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Technical Supplement to *Wasted space: Axe car-parking rules to ease the housing crisis*

Ashleigh Chang and Dominic Behrens

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Appendix A: State and local off-street car-parking requirements

This appendix provides greater detail on the car-parking requirements that operate across Australian states and territories.

Car-parking requirements typically vary depending on the dwelling type, number of bedrooms, and location (including access to public transport). And some jurisdictions have switched from specifying minimum to maximum car-parking requirements.

In **NSW**, State Environmental Planning Policies (SEPPs) override council parking controls. Under the Housing SEPP, the Apartment Design Guide (ADG) overrides council parking controls for residential flats (of 3 or more storeys or 4 or more dwellings) near railway/light rail stations or major commercial zones. It mandates the lower of the Development Control Plan (DCP) minimum or Guide to Transport Impact Assessment (GTIA) rate (Figure A.1). Likewise, the Low and Mid-Rise Housing (LMRH) policy supersedes these rates in LMRH areas, where it is lower. LMRH minimum parking rates apply only where no Environmental Planning Instrument (EPI) or DCP specifies a maximum number of spaces per dwelling. Local governments set minimum (and in some cases maximum) off-street parking rates through DCPs and Local Environmental Plans (LEPs), which vary widely across local government areas.[1]

In **Victoria**, parking requirements for new homes are now set with reference to Public Transport Accessibility Level (PTAL) categories. In areas deemed well-serviced by public transport (i.e. 'high' or 'medium'), maximum parking rates apply. Whereas minimum parking requirements for new housing developments apply in areas with 'low' or 'poor' access to public transport. Local councils have the authority to opt-out and set their own (higher or lower) minimum rates, or to instead adopt maximum permitted parking rates in new housing developments (Figure A.1 on the following page).

In **South Australia**, parking requirements are set centrally in the new statewide Planning and Design Code. In most areas, 'standard' minimum rates of at least one off-street parking space per new home (for townhouses and apartments) applies. Although some designated areas, such as those in the Capital City Zone, stipulate maximum parking rates rather than minimums (Figure A.1 on the next page).

In **Western Australia**, the state government sets a 'deemed to comply' baseline in the statewide Residential Design Codes (R-Codes). These vary based on whether areas are deemed to be well serviced by public transport (Figure A.1 on the following page). Councils can vary the state-wide baseline within their local planning schemes.

In **Queensland**, the state government does not set binding car-parking rates for new housing. Instead, the amount of off-street parking required in new developments is set through local planning schemes, creating a patchwork of requirements across metropolitan areas (Figure A.2.[2])

1. Specific parking rates also apply to the affordable housing component of developments under the Transport Oriented Development (TOD) Program. Minimum requirements for affordable infill projects take precedence over local controls, with separate rates for the affordable and non-affordable components.

2. A proposed 2026 Brisbane City Council amendment ('More Homes, Sooner') would introduce a new 'Key Locations' category — covering land within principal, major and district centre zones, mixed use zones, and within 400m of major public transport interchanges or high-frequency stops (maximum 20-minute weekday headways) — with reduced minimum parking rates for multiple dwellings. This amendment is not yet adopted and is not reflected in Figure A.2.

Figure A.1: Off-street car-parking requirements for new residential developments in NSW, Victoria, South Australia, and Western Australia

NSW

Guide to Transport Impact Assessment (GTIA) minimum car-parking reference rates

	Apartments			Townhouses		
Bedrooms	**Category 1: High accessibility to public transport**	**Category 2: Medium accessibility to public transport**	**Category 3: Low accessibility to public transport**	**Category 1: High accessibility to public transport**	**Category 2: Medium accessibility to public transport**	**Category 3: Low accessibility to public transport**
1	0.4	0.6	1	0.5	0.7	1
2	0.7	0.9	1.3	0.8	1	1.7
3	1.2	1.4	1.5	1.2	1.6	2

Council requirements: Varies by local council according to Development Control Plans (DCPs) and Local Environment Plans (LEPs).

Victoria

Statewide baseline minimum car-parking requirements (per dwelling rate)

	Category 1 (poor PTAL access)	**Category 2 (low PTAL access)**	**Category 3 (medium PTAL access)**	**Category 4 (high PTAL access)**
Minimum	1.2	1	0	0
Maximum	None	None	2	2

Council requirements: Varies at council level if a parking overlay (clause 45.09) is present.

South Australia

Statewide baseline minimum car-parking requirements

Bedrooms	**Townhouses**			**Apartments**		
	Standard	**Designated areas**		**Standard**	**Designated areas**	
		Lowest	**Highest**		**Lowest**	**Highest**
1	1	0	0.75	1	0	0.75
2	2	0	0.75	1	0	1
3+	2	0	0.75	2	0	1.25

Western Australia

Statewide baseline minimum car-parking requirements

	Townhouses				**Apartments**					
	Location A: well-serviced by public transport		**Location B: all other areas**		**Location A: well-serviced by public transport**			**Location B: all other areas**		
Bedrooms	**Low density (R10-R30)**	**Medium density (R30+)**	**Low density (R10-R30)**	**Medium density (R30+)**	**Low density (R10-R30)**	**Medium density (R30-R60)**	**High Density (R80+)**	**Low density (R10-R30)**	**Medium density (R30-R60)**	**High Density (R80+)**
1	1	0	1	1	1	0	0.75	1	1	1
2	1	0	2	1	1	0	1	2	2	1.25
3+	1	1	2	1	1	1	1	2	2	1.25

Council requirements: Varies by council according to Local Planning Strategies, Schemes and Structure Plans.

Notes: Excludes visitor car-parking requirements. In NSW, categories determined at the SA2 level to reflect degrees of transport accessibility (via walking or public transport) to nearby urban or regional centres, share of all trips by car, and population density. In Western Australia, Location A encompasses areas within 800 metres of high-frequency rail stations or 250 metres of high-frequency bus transit stops; parking rates for townhouses apply the grouped dwelling requirements; and parking rates for apartments apply the multiple dwelling requirements. In South Australia, designated areas include areas of Adelaide zoned for higher density, such as the City Living Zone, whereas other designated areas such as the Capital City Zone mandate maximum car-parking rates, rather than minimums. Local councils in South Australia have no control over off-street car-parking requirements.

Sources: NSW Government (2024); Victorian Government (2025); Department of Planning Lands and Heritage (2024); and South Australian Government (2025).

Figure A.2: Off-street car-parking requirements for new multiple-dwelling developments in South East Queensland councils

Brisbane City Council

Bedrooms	Maximum car-parking permitted – City Core	Minimum required car-parking spaces – City Frame	Minimum required car-parking spaces – All other areas
1	0.5	0.9	1
2	1	1.1	2
3	1.5	1.3	2
4+	2	1.3	2.5

Ipswich Council

Bedrooms	Minimum required car-parking spaces – High Density Residential Zone	Minimum required car-parking spaces – All Other Areas
1	1	1
2	1	1.5
3+	1.5	2

Redland Council

Bedrooms	Minimum required car-parking spaces – Within specified centres or close proximity to PT	Minimum required car-parking spaces – All other areas
1	1	1.5
2	1.5	2
3+	2	2

Moreton Bay Regional Council

Bedrooms	Minimum required car-parking spaces – Urban / Next generation precincts (lowest)	Suburban / Coastal precincts (highest)	Centre zone (Caboolture and Strathpine centre precincts)	Centre zone (District and Local centre precincts)
1	1	1.75*	Long term: 2 per 5 dwellings Short term: 1 per 10 dwellings + staff spaces	Long term: 1 per dwelling Short term: 1 per 5 dwellings + staff space
2	1.25	1.75*		
3	1.5	1.75*		
4+	2	1.75*		

Logan Council

Bedrooms	Minimum required-car parking spaces – In the Loganlea local plan	Centre zone/ medium density	All other areas
1	1.15	1	1.5
2	1.3	1	2
3+	1.3	1	2

*Notes: * Per dwelling rate. Rates apply to multi-dwelling types: three or more dwellings on a single lot. See local planning schemes for more detail. Car ride-share is excluded from maximum car-parking permitted in City Core area in Brisbane City Council but included in minimum requirements in other areas. Special Centre activities rates excluded from Brisbane City Council. Excludes visitor car-parking requirements.*

Sources: **bcc-2025-ps**; *Ipswich City Council (2025); Logan City Council (2025); Moreton Bay Regional Council (2025); and Redland City Council (2025).*

Figure A.3: Minimum car-parking requirements are especially large for 3-bedroom dwellings

State	Townhouses	Apartments
NSW	0.0 – 2.0	0.0 – 2.0
Vic	0.0 – 1.2	0.0 – 1.2
Qld	1.3 – 2.0	1.3 – 2.0
WA	1.0 – 2.0	1.0 – 2.0
SA	0.0 – 2.0	0.0 – 2.0

Notes: Excludes visitor car-parking requirements. For NSW, the range represents Greater Sydney DCPs only, with rates based on general requirements – accounting for variation by rail proximity, zone, and floor area – with GTIA rates applied per the ADG and LMRH rates applied where relevant. Where specific streets or drawn catchments are mentioned in Sydney DCPs, these are not included. See notes in Figure 1.1 and Figure A.2 for more detailed parking rules of what is included in this range.

