THE UNIVERSITY OF SYDNEY

The Henry Halloran Trust

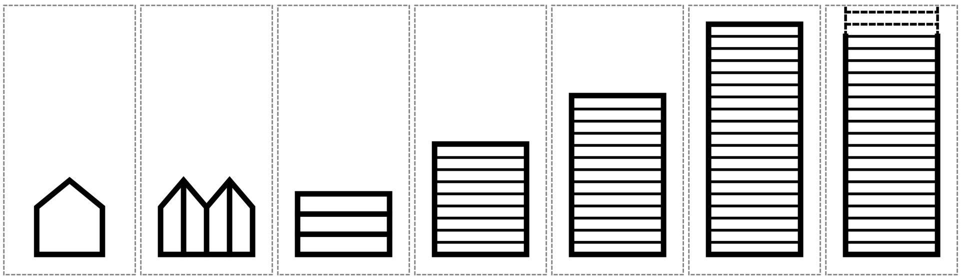
# Feasibility Guide for Town Planners

## Density must be viable as well as allowable

Cameron K. Murray

Henry Halloran Trust, The University of Sydney

2020



# Table of Contents

# Glossary of terms

| Economic term | Definition |
| --- | --- |
| **Average cost** | The total development cost for a building divided by the number of dwellings in the building (for average cost per dwelling) or divided by the total dwelling area (for average cost per sqm of dwelling space). |
| **Marginal cost** | The additional development cost necessary to increase a building's size by one extra dwelling (or one extra sqm). |
| **Price** | The arms-length market price for the sale of a dwelling, typically determined by the capitalisation of the flow of future rents. |
| **Marginal price** | The market price of the next increment of a product, for example, for the next square metre of dwelling floor space or lot land area. |
| **Rent** | The arms-length market price for the annual rent of a dwelling, determined by the supply and demand for dwellings. |
| **Economic profit** | The difference between revenue and input costs arising from new production. For a housing developer, the cost of land at the market price is considered to be an input cost. |
| **Betterment** | A change in the value of land that arises due to external factors, such as changes to planning controls or local public infrastructure investment, without any construction investment being made on the land. |
| **Residual land value model** | An asset pricing model for land valuation, particularly undeveloped land, based on the residual value of revenue minus development costs (including a profit margin). |
| **Capitalisation** | The way a flow of income over time from an asset is converted to its present value. The flow of income is "capitalised" into the asset price. |
| **Present value / Time value of money** | The idea that value able to be realised today is worth more than the same dollar value able to be realised at a future date. |
| **Perpetual real option** | The right, but not the obligation, that a landowner has to undertake development without any time limit. |

# Introduction

Densification of established suburbs is often a desirable planning outcome, providing benefits in terms of the efficiency of transport networks, land use, and provision of public services. However, planning for density will not entice private landowners to redevelop to higher density unless it is also economically advantageous to do so.

There are economic limits to density as well as regulatory ones

This guide is designed to help planners incorporate considerations of the economic limits to, and benefits of, density in the creation of planning instruments to ensure that their objectives align with those that are also economically viable.

We first describe the residual land value model that forms the basis for understanding the economic effects of planning on land values and development feasibility. We then outline the three key economic conditions that exist for development to be viable.

1. Total market price must exceed total development cost
2. The marginal cost of additional density equals the market price at the optimal density
3. Land value at the optimal density use must exceed the value for current uses

These conditions need to be considered in the development of planning policies if they are to achieve their objectives.

In addition, this guide shows how planning changes that allow additional density can result in windfall gains to landowners when these economic conditions are all met. These gains are known as *betterment* and are a form of economic value created publicly through planning decisions that can be captured for public purposes through taxation. Economically speaking, the creation of betterment can be thought of as creating new land that should be sold by the public at market prices.

We propose taxing betterment in a similar manner to the current betterment tax in the Australian Capital Territory (ACT), and some councils, such as Waverly City Council in New South Wales (NSW). Indeed, even Sydney had a betterment tax from 1969-1973. However, the economic interests who currently gain betterment for free through planning decisions will be a political barrier to change.

As a rule of thumb, rezoning for high density in high-value locations will make these denser uses economically feasible, and in the process, create betterment value. But in low-value areas, these denser uses may not be viable compared to current lower value uses, hence leaving no betterment effect.

Whether planning for density creates additional value and development opportunities, or whether higher density is constrained by economics, regardless of planning controls, must be considered if plan-making is to generate its desired outcomes.

The reference tables at the end of this guide show what sort of incremental increases in uses may be profitable at different value locations.

# Key development feasibility concepts

## The residual land value model

Development feasibility is often misunderstood. Many policymakers and professionals involved in urban planning typically imagine that dwelling prices are determined by the sum of land and construction costs. However, this gets causality backwards. In reality, it is the land value that is determined by the market price of dwellings minus development costs. This fundamental insight is the basis of the **residual land value model**, a principle method of determining the market price of land.

A similar **asset pricing principle** applies to the determination of dwelling prices. Rather than being determined by the land and development cost of new homes, rents reflect the demand and supply of dwellings. Dwelling prices simply reflect the capitalisation of net dwelling rents; causality runs from rents to prices, moderated by ongoing holding costs, interest rates, and tax settings.

Since new housing is a tiny fraction of all housing, it is a price-taker from the broader housing asset market in which it is competing. The only margin upon which a developer has a choice about price is how much they pay for the land or site.

*Land value is determined by the revenue from dwelling sales minus development costs.*

Because of these tight economic constraints, developers have limited ways to increase profits. Often, they will purchase sites with low potential revenue when fully developed, usually limited by planning controls. This means they can pay a lower land value then seek to have planning controls removed to increase the residual land value. Since all input costs and dwelling prices are out of the control of any developer, the only point at which they can influence their profits is through the planning system.

In Figure 1 we see how this residual land valuation approach to development feasibility works. The total revenue from development is the number of dwellings able to be built multiplied by the price per dwelling, which comes from the prevailing market. All costs, including fees and charges, construction, and a buffer for profits and financing that reflects the assessed risk of the project, are subtracted to leave a residual land value that a developer would pay for that site in order to receive those risk-adjusted profits.

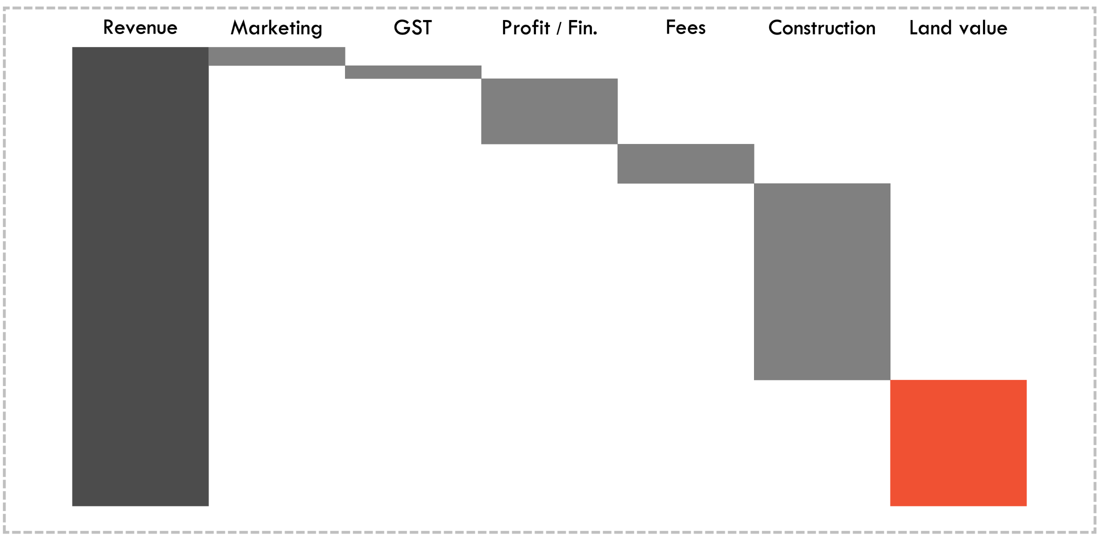



*Figure 1: Example of residual land valuation for site development*

An example may be useful. The value of a site that is able to be developed into 50 two-bedroom apartments in a location where the market price of those apartments is $600,000 can be calculated by subtracting the development costs from the expected $30 million of revenue as follows.

