statutory controls in established Melbourne neighbourhoods, led to a renewed focus on metropolitan strategic planning and thus more emphasis on the first approach. No serious consideration was afforded to the third approach, although aspirational density targets for greenfield developments are featured in the *Melbourne 2030* strategy and comparable documents in other cities (Buxton and Scheurer 2007).

Two streams of thought about the impact of urban consolidation policies on housing outcomes in the Australian debate are distinguished by Yates (2001). While both streams agree that urban consolidation increases the choice of housing types for consumers, acknowledging that the market-dominating family-sized detached house does not cater well for the needs of a growing proportion of non-nuclear family households, there are differences of opinion about its impact on housing affordability. Proponents of the view that urban consolidation enhances housing affordability, expressed for example in the National Housing Strategy of the Hawke-Keating Government (NHS 1991) and in Forster (1999) point to the savings in land and infrastructure costs associated with dwellings on smaller lots and within more compact settlement patterns. They also argue that urban consolidation enables older householders to vacate low-density family homes that are too large and maintenance-intensive for their needs, and lowers the threshold for young households to enter the property market (Yates 2001).

Critics of the view that urban consolidation enhances housing affordability, among others Kirwan (1989) and Troy (1996), question the cost savings through more frugal use of urban land and point to higher construction costs for higher-density buildings, and for buildings in more central locations. They argue that urban consolidation will not reduce housing or land costs, and that infrastructure costs of conventional fringe area subdivision have been exaggerated. They also question whether most Australian households, accustomed to considering the separate family home as the top of the aspirational ladder, will prefer higher-density dwellings out of choice.

Yates (2001) concludes from these arguments that the effect of urban consolidation on housing prices depends on whether such policies are able to deliver products of reduced housing services, such as lower quality housing, smaller dwellings and/or a reduced component of land costs in the house-and-land package. In an empirical study for Sydney and Melbourne based on 1986 and 1996 census data, she found that households headed by middle-aged and older adults (45 years and over) tended to prioritise housing type over tenure form, tending to prefer a rented separate house to apartment ownership if their income did not allow for ownership of a separate house. Among younger households (25–44 years old) there was a more pronounced trend towards prioritising home ownership over housing type within income constraints, leading to a greater acceptance of apartment living if this allowed them to enter the property market. Younger households also showed a clearer preference for inner urban locations than older generations, echoing findings from earlier studies by Vipond et al (1998) and Reynolds and Porter (1998).

Urban consolidation, Yates (2001) argues, is particularly attractive to younger households with higher incomes because it assists them to find dwellings whose location and tenure type might otherwise be unaffordable. Simultaneously, higher density housing in outer urban locations creates both more affordable housing options for low-income households directly, as well as fostering an expanded rental market within the low-density housing stock in such areas. This could result in a more equitable geography of housing in Australian cities:

These increased choices can limit the degree of spatial polarisation of income within Australian cities ... by increasing the range of dwellings available in higher cost locations and thereby increasing the access of lower income households to these locations (Yates 2001, p.495).

Conversely, Randolph (2004) argues that new urban development in recent years has led to increased socio-spatial polarisation and terms this phenomenon the 'suburbanisation of disadvantage' (Randolph 2004, p.488). This primarily affects middle and outer suburban areas with older, sub-standard housing stock and relatively low local amenity. As older residents who helped establish these communities in their early years reach the end of their lives, and higher-income groups relocate to more amenity-rich areas either in intensifying inner urban areas or in newly built suburbs at the urban fringe, a demographic diversification takes place with a tendency towards greater representation of lower-income groups and immigrant communities. Simultaneously, a market-driven, incremental urban renewal process leads to the gradual conversion of relatively spacious blocks with older, smaller houses into dual occupancy or strata-titled subdivisions, or the replacement by larger structures with an associated loss of private open space and, in some cases, public amenity. This is also associated with the difficulty of site assembly for larger-scale redevelopment projects in urban patterns configured for single-family housing (Bunker et al 2005).

In contrast, the inner urban areas are characterised by a loss of demographic and land use diversity though perhaps a gain in activity and density, as high land values increase the profitability of land use intensification aimed at the high end of the market, and the conversion of industrial land to residential and commercial uses. New urban fringe suburbs, and in particular master planned estates on the fringe, display a tendency towards greater uniformity and suitability for more affluent groups. This tendency has been analysed in several recent studies (Bosman 2003; Gwyther 2005; Kenna 2007; Goodman and Douglas 2008) and is reminiscent of the outcomes of exclusionary zoning regimes in the US as described above. This point is reinforced by Randolph who found that

[n]ew suburban housing developments are increasingly marketed to a very limited range of households, with little variety in housing choice and tenure. The communities being produced are therefore imbalanced, and will continue to be so, for estates of large single dwellings will be difficult to re-tool in later years for smaller households. The penchant for flat developments around town centres is leading to similarly imbalanced community outcomes, with comparably limited housing choices, this time for rental (Randolph 2004, p.491).

Randolph (2004) contends, however, that there is uncertainty about the threshold beyond which such polarisations and imbalances, manifest in increasing spatial disassociation between residential and employment locations particularly for disadvantaged groups, will translate into serious problems for cities.

Patterns of urban consolidation in the Melbourne metropolitan area during the 1990s and early 2000s were analysed by Buxton and Tieman (2005) using ABS census data and figures on planning approvals for different categories of housing types. They showed that multi-dwelling unit approvals increased by 700 per cent in the ten years from the main recession year of 1990–91. Across Melbourne, multi-unit dwellings accounted for 42 per cent of the net increase in dwellings between 1991 and 2001, associated with a decline of detached housing as a proportion of the total housing stock from 77 per cent to 74 per cent during that period. A clear trend was evident towards multi-storey buildings with the proportion of multi-unit buildings of four or more storeys accounting for 86 per cent of new multi-story approvals in 2002–03, a figure which has varied since. The overwhelming majority of multi-unit and medium-density housing units were constructed within the innermost 15 of Melbourne's 31 local government areas, while the outer suburban areas were characterised by a similar dominance of growth in detached housing. A growing mismatch was detected between the proportion of new housing stock produced in these two regions and their share of overall population growth. While the 1990s saw a reversal of previous population decline in Inner Melbourne, it accounted for less than 20 per cent of metropolitan growth over the decade, despite attracting around 40 per cent of planning approvals for new dwellings. This is associated with a continuing decline in dwelling occupancy rates in inner areas, compromising the ability of urban consolidation programs to absorb a growing share of households and suggesting that the outer suburbs remained the first preference for most larger households, particularly those with children.