Sources: **bcc-2025-ps**; *Ipswich City Council (2025); Logan City Council (2025); Moreton Bay Regional Council (2025); and Redland City Council (2025); NSW Government (2024); Victorian Government (2025); Department of Planning Lands and Heritage (2024); and South Australian Government (2025).*

Appendix B: Our hedonic regression methodology

This appendix describes the hedonic price regression models used to estimate the market value of car-parking spaces for Melbourne and Sydney apartments. The estimates feed into the analysis described in Chapters 2 and 4.

B.1 Data and sample construction

B.1.1 Data source

Property microdata come from Cotality (2025), covering apartment transactions across Greater Melbourne and Greater Sydney. The Cotality database includes attributes such as sale price, floor area, bedroom and bathroom count, parking spaces, property type, build year, and geographic identifiers (SA2, suburb, address, postcode).

B.1.2 Sample restrictions

We restricted the analysis sample to meet the following criteria:

- **Property type**: units and flats only; townhouses excluded.[3]
- **Build year**: 2015 or later for both cities.[4]
- **Non-missing covariates**: floor area, bedroom count, and bathroom count must all be present.
- **Arm's-length sales**: restricted to transactions with a positive contract price.[5] Where a property appears in the sales data more than once, we retain only the most recent transaction.
- **Bedroom count**: 1–4 bedrooms. Dwellings with more than 4 bedrooms are excluded.[6]
- **Parking count**: we group parking spaces into categories 0, 1, 2, and 3+, where the top category captures all dwellings with three or more spaces.

Before logging, we adjust floor area by deducting 5sqm in both cities:

$$\text{floor\_area\_adj}_i = \text{floor\_area}_i - 5 \tag{B.1}$$

The deduction is a rough correction for the fact that listed floor areas in the Cotality data tend to overstate internal usable area, because the listed figure can include balconies or common-area allocations that vary by development.

3. Townhouse parking arrangements – driveways, tandem spaces, double-width garages – are likely recorded less consistently in the Cotality data than the discrete basement bays typical of apartment buildings. This measurement inconsistency biases the coefficient on parking. Separate regressions estimated on townhouses confirm a smaller, less precisely estimated parking coefficient.
4. The 2015 cut-off balances sample recency against sample size. We considered filtering for a policy window — for Melbourne, Amendment VC148 (July 2018) was the last substantive change to state-wide requirements before the December 2025 reform. However, lags between approval and completion make it hard to isolate a clean regulatory break in the data. For Sydney, minimum parking requirements are set through a multi-layered system of state and local planning controls, making a single reform year less natural as a sample boundary.
5. We only include observations where the non-standard transfer flag is equal to zero, and multi-sale flag is equal to zero.
6. Very large apartments tend to be high-end developments where unobserved quality may confound the parking coefficient.

B.1.3 Parking variable construction

Cotality records car spaces and garages separately. Because listing agents can sometimes report the same physical spaces in both fields, we measure total parking as the maximum of the two rather than the sum[7]:

$$\text{total\_parking}_i = \max(\text{garages}_i,\ \text{car\_spaces}_i)$$

B.1.4 Outlier trimming

We apply a citywide ± 3 standard deviation trim in log space to both sale price and floor area. We drop observations outside these bounds. We apply this trim citywide rather than within SA2s to avoid losing too many observations in small geographic units and to ensure the trim threshold is robust to local outliers. It removes approximately 2 per cent of matched observations in each city.

B.1.5 Final sample sizes

After all restrictions and trimming, the analysis samples comprise:

- **Melbourne**: 31,670 apartment sales across 245 SA2s, covering sale years 2015–2025.
- **Sydney**: 54,010 apartment sales across 227 SA2s, covering sale years 2015–2025.

B.1.6 Distribution of parking spaces in the sample

The distribution of parking spaces across apartments in each city's sample, broken down by distance ring, shows that roughly 74 per cent of both Melbourne and Sydney apartments have exactly 1 space; around 19 per cent of Melbourne and 18 per cent of Sydney apartments have 2; around 7 per cent of Melbourne and 7 per cent of Sydney apartments have none; and around 1 per cent or fewer in either city have 3 or more.

7. Inspection of the raw distributions under an additive assumption revealed implausibly high parking counts in both cities, consistent with widespread double-reporting; the conservative maximum removes this artefact. This avoids double-counting at the cost of potentially understating parking for the small number of properties with genuinely separate garages and open car spaces.

B.2 Model specification

B.2.1 Main specification

The main specification for both cities is:

$$\log P_i = \alpha + \sum_{k=1}^{3} \beta_k \cdot \mathbf{1}[\text{spaces}_i = k] + \mathbf{X}_i'\gamma + \mu_{s(i)} + \tau_{t(i)} + \varepsilon_i \quad \text{(B.2)}$$

where:

- P_i is the transaction sale price of apartment i.
- $\mathbf{1}[\text{spaces}_i = k]$ are indicator variables for having exactly $k = 1, 2$, or $3+$ parking spaces, with zero spaces as the reference category.
- $\mathbf{X}_i$ is a vector of dwelling controls: log adjusted floor area, bedroom count, bathroom count, property age (linear and quadratic), and an indicator for flats versus units.
- $\mu_{s(i)}$ are SA2 fixed effects, absorbing all time-invariant neighbourhood characteristics common to dwellings in the same SA2.
- $\tau_{t(i)}$ are sale year-month fixed effects, absorbing aggregate price-level movements over time.
- ε_i is the residual, with heteroskedasticity-robust standard errors.

The factor specification allows a separate coefficient for each parking category, and is applied consistently across both cities. The proportional price premium for each transition is computed as $\exp(\hat{\beta}_k - \hat{\beta}_{k-1}) - 1$, with $\hat{\beta}_0 \equiv 0$. We derive standard errors for these marginal effects from the full variance–covariance matrix of the coefficient vector, accounting for the covariance between the β_k terms.

B.2.2 Fixed effects and location controls

The main specification includes two sets of fixed effects. SA2 fixed effects absorb all time-invariant neighbourhood characteristics common to dwellings in the same SA2. Sale year-month fixed effects ($\tau_{t(i)}$ in Equation (B.2)) absorb aggregate price-level movements and seasonal patterns over time. To ensure both sets of fixed effects are reliably identified, we drop SA2s and sale year-months with fewer than 20 observations from the estimation sample after trimming.

In Melbourne, SA2 fixed effects also absorb 45–60 per cent of variation in the Principal Public Transport Network (PPTN) flag, log lot area, and planning zone indicators, leaving meaningful within-SA2 variation in these controls.

To test whether omitting these controls biases the parking estimates, we re-estimate the factor specification with CBD distance, PPTN access, and log lot area added explicitly. The parking coefficients are essentially unchanged: in Melbourne the raw log-coefficient on the first space shifts from 0.1114 to 0.1133, and the marginal log-difference for the second space from 0.0597 to 0.0593; in Sydney the equivalent changes are 0.0649 to 0.0643 and 0.0646 to 0.0636.[8] This stability – rather than the absorption of CBD distance per se – justifies the more parsimonious specification.

8. Log-coefficients here show stability at the regression level; we report the corresponding percentage price premiums–computed as $\exp(\hat{\beta}_k - \hat{\beta}_{k-1}) - 1$– in Table B.1.

B.3 Results

B.3.1 Main specification estimates

Table B.1 presents the marginal effects for each city.

Table B.1: Marginal effects from parking factor specification

Transition	Melbourne	95% CI	Sydney	95% CI
0 $\rightarrow$ 1 space	11.78%	[10.69, 12.89]	6.71%	[5.85, 7.57]
1 $\rightarrow$ 2 spaces	6.15%	[5.38, 6.92]	6.67%	[5.96, 7.39]
2 $\rightarrow$ 3+ spaces	7.51%	[3.50, 11.68]	14.13%	[10.31, 18.09]

Notes: All estimates significant at the 1% level (heteroskedasticity-robust SEs). Percentage effects: $\exp(\hat{\beta}_k - \hat{\beta}_{k-1}) - 1$. Melbourne $n = 31{,}670$; Sydney $n = 54{,}010$.

In Melbourne, the estimates exhibit a clear diminishing pattern across the first two policy-relevant transitions: the first parking space is associated with a premium of 11.78 per cent, falling to 6.15 per cent for the second space. A Wald test on the linear combination $2\hat{\beta}_1 - \hat{\beta}_2$ formally confirms these two marginals are statistically distinguishable ($p < 0.001$), supporting separate treatment in the feasibility analysis.

In Sydney, the 0$\rightarrow$1 and 1$\rightarrow$2 marginals are 6.71 and 6.67 per cent respectively – effectively equal. A Wald test fails to reject the null of equal marginals ($p = 0.95$). The Sydney parking premium is therefore best described as approximately constant across the first two transitions at around 6.7 per cent per space, rather than exhibiting the diminishing pattern seen in Melbourne. The feasibility analysis nonetheless treats the two transitions separately for consistency with Melbourne.