*Land Value = [(Price/Unit) – (Dev. Cost/Unit)] x Units*
*or*
*Total price – total development cost*

If a 50-apartment complex has a construction cost of $12.5 million, marketing costs of 4% of revenue ($2 million), fees of $50,000 per apartment, a net GST obligation of $1 million, and a factor for profit and risk of 20% of revenue ($10 million), then the land value is calculated as:

*Development cost per unit =*
*$250,000 construction + $50,000 fees + $100,000 finance and profit +*
*$20,000 GST + $20,000 marketing and sales*
***=$440,000***

*Site (land) value is*
*( $600,000 — $440,000 ) x 50 = $8 million*

Any increase in the market price of apartments adds to the land value, and any increase in costs comes off the land value. In Figure 2 we show how these changes affect land values. On the left panel, an increase in the market price of dwellings is shown to flow straight through to the land value, since other input costs for development are fixed. Even prior to development this land value can be gained by a landowner without developing by selling the site to a buyer willing to pay this higher land value. Price declines have the same effect in reverse.

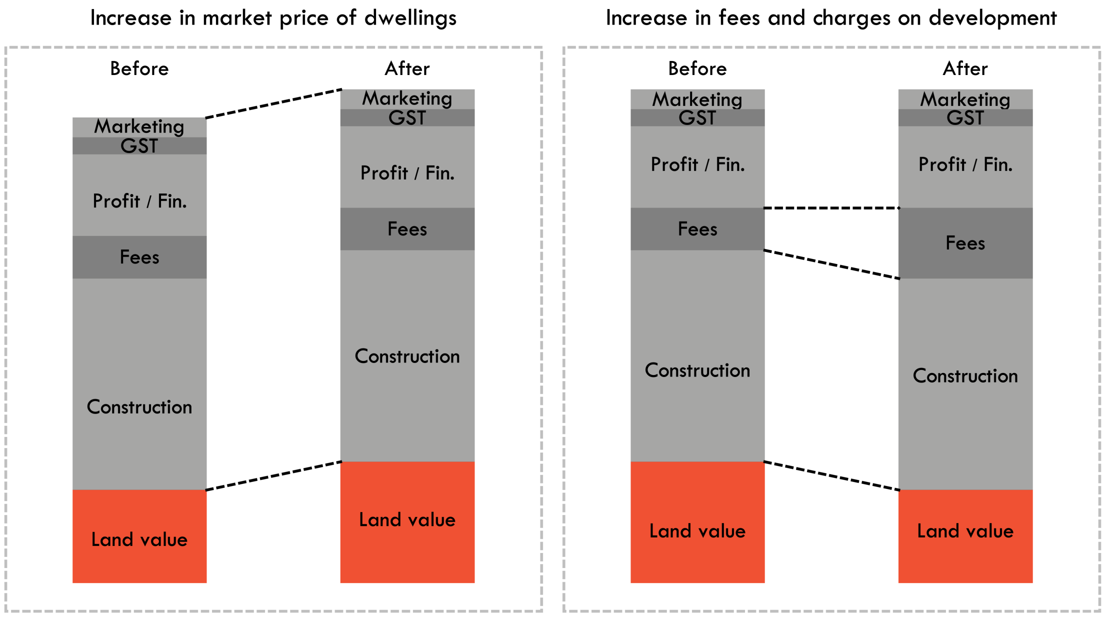



*Figure 2: How cost and price changes affect feasibility*

The difference between land value and profit is important to understand here. It is certainly the case that an increase in market price, or a reduction in costs that occurs between site purchase and the sale of new dwellings, is an additional economic profit; but that profit is not associated with the risk of the development. The gain not associated with any production of goods and services is usually understood as an economic rent — an abnormal profit that is not required for the production to take place. The name for this value is **betterment**.

On the right panel of Figure 2 is a scenario where fees or charges are increased on development, but this same effect could also arise from increases in other costs, such as construction. Here, the market price of dwellings remains unchanged, since this price is not determined by costs but by the larger market for existing and new dwellings. Total development costs rise, and because land value is revenue minus development costs, these added costs are subtracted from revenues and reduce land values by the same amount.

# What is Betterment?

It is critical to differentiate here between **economic profit** and **betterment**. Both are economic gains to landowners or housing developers, but they are conceptually distinct.

**Betterment** is an increase in land value arising from external policy changes that affect site-specific property values without any new investment being made on the property such as new buildings.[1] This can include local infrastructure investment decisions that add value to specific localities, but they also include changes to planning controls, either for a single site, for a set of sites within a designated area in a planning scheme. Where local prices are high enough to justify much higher densities, planning changes that allow these higher densities result in **betterment** for property owners. **Economic profit**, by contrast, is simply the margin on all input costs (at the market prices) for producing new goods and services. In the case of new housing, the way to differentiate is that if you receive the gain without producing new housing, it is not **economic profit. Betterment**, for example, can be realised by selling an undeveloped site after rezoning, planning approval, or following local infrastructure investment, without producing any new housing (or commercial or industrial) services.

We can show how **betterment** arises in **the residual value model**, and the conceptual difference to economic profit, with the help of Figure 3. The left column shows the residual value model for a site that is limited in its density by planning controls, capping the number of dwellings and hence total revenues. The centre column shows the change in land value due to an increase in the allowable density due to planning changes. All the component development costs increase, as more construction will take place, but even accounting for this, there remains a large increase in the land value (the light red area). This is the **betterment** arising from this change, which is quite different from light grey profit area which shows the increase in economic profit, or margin.

Betterment for rezoning vs profit from development

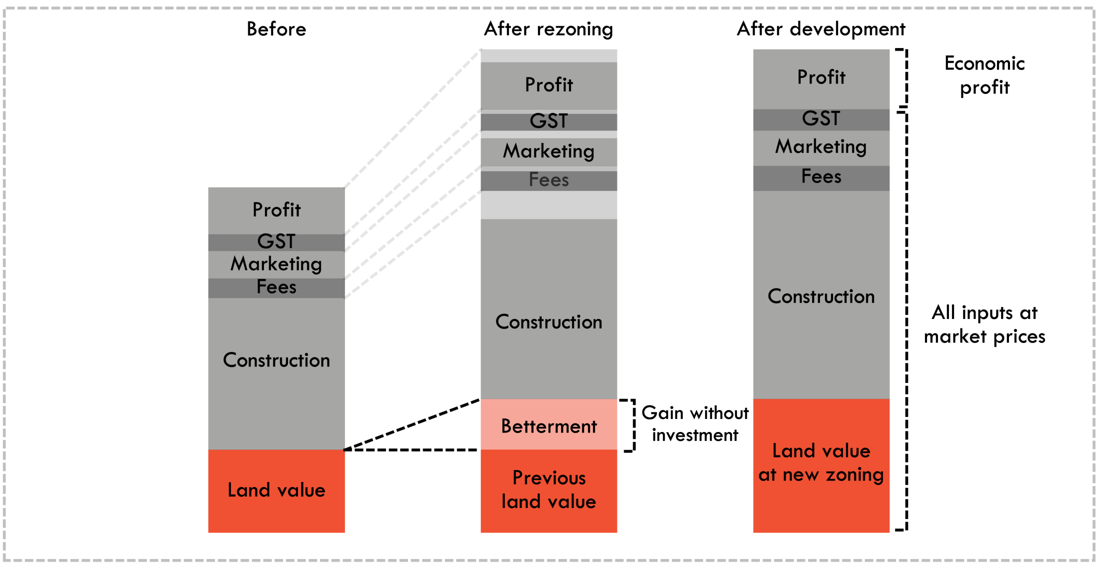



*Figure 3: How betterment arises from higher density and differentiating it from economic profit*

[1] This excludes market level changes such as higher household income that increase rents, or lower-interest rates.

To drive home this point. The third column shows the residual value method with all input costs factored in at their market price, including the land at this new higher value. Recall that economic profit must account for all inputs at their market price, and the land now has a higher price that could be received by selling the site undeveloped due to the planning change.