Focusing on the locations and types of multi-unit housing in more detail by analysing planning approval data in four Melbourne municipalities, Buxton and Tieman (2005) found a clear trend towards the growing height of construction and the size of development sites, which suggests that urban consolidation by incremental, small-scale redevelopment began to lose ground to the larger-scale projects. Location analysis showed that such larger-scale projects tend to have a greater spatial association with public transport routes and designated activity centres; however, there is no discernable trend towards intensification of train station precincts (where the highest quality of public transport service is offered in terms of travel speeds) over corridors along tram and bus routes. There is some recent evidence of more even spatial distribution of multi-unit developments across the metropolitan area. However, in established outer suburbs, there is little evidence of concentration of development, and almost no apartment construction around activity centres.

In the outer suburbs, policy initiatives to recommend or mandate minimum densities in the past have been contested and to date largely ineffective, with average gross residential densities hovering around the 10 dwellings per hectare mark. Buxton and Scheurer (2007) review an argument made by McLoughlin (1991) and Lewis (1999) that claimed density increases in greenfield growth areas resulted in a negligible impact on overall land consumption. By reassessing the assumptions used for these calculations and by relating them to the principle of land use-transport integration referred to in the *Melbourne 2030* strategy, Buxton and Scheurer show that land use efficiency at the urban fringe could increase by up to 64 per cent within the existing strategic policy framework. This would effectively remove the need for expansions to Melbourne's UGB before 2020.

Bunker et al (2005), from a Sydney perspective, agree with Buxton and Tieman (2005) that incremental, lot-by-lot redevelopment and intensification in established suburbs as described above was characteristic for an earlier phase of the urban consolidation process. Since the 1990s, this pattern in Sydney has declined in relative importance in favour of semi-detached dwellings and particularly high-rise structures,

reflecting the emergence of a high-income housing sub-market for apartments in CBDs and inner suburbs, and to a higher degree driven by investors rather than owner-occupiers. This focus on investors has implications on the type of urban growth and the process of delivery, as the interests of investors and their responsiveness to policy incentives differ from those of owner occupiers. It is also subject to different economic cycles, not necessarily directly related to the demand for homes to purchase or rent as driven by occupiers (Randolph 2006).

Bunker et al (2005) lament a relative lack of knowledge about the population groups who live in the attached-house or apartment buildings favoured under urban consolidation policies. A study by the Urban Frontiers Program (2001) at the University of Western Sydney (UWS) examining several clusters of higher-density housing in different parts of the Sydney metropolitan area indicated the following five key user groups, with most clusters accommodating more than one:

- Immigrants in the process of establishing themselves in Australia in a lower-cost rental stock.
- An elderly population presumably 'down-sizing' from larger owned property and able to buy outright a dwelling more suited to their changing needs.
- A mature population 'ageing in place' within attached dwellings in areas in which they may have lived for most of their life.
- A distinctive sub-market for young people, either as single-person households, couples or groups, predominantly renting, but with some first home purchase.
- A more marginalised cheaper rental housing sector accommodating households in financial or social disadvantage, including low-income single parents. (Bunker et al 2005, p.776).

Importantly, Bunker et al (2005), drawing on research by Wulff et al (2004), point out that a trend towards smaller households does not necessarily translate into demand for smaller dwellings. However, a focus on development of smaller dwellings in urban consolidation areas acts to preclude larger households from living there, unless forced to do so by income constraints. The result is a growing effect of spatial segregation by household type in Australian cities of the future, further manifested in terms of lifestyle preference and life stage (Randolph 2006).

The authors proceed to undertake a factor analysis from 2001 census data to identify distinct and not necessarily spatially continuous housing sub-markets in medium and high-density buildings across Sydney. A factor analysis attempts to consolidate a broad range of indicators into a smaller number of generic ones, which are then assessed for their explanatory depth by considering the statistical variance among component indicators. The two most significant factors in Bunker et al's (2005) analysis describe the suburban low-income, rental, immigrant housing sub-market (concentrated in older higher-density housing stock in or near suburban centres) and the high-amenity, inner-city housing sub-market (concentrated in new or renovated housing stock in attractive central or waterfront locations). Further factors include the Generation X rental and home-purchase sub-market (with similar locational preferences as the previous group, but a greater share of renters and higher turnover), and three sub-markets associated with specific housing types (semi-detached, medium density, high density), each with a substantial proportion of public housing.

It is recommended that strategic planning takes the characteristics of these housing sub-markets into account, and in fact assumes a proactive stance to overcome the growing spatial segregation between the associated population groups to achieve

social sustainability outcomes, such as by limiting the concentration of disadvantaged groups in the most affected areas and by creating opportunities for lower-income groups in areas most in demand by affluent residents.

The extensive programs of urban renewal and redevelopment envisaged for existing built-up areas cannot rely on blunt planning measures and ratings on unimproved capital value to achieve their 'highest and best use'. These instruments on their own can only bring about disconnected and ad hoc change, and need supplementary measures and incentives to achieve reasonably outcomes. (Bunker et al 2005, p.791)

2.4 Conclusions

This investigation of the available evidence has pointed to the difficulties in making causal claims about the influence of regulatory land use planning policies and mechanisms on land price. The connections between land supply and price are complex. Many other factors can affect land price. City types, and city and country specific variables or their application differ. Types of regulation vary as do data sources, methodologies and variables used in studies. Such factors complicate the drawing of generalised conclusions.

Housing price can be affected by regulation, but generally to a minor extent, initially on construction costs, with long-term benefits on household running costs. There is evidence that land use regulations that mandate high minimum lot sizes lead to the construction of large houses on large residential lots. Land tends to be used inefficiently where the supply of land is high, either because of the use of such regulations or because public authorities allow land development companies to make the principal decisions on residential density, lot pattern and house size and type.