We exclude the 2→3+ transition from willingness to pay (WTP) calculations in the feasibility analysis. Both cities' 2→3+ estimates are unreliable: the category is very sparsely populated, producing wide confidence intervals that preclude meaningful inference. The anomalously high point estimates in both cities are also consistent with unobserved quality confounding – high-end developments that offer three or more spaces may command a premium for reasons beyond the parking itself – but the primary concern is simply the lack of statistical precision at this transition.

B.3.2 Dwelling attribute coefficients

Other dwelling attributes carry expected signs. Log adjusted floor area has a coefficient of approximately 0.28 in Sydney and 0.50 in Melbourne, consistent with diminishing returns to size. Bedroom count carries a positive premium, though the magnitude falls once floor area is controlled. Bathroom count carries a smaller positive premium. Property age carries a negative (depreciation) effect in both cities. In Sydney the quadratic term is positive, implying depreciation flattens at older ages; in Melbourne the quadratic term is negative, implying a modest acceleration in depreciation, though both terms are small relative to the linear effect.

B.4 Geographic heterogeneity

While SA2 fixed effects absorb neighbourhood-level unobservables, they produce a single pooled parking coefficient. Testing with geographic subsamples allows the implicit price of parking to vary across broad rings of distance from the CBD, providing a check on whether that pooling masks important spatial heterogeneity. We re-estimate a linear parking specification separately for three rings: inner ($<$10 km), middle (10–20 km), and outer ($\geq$20 km) from the CBD. A linear specification is used as outer rings have too few zero-parking apartments to identify all factor levels; the coefficient captures the average premium per additional space across all transitions.

In Melbourne, the results show a clear declining gradient – 9.11 per cent in the inner ring, 5.52 per cent in the middle, and 6.12 per cent in the outer – broadly consistent with greater on-street parking scarcity closer to the centre, though the outer ring is slightly above the middle.

In Sydney, the gradient is less clean. The middle-ring estimate (5.80 per cent, 95% CI: 4.61–6.66) is statistically significant. The outer-ring estimate (2.48 per cent, 95% CI: 1.20–3.70) is also significant and meaningfully lower, suggesting buyers value parking less in areas where on-street parking is more plentiful. The inner-ring estimate (4.23 per cent, 95% CI: $-$0.23 to 8.51) is imprecisely estimated and spans zero. This likely reflects the smaller effective sample per SA2 in the transaction-based estimation rather than a lack of variation in parking provision: inner Sydney has a zero-parking share of approximately 11 per cent, comparable to inner Melbourne (12 per cent), so the imprecision is likely a power issue rather than an identification issue.

The city-wide coefficient therefore represents an average across rings. The feasibility model partially accommodates this limitation: because dollar WTP is derived by applying the percentage premium to local apartment prices, the feasibility hit naturally varies with location even under a constant city-wide premium.

B.4.1 Interaction terms

We also test whether the linear parking coefficient varies with property characteristics by interacting parking spaces with CBD distance, bedroom count, and floor area. Table B.2 shows the adjusted R^2 uplift from each interaction.

Table B.2: Adjusted R^2 uplift from parking interaction terms

Interaction	Melbourne	Sydney
Parking × CBD distance	$+0.006$	-0.0004
Parking × bedroom count	$+0.003$	-0.002
Parking × log floor area	$+0.001$	-0.001

Notes: Uplifts relative to main specification without interaction terms.

The Melbourne interactions are positive and the CBD-distance interaction is highly significant, confirming that parking values vary meaningfully with location in Melbourne. In Sydney, all three interactions produce negligible or negative adjusted R^2 uplifts, indicating that the parking premium does not vary meaningfully with these property characteristics in the Sydney transaction sample.

The absence of a significant CBD-distance interaction in Sydney is consistent with a more gradual spatial gradient in zero-parking prevalence across rings. Zero-parking apartments account for around 11 per cent of inner-Sydney apartments but remain present at 4–5 per cent in middle and outer rings. By contrast, in Melbourne the zero-parking share falls sharply from 12 per cent in the inner ring to around 1–1.5 per cent in both middle and outer rings. This steep Melbourne gradient in identifying variation drives the significant CBD-distance interaction there; Sydney's flatter gradient does not generate the same signal.

The Melbourne analysis additionally tested an interaction between parking provision and public transport accessibility, using Victoria's PPTN flag. The interaction is statistically significant, suggesting the parking premium is larger in transit-rich areas. This is somewhat counter-intuitive; it likely reflects the fact that zero-parking apartments – which identify the coefficient – are heavily concentrated in inner, transit-rich areas, leaving limited identifying variation elsewhere.

Because the Melbourne CBD-distance interaction is likely driven by compositional differences in zero-parking prevalence rather than a genuine shift in preferences, and because no comparable interaction holds in Sydney, we do not carry these interactions into the main specification.

B.5 Alternative specifications

We subject the parking price marginal effects to a battery of robustness checks to assess sensitivity to specification choices. For each check, we re-estimate the main model with one alteration and report the implied marginal effect for all three transitions. Figure B.1 presents these.

B.5.1 Alternative location fixed effect levels

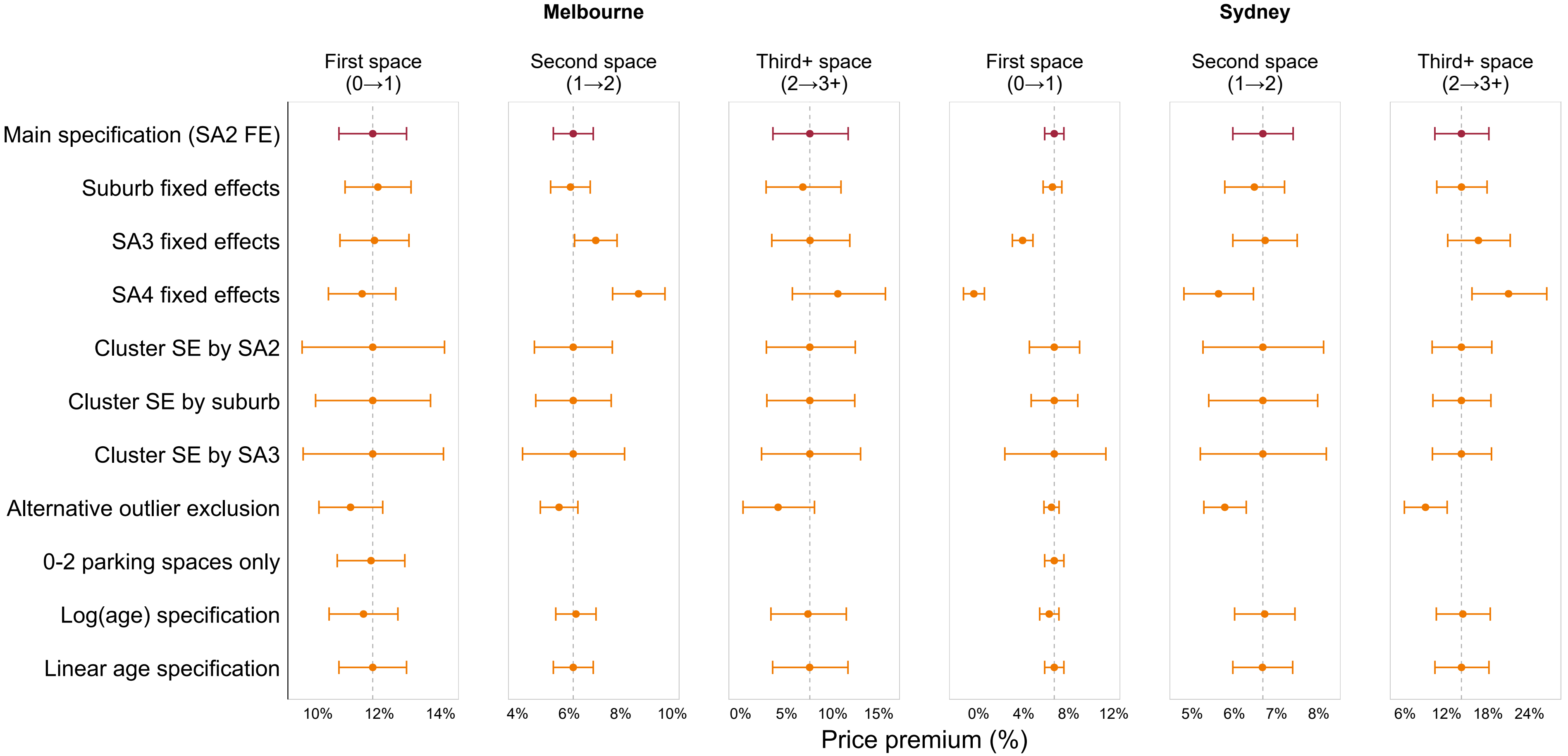
We estimate the model replacing SA2 fixed effects with fixed effects at the suburb, SA3, and SA4 levels. Suburb fixed effects produce estimates close to the SA2 baseline for both transitions in both cities.