Because economic profits are difficult to increase though innovation or product changes, it is the opportunity to secure this **betterment** that motives developers to seek exemptions from planning controls, rezoning decisions, and reductions in fees and charges for development. These decisions provide windfall gains that go straight to their bottom line without having to take on development risks.

# Timing decisions for housing developers

The **residual value model** reveals the basic economic reality of housing development, but one element is missing; time. For simplicity, the **residual value model** collapses a process of development that takes time into a single period to be able to compare the present value of costs and revenues. It is important to recognise that the right to develop a site into new use has no time limit; it is known as a **perpetual real option** meaning that the right, but not obligation, to develop is owned by the landowner with no expiry date when development must be undertaken.

The timing decisions of all potential housing developers – i.e. all landowners with the option to develop if they choose to – is ultimately what determines the overall rate of new housing supply in a region over a given time period. Often when analysing housing supply, the density of housing in approved developments is wrongly thought to be synonymous with the rate of housing supply per period of time across all sites with development options. But adding density does not necessarily accelerate supply either on that site or in a suburb.

The reason that the stock of approved or zoned housing does not affect the rate of housing supply is because the optimal rate of sales per period for a developer, and for all housing developers collectively, is the one that maximises the present value of those sales revenues. If selling two new dwellings per month in the current market conditions is optimal for a 10-dwelling development, then selling two per month is optimal for a 20-dwelling development as well.

This optimality condition arises from the interaction of 1. the own-price effect on price, meaning that if you want to sell faster you must decrease the price, 2. the risk-adjusted interest rate at which you value future revenue compared to revenue today (mostly determined by the policy interest rate), and 3. the growth in market demand and hence the expectation of future price growth, which is especially important in a rising market where delayed sales may result in much higher prices.

In fact, single developments at high density can affect the decision of neighbouring landowners who may delay their own development until the market is less saturated by the large number of dwellings available for sale in the nearby high density development.

# The asset pricing model

Recall the earlier claim that dwelling prices are determined by rents, which are the product of the supply and demand for dwelling occupancy. How then do rents translate into prices? The way this is done can be demonstrated with the **asset pricing model**,[2] which shows how streams of future incomes are **capitalised** into asset prices.

---

[2] Also known as the Dividend Discount Model. A good discussion of this model as it relates to housing comes from the Bank of England and is available here https://bankunderground.co.uk/2019/09/06/houses-are-assets-not-goods-taking-the-theory-to-the-uk-data/

It is important to reinforce the main point of the asset pricing model—that rents cause housing prices rather than the reverse—by analogy. Apple makes iPhones. The value of shares in the Apple company are an asset, the value of which is determined by the net revenue from selling iPhones. The same applies to dwellings. The dwelling is the asset, which gets its value from the future revenue streams of net rent. Just like you would not argue that the Apple share price is causing higher iPhone prices, you cannot argue that higher dwelling prices are causing higher rents.

The value of a dwelling reflects an upfront payment that is equivalent to the future stream of net rents. In short, it is the price that answers the question "How much would you pay today to not pay rent on this dwelling for the infinite future?"

To calculate that price, we need to determine the **present value** of those future net rents. This is what the **asset pricing model** does; it **capitalises** the stream of future net rents into a single price today. More formally, the dwelling value in the **asset pricing model** is:

$$\textit{Dwelling value} = \frac{\textit{Net annual revenue}}{\textit{capitalisation rate}}$$

$$\textit{Dwelling value} = \frac{\textit{Gross annual rent} - \textit{annual costs}}{\textit{risk-adjusted interest rate} - \textit{expected growth rate}}$$

Net annual revenue is the gross rent minus any ongoing costs, such as council rates, land taxes, and maintenance (but not financial cost such and interest on any borrowing, as the choice of leverage is a separate issue). The capitalisation rate depends on the risk-free interest rate (i.e. the prevailing policy rate set by the central bank), the assessment of the risk-premium[3] for housing investment above holding cash, and the expected growth in rents and is usually the risk-adjusted interest rate minus expected net rental (or price) growth rate. The reason that price growth and rental growth are substitutable assumption is that

For example, if the gross rent is \$500/week, or \$25,000/year,[4] and the annual costs are \$7,500 in rates, insurance, maintenance allowance and other costs, then the net revenue is \$17,500/year. With the risk-free interest rates at 3%, the risk-adjusted rate for a large illiquid investment like housing might be 5.5%, with an expected rental growth rate of 2%.

Putting these assumptions in our **asset pricing model** gives a dwelling value of \$500,000 as per the following calculation.

$$\textit{Dwelling value} = \frac{25{,}000 - 7{,}500}{0.055 - 0.02}$$

$$\textit{Dwelling value} = \frac{17{,}500}{0.035} = \$500{,}000$$

This means that although rents are related to prices, that relationship is strongly influenced by 1. annual holding costs of housing, such as rates and taxes, insurance, and maintenance, 2. Interest rate, with lower rates leading to higher prices,[5] and 3. expectations of rental and/or price growth. When prices deviate from rents, one of these other factors must be involved, rather than the supply and demand for housing, which is reflected in the rental price.

[3] The risk-premium is the increase in return above the risk-free interest rate that is desirable because of the potential for that investment to have much more variable returns, including the possibility of losing money due to changing market conditions.
[4] Assuming two weeks per year vacancy allowance.
[5] All else held constant and with no rental growth expectations, a doubling of interest rates will halve the price, and vice-versa.

## Why are these models important for planners?

For planners, all of these models and concepts are crucial for dealing with the economic realities of day-to-day professional practice. The **residual value model**, for example, forms the basis of the subsequent three Rules in this feasibility guide, which demonstrate when planning for density might work, and when it may fail due to economic limits. Planning changes can greatly enhance land values, reduce values, or change which uses maximise land value. For example, an increase in the allowable density of development can greatly increase land values by increasing the total revenue gained per site (the number of dwellings able to be sold) by much more than the costs increase (the increase in cost of building those additional dwellings). Alternatively, planning changes can be rendered ineffective by economic limits that constrain density and uses even when allowable under planning controls. In low-value areas, the high-cost of building greater density may not be able to be recovered in the market price.

Understanding that planning regulations, and changes to them, are key determinants of land values and a source of **betterment** is also important for understanding the motives behind planning applications that might be at odds with planning controls and intended planning outcomes.

An understanding of the **asset pricing model** enables planners to think clearly about where housing process come from and help identify misleading or mistaken economic analysis of housing price. Planners should be able to defend their profession against economically misinformed opinions about supply, demand and dwelling prices. The model also demonstrates that the economic feasibility of different types of development can be heavily influenced by financial and tax factors, rather than being only the result the demand for housing as reflected in the rental price.

Finally, dynamic thinking about timing decisions in the development process is useful, especially for ensuring clear thinking about the two distinct concepts of dwelling density versus the rate of new dwelling supply. Approving more applications for housing development, or approving more dense housing proposals, is often thought to help increase supply. But this confuses density for the rate of supply. Even if a more dense development is approved, it will be optimal for that developers to sell the dwellings at the same rate period of time, but simply sell them over a longer period of time – the optimal rate of sales is not dependent on the available sites with development options, nor the number of approvals.

For example, housing developers will often claim in planning applications that their higher density development proposal is necessary to solve local housing shortages. But in a study of the annual reports of Australia's top eight publicly traded housing developers, it was shown that when obliged to report truthfully to their investors, they instead claim that their denser approvals will last them much longer, rather than increase their annual sales targets.[6]

In general, a degree of economic proficiency and understanding of these models will help planners to ensure that their actions interact with economic forces in a way to enhance their desired outcomes rather than work against them.

[6] Murray, C. 2020. "Time Is Money: How Landbanking Constrains Housing Supply." OSF Preprints. February 14. doi:10.31219/osf.io/hym43

# Feasibility Rules

The following three rules extend the basic **residual value model** to show the economic determinants of, and limits to, dwelling density. These economic principles apply to all land use types, including commercial and industrial, but we focus here on residential uses.

These economic determinants of density are crucial for ensuring that desired planning outcomes are also economically feasible.

## Rule 1: Price must exceed development cost

It seems obvious, but the first economic condition for higher planned densities to be effective is that the market price a dwelling must exceed the development costs of a dwelling at the planned density. These costs exclude land, but include construction, fees and charges, marketing and selling, as well as profit margins and financing costs.