Public authorities are able to strongly influence the type of housing supplied on the fringes of cities by stipulating housing densities, type and environmental performance. The effects of different levels of regulation have resulted in widely different housing types on the edges of cities globally with the least regulated housing tending to be predominately lower density and detached, located in car-based, single use subdivisions.

Urban consolidation in Australian cities has led to higher residential densities in the inner and middle ring localities of Australian cities, limited opportunistic unit development in established outer suburbs, but little evidence of substantially higher densities on the urban fringe. Different types of housing companies construct different types of housing between inner and outer areas of Australian cities, with inner area consolidation dominated by apartments and townhouses. These varying types of housing are making an important contribution to the creation of two emerging city types between inner and outer urban areas of Australian cities.

3 RESEARCH DESIGN AND METHODS

3.1 Database development methodology

3.1.1 Introduction

The aim of this research project is to explore possible links between land use planning policies and mechanisms, and the form of housing supplied. Using a set of disparate databases, namely, valuations, sales records and VicMap data, this part of the project develops a methodology to integrate these databases. The merged database permits analyses of housing supply—with the analysis segmented by property characteristics, price, time, and location. Unit-record property transactions are utilised to identify what housing has been constructed between 1990 and 2006 in Melbourne using information compiled at the point of valuation as well as at the point of sale. This is then overlaid with key planning changes to explore their impact on housing outcomes.

The database design is innovative for three main reasons:

- First for its ability to integrate disparate datasets at a disaggregate level (i.e. parcel). The merged database design joins sales information, which records what has been sold and where, with valuation information that records details of properties through a unique identifier. The valuation data is collected for the purposes of setting rateable values and so every sale should match with a valuation record; because a property may have sold more than once (between 1990 and 2006) two or more sales records can match with the same valuation record.
- Second is the spatially integrated aspect of the core database that enables spatial queries to be conducted. Both data sources identify the geographic location of the property, and so it is possible to undertake sophisticated spatial analyses—for example, calculating distance from a property to selected amenities or the application of different planning mechanisms.
- Third, this database design allows simultaneous analysis of the spatial and time dynamics of land and property markets, which is rare. Spatial-temporal database queries can be undertaken on this database (or multiple databases) for more complex inquiries, such as ‘identify the vacant lots and compute the total land area within a one kilometre radius from an activity centre for a period between January 2001 and September 2009’. The detailed property characteristics available to researchers is also unusual and offers exciting prospects because it allows examination of price patterns in different value and location segments, and their correlation with changes in planning regime over time, as well as cross section differences in parameters of the planning system.

Combining the large datasets presents data processing challenges. The datasets are large (millions of records) and contain great variation in data formats, including incomplete property identification data. Not all records can be successfully cleaned and joined, and careful attention needs to be paid to any issues of bias in the types of records not successfully integrated. We begin this methodology section by describing the salient features of the valuation and sales data, and then explain how the data has been cleaned and how problems caused by missing fields have been addressed.

3.2 Methodology

The database development involves integrating two input datasets using a common identifier. These datasets include:

1. Property valuation data, collected by LGAs and audited by the Valuer General.
2. Property sales data, collected by the Valuer-General.

The database development process joins the two data sources together, and identifies the geographic location of each property record (with this process known as geocoding) to create a spatially-integrated merged database. The location data used for geocoding is held in VicMap datasets of Property and Address information (Victorian Government spatial reference data).

3.2.1 *The datasets*

The characteristics and relevant fields in the input datasets are described below (see Appendixes I & II).

1. Valuations dataset

This is a single file compiled by the Victorian Valuer-General, from data collected by individual LGAs, and used to create a property rates base. This is a point in time record of all rateable properties: each property should appear, but can appear only once.

The valuations dataset includes the following property characteristics: size of land, dwelling type, number of bedrooms, land classification category, year of construction, and building materials used in construction. It allows an analysis of housing supply by dwelling type, as well as property-related control variables for modelling property price variability.

2. Sales dataset

The sales dataset consists of one file for each year and property type (house, land, unit), e.g. house sales in 2001. Sales information is collected for the purposes of stamp duty collection. Any property may appear multiple times, or may not appear at all (i.e. may not have been sold). The sales dataset includes the following property sale information: date and price, for houses, units, and vacant land sales. This research project is particularly interested in the identification of vacant land sales; the dataset allows the analysis of land sale prices over time.

3. VicMap datasets (Address, Property, Admin)

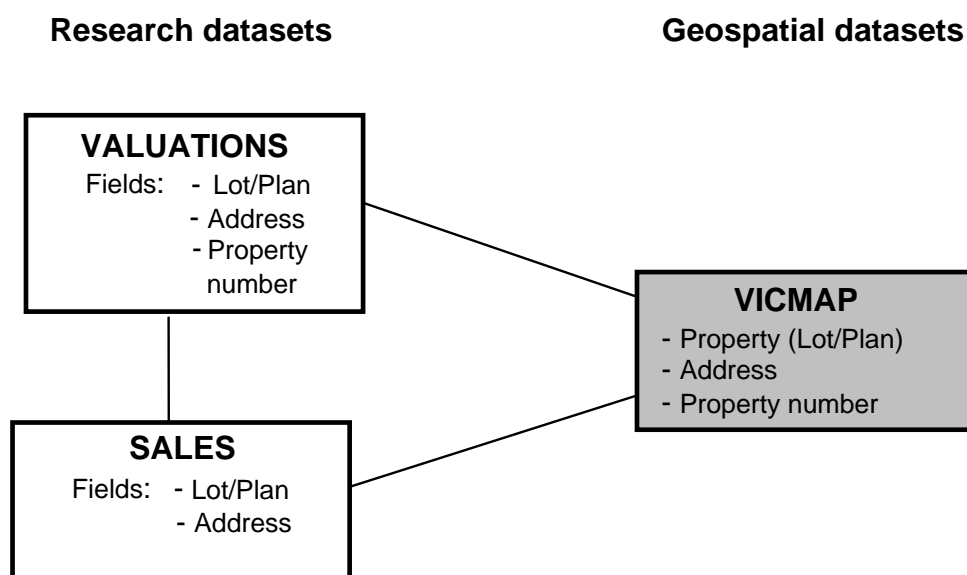
VicMap is the authoritative reference database for spatial information in Victoria. It is compiled by Spatial Information Infrastructure (a department of DSE), and is in common use across Victoria. It includes street address and property/parcel reference files. Address data is sourced from LGAs. Property data is sourced from the Land Titles Office.