SA3 fixed effects are stable for the 1→2 transition in both cities, and for Melbourne's 0→1 transition (11.84 per cent versus 11.78 per cent). However, Sydney's 0→1 estimate departs more notably under SA3 fixed effects (3.89 per cent versus 6.71 per cent), suggesting SA3 units in Sydney are insufficiently granular to fully absorb neighbourhood characteristics correlated with first-space provision.

Moving to SA4 fixed effects produces further instability across both transitions and both cities – Melbourne's 0→1 rises modestly to 11.44 per cent while Sydney's falls to -0.43 per cent, and Melbourne's 1→2 rises to 8.69 per cent while Sydney's falls to 5.62 per cent – consistent with SA4 units being too coarse to absorb within-area variation in neighbourhood characteristics, with residual confounding running in different directions across cities.

This supports the choice of SA2 as the preferred geographic control.

Figure B.1: Marginal effects across robustness checks: Melbourne and Sydney



B.5.2 Alternative standard errors

The main specification uses heteroskedasticity-robust standard errors. We also estimate the model with standard errors clustered by SA2, suburb, and SA3 to allow for within-cluster correlation of residuals. Clustered standard errors are generally wider – especially when clustering at larger geographic units – but the parking point estimates are identical to the main specification across all clustering levels, and remain statistically significant on both the 0→1 and 1→2 transitions in both cities.

B.5.3 Alternative sample restrictions

Alternative outlier exclusion. In addition to the citywide ± 3 SD log trim, we also test trimming the top and bottom 1 per cent of prices citywide. In Melbourne, the first-space premium falls from 11.78 per cent to approximately 11.07 per cent; in Sydney from 6.71 to 6.46 per cent. The estimates are stable in both cities, confirming that the main results are not driven by price outliers.

0–2 spaces only. We restrict the sample to dwellings with 0, 1, or 2 spaces, dropping those with 3+ spaces entirely. This avoids any risk that the 3+ category influences the 0→1 and 1→2 estimates through the fixed effects. The marginal effects for the first two transitions are essentially unchanged in both cities.

B.5.4 Alternative age specifications

The main specification includes property age as a linear and quadratic term. We also estimate:

- **Log age**: $\log(1 + \text{age})$ as a single term.
- **Linear age**: age entered as a single linear term without the quadratic.

Both alternatives produce parking effects very close to the main specification in both cities, confirming that the treatment of property age does not drive the results.

B.6 Deriving willingness to pay

The hedonic regressions are estimated in log-price, so each parking coefficient $\hat{\beta}_k$ is a semi-elasticity: it gives the approximate percentage change in apartment value associated with having exactly k parking spaces, relative to zero. To translate these into dollar values, we apply:

$$\text{WTP}_i^{(k)} = P_i \times \left[\exp(\hat{\beta}_k - \hat{\beta}_{k-1}) - 1\right] \quad \text{(B.3)}$$

where P_i is an automated valuation model (AVM) estimate of the current market value of apartment i, $\hat{\beta}_k$ is the coefficient on the indicator for having exactly k parking spaces (with $\hat{\beta}_0 \equiv 0$), and $\text{WTP}_i^{(k)}$ is the implicit dollar price of moving from $k-1$ to k spaces.

This produces current WTP estimates representative of apartments built since 2015 in each city's Cotality dataset, not just those that happened to sell.[9] Because the percentage premium at each transition is constant within a city, dollar WTP varies across properties solely through variation in P_i: higher-valued apartments imply a larger dollar value placed on parking.

Both Melbourne and Sydney use the factor specification (Equation (B.2)), so the same formula applies in each city. The analysis in Chapters 2 and 4 uses only the first- and second-space marginals ($\hat{\beta}_1$ and $\hat{\beta}_2 - \hat{\beta}_1$); the $2 \to 3+$ transition is excluded for the reasons discussed in Section B.8.

9. WTPs are computed for every apartment in the Cotality AVM stock built since 2015, after applying the same data-quality filters used in the regression sample.

B.7 LGA-level feasibility implications

B.7.1 Aggregation from property to LGA

Property-level WTPs are aggregated to LGAs by taking the median[10] across all Cotality apartment records built between 2010 and 2025 located within each LGA:

$$\overline{\text{WTP}}_{\ell}^{(k)} = \underset{i\in\ell}{\text{median}}\left(\text{WTP}_i^{(k)}\right) \tag{B.4}$$

where $i \in \ell$ denotes apartments in the Cotality stock belonging to SA2s whose centroid falls within LGA ℓ. Only LGAs with at least 30 apartments are shown.

B.7.2 Feasibility impact definition

The feasibility hit compares the cost of providing a parking space to buyers' WTP:

$$\text{Feasibility impact}_{\ell}^{(k)} = C - \overline{\text{WTP}}_{\ell}^{(k)} \tag{B.5}$$

where C is the assumed per-space construction cost. A positive feasibility hit means providing parking costs more than buyers are willing to pay – parking mandates therefore impose a net cost on developers that reduces project viability. A negative feasibility hit means the parking space pays for itself through the price premium it commands.

Cost benchmarks are the midpoints of basement construction costs shown in Figure 2.1, applied identically to first and second spaces. We hold costs constant across LGAs; the spatial variation in feasibility hits therefore reflects variation in WTP.

10. The median is preferred to the mean because dollar WTP scales linearly with property price ($\text{WTP}_i = P_i \cdot (e^{\beta_k} - 1)$) and inherits the right-skew of the within-LGA price distribution. The mean would be pulled upward by a small number of high-value apartments and likely would not represent the typical apartment buyer's valuation in the LGA.

B.8 Interpretation

B.8.1 Interpreting the WTP estimates

The hedonic price effects estimated here measure what apartment buyers have historically paid for parking in markets where parking is typically bundled with dwellings and minimum parking requirements apply broadly.

They are reduced-form associations, not structural estimates of consumer surplus or unconstrained demand. Both the identification of the coefficient and its interpretation as a guide to post-reform behaviour are subject to important caveats.

Identification. Because minimum requirements apply broadly, the counterfactual – what buyers would pay if parking were truly optional – is difficult to observe directly. Zero-parking apartments are rare (around 6–7 per cent of apartments in each city), and those that do exist are disproportionately concentrated in inner-city locations where residents genuinely have low demand for cars and parking requirements allow no parking to be built. Outer and middle suburban buyers who might also choose no parking are simply not observed, because minimum requirements prevent that option. The 0→1 coefficient therefore captures the average valuation of buyers within the current constrained regime, which may not reflect the marginal buyer's WTP if parking were genuinely optional.

Additionally, where developers voluntarily exceed minimums, they may be targeting a premium market segment, meaning the parking coefficient may absorb some unobserved quality premium. SA2 fixed effects absorb part of the location-level quality variation, and the robustness checks show estimates are stable across specifications, but we cannot fully rule out within-SA2 quality differences correlated with parking provision. This source of bias, like the selection concern above, would push estimated WTP upward – reinforcing that the feasibility conclusions are conservative.

External validity. Setting aside identification, estimates from a bundled, regulated market may not cleanly predict behaviour in a reformed one. Buyers who would not voluntarily purchase parking may no longer pay for it when given the option to opt out. And revealed-preference estimates from markets where parking is typically bundled and minimum requirements apply broadly may systematically overstate WTP in a deregulated market, where buyers with low valuations could opt out.

Margin of evaluation. A related point, working in the opposite direction: the hedonic coefficient identifies marginal WTP at current provision levels, where minimums bind and most apartments are built at or near the mandated amount. If reform reduces provision, the marginal WTP for the spaces that remain would rise – buyers value their first space more than their second, and shifting along that demand curve means the last unit retained is worth more than the average estimated here. Per-apartment dollar figures in Chapter 4 should therefore be read as partial-equilibrium scale measures of the distortion, rather than as predictions of post-reform price reductions.

B.8.2 Geographic heterogeneity

The main specification imposes a single set of parking marginal effects across all SA2s within each city. Location-ring-level estimates from a supplementary linear specification (Section B.4) confirm that parking values decline with CBD distance in Melbourne, and that the middle-to-outer gradient is present in Sydney as well. The inner-ring estimate for Sydney is imprecisely estimated, likely due to the smaller effective transaction sample per SA2 rather than any lack of variation in parking provision.

The feasibility model partially accommodates spatial heterogeneity via price variation, but the model constrains parking coefficients themselves to be city-wide. Allowing fully heterogeneous coefficients would require substantially more within-SA2 data than is currently available.

Appendix C: Estimating the costs of car-parking minimums

This appendix outlines the approach to estimating the feasibility impacts of removing minimum parking requirements using the Grattan Model of Australian Planning Systems (GMAPS).[11]

The model compares a *baseline scenario*, representing current policy settings where parking provision is subject to regulatory minimums, with a *reform scenario* in which minimums are fully removed and developers are not required to build any parking.

C.1 Overview of the modelling approach

The model operates in three broad stages.