*Price > Total Development Cost (excluding land)*

While this Rule might seem self-evident, an awareness of total development costs is crucial for understanding the viability of density. Specifically, because **per dwelling construction costs increase with density,** low-price areas will be economically constrained on their ability to densify due to the higher costs of more dense housing, particularly tower blocks.

In Table 1we show the typical construction costs per square metre (sqm) of dwelling for a variety of dwelling types with increasing density. Other development costs include economic profits (margins), which, given the risk and time involved in large developments, are usually 20-30% of development costs (depending on market conditions and financing they could be higher). Selling costs are usually about 5-10% of the revenue, and involve agent commissions, marketing and advertising. Fees and charges per dwelling (e.g. infrastructure charges) vary greatly, but in some areas can be as high as $30,000 per apartment, or about $300/sqm.

*Table 1: Average construction costs ($/sqm) for residential buildings per sqm of saleable dwelling*

| | Detached | Town house | Walk-up | Mid-rise (<10 storeys) | High-rise (11-20) | High-rise (21-40) | High-rise (40+) |
|---|---|---|---|---|---|---|---|
| **Sydney** | 2,590 | 2,600 | 2,670 | 4,050 | 4,460 | 5,500 | 6,640 |
| **Melbourne** | 2,470 | 2,590 | 2,640 | 3,630 | 4,050 | 4,630 | 5,260 |
| **Brisbane** | 2,560 | 2,380 | 2,660 | 3,520 | 4,010 | 4,330 | 4,810 |
| **Adelaide** | 2,280 | 2,440 | 2,380 | 3,330 | 3,520 | 3,770 | |
| **Perth** | 2,200 | 2,230 | 2,230 | 2,960 | 3,370 | 4,010 | 4,830 |
| **Darwin** | 2,640 | 2,830 | 2,830 | 3,160 | 3,190 | 3,520 | |
| **Canberra** | 2,410 | 2,720 | 2,850 | 4,330 | 4,710 | 5,260 | |

*Taking a weighted average (minimum weighted of four-fifths and maximum weighted at one-fifth) of the cost range from the 2019 Riders Digest and include the same weighted average for building services.*

As an example, for a 90sqm apartment in Sydney, the average construction cost in a walk-up low-rise block is $240,000, but in a 30-storey tower is $495,000. Add to both of these the marketing, GST, fees, and profit margins, total development costs are closer to $350,000 for the low-rise apartment, and $620,000 for the high-rise apartment. If the market price in an area for an apartment of this size is $500,000, a high-rise block will never be economically viable, even if the planning system allows them to be built. A walk-up three-storey block, or townhouse development, is much more likely and should be considered in establishing the type of planning and zoning that matches the economic incentives to densify the area.

# Rule 2: Marginal cost of density equals price

At a given market price for a new dwelling, what density is optimal? Is it always better to go higher or denser? There is a simple economic rule that determines the optimal density for a site based on the market price and development costs, which is:

*The economically optimal density is where Price = Marginal Cost*

The **marginal cost** is the change in the total cost of development due to the addition of a single extra dwelling. For example, while the average cost to build a 5-storey block might be $3,500 per sqm, the cost of going an extra storey higher is more than the average cost of the first five storeys due to the additional building services, circulation space, depth of carparks and foundations, and other design and construction considerations. There are diseconomies of scale for higher density buildings as they require more construction cost per dwelling unit.[7]

The economic incentive is to keep increasing the density until the costs of the incremental increase in density—the marginal cost—is equal to the price of the additional dwellings that come from the extra density. This is the density that maximises both the land value and the profits from the site. The average, or per dwelling, development cost is irrelevant to this economically optimal density decision.

In Figure 4 we show the economic logic of this optimality condition. We calculate the total development cost, including a risk-adjusted profit margin, at each potential development density, shown in the left panel. One noticeable feature of this total cost curve is that the cost rises more than proportionally with density—a feature of diseconomies of scale. The dashed line shows the total cost if each additional dwelling could be developed without rising costs.

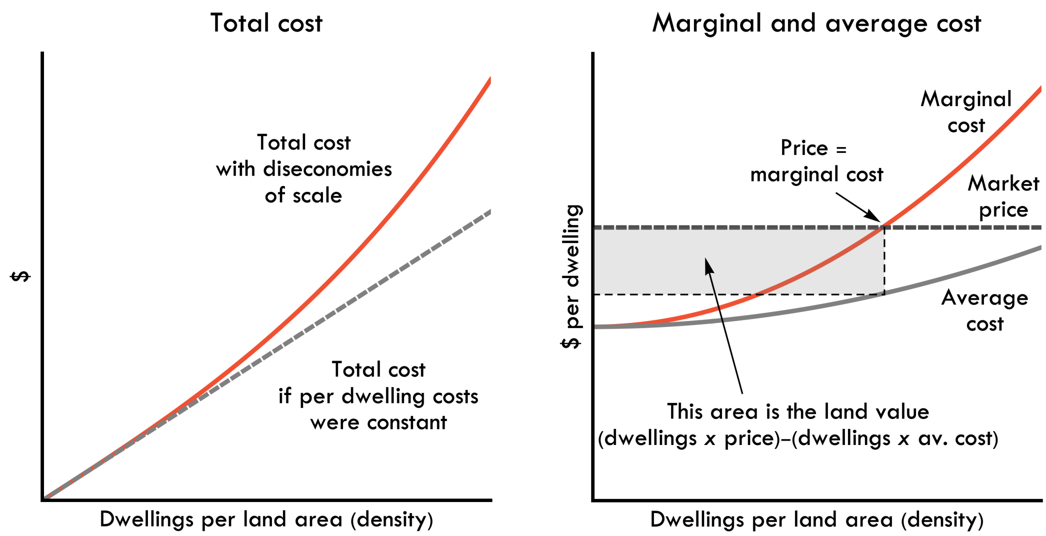



*Figure 4: Economic logic of Price=MC for land value maximisation*

[7] If there were economies of scale to building more dense buildings there would be no single detached or medium-density dwellings as it would always be cheaper per dwelling to build multi-unit buildings (assuming comparable size and market appetite).

In the right panel of Figure 4 we show the per dwelling cost, the average cost, and the marginal cost of adding the next dwelling to the building, the **marginal cost**. Recall that in the **residual value model** that the land value is the revenue minus the development cost (where the development cost includes a risk-adjusted profit margin). This land value is maximised when the price equals the marginal cost. The marked rectangle is the land value, which is calculated as follows.

*Land value = Revenue – Development costs*

*which is the same as*

*Land value = Price x quantity – average cost x quantity*

The reason this point maximises the land value is that adding another dwelling at any density below this point comes at a **marginal cost** below the price, meaning that adding that dwelling adds to the land value. Above that point, the **marginal cost** of adding that extra dwelling is above the price, therefore decreasing the land value. Because the market for purchasing development sites is competitive, the buyer who will pay the most is always going to plan to develop at this optimal density.

Because of the diseconomies to density, the marginal cost of adding comparable sized dwellings will always be above the average cost. In Figure 5 we show Australian data from quantity surveyors on average and marginal construction cost (excluding profit margins and fees and charges for now), with the marginal cost always higher than the average. Although the pattern of real average and marginal costs is not as pronounced as the above example, the key feature (marginal is always above average) must exist.

Looking at Figure 5 we can see that, for example, the marginal costs of going from a 40 to 80-storey building in Sydney is $7,900 per sqm, yet the average cost per sqm of dwelling in an 80-storey building is $6,700 per sqm. If the market price was $7,000 per sqm, the optimal building height will be somewhere around 40-storeys, even though that price is above the average cost for an 80-storey building.