These data bases have qualities that are attractive to researchers. Their great strength is reliability because both valuations and sale information are collected for the purposes of revenue collection. Those collecting the information have an interest in accuracy and completeness of coverage since they are used to collect stamp duties, land taxes and local government rates. A second strong attribute is that unit records are collected for the population of sales and properties. Most data bases are samples, not populations, and questions of how well the sample represents the population inevitably arise. The analysis conducted in this project does not in principle have to contend with such problems. However, not all sales records can be joined to a matching valuation record, so there are potential sample selection issues (see Appendix V).

3.2.2 Database design process

To enable joining and geocoding, a common identifier must be located in each dataset. To join multiple datasets, this common identifier (called a matching field) must be identical in all datasets. Since the data in the matching field in our datasets (sales, valuations) are stored using different protocols, reformatting (cleaning) to create identical matching fields is required. The reformatted field is used as a common ID to integrate sales and valuations data with the VicMap geospatial datasets. This has been attempted using a number of fields including Lot/Plan, property number and address. Figure 1 depicts the simplified database design.

Figure 1: Dataset joins, showing matching fields used for joins

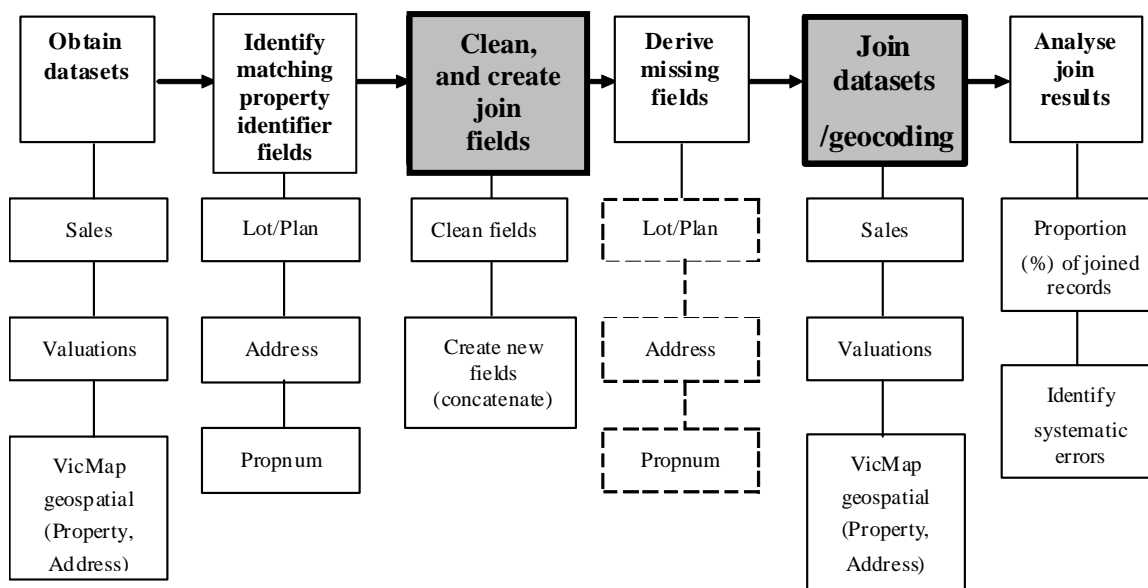


The database construction process consists of three basic tasks:

1. Cleaning (e.g. reformatting of address fields).
2. Joining/geocoding (e.g. joining of sales to valuations, and geocoding to an address point, based on the cleaned fields).
3. Adding spatially-derived measures (e.g. computing distance from a property to different amenities such as railway stations).

Each step informs the subsequent step. Both the spatial analysis and joining requires that cleaning of fields be undertaken first. The addition of spatially-derived measures requires that each record be geocoded. This in turn requires that records be joined to the georeferenced VicMap reference file using the cleaned join fields, and that the sale and valuation information be joined together (again using the cleaned fields) to track the same properties over time. Figure 2 below shows the database development process. Appendix III offers a detailed explanation, with illustrative examples, of how matching fields have been created in order to join sale and valuation information.

Figure 2: Database development process



Note: Propnum is property number

Due to missing or incomplete data (see Appendixes IV & V for more details), not all property records will be either joined or geocoded. Our target is to match 85 per cent to 90 per cent of records, and we expect to achieve this by November 2009. This is a very high level of coverage and would ordinarily be considered a population, rather than a sample of properties. However, this proposition assumes that the missing records are a random selection from the population of sales records. If, on the other hand, missing records are highly concentrated in one or more LGAs in the metropolitan area, or the missing records relate to (say) small lot sizes only, we have sample selection bias. In the next stage of the project we will be scrutinising the records that cannot be joined for evidence of sample selection bias. Despite this qualification, the fact that 85–90 per cent of all sales records will be joined and geocoded substantiates the conclusion that our database design will capture and describe most of the sales of vacant residential land over the study time frame (1990–2006), and therefore the majority of new construction (housing supply) on vacant residential land.

Tables 1 and 2 present some basic descriptive statistics describing the data that we are using for the analyses of land and housing supply. Table 1 lists the number of vacant land sales during 1990–2004. Between 1990 and 1995, sales fluctuated between 12,000 and 15,000 a year; but from 1996 the Melbourne land market boomed as prices soared (see figure 3). In 2001, there were over 26,000 vacant land sales; the volume of activity remained high at over 20,000 sales per year, before plummeting to just over 7,000 sales in 2004. Since 1996, there has also been a trend increase in the proportion of vacant land sales in growth area LGAs, peaking at around two-thirds of all land sales in the early years of the new millennium.