1. First, we establish the minimum parking requirement (MPR) that applies to each type of development in each local government area (LGA), drawing on recently built dwellings in Cotality (2025) data and current planning scheme requirements.
2. Second, we set parking provision to zero under the reform scenario, reflecting full abolition of minimum parking requirements.
3. Third, we calculate the feasibility of development under each scenario – comparing costs, revenues, and required profit margins – to identify dwellings that become feasible once the obligation to provide parking is removed.

C.2 Minimum parking requirements

C.2.1 Data and sample

We establish minimum parking requirements using Cotality microdata matched to each city's planning scheme. Since some planning schemes specify parking rates by bedroom count, we use the actual bedroom count recorded in Cotality data to determine the regulatory minimum applicable to each recently built dwelling, given its LGA and dwelling typology. This distribution of minimum rates is then aggregated into representative parking requirements for future development in each LGA (see below).

Data on planning scheme parking requirements come from:

- **Melbourne**: Clause 52.06 of the Victoria Planning Provisions, using Public Transport Accessibility Level (PTAL) category spatial maps, parking overlay spatial data, and the specific reductions assigned to each parking overlay in the relevant local planning scheme.[12]
- **Sydney**: Development Control Plans (DCPs) across the Sydney GCCSA, and relevant SEPPs. We compiled minimum parking rates from the DCPs of 34 Sydney LGAs for apartments and townhouses, recording applicable conditions including dwelling type, gross floor area, proximity to rail, and zones. For each property in the Cotality sample, we match to the most specific applicable DCP rate given its planning zone, recorded floor area, and location relative to rail infrastructure. Where multiple DCP conditions could apply, we select the most specific matching rule,

11. See Coates et al (2025, Appendix B) for the full methodology behind GMAPS.

12. The analysis applies current PTAL-based minimums, introduced by Amendment VC277 in December 2025, to properties built between 2020 and 2025. Therefore, all sampled dwellings were approved under the prior PPTN framework, rather than the current PTAL approach. We use these historical builds to capture the bedroom and typology mix of recent development in each LGA. Properties where actual parking built falls below the current PTAL minimum are excluded as they likely reflect the more permissive prior rules.

i.e. if one DCP rule applies to a zone, and another applies to a subzone in that zone, we take the latter.

Within Low and Mid Rise Housing (LMRH) precincts and where ADG applies, the relevant LMRH or $min(GTIA, DCP)$ rate applies (see Appendix E).[13]

The sample includes dwellings classified as apartments or townhouses where:

- Dwellings were built within the last five years (2020–2025).
- Bedroom count is non-missing and greater than zero.
- Floor area is recorded and greater than 5sqm.[14]
- At least one parking field (car spaces or garages) is non-missing.
- Bathroom count is non-missing.

We compute the mean minimum rate at the LGA $\times$ typology $\times$ bedroom count level as:

$$\bar{r}_{min,l,t,b} = \text{mean}_{i \in (l,t,b)} \left(r_{min,i} \right) \quad \text{(C.1)}$$

where l indexes LGAs, t indexes typology (apartment or townhouse), and b indexes bedroom count. No minimum sample size restriction is applied at this stage; cells with few observations are implicitly smoothed when the rates are collapsed into bedroom-weighted averages.

The yield model assumes a fixed dwelling size for all developments of a given typology (80 sqm for apartments and 120 sqm for townhouses) and does not assign bedroom counts to individual modelled dwellings. We therefore collapse the bedroom dimension by computing a bedroom-weighted average for each LGA and typology:

$$\bar{r}_{min,l,t} = \sum_{b} \bar{r}_{min,l,t,b} \times \omega_b \quad \text{(C.2)}$$

where ω_b is the city-wide share of recently built dwellings of typology t with bedroom count b. This produces a single representative minimum parking rate per LGA and typology that reflects the bedroom mix of recent development.

C.3 Baseline scenario: minimum parking requirements

In the baseline scenario, parking provision equals the regulatory minimum derived from the MPR lookup table explained in the prior section. For a development with N dwellings:

$$S_{baseline} = \text{round} \left(N \times \bar{r}_{min,l,t} \right) \quad \text{(C.3)}$$

where $\bar{r}_{min,l,t}$ is the LGA and typology-specific bedroom-weighted average minimum parking rate. This applies to both apartments and townhouses.

C.4 Reform scenario: zero parking requirements

In the reform scenario, parking provision is set to zero:

$$S_{reform} = 0 \quad \text{(C.4)}$$

This reflects full abolition of minimum parking requirements. The scenario does not assume developers would build no parking in practice – it asks whether a project can stack up commercially without being compelled to. The feasibility comparison therefore identifies sites where parking requirements are currently the decisive factor in commercial infeasibility: sites that become feasible when the obligation to build parking is removed.

13. The ADG applies under SEPP 65 to residential flat buildings with at least three storeys or at least four dwellings.
14. Properties with implausibly small recorded floor areas are removed as likely data errors; see Appendix B for further discussion of this filter.

C.5 Where minimums remain binding: spatial variation in reform impact

The feasibility gains from reform are not uniformly distributed across each city. They concentrate where current minimums remain high relative to what the market would build in the absence of regulation – that is, where the cost of complying with parking requirements is still large enough to tip marginal projects into unprofitability.

To illustrate this spatial variation, Figure C.1 plots every apartment and townhouse built in Sydney and Melbourne between 2020 and 2025, coloured by whether the current minimum at that address sits above or at-or-below an estimate of that property's implied market demand. Implied demand is estimated by scaling observed parking provision by a city-specific market fraction – 0.6 for Melbourne and 0.8 for Sydney – calibrated to international evidence on post-reform provision in comparable cities.[15]

Properties shown in red are those where the current minimum exceeds estimated demand – locations where minimums are still actively constraining development. Properties in orange are those where the current minimum is already at or below estimated demand – locations where reform would change little. Grey points sit in zones where no minimum currently applies.

This map does not directly drive the feasibility estimates, which are based on the zero parking scenario described above. Rather, it illustrates the underlying regulatory landscape: reform delivers the largest feasibility gains in areas where minimums remain well above market demand, and little gain where minimums have already been reformed downward.

In Melbourne, Victoria's December 2025 parking reform reduced minimums across much of the inner ring, particularly in areas well-served by public transport. In those inner-ring areas, average minimums are now low, so the impact of removing minimums entirely is small. But across much of Melbourne's middle and outer suburbs, the cost gap continues to weigh on development viability.

In Sydney, the gains are concentrated across the middle ring and inner east – where a combination of high minimums and high land values mean that the cost of parking provision can make an otherwise commercially feasible project unprofitable. Inner LGAs that have already removed minimums, like City of Sydney and Canada Bay, see little uplift – as they already allow zero parking to be built. Outer western Sydney has high minimums too, but projects are generally not close to profitability, so removing parking alone is not enough to tip many over.

C.6 Estimating the market value of parking spaces

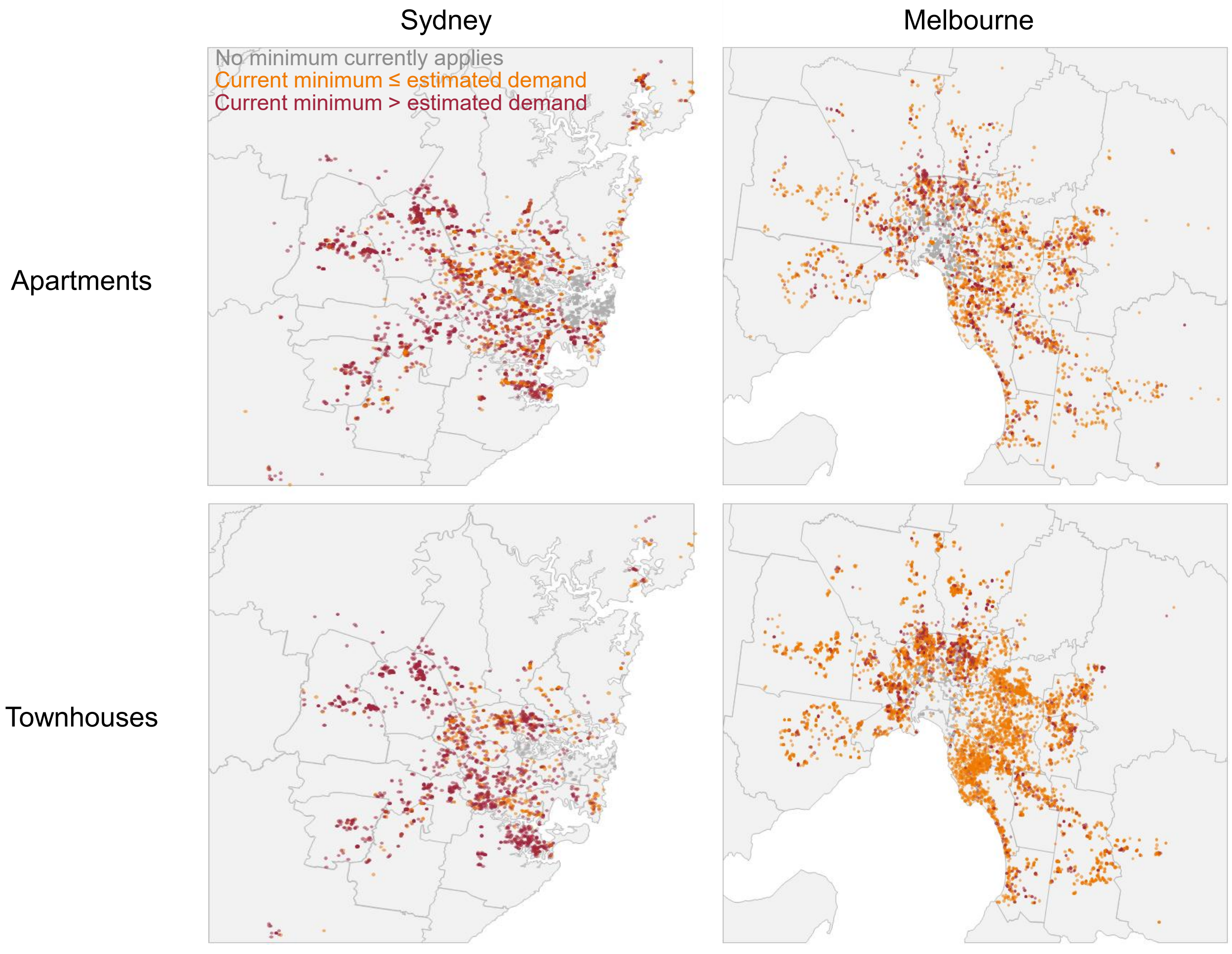
To calculate the revenue effect of changing parking provision, we estimate the market value of a parking space from hedonic price regressions. These are described fully in Appendix B. Here we summarise the key outputs used in the feasibility model.