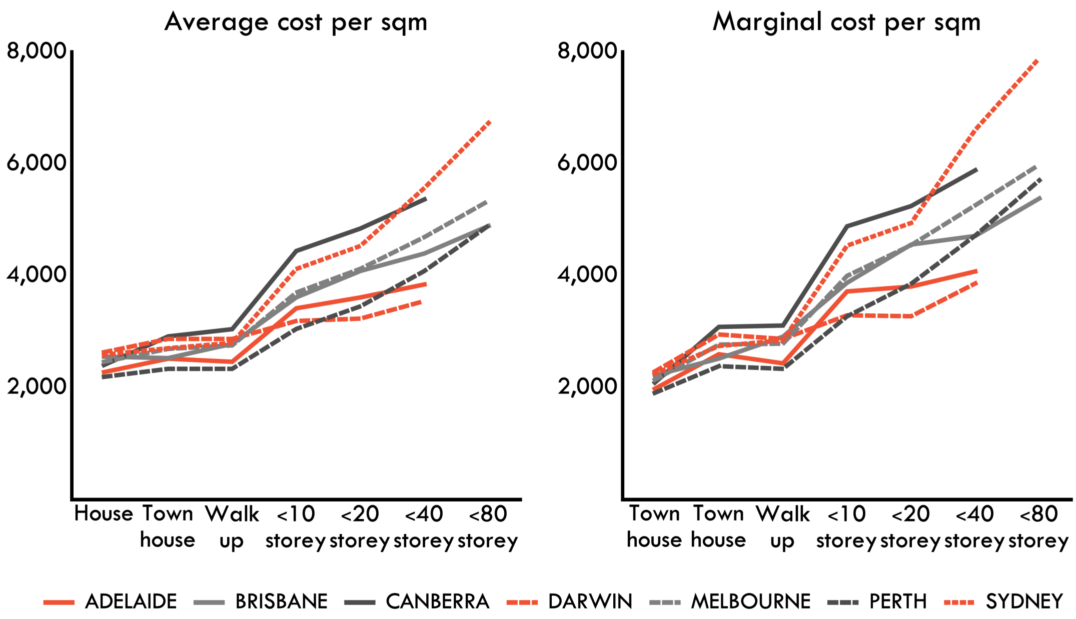



*Figure 5: Rising construction costs with density across Australian capital cities*[8]

[8] Construction costs are from the 2019 Riders Digest and factor in services and external works.

An example can demonstrate this logic. The first four columns of each row in Table 2 show the **total, marginal,** and **average development costs** of a hypothetical residential development at different possible building heights. Rather than on a per dwelling basis, this data is summarised on per square metre of saleable dwelling area basis (i.e. both development costs and prices are in per square metre terms). **Marginal costs** are above **average costs** and rise more quickly with additional height/density, as in per the theory and data.

The next two columns of Table 2 show the total revenue from the sale of the dwellings in that building for each height scenario, as well as the land value calculated by the **residual value method**, assuming that the market price of dwellings at that location is $6,000/sqm.

Notice that a building height of 60 storeys maximises the land value given this market price and cost structure, whereas going above this height reduces land value. This means that any buyer of this site with plans to build a 60-storey building will be able to bid the most and buy the site at this price. Even when height is unrestricted, market conditions and cost structures constrain the height to 60-storeys.

The patterns here also help show the land value gains from changes to planning controls that limit density where those limits are below this optimum density. For example, at the $6,000/sqm market price and the cost structure in Table 2, if planning controls limited height on this site to 20 storeys, it would limit the land value to $23 million. Changing this planning controls to allow 40 storeys would increase the land value to $41million and eliminating height limits altogether would increase the value to the economic maximum of $49 million. These increases in land value from changes to planning controls are **betterment,** and they happen when the planning control limits density rather than the economic feasibility.

Above the density of 60 storeys, planning controls have no effect on density. If there was a height limit of 60 storeys and that was raised to 80 storeys, only 60 storey buildings would be built in these market conditions because of economic constraints.

*Table 2: Choice of height to maximise residual land value (480sqm per storey of saleable dwelling area)*

| | | | | $6,000/sqm price | | $4,500/sqm price | |
|---|---|---|---|---|---|---|---|
| **Building height (storeys)** | **Total cost ($m)** | **Marginal cost ($/sqm)** | **Average cost ($/sqm)** | **Total revenue ($m)** | **Land value ($m)** | **Total revenue ($m)** | **Land value ($m)** |
| **80** | 189 | 7,800 | 4,900 | 230 | 41 | 173 | |
| **70** | 154 | 6,800 | 4,600 | 202 | 47 | 151 | |
| **60** | **124** | **5,900** | **4,300** | **173** | **49** | 130 | -3 |
| **50** | 97 | 5,200 | 4,100 | 144 | 47 | 108 | 6 |
| **40** | 74 | 4,600 | 3,900 | 115 | 41 | 87 | 11 |
| **30** | **53** | **4,100** | **3,700** | 86 | 33 | **65** | **12** |
| **20** | 35 | 3,800 | 3,600 | 58 | 23 | 43 | 9 |
| **10** | 17 | 3,600 | 3,500 | 29 | 12 | 22 | 5 |

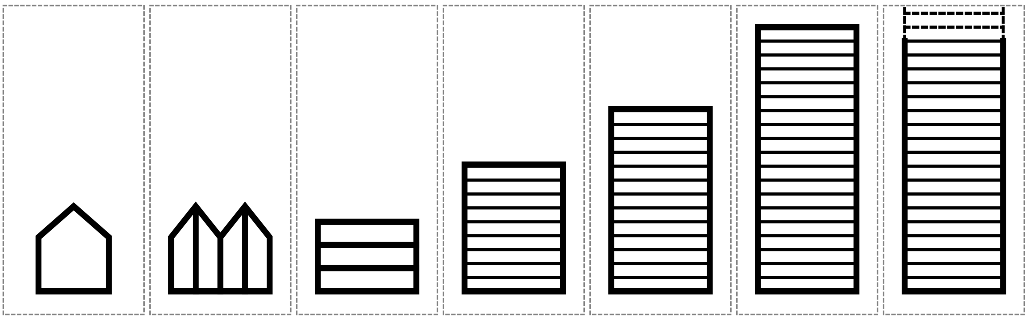
The right two columns of Table 2 show what happens in our hypothetical example when the cost structure remains the same, but the market price falls to $4,500 per saleable sqm. This reduction in market price changes the economically optimal density—the density that maximises land value—from 60 to 30 storeys, while reducing the land value from $49 to $12 million. Under these new market conditions, even if higher densities are allowed, only buildings of 30 storeys will be built.

A 25% price reduction changed the economics of this project so much that a 50% decline in density was optimal, while reducing the land value by 75%. The same effect happens in reverse when the price rises from $4,500 to $6,000/sqm, increasing both optimal height and land value more than proportionally to the price rise.

Rule 2 provides guidance about what dwelling densities are economically optimal at different dwelling prices. Some guidance for each Australia capital city about these optimal densities is in Table 3. As market prices increase (or decrease), the density of development that will maximise the land value increases (or decreases) in all cities. This same effect happens within cities. Premium locations command higher market prices making developing to higher densities optimal, while inferior locations with lower market prices make much lower densities optimal, even when unconstrained by planning controls.

Notice also the relationship with development costs (the construction cost component of development costs was plotted earlier in Figure 5). Higher development costs in Sydney and Canberra make higher density developments only optimal at much higher prices than in Brisbane, Perth, or Adelaide. This means that higher per-dwelling government charges, such as development charges and stamp duties, also have an effect of reducing the optimal density choice.

*Table 3: Price guideline for optimal density choice*



**Market price range of a "standard" dwelling ($'000)**

| | Detached | Duplex | Low-rise walk-up | Mid-rise <10 storey | High-rise 11-20 | High-rise 21-40 | High-rise 40+ |
|---|---|---|---|---|---|---|---|
| Syd | 260-390 | 320-470 | 330-490 | 520-780 | 570-850 | 760-1,140 | 910-1,360 |
| Mel | 250-370 | 320-480 | 320-480 | 460-690 | 520-790 | 610-910 | 690-1,030 |
| Bri | 260-380 | 290-440 | 340-500 | 450-670 | 530-790 | 540-810 | 620-930 |
| Per | 220-330 | 270-410 | 270-400 | 380-570 | 440-670 | 540-820 | 660-990 |
| Ade | 230-340 | 300-450 | 280-420 | 430-640 | 440-660 | 470-700 | — |
| Can | 240-360 | 360-530 | 360-540 | 560-840 | 600-910 | 680-1,020 | — |
| Dar | 260-400 | 330-510 | 330-500 | 460-690 | 380-570 | 450-670 | — |

*A "standard" dwelling is a 90sqm two-bedroom two-bathroom dwelling. Non-construction development costs—profit margin, fees, marketing, GST, etc.—are assumed for this exercise to be 60% of construction costs. Range is +/– 20% of the mean estimate. Construction costs are calculated from 2019 Riders Digest data. Empty cells are due to lack of construction in these cities at that density, meaning cost data is unavailable. Hobart is also excluded for that reason.*

The first column of Table 3 is highlighted because it helps show some of the subtleties of this approach, particularly the need to consider that dwellings are not uniform products. Few detached dwellings are constructed to the typical size of apartments. Instead, as market prices have increase over the long term, detached dwellings have grown in size. Considered as a separate class of dwellings, there is also an optimal density choice for detached housing subdivisions. How large a house should be built for given lot size to maximise the land value? The answer to this question is the same as the answer to the question of the optimal height of apartment buildings—until the marginal cost of developing that extra floor space equals the market price for that extra floor space.