Table 2 lists the number of residential units constructed over the 1990–2007 timeframe. A peak of over 30,000 units in 1990 was followed by a prolonged period of relatively low levels of construction—21,000 units or less per year 1991–1997. Construction then leaped to nearly 38,000 units in 2000, and then fluctuated around the 30,000 units a year level of activity, before dipping to around 21,000 in 2007 (see figure 4).

Table 1: Number of land sales by year and area (growth area municipalities, other Melbourne municipalities)

<i>Vacant Land Sales</i>						
<i>Year</i>	<i>Growth area LGAs</i>	<i>%</i>	<i>Other LGAs</i>	<i>%</i>	<i>Total</i>	<i>%</i>
1990	5,910	50.30%	5,836	49.70%	11,746	100.00%
1991	6,138	50.30%	6,057	49.70%	12,195	100.00%
1992	7,298	51.90%	6,756	48.10%	14,054	100.00%
1993	7,587	50.20%	7,527	49.80%	15,114	100.00%
1994	6,711	44.50%	8,379	55.50%	15,090	100.00%
1995	4,974	38.60%	7,900	61.40%	12,874	100.00%
1996	4,579	37.10%	7,779	62.90%	12,358	100.00%
1997	6,647	36.40%	11,595	63.60%	18,242	100.00%
1998	8,026	37.30%	13,466	62.70%	21,492	100.00%
1999	11,468	47.60%	12,607	52.40%	24,075	100.00%
2000	9,165	54.10%	7,765	45.90%	16,930	100.00%
2001	16,156	61.20%	10,260	38.80%	26,416	100.00%
2002	16,554	70.30%	6,977	29.70%	23,531	100.00%
2003	15,535	69.70%	6,764	30.30%	22,299	100.00%
2004	4,880	66.30%	2,476	33.70%	7,356	100.00%
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	-	-	-	-	-	-

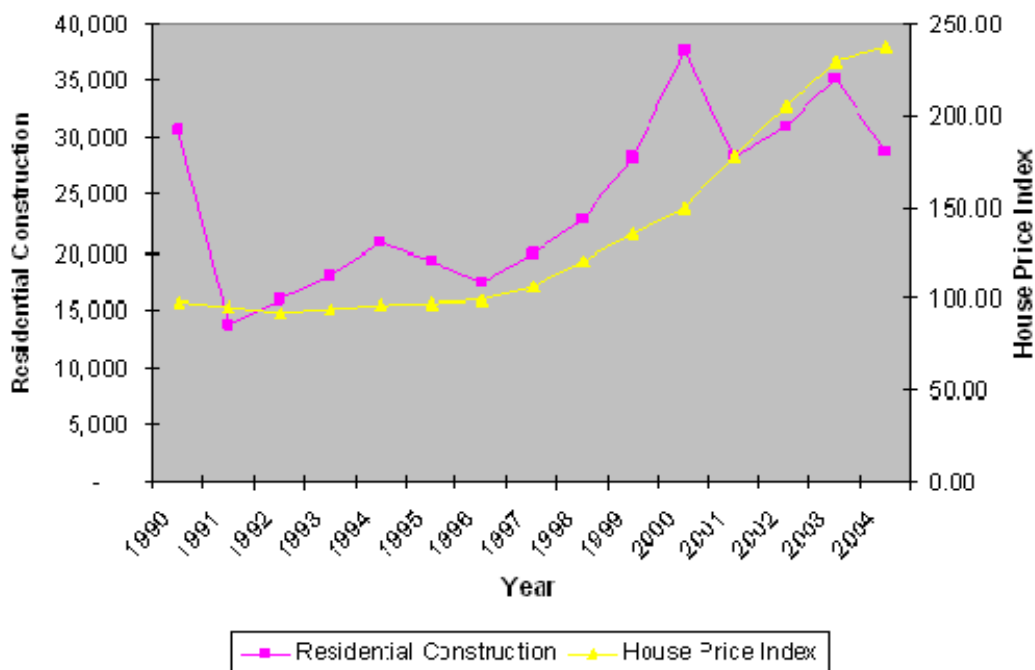
Figure 3: House price and land sales



Table 2: Residential construction by year and area (growth area municipalities, other Melbourne municipalities—based on year of construction in valuation records)

<i>Residential Construction</i>						
<i>Year</i>	<i>Growth Area LGAs</i>	<i>%</i>	<i>Other LGAs</i>	<i>%</i>	<i>Total</i>	<i>%</i>
1990	7,287	23.80%	23,395	76.20%	30,682	100.00%
1991	5,659	41.40%	7,995	58.60%	13,654	100.00%
1992	6,287	39.40%	9,660	60.60%	15,947	100.00%
1993	6,448	36.00%	11,486	64.00%	17,934	100.00%
1994	7,190	34.40%	13,717	65.60%	20,907	100.00%
1995	5,430	28.10%	13,862	71.90%	19,292	100.00%
1996	4,307	24.90%	12,988	75.10%	17,295	100.00%
1997	4,664	23.50%	15,180	76.50%	19,844	100.00%
1998	5,865	25.60%	17,067	74.40%	22,932	100.00%
1999	7,395	26.20%	20,874	73.80%	28,269	100.00%
2000	7,612	20.20%	29,998	79.80%	37,610	100.00%
2001	11,420	40.30%	16,898	59.70%	28,318	100.00%
2002	11,485	37.10%	19,466	62.90%	30,951	100.00%
2003	13,197	37.50%	21,968	62.50%	35,165	100.00%
2004	10,752	37.50%	17,952	62.50%	28,704	100.00%
2005	10,108	37.20%	17,078	62.80%	27,186	100.00%
2006	10,805	37.10%	18,281	62.90%	29,086	100.00%
2007	9,511	44.60%	11,832	55.40%	21,343	100.00%

Figure 4: Residential construction and house prices



4 NEXT STEPS IN THE RESEARCH

The next stage of the research has two main components. The first involves use of the data base that we have designed to describe the spatial and temporal pattern of housing supply. We describe this component first.