C.6.1 Apartment parking values

We estimate apartment hedonic price models separately for Melbourne and Sydney using apartment-only data, as described in Appendix B.

15. See for example Guo and Li (2014) on London, Gabbe et al (2020) on Seattle, Hess and Rehler (2021) on Buffalo, Sohoni and Lee (2026) on San Francisco, and McCracken (2022) on Lower Hutt, where post-reform provision typically falls 15–50 per cent below the prior regulated level. We set the market fractions to match the post-reform provision levels from these studies, accounting for differences in starting minimums between cities. Melbourne's fraction is lower (0.6) because its pre-reform provision is based on old PPTN rules.

Figure C.1: Minimums remain above estimated market demand across much of both cities
Dwellings built 2020–2025, by whether the current minimum exceeds estimated market demand.



Notes: Each point is an apartment or townhouse completed between 2020 and 2025. Estimated market demand is observed parking provision multiplied by the city-specific market fraction (0.6 in Melbourne, 0.8 in Sydney), calibrated to international evidence on post-reform parking provision. The map illustrates where minimums remain binding; it does not drive the feasibility estimates, which are based on a zero parking reform scenario.

Sources: Cotality (2025) and relevant planing data (see Appendix E for details).

Parking revenue for apartments is calculated as:

$$\text{Rev}_{park,apt} = \min(1, S) \times v_1 + \max(0, S-1) \times v_2 \qquad \text{(C.5)}$$

where S is the number of sellable parking spaces, v_1 is the estimated market value of the first space, and v_2 is the marginal value of each additional space beyond the first[16] – both derived from the hedonic coefficients in Appendix B.[17]

C.6.2 Townhouse parking values

Townhouse parking values are estimated from a separate hedonic regression that uses a linear parking specification (all spaces valued equally):

$$\log P_i = \alpha + \beta \cdot s_i + \mathbf{X}_i' \boldsymbol{\gamma} + \mu_s + \varepsilon_i$$

A single marginal price estimate v_{town} is applied to all townhouse parking spaces regardless of count.

C.6.3 Spatial estimation and kriging

We estimate coefficients at the SA2 level where the data support reliable estimation. SA2s with insufficient data, negative floor area coefficients, or extreme parking values are imputed using kriging – a spatial interpolation procedure that borrows information from nearby SA2s and SA3-level estimates based on property price characteristics and geographic proximity.

16. Adopting the second space coefficient as per Appendix B.
17. Dwelling prices used in the revenue calculation are estimated with parking value removed – that is, prices are estimated for a dwelling with zero parking spaces – so that parking revenue is added separately. This ensures the model does not double-count parking value.

C.7 Feasibility calculation

C.7.1 Revenue

Total development revenue under each scenario has three components:

$$\text{Rev}_{total} = \underbrace{\text{GFA}_{sellable} \times p_{sqm}}_{\text{dwelling revenue}} + \underbrace{\text{Rev}_{park}}_{\text{parking revenue}} + \underbrace{\text{Rev}_{comm}}_{\text{commercial revenue}} \qquad \text{(C.6)}$$

Dwelling revenue uses the SA2-level price per square metre from the hedonic model (with parking value removed). Parking revenue uses the city-specific formulas above. Commercial revenue is calculated as construction cost plus a fixed margin.

The key difference between scenarios is parking provision S: the baseline uses $S_{baseline}$ (the MPR minimum) and the reform uses $S_{reform} = 0$. Under reform, parking construction costs fall to zero and parking sales revenue is also zero. All other revenue and cost parameters are held constant across scenarios.

For Melbourne townhouses built with above-ground garages, removing the parking requirement also increases dwelling count and sellable floor area in the upstream yield model, since mandatory garage space within the building footprint would otherwise displace habitable area. This yield effect feeds through to dwelling revenue in the feasibility calculation.

C.7.2 Feasibility assessment

A development is considered commercially feasible if the achieved profit margin meets or exceeds the required developer return of 18 per cent on total costs (excluding required profit):

$$m = \frac{\text{Rev}_{total} - C_{total}}{C_{total}} \geq 0.18 \tag{C.7}$$

where C_{total} is total costs excluding the profit margin itself.[18]

For each modelled property, we evaluate all feasible typology and height combinations and select the most profitable option. Comparing baseline and reform scenarios across the same set of properties reveals the number of developments that become newly feasible under reform – that is, infeasible under current parking requirements but viable when those requirements are removed.

The model is run on a 20 per cent random sample of all residential properties in each city, with results scaled to city-wide totals.

18. C_{total} includes construction costs, land acquisition costs, development application and holding costs, and GST. Construction costs vary by typology, height, and parking type; land values are estimated from Cotality sales data. See Figure B.3 of the *More homes, better cities* report for full cost parameters.

Appendix D: Estimating availability and utilisation of on-street parking

This appendix describes the approach used to estimate the number of on-street parking spaces in Australia's capital cities, and our estimates of the utilisation of that street parking.

D.1 Supply and regulation of on-street parking in Australian capital cities

This analysis leverages detailed data from Brisbane City Council to identify the distribution of on-street parking availability and restrictions. This is then extended to other cities around Australia to provide a higher-level indication of the availability of street parking in these cities.

D.1.1 Detailed Brisbane City Council Analysis

Brisbane City Council publishes detailed data on the location of parking restriction signs and lines, as well as areas where time limits apply by default. This allows us to estimate the restrictions on parking that apply to each section of kerb for the whole of Brisbane. The process and logic is described below.

1. We take the road network, and buffer each road sideways to estimate the location of the kerb, the key unit of analysis for this work.
2. We remove roads that are highly unlikely to have on-street parking: roundabouts, motorways, tunnels and arterials.
3. We assign lines and signs to their nearest kerbside.
4. For each kerbside, we apply the following process:
   - Kerbs within 20 metres of a signalised intersection or 10m of an unsignalised intersection are removed, as Queensland road rules prevent parking in these locations.
   - Each kerb is split into sections at each sign and the start and end of each line.
   - Where a line is present, its restriction is applied to that section of kerb.
   - For sections that do not have a line, restrictions are applied to sections based on the relevant sign.
   - For areas that do not have a sign or line restriction, we check if they are in areas such as the Brisbane Central Traffic Area where time limits apply by default.
   - Remaining kerbsides are assigned to be unrestricted.
5. To convert this to a count of the number of parking spaces, we apply the following assumptions:
   - For areas marked as parallel parking, we assume one parking space per six metres of kerbside (rounding down).
   - For areas marked as angle parking, we assume one parking space per 2.5 metres of kerbside (rounding down).

Driveways and other kerb crossings are, in some places but not always, captured by the signs and lines data. To account for this, we reduce the 'parkable' length of each kerb segment which is longer than 15 metres by 18 per cent to account for an average number of driveways. This assumption was based on manual inspection of aerial imagery for a stratified sample of Brisbane suburbs and represents an overall average. Some areas will have more or less of the kerb lost to driveways.

D.1.2 Extension to other cities

To extend this to other cities (and the non-BCC parts of Brisbane) we fit a simple regression model that predicts parking spaces per km of road as a function of population density at a postcode level. This reflects that denser areas have additional competing demands for kerbspace, more no stopping and no parking zones, loading zones and additional driveways, as well as other uses for the kerb such as street dining, cycleways, and trees.