What limits the size of detached dwellings is that the market price for the extra floor space (the **marginal price**) falls as dwelling size increase. It is not constant. People are willing to pay less per square metre for larger dwellings than smaller dwellings, assuming the same standards of construction. This same logic applies to the choice of apartment sizes within new buildings.

A similar logic applies to the choice of lot sizes for detached dwellings. People are willing to pay less per square metre of lot area as lot size increases. In other words, after a point where the size is large enough to build based on market norms in an area, the **marginal price** of extra land begins falls as lot size increases. When subdividing a site into housing lots, the choice of lot size will be the one that maximises the land value. This will be the point where the **marginal price** of land peaks—right before it starts to fall. This happens to be the point where the **average price** of land and **marginal price** for a lot are equal (given constraints on the shape of lots in a subdivision).[9] Obviously, once subdivision has occurred, changes to the market price will make alternative size lot sizes optimal. This is why developers like to stage large subdivisions, as the design of later stages can be adjusted to changing market conditions.

In sum, these two conditions provide some insight into density choices in the detached dwelling market. First, to maximise land value of the site, housing lot sizes will made as close as possible to the point where the **average** and **marginal price** of the land is equal in that market. Then, detached houses will be built to the point where the **marginal cost** of extra dwelling space is equal to the **marginal price** in the market for extra dwelling space, noting that the marginal price (the demand) for dwelling space will be falling (people are willing to pay less for an extra increment of dwelling space that the previous increment).

**Box 1: Parking requirements at the margins**

A common argument for removing minimum car park requirements in planning schemes is that the imposition of these additional development costs increases the price of housing. But as the **residual value model** shows, these costs are subtracted from revenue to determine site values.

Even in the absence of car parking requirements, housing developers will include car parks if they increase their profit from a dwelling at the **margin**. If an apartment with a carpark sells for $100,000 more than an apartment without a car park, and the car park costs $50,000 to develop, then they will choose to include car parks even if they are not required to. In fact, if a second car park per dwelling adds another $60,000 of value (the marginal revenue) and costs $55,000 (the marginal cost), two car parks per dwelling will be economically optimal.

Only if the market value of a car park is less than its development cost an area will minimum parking requirements enforce more parking to be built than otherwise would occur.

[9] More analysis of this condition and the shape of housing demand that creates it is in Murray, C. 2019. "Marginal and average prices of land lots should not be equal: A critiques of Glaeser and Gyourko's method for identifying residential price effects of town planning regulations." OSF Preprints. November 25. doi:10.31219/osf.io/fnz7v. It is argued here

# Rule 3: Land value at the optimal density must exceed current use value

Not only must prices exceed construction cost at the optimal density (where the **marginal cost** equals the price) but the land value at that optimal density use must exceed the value of the site for its alternative, or current, use.

*Revenue – Development Costs > Site value for current use*

For example, a site where the current use is detached housing, but the planning scheme allows townhouses or other "missing middle" housing such as low-rise walk-ups, the value of the current detached housing might quarantine the area from development because the value of the current house value exceeds the residual land value for a "missing middle" development.

Table 4 shows the **residual value model** calculation for a hypothetical site under three alternative uses — detached housing, townhouses, and apartments. If this site was vacant, the higher-density apartment development would maximise the land value out of these alternatives, with a residual site value of $2 million. A detached home development would have a residual land value of just $1 million. If this site was vacant then development into apartments would be more viable than into detached housing or townhouses.

However, if the site already has detached housing on it, any developer must also buy the home already attached to the land. If the residual value as a development site does not exceed the value at the site's current use, then it will not be developed. In this hypothetical example, an existing detached dwelling (on a large site that may have redevelopment potential) sells for $2.2 million (the shaded cell). No developer will be able to outbid a buyer for the detached home at these market prices and development costs, and hence the site will be economically quarantined from development into these uses, even if the planning system allows them. This effect is amplified by the additional development costs of demolishing existing site buildings, which further reduces the value of the site for redevelopment.

*Table 4: Residual site value for alternative denser uses where none exceed the value for the current use*

| | **Alternative possible uses** | | |
|---|---|---|---|
| | Detached housing (1x house) | Middle density residential (4x townhouses) | Higher density residential (10x apartments) |
| **Revenue from development** | $2.2m | $3.9m | $6m |
| **Development costs** | $1m | $2.4m | $4m |
| **Residual land (site) value** | $1.2m | $1.5m | $2m |

*Middle density housing is four townhouses with a market price of $1.3m and a development cost of $600,000 each. High density is ten two-bedroom apartments with a price of $600,000 and a development cost of $400,000 each.*

This effect is one reason for the "missing middle" in many cities that largely developed with detached housing on the city fringes. We can demonstrate that only allowing a much greater density of development would this site be economical to redevelop. For example, if 30apartments could be developed in a much taller building instead of ten, with a market price of $600,000 and a per-apartment development cost of $450,000, the site value would be $4.5 million — much higher than the site value for its current detached housing use.

The lesson here is that incremental changes to housing density are typically uneconomical because of the existing sites uses. Medium density housing in existing urban areas is therefore likely to only appear when dwelling prices are high, but the density of redevelopment is constrained by planning limits.

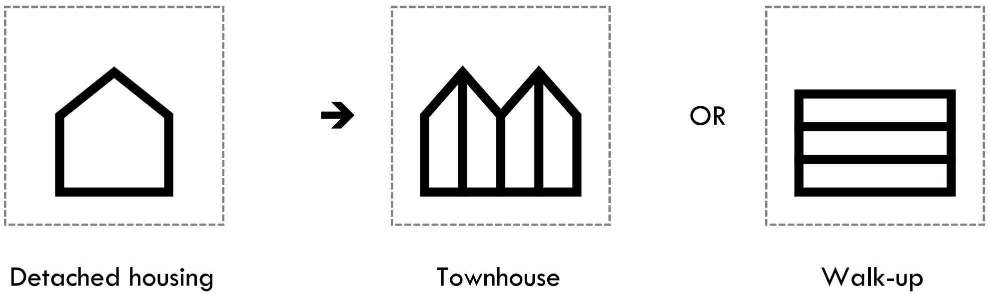
The quarantining effect of existing development is not acknowledged as much as it should be, however it is occasionally acknowledged. For example, this report explains how recently approved non-residential uses will stop these sites from being able to be economically redeveloped in the foreseeable future.

> *Where an existing development approval for a non-residential use was granted over residential land and had been acted upon, that land was excluded from the analysis due to the nature of the use being generally higher yielding (financially) than that which could be achieved through the development of the land for residential purposes.*[10]

[10] Zone Planning Group. 2020. "Gold Coast Dwelling Supply: Assessing the Gold Coast's expansion area dwelling supply." p10.

# Example planning changes

## Example 1. Medium density in established detached housing areas




We expand here on the example of creating a "missing middle" density by allowing areas previously developed for detached housing to be redeveloped into incrementally more dense uses, such as townhouses and walk-up apartments, or the addition of granny flats or secondary dwellings.

For granny flats and secondary dwellings, this is usually more effective, depending on the design of existing dwellings and regulatory requirements (frontage, side access, setbacks, fire-safety, etc). With minimal construction investment, dwelling stock can be expanded as the existing use does not quarantine sites from expansion.

But for a "missing middle" that requires complete site redevelopment, like terrace- and town-house development, or walk-up and medium-rise apartments, there can be binding economic constraints.