4.1 Data analysis

The transaction and valuation database that is central to our quantitative research is an ideal tool for the investigation of policy and regulatory changes and their impacts on types of housing, density and location. It will be used to document the quantity, diversity and density of housing constructed in each Local Government Area (LGA) over the timeframe 1990–2007. We will then be able to diagnose cyclical changes in measures of housing supply that arise as market activity ebbs and flows in response to background changes in the economic environment (e.g. interest rates), as well as secular trends, such as underlying changes in the geography of housing supply. These secular trends will inform judgements on whether new housing is now typically constructed at higher densities, and in locations that offer better access to urban amenities such as public transport. Our analyses of price dynamics will be of particular interest; it will describe the changing geography of affordable new housing, a critical issue from the perspective of those low-income groups who may be more reliant on public transport, and have a preference for inner-urban living to gain access to employment opportunities.

Policy relevant questions will be addressed using ‘before and after policy change’ comparisons of the density of developments, their position in the price/value distribution of housing, and their location relative to activity centres, transport, centres of employment provision and other attributes that might add to the cost of living in that location. Using appropriate statistical tests, the strength and significance of impacts will be measured.

The quantitative data alone may not be able to identify and precisely estimate effects that are due to planning policy, because these effects can be confounded with those attributable to other variables. However, the before and after comparisons will be able to show whether the characteristics of new housing supply following the introduction of a new policy regime are consistent with the stated policy aims. It can be helpful to combine quantitative data analysis with qualitative approaches, as the latter can help interpret the findings from the former. Thus a second component of the research plan is interviews with key actors in the land development process.

4.2 Interviews

Having established the characteristics of housing that has been built under a variety of policy and governance regimes, we will then seek explanations for the outcomes by conducting a number of detailed semi-structured interviews with key leaders from private development corporations and local government. The purpose of the interviews is to answer the fourth research question: *To what extent and in what way do government policies impact on decisions on housing supply made by the development industry?* The interviews will add depth to our understanding and enable a more coherent and nuanced explanation of the data analysis findings.

A number of key figures, representatives of the largest firms in the development industry, local government planning managers and the Growth Area Authority will be approached for interview. We will seek to interview representatives of the six largest firms building new housing in the growth areas of Melbourne. An additional, and perhaps smaller, sample of developers, who concentrate on building housing in

established infill areas, will also be approached for interview. The aim here will be to identify whether they have different considerations in determining the type of housing they build. In addition, we will seek to interview the planning managers of the six growth area councils on the fringe of metropolitan Melbourne in order to provide an alternate perspective. The interviews with local government planning managers will seek to understand the extent to which they believe government policy affects housing form. These interviews might either corroborate or provide an alternative point of view to those of the developers.

The interviews will explore the extent to which current government housing policies guide decisions at local government level. Specific interview questions will focus on: what factors determine the form and location of housing being constructed; what role government policy plays in determining the form, location and pricing of housing; whether the determining mix of considerations varies across the metropolitan area; and, in particular, whether policies such as density targets and the imposition of the UGB are major considerations when determining housing supply. We will be able to explore the degree to which government policy (particularly that which is aspirational rather than regulatory) influences decisions around the form of housing. Where considerations are deemed to be purely financial, we will explore the elements of cost that affect decision-making and the part that government policy might be seen to contribute to these from the developer's point of view.

The research will enable policy-makers to judge the impact of planning system and planning policy changes. The planning system's impact on housing form and affordability is a neglected dimension of urban policy, and the project has potentially important implications for the future design of planning policies.

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APPENDIX I

Creation of a core dataset

The procedures for identifying the common property identifier field/s in all datasets are described here. Address and lot plan number were found to be the unique identifiers that exist in both input datasets (Sales and Valuations). In addition, Property Number ('Propnum') was also considered as another potential field that could be used as a common field to integrate valuations dataset with VicMap spatial data so that attributes of the Sales and Valuations could be spatially represented.

After examining the potential common identifiers across all datasets, address field was selected as a primary key to link valuations, sales and VicMap databases. The aim of cleaning is to format joining fields as uniformly as is reasonably possible with minimal or no manual intervention. The benchmark for uniform formatting is that found in the VicMap dataset. A high success rate has been achieved, though not all records are successfully cleaned and joined.

Datasets: Listed below are the attribute information that each data source contains and their potential use for data analysis. Attributes (Fields) that enable integration of Sales and Valuations databases, and the VicMap reference files are also provided.

Valuations

Used for:

- Property characteristics: including size of land, housing type, number of bedrooms, land classification category, year of construction, and building materials used in construction.
- Allowing the segmentation of housing supply analysis by housing type, and to control for property characteristics in the analysis of price and location.

Joining fields:

- Address (good format—close match to VicMap).
- Lot and Plan (data quality varies significantly by LGA).
- Assessment Number (possible match to VicMap Propnum).

Sales

Used for:

- Property sale information: date and price.
- Houses, units, and vacant land sales although the methodology is particularly interested in vacant land.
- Sale information that allows the analysis of sale price over time.

Joining fields:

- Address (poor format—does not closely match VicMap).
- Lot and Plan (consistently good data quality, though not formatted exactly to VicMap conventions).

APPENDIX II

Data cleaning routine

Data in the two input datasets (sales, valuations) requires reformatting to create identical matching fields to join both with each other, and with the VicMap geospatial datasets:

1. Two or more fields may need to be combined (concatenated) to create a new field. This is a single concatenated field that combines street number, street name and street type fields together in order to match the street address field (address is coded as a single field) in VicMap Address.
2. Data in the input dataset fields require substantial cleaning to ensure a consistent formatting. In the simplest case, street type data presented as abbreviations (i.e. st, rd, crt, la, etc) need to be converted to the appropriate VicMap standard street type (i.e. street, road, court, lane, etc).

The procedure for cleaning of data fields has been automated. Manual cleaning is not possible when dealing with millions of records. Furthermore, cleaning needs to be readily repeatable, should updated datasets be introduced later in the study. A code using Visual Basic programming was written to clean the necessary data fields within the Microsoft Access environment. Additional code was written to annotate where the cleaning process failed, e.g. where data was incomplete.