We apply this model to estimates of population density across other cities. This implicitly assumes that areas of similar densities across Australian cities have similar road networks in terms of the provision of on-street parking spaces. This is most likely to be true in suburban and lower-density areas, while the denser cores have greater variation. Results for specific locations should be interpreted with caution – this analysis is best considered at a broad, city-wide level.

We apply this estimate of parking spaces per kilometre to the road network for each city, taken from OpenStreetMap (OSM), a commonly used crowdsourced database of road networks. In Sydney, rather than OSM, we use Transport for NSW Road Segment data, as OSM misses a meaningful number of parkable roads in some areas. We exclude clearly non-parkable road types, including cycleways, footways, motorways, non-sealed roads and those with no public access.

D.2 Utilisation of on-street parking in Australian capital cities

This analysis uses a three-step approach to identify cars parked on the street.

- **Step 1** uses a visual segmentation model to identify all cars in an aerial image.
- **Step 2** combines these identifications with road network and other relevant data, and trains a machine learning model to categorise identified cars into three categories:
  - Parked on the street
  - Parked off the street
  - Driving
- **Step 3** adjusts these results to reflect that street parking spaces can be obscured by trees and other objects, and where available, combines it with street-level estimates of parking availability.

D.2.1 Data

- **Images**: Aerial images from provider Nearmap, providing 5.5-7.5cm resolution imagery over time for selected areas.
- **Road network**: OpenStreetMap data for road centrelines.
- **Property parcels**: Queensland Digital Cadastre.

D.2.2 Step 1: Identify Cars

We download georeferenced aerial images from Nearmap for our study areas for a given day. Image coverage each day does not line up exactly with council or ABS borders. In Brisbane, for example, approximately the inner-most 10km is covered by the imagery we use for our main results.

To maximise the number of cars that are likely to be at home, we only use images from weekends. This reflects that on weekdays, many cars are likely to be parked at work, which may result in underestimating parking utilisation. We also present inflated results to explicitly adjust for the additional cars that are likely to be parked on residential streets at night-time, drawing on existing research which suggests around

35 per cent of cars are not at home during the day.[19] This is not a weekend specific figure, so is likely to be a conservative assumption (i.e. it is more likely that we over- rather than under-estimate night-time parking utilisation).

We process these images using the SAM3 (Segment Anything Model 3) model developed by Meta, a publicly available segmentation machine learning model, which identifies all examples of an object in a given image.[20]

This gives us the location, size, bounding box, angle and an image of each car visible from the air.

Manual verification and benchmarking found that this model was highly effective at identifying cars, with an F1 score, the harmonic mean of precision and recall, of over 94 per cent following manual verification. Slightly more false negatives than false positive were detected and we adjust our estimates upward to reflect this.

D.2.3 Step 2: Classify cars

To identify which cars are parked on the street, we construct a dataset of relevant features that can explain if a given car is parked on the street or not. We summarise the key features below. In addition to these features, we include a range of geographic indicators (such as the distance and bearing to the CBD).

- **Distance to kerbline.** First, we construct a datset of road widths that allows us to identify kerbs. We again use SAM3 to extract the road surface from the same aerial images. Each 20m along the road network, we prompt SAM3 to identify the parts of the image that are road surfaces. For each point, we measure the distance from the sampled point to the outer edge of the detected road surface, allowing us to estimate the width of the road. We then place the kerbline for each section of road at its widest in this metric – allowing us to capture the full width of the road, reflecting that parts are obscured by trees and other objects. This feature is highly informative – cars that are very close to the kerb are highly likely to be street parked. We implement this in a variety of ways in the model, including the raw distance to kerbline, ratio of distance to kerbline vs centreline, and a simple flag for if a car is located in the carriageway or not.
- **Angle to road.** We extract the angle of the car relative to its nearest road centreline. This captures whether or not a car is parallel or at an angle on the street, a useful factor in determining if it is parked on the street.
- **Road category.** We apply the OSM road classification (e.g. motorway, residential, primary). This enables the model to capture that cars on motorways are less likely to be parked than those on residential streets.
- **Colour Ratios.** We extract the average proportion of greens and greys in the pixels surrounding each car. This captures that cars parked on grass are unlikely to be parked on the street, and those fully surrounded by grey (asphalt) are more likely to be driving. Those with part-green and part-grey (such as a car parked on the street with grass next to it) are likely to be parked on the street.
- **Parking Restrictions.** Where available, we apply our estimates of the parking restrictions (i.e. angle parking, parallel, no parking).

We manually labelled a stratified sample of more than 1,000 cars as parked on the street or not and use this to train a Light Gradient Boosting Model (LightGBM), a flexible decision-tree based machine learning algorithm commonly used for classification. We also considered other approaches, such as a simple rule-based classifier

19. Schmitt (2013).
20. Model details available at: https://huggingface.co/facebook/sam3.

and logistic regression, and found that the LightGBM approach performed best, with manually verified accuracy and recall of over 96 per cent on a sample of over 3,000 cars. Precision and recall were balanced, suggesting that the model does not systematically over- or under-count cars as being parked on the street.

With this being a complex classification task with many overlapping and interacting features, this approach is well-suited, as it captures these complex interactions. For example, on streets where only 45 degree parking is permitted, the impact of the angle of the car will be different than on streets with parallel parking.

D.2.4 Step 3: Adjust and summarise

We join each car identified as parked on the street to our estimates of parking capacity in Brisbane City Council. In other areas, our estimates of capacity are not precise enough for street-level analysis.

A key concern is that not all of the street is visible from the air and thus we may miss cars that are obscured. We use two approaches to account for this. Firstly, we use imagery from winter (or as close as possible), to minimise foliage coverage. Secondly, we again use our road surface segmentation to adjust our estimates for the share of parking spaces that are visible in each image. We sample points every 5m along the road, and identify if that point contains visible road surface. We take the share of these points which are not identified as containing visible road as the share that is obscured, and up-rate our estimate of the number of cars parked on that street by this share. This implicitly assumes that the areas that are under a tree or other obstruction are similarly utilised as areas that are not. We exclude streets with less than 15 per cent visibility.

We apply our estimates of parking capacity (outlined above) to get a point in time estimate of the share of parking capacity utilised.

D.3 Relationship between increased density and parking utilisation

To estimate how parking minimums impact the relationship between increases in density and parking utilisation, we fit a regression model to data on parking utilisation from 2019 and 2025 and Statistical Area Level 2 (SA2)[21]-level population estimates. For each SA2 for which we have parking data, we take the parking utilisation for the 75th percentile-utilised street. This ensures that we capture variation on a street with a meaningful amount of parking utilisation, as in many outer suburban areas the median street has very low utilisation and little variation over time.

We interact the increase in density with SA2s that are inside the ‘City Core’ or ‘City Frame’ areas, as defined by Brisbane City Council. These areas have lower (or no) parking minimums. The coefficient on this interaction term represents the difference between the relationship in density for the two areas. This coefficient is indistinguishable from zero (0.01, 95% CI -10.29,10.31), suggesting that parking minimums do not reduce the impact on street parking from new development. The model outputs and plot are shown in Table D.1 and Figure D.1.

Table D.1: Population density growth and street parking utilisation

Variable	Estimate (SE)	p-value
Intercept	7.08 (1.80)	< 0.001
Density change	4.61 (1.43)	0.002
Other areas	-4.05 (2.04)	0.050
Density change $\times$ other	0.01 (5.26)	0.998
$N = 100$; $R^2 = 0.323$		

The city core and city frame areas are denser than the rest of Brisbane. As a robustness test, we estimate a model including initial density as a variable (Table D.2). In this model the interaction term is again insignificantly different from zero (-5.28, 95% CI -7.57,18.13).