The economic constraint comes in multiple forms. First, in low-value areas, the cost of building these higher-density dwellings may simply exceed their market value. Second, in high-price areas, the value of building to even higher density is likely greater than building at a "middle" density. In all areas, existing uses may quarantine the site from development as per Rule #3, depending on development costs and market conditions.

### Low value areas

In Table 5 we show the market price and development cost for different dwelling types in a low-value area, for example, an outer fringe suburbs of one of the major capital cities or in the suburbs of a large regional town.

Because the location value is low, residents are more price sensitive to the size of their dwellings — apartments are worth a lot less than houses. The last row shows the land value of a hypothetical site based on the **residual value model** for the different density housing options.

In this scenario townhouse development maximises the land value. However, neither townhouses, nor walk-up apartments, are feasible in sites that have existing detached homes. Thus, if there are vacant sites in this suburb, building townhouses will maximise land value.

This demonstrates the economic incentives in many large-scale housing subdivisions on the city fringes. Because they have so many vacant sites in their subdivisions, they are able to use some of the vacant land for denser townhouse development (or very dense detached housing with lot sizes of around 200sqm) to increase the value of that land. Townhouses would not be feasible in neighbouring suburbs with existing detached housing, except in the few cases where existing housing is in irreparable condition.  More dense walk-up apartments are always uneconomical compared to detached homes and townhouses, and mid-rise apartments are not feasible because the market price in these areas exceeds the development cost.

*Table 5: Low-value area density constraint*

| Dwelling type (dwell/site) | Detached dwelling (1) | Townhouse (3) | Walk-up (8) | Mid-rise (25) |
|---|---|---|---|---|
| **Market price per dwelling** | $420,000 | $300,000 | $220,000 | $250,000 |
| **Development cost/dwelling** | $260,000 | $230,000 | $200,000 | $250,000 |
| **Residual site value** | $160,000 | $210,000 | $160,000 | — |

*Market prices reflect new outer urban estates such as North Lakes (north of Brisbane), Cloverton and Olivine (north of Melbourne) with development costs estimated from the 2019 Riders Digest. Equivalent Sydney prices are 50% higher.*

## High value area

In Table 6 we show the market price and development cost for different dwelling types in a high-value area representing middle-ring suburbs of the capital cities (construction prices are higher to reflect the higher construction quality that maximises value in this area).[11] Notice the different result. Rather than higher-density mid-rise apartments being uneconomical, they now represent the most valuable development, surpassing the "missing middle". While it may be feasible to develop a site with an existing detached dwelling into townhouses or a walk-up apartment block, the economic gain is much higher from developing a mid-rise tower with 25 apartments. Only if this denser option is prohibited by planning constraints would "missing middle" development take place. But even in this scenario, the small difference in site value compared to existing housing may prohibit redevelopment on the vast majority of existing housing sites.

*Table 6: High-value area density constraint*

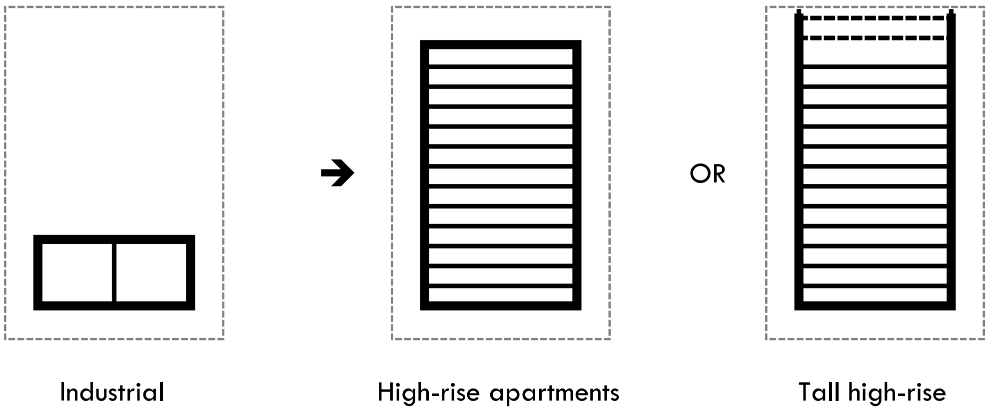
| | Detached dwelling (1) | Townhouse (3) | Walk-up (8) | Mid-rise (25) |
|---|---|---|---|---|
| **Market price per dwelling** | $900,000 | $700,000 | $500,000 | $550,000 |
| **Development cost/dwelling** | $400,000 | $330,000 | $320,000 | $350,000 |
| **Residual site value** | $500,000 | $1,110,000 | $1,440,000 | $5,000,000 |

*These prices reflect Brisbane middle ring suburbs and more distant Melbourne and Sydney suburbs.*

These two stylised examples show the challenges of redeveloping established areas into "missing middle" housing type. The most likely scenario for "missing middle" housing density to be viable is actually in new fringe areas being converted from low-value agricultural or industrial uses into residential uses, skipping detached housing development altogether. Historical "missing middle" housing types, which are now in inner-city areas, were the once the new fringe developments of transit-constrained cities when they were built.

[11] Note that Sydney and Melbourne middle-ring home prices were about 25% higher that this, yet in other capital cities the prices are lower.

# Example 2. High-rise apartment in suburban industrial area




Another common planning objective is to transform industrial areas into high-density residential and mixed-use areas. These areas were often historically developed as industrial precincts on the outskirts of the city, but the growth of the city has since surrounded these areas by residential suburbs. The opportunity to densify within the city footprint using these areas is often seen as an advantage to liveability by planners. Occasionally, these industrial areas are in high-value inner-urban locations as well.

The same redevelopment feasibility issues arise as with “missing middle” housing. When the market price of dwellings is low, such as in outer suburbs, high density housing can be unviable because development costs exceed market prices, as per Rule #1. It is also the case that Rule #2 constrains the density of any redevelopment, while Rule #3 may be at play when existing industrial uses mean the site is much more valuable than the land alone, and where extensive demolition and remediation works are required for redevelopment.

A summary of how these Rules apply to the consideration of this type of redevelopment is in Table 7. It is difficult to summarise the full spectrum of outcomes in this type of redevelopment. However, it is worth keeping in mind that suburban industrial land can sell for $250-500/sqm, with the price for existing uses in the $700-2,000/sqm of site area range (depending on the extend of capital improvements).[12] Residential land for high-rise is typically much higher in value, but this only occurs in high value inner-urban areas (except in Sydney where these high values occur throughout the city).

*Table 7: Likelihood and relevant Rules for industrial conversion to high-rise residential*

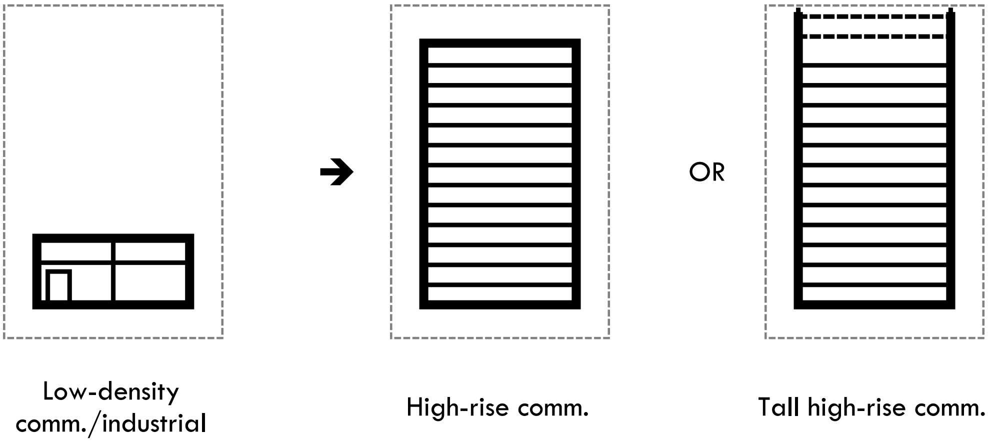
| | | **Industrial** | |
|---|---|---|---|
| | | High value | Low value |
| **Residential** | High value | More likely—Rule #2 & #3 | More likely—Rule #2 & #3 |
| | Low value | Less likely—Rule #1, #2, & #3 | Less likely—Rule #1 & #2 |

In locations where dwelling prices are high, this change going to be economically viable if the planning system allows it. Many dense urban suburbs in Australia’s capital cities have been

[12] Colliers. 2019. “Industrial – Second half of 2019.” Research and Forecast Report.

developed this way in the past two decades (such as Green Square in Sydney and Newstead in Brisbane). The lower the allowable residential density in the planning system, and the higher the value of industrial uses, the less likely this type of redevelopment is economically feasible, even in high-value areas.