For practical reasons, we have not attempted to clean 100 per cent of available data fields. Lot/Plan data particularly required extensive manual cleaning due to the inconsistencies in coding the data. Code was written on a diminishing returns basis, beginning with the most common data formatting problems, and continuing until programming time surpassed the returns in terms of records cleaned. Tables 3 and 4 provide some examples through which the procedure for cleaning the data is demonstrated.

Table A1: Example of reformatting lot/plan information (format required: [lot number][plan prefix][plan number], e.g. 31\PS12345)

<i>Source data</i>	<i>Issue</i>	<i>Refined output</i>
PS 93284 PT LOT 5 PS CA 3 S 10	Reverse order	5\PS93284
LOT:563 LP:85418	Variable separator	563\LP85418
L2 PS: 605033N	Variable separator	2\PS605033

Table A2: Example of reformatting address information

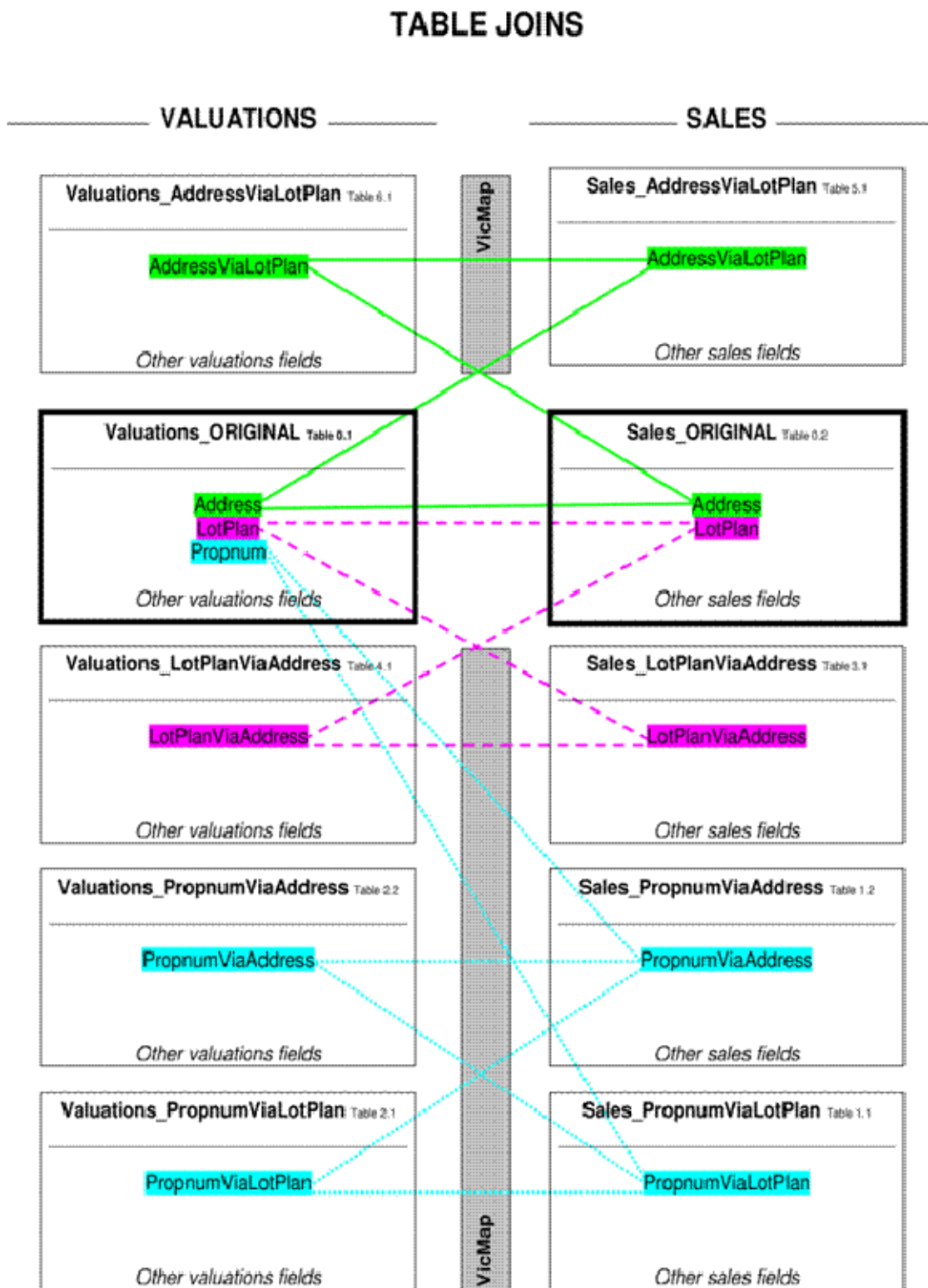
<i>Source data field 1</i>	<i>Source data field 2</i>	<i>Refined output</i>
10	Jackson St	10 Jackson Street
25	Gold Ave	25 Gold Avenue
9	Crimean Ct	9 Crimean Court

APPENDIX III

Design of joins

The more detailed design of the joins and join fields are illustrated in the diagram below. Some joins involve direct link between the sales and valuations files via shared VicMap Property or VicMap Address fields. In some cases, the joins also require sub-joins with VicMap Property and VicMap Address. Hence, consistent formatting between Sales, Valuations, and VicMap is fundamental.

Figure A1: Diagram — table joins



APPENDIX IV

Methods for dealing with missing values

Data for the joining fields is in many cases absent, such as LGA valuations with missing Lot/Plan data. In some cases, LGAs include no or incomplete data for a particular field. In other cases, data for a given LGA is patchy, with a proportion of records with missing data. Sales records, particularly vacant land sales, may have missing or changed address information. In these cases, the sales and valuations data are joined by a single matching field. To provide a second joining field for cross-checking, the missing data field can be derived from the VicMap datasets. Once a join to the VicMap data is obtained, say from the Sales dataset: Address field, the missing data (say Lot/Plan) can be obtained from VicMap and used as a cross-checking join to the Valuations dataset.