# Example 3. High-density commercial in satellite area




Another common planning objective is to create satellite commercial hubs where there are limitations to commercial densification in existing city centres, for example, because of extensive heritage protections or existing development.[13] In Australian cities, many dense activity centres have been proposed to relieve pressure on commercial locations in the CBD, with the Greater Sydney Commission's A Metropolis of Three Cities plan being a recent key example.[14]

The economic logic at play is the same as in Example 2—high density is typically only viable if there is a high location value which justifies the additional development costs and ensure that the residual land value for development exceed the value of current uses. Simply planning for high density commercial development in low-value fringe areas will not automatically lead to more density.

The success of these planning objectives usually relies on enhancing the value of these locations, such as via public investments in transit, public amenity, and services. Transit investments are usually a trigger for "opening up" new areas to be economically viable for even low-density development. Value can be created in these areas by locating public services and public offices there, kick-starting agglomeration benefits for complementary businesses.

Without investments in creating location value, planning for high-density commercial (or residential) uses in satellite areas will often not lead to private landowners making those investments. They must be economically viable as well as allowable.

[13] Paris, France, and Vienna, Austria, are two example that spring to mind where city planners directed commercial investment into new hubs on the fringes of the old city. In Australia, examples such as Logan and Chermside in Brisbane have been planned as new commercial hubs.
[14] Also known as the Greater Sydney Region Plan, the full document is available here https://www.greater.sydney/metropolis-of-three-cities/about-plan

# Capturing betterment from planning

The **residual value model** and **asset price model**, alongside the three feasibility Rules, demonstrate that planning permissibility and economic viability interact in important ways. One of the key ideas to fall out of these models is that of betterment — the value gain to land from changes to planning rules that occur without any development taking place.

As noted earlier, the ability to gain betterment through planning decisions attracts intense effort from developers as they have few other ways to increase earnings; they must competitively bid to buy sites and take the price of their product from the existing market. Flexibility in the planning system provides an avenue for economic gains.

This has two effects. First, it encourages corruption of planning. During the formation of planning schemes and their implementation, those who stand to gain large betterment windfalls have a strong incentive to manipulate outcomes in their favour. These gains add up to tens of billions in value per year in Australia.[15] Second, it can create unexpected economic incentives to develop outside of the areas that are planned for certain uses rather than inside. Buying a site inside such areas leaves little scope for betterment, whereas buying outside and capitalising on the flexibility of the planning system to get the same outcome can results in enormous betterment gains.

For example, buying agricultural land just outside an urban growth boundary (such as around Melbourne) and lobbying for changes to the planning system to allow housing development can provide large betterment gains. In contrast, buying a site inside the urban growth boundary requires purchasing the site at a price that reflects higher value housing uses, limiting any change of betterment windfalls.

The best way is to ensure that planning decisions that create betterment are not being gamed by developers is to charge for additional rights to develop to higher densities at a price that represents a share of betterment.[16] The **residual value model** helps here. It can be used to evaluate the betterment value arising from the right to change the use of a site from its current use to its allowable use.

In practice, planning approvals can be conditional upon paying a share of the difference in land value between the value assuming that only current uses can continue, and the land value of the approved use based on the residual value model.

The Australian Capital Territory (ACT) has had such tax since 1971, applying a 75% tax rate on betterment. In Sydney between 1969-73 there was a 30% betterment tax when rural land was converted to urban uses.[17] After lobbying by wealthy landowners whose rural land was diminished in value by this tax, it was removed after the next election cycle.

Betterment is no longer seen as the market value of development rights held by the public and granted to landowners.

---

[15] Murray, C. K. and P. Frijters. 2017. "Game of Mates: How favours bleed the nation". Publicious.
[16] The Australian Capital Territory has a 75% betterment tax, and from 1969-1973 Sydney had a 30% betterment tax. See proposals by Marcus Spiller for how to implement this approach broadly https://www.sgsep.com.au/publications/insights/the-corruption-honey-pot-an-economic-fix-for-planning-scandals
[17] Archer, R. W. 1976. "The Sydney Betterment Levy, 1969-1973: An Experiment in Functional Funding for Metropolitan Development." Urban Studies. Volume 13, 339-342.

# Planning Guide: Checklist

Where is higher density likely to be economical? The following checklist follows through the three Feasibility Rules to help guide decision-making during plan development to ensure that what is planned is also what is economically viable.

## Check Rule #1

Use this table to put rough numbers together and check whether sites in an area are going to pass Rule #1 and ensure that market prices exceed development cost at the planned use.

| | | |
|---|---|---|
| | **Market price per unit or sqm** | |
| **Minus Development costs** | Construction | |
| | Fees | |
| | GST | |
| | Marketing and sales | |
| | Margin (~25% on costs) | |
| | **Residual land (site) value per unit or sqm** | |

## Check Rule #2

As a rule of thumb, marginal construction costs are around 20% higher than average costs, with other components of development cost fixed per unit. We can then simply add 20% to the construction costs, add in the fixed per unit costs, and check that this marginal development cost at the planned density is over or under the market price.

If the marginal development cost is now above the market price at the planned density, then the planned density is higher than is economical. If the marginal development cost is below the market price at the planned density, then additional density would be economical and desirable to landowners and developers (i.e. it is likely that they will seek approval for even higher density as this will provide them betterment).

## Check Rule #3

Finally, the last check is to compare the value of sites developed at the planned use to the value of sites in the area at their current use.

| | |
|---|---|
| **Typical value of sites at current use per sqm** | |
| **Residual land (site) value per sqm** | |

# Apply the checklist

Take Chermside in Brisbane as an example with mid-rise (<10 storey) apartments. First, check that the market price exceeds the development cost.

| | | |
|---|---|---|
| | **Market price per unit** | **$440,000** |
| **Minus Development costs** | Construction | $250,000 |
| | Fees | $21,000 |
| | GST | $10,000 |
| | Marketing and sales | $20,000 |
| | Margin (~25% on costs) | $90,000 |
| | **Residual land (site) value per unit** | $49,000 |

With these market prices mid-rise residential can be viable. However, what we can observe is that in areas where the market prices for new apartments is less than $391,000 (the total development cost), these types of developments won't be viable (such as in new urban fringe suburbs).

Then, check if the marginal price at the height or density limit (say 10 storeys) still applies. Use the rule of thumb that the marginal is higher than the average development cost by 20% of the construction cost component. In this case, that make marginal development costs about $441,000 per unit.

This is roughly the same as the price. Hence, we can say that increasing height limits to much great than 10 storeys will have little effect on encouraging taller buildings, as these are currently uneconomical (though if market conditions change, they may become viable).

Finally, the last check is to compare the value of sites developed at the planned use to the value of sites in the area at their current use. With 6 units per storey and 10 storeys the total residual site value for a 1,000sqm block would be about $3 million (or $3,000/sqm). If these blocks are worth far less than this for their current detached housing uses, then it is feasible that many sites will be developed. However, if the typical current uses are worth more than $3,000/sqm, these sites will not be viable for this type of development and planning for mid-rise residential will result in few, if any, new developments at that planned use.

To provide an overall picture of viable economic conditions, this exercise can be repeated at different market price and the site values to provide the below traffic-light table that shows under what conditions 10-storey residential zoning will be viable (and which Rule is a limiting factor). Planners can conduct this exercise during plan development, and after market price changes, to monitor the interaction of the planning system and economic viability.

| | | **Apartment prices** | | | |
|---|---|---|---|---|---|
| | | **$350,000** | **$400,000** | **$450,000** | **$500,000** |
| **Site value** | **$1,000/sqm** | | Rule #1 & #3 | | |
| | **$2,000/sqm** | | | | |
| | **$3,000/sqm** | | | Rule #3 | |