Thus, a combination of all available fields is used in order to triangulate the joining process. (See the more detailed illustration in Appendix III.) The advantage of using multiple fields is that a higher degree of joining is enabled, and also that cross referencing (for example, determining whether the address and property results are consistent) allows for error control. By joining the datasets by both potential matching fields—Lot/Plan and Address—records not matched by one join (e.g. Lot/Plan) may be matched by the other join (e.g. Address). Additionally, multiple joins provide a cross-checking mechanism to identify potential errors in the data joins, especially when joining sales and valuations datasets.

Here is an example of the core data structure. A land sale is recorded in 1994 for a piece of land (Lot 180, Plan Number LP145400) at 23 Example Drive, Exampleville. This lot and plan information is matched to the VicMap Property file, and the address information is matched to the VicMap Address file, to provide two sources of spatial information (the two matches link to the same information as, in this case, sufficient correct information is provided for each match field). A valuation record for 23 Example Drive, Exampleville, shows that, in 2008, this property contains a detached brick veneer house of three bedrooms, with a 212 square metre floor area. The house was constructed in 1994 and the lot size is 994 square metres. The address information from the valuation is linked to the VicMap Address file. As a result the land sale in 1994 is linked to the valuation record for the same property in the merged data file, with the spatial IDs from VicMap attached and additional spatial information derived.

APPENDIX V

Methodological issues

Combining the data sources represents multiple challenges in resource terms. The data sources are large and contain great variation in field formats. Not all records can be successfully cleaned and joined, although a high level of success has been achieved. With the sales records in particular, there are also problems with controlling for change over time in street addresses and property information (as a result of subdivision).

The focus for data source issues is the joining fields described earlier (i.e. Address, Lot/Plan, and Propnum). The aim has been to format these joining fields as uniformly as reasonably possible with minimal or no manual intervention. The issues that were confronted are now discussed as follows:

Valuations

Lot/Plan

From a perspective of joining the databases, the Lot/Plan data is the principle data quality issue for Valuations data. This data quality varies systematically by LGA, though there are issues for individual properties.

The source data Lot and Plan are concatenated into a single field. To enable joins, this data needs to be separated into a single Lot field and Plan field per record, complete as per VicMap Property.

Basic issues encountered were:

Non-standardised format:

- Differing separators and spacing.
- Differing ordering: Lot then Plan, or Plan then Lot.
- Multiple Lot/Plan listings for a single property.
- Multiple Lot information for a single property.
- Excess unneeded text after the Lot/Plan listing.

Incomplete:

- Missing Plan prefix, eg. '123456' instead of 'PS123456'.
- Missing Lot number.
- Missing Lot/Plan information altogether, eg. almost all of Yarra LGA.

Address

The Address data within Valuations is well formatted, though as for any address-based information, missing and misspelt data is to be expected.

Assessment number

Unlike Sales data, the Valuations data contains a field that *may* match to the Propnum field in VicMap Property. This is 'Assessment Number'. Data content varies by LGA. Some LGAs leave this field blank. In other cases, it is not clear whether the number is a match to VicMap Property, or an individual identifier specific to the LGA.

File size

The size of the Valuations file (2.5 million records) makes the process of refining records en masse problematic, with application crash likely. It is necessary to *segregate* into sub-files (by municipality) for refining data.

Sales

Address

From a joining perspective, Address is the principle data quality issue for Sales data. However, this issue is less variable than for the Valuations Lot/Plan data, and therefore less complex to account for.

To match VicMap Address and the Valuations data, ideally the Address information should be separated into a street address field (eg. '10 Smith Street'), locality and postcode fields. The source data street address format is presently a combination of abbreviation and concatenation (eg. '10' 'Smith St').

Basic issues encountered were:

Abbreviated street type:

→ The street type (eg. 'court' or 'street') is abbreviated ('ct' or 'st'), whereas the VicMap Address is not.

Too much concatenation:

→ Street name and street type are concatenated into a single field, 'streetname' making it harder to separate and de-abbreviate the street type.

As per Valuations, and any address-based information, missing and misspelt data is to be expected.

Multiple files

Ultimately it is also useful to join the multiple years of sales data into a single table, as the many single tables for each year would necessitate too many joins to reasonably keep track of.

Joining

The structure of the joined files will comprise one, multiple, or no sale records for each one valuation record. Both the sale and valuation record will contain multiple join fields, with potentially varying levels of success. The structure of the files used in the analysis needs to make use of the most reliable available join fields for each record, and to control for inconsistent join results.

With the sales records in particular, there are potential problems with controlling for change over time in street addresses and property information (as a result of subdivision).

A sale may be made in the past, wherein the property information refers to an address that has subsequently changed, or to a parcel that has subsequently been subdivided. This is more problematic where both changes take place, as the sale will not join to either the reference file or to the valuation of the site at present.

Although this issue impacts only a small number of records, these records are of particular interest to the research question. As a result these non-joining historical records are being processed separately to control and check for systematic bias, on a problem-by-problem basis.

GLOSSARY: DATABASE METHODOLOGY

Address	A description of address point comprising street number, street name and type, suburb and/or postcode. The reference list for Victoria is contained in VicMap Address.
Clean	Also referred to as 'parsing' or refining. The process of reformatting information to a standardised format to allow joining.
Concatenation	The process of joining separate fields or texts end to end—eg. 'Smith' and 'Street' concatenated to 'Smith Street'.
Geocode/Geocoding	Geocoding is the process of ascribing reliable spatial information to a non-spatial piece of information. A geocoded record is 'pinpointed' to a geographic location and can then be analysed spatially within GIS. In this project, property records are geocoded using VicMap.
Geographic Information System	A Geographic Information System (GIS) is a way of storing, analysing, and presenting (mapping) spatial data.
Join	A link between datasets based on common fields.
Lot/Plan	Lot and plan information refers to individual land parcels and refers to the land title information, comprising the plan of subdivision and the lot number.
Parcel	An individual parcel of land, identified by its lot number and its plan number.
Property	A property may comprise multiple parcels of land.
VicMap	Reference database for spatial information in the State of Victoria. Includes the VicMap Address, VicMap Property, VicMap Admin and VicMap Planning products used in this project. Comprises

	many linked tables as described in VicMap Product descriptions.
VicMap Address	Reference database of street addresses.
VicMap Property	Reference database of land parcels and properties. Comprises both parcel and property tables.

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