21. SA2s are ABS-defined areas containing an average of 10,000 people.

Figure D.1: Relationship between increases in density and parking utilisation, 2019 to 2025

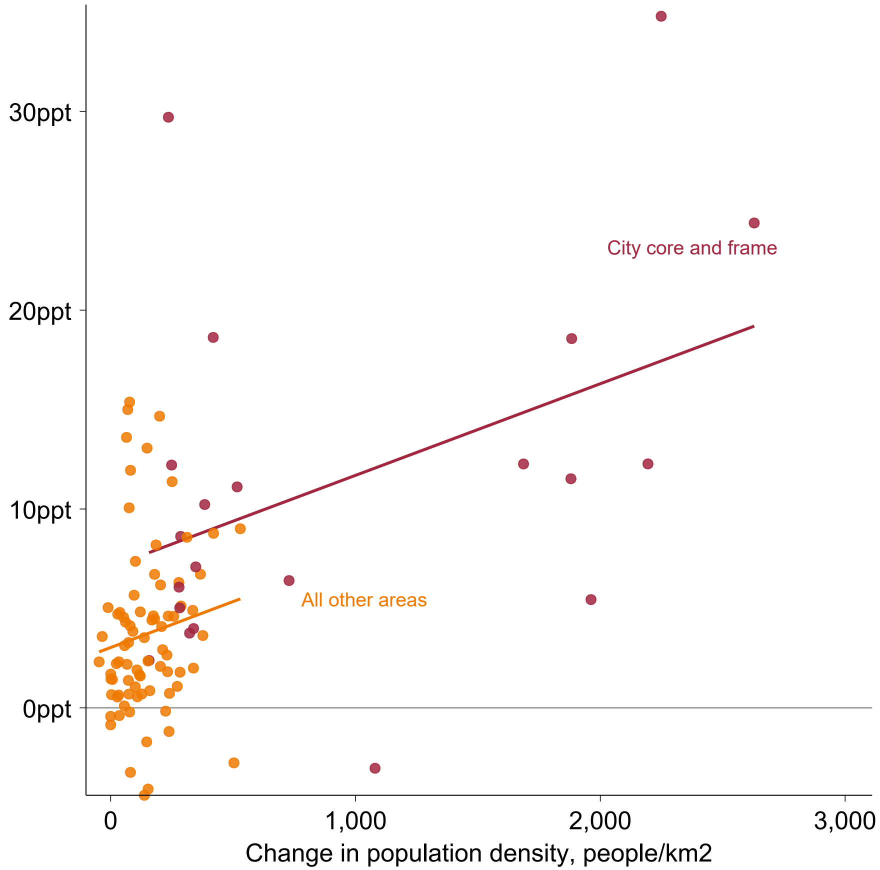


Table D.2: Population density growth, initial density, and street parking utilisation

Variable	Estimate (SE)	p-value
Intercept	-3.07 (4.51)	0.497
Density change	-0.04 (2.34)	0.988
Initial density	3.23 (1.33)	0.017
Other areas	3.76 (4.68)	0.425
Density change $\times$ other	-5.28 (6.56)	0.423
Initial density $\times$ other	-1.33 (1.51)	0.381
$N = 100$; $R^2 = 0.404$		

Appendix E: Estimating typical minimum parking requirements

This appendix describes how we estimated the typical minimum parking requirements (MPRs) across Australian cities.

For Sydney and Melbourne, we assign MPRs to individual properties. These property-level minimums underpin the average parking requirements reported in Figure 1.2 and Figure 2.1, which show the cost of meeting the typical minimum by city, dwelling type, and bedroom count.

For Sydney and Melbourne, we calculate the average MPR for each city, typology, and bedroom-count as the dwelling-weighted mean across all recently built properties (2020 to 2025) in Cotality microdata.

For Adelaide, Perth, and Brisbane, we use a weighted average based upon building approvals across Statistical Area Level 2 (SA2) regions: each SA2 is assigned a planning scheme rate by spatially joining its centroid to the relevant planning layer, and we then average rates across SA2s based upon the number of new multi-dwelling building approvals in each SA2.

We exclude visitor car parks from these averages.

E.1 Melbourne

Melbourne's parking requirements are set by the Victoria Planning Provisions, with local variations permitted through planning scheme amendments. We map requirements to individual properties using a three-step hierarchy, reflecting the structure of the planning scheme.

E.1.1 New rules: PTAL parking categories

In December 2025, Victoria introduced new state-wide parking provisions based on Public Transport Accessibility Levels (PTAL). Under the new rules, each property falls into one of four parking categories based on its location within PTAL spatial overlays. Minimum requirements on residential dwellings are as follows:

- **Category 4**: 0 spaces per dwelling (highest public transport accessibility)
- **Category 3**: 0 spaces per dwelling
- **Category 2**: 1 space per dwelling
- **Category 1**: 1.2 spaces per dwelling (lowest public transport accessibility)

These rates apply uniformly regardless of bedroom count or dwelling typology (apartment or townhouse). Properties are assigned to a category by spatially joining each Cotality property point to the PTAL polygon layer.[22]

22. Victorian Department of Transport and Planning (2026)

E.1.2 Planning overlay exceptions

Many Local Government Areas (LGAs) have parking overlays (POs) that specify parking requirements different from the state-wide defaults. We compiled parking overlays across 24 Melbourne LGAs, drawing on the relevant planning scheme schedules.[23]

Each PO specifies a parking rate for a named location (e.g. 'Footscray Metropolitan Activity Centre – Inner Parking Precinct' in Maribyrnong, or 'Box Hill Activity Centre' in Whitehorse). Where an overlay references 'Column B' rates, the reduced state-wide rates that previously applied within 400 metres of the Principal Public Transport Network (PPTN) are applied.

For each property, the MPR is determined by the following priority order:

1. **Location-specific PO exception**: If the property falls within a parking overlay polygon that has a location-specific rate for the property's bedroom count, this rate applies.
2. **LGA-wide PO exception**: If the LGA has an LGA-wide parking overlay rate (not location-specific) for the property's bedroom count, this rate applies.
3. **State-wide PTAL default**: The rate from the PTAL parking category assigned to the property.

Some LGA planning schemes use different dwelling-type labels (e.g. 'All Dwellings', 'Private Housing', 'Residential Building'). Where multiple labels could apply, we selected the most general category applicable to standard private residential development.

23. Planning schemes consulted: Banyule, Bayside, Boroondara, Brimbank, Cardinia, Casey, Darebin, Frankston, Glen Eira, Greater Dandenong, Kingston, Manningham, Maribyrnong, Melbourne, Merri-bek, Moonee Valley, Mornington Peninsula, Nillumbik, Port Phillip, Stonnington, Whitehorse, Whittlesea, Wyndham, and Yarra Planning Schemes. All schemes accessed via PropCode (2026)

E.1.3 Boundary corrections

The centrepoints for a small number of properties (<1 per cent) fall precisely on polygon boundaries and are not matched by the spatial join. For these, we assign to them the parking category of the nearest planning polygon.

E.2 Sydney

In New South Wales, parking requirements are primarily set at the LGA level through Development Control Plans (DCPs), though state-level policies can override these in certain locations, as described below (see also Figure 1.1).

E.2.1 LGA-specific DCP rates

We compiled parking requirements from the DCPs of 34 Sydney LGAs for apartments and townhouses. We recorded each LGA's requirements with any applicable conditions, including:

- **Dwelling type**: Some DCPs specify different rates for apartments and townhouses.
- **Gross floor area (GFA)**: Some DCPs set different rates by dwelling size (e.g. GFA <55sqm, 55–85sqm, >85sqm).
- **Proximity to rail**: Some DCPs reduce requirements for properties within 400 or 800 metres of a railway station.
- **Zoning**: Some DCPs specify different rates by zone code.

For each property, we match to the most specific applicable DCP rate.[24] Where multiple DCP rows could apply (e.g. a general rate and a rate conditional on GFA), we select the row with the greatest number of matching conditions, preferring more specific rules over general ones.

Where a DCP defines rate-amendment catchments by reference to a spatially drawn map rather than a measurable distance to a fixed feature (such as a named precinct boundary shown only in the DCP document), we do not attempt to replicate that boundary. These are used to set both higher and lower rates. In these cases we use the general DCP rate that applies outside the drawn catchment. This is a conservative choice that may slightly over- or under-state MPRs for properties that would fall within the drawn catchment.

Where a DCP specifies multiple rate tiers by density or location (for example, distinguishing between high-density residential zones and lower-density areas), we apply the rate for the general or medium-density scenario – broadly corresponding to the rate that would apply to standard medium-density residential development outside designated activity centres or transit corridors. This is consistent with our focus on the typical new apartment and townhouse development, rather than development in the highest-density or most transit-accessible locations.

E.2.2 LGAs with no minimum requirements

Four Sydney LGAs – Canada Bay, City of Sydney, Woollahra, and (for a subset of properties) North Sydney – do not impose MPRs in their DCPs, specifying only maximum rates. For properties in these LGAs, the minimum parking requirement is set to zero.

E.2.3 Low- and Mid-Rise Housing non-discretionary standards

The NSW Low- and Mid-Rise Housing (LMRH) policy introduced non-discretionary parking standards for residential development within LMRH precincts – areas within 800 metres walking distance of a nominated town centre or train, metro, or light rail station. Within these precincts, if a proposed development complies with the non-discretionary standard, the consent authority cannot refuse the application on the grounds that it does not comply with a more onerous standard in an Local Environment Plan (LEP) or DCP.

The LMRH standard functions as a ceiling rather than a floor: the binding minimum is the lesser of the Apartment Design Guide (ADG) or DCP rate (whichever is applicable) and the LMRH standard. The LMRH minimum parking rates apply only where no Environmental Planning Instrument or DCP specifies a maximum number of spaces per dwelling. The applicable LMRH rates for our analysis are:

- **Dual occupancy**: 1.0 space per dwelling in R1–R4 zones.[25]
- **Multi-dwelling housing**: 1.0 space per dwelling in R1–R4 zones.
- **Multi-dwelling housing (terraces)**: 0.5 spaces per dwelling in R1–R4 zones.
- **Residential flat buildings**: 0.5 spaces per dwelling in R1 and R2 zones. No LMRH standard minimum is specified for R3 or R4 zones.
- **Shop top housing**: 0.5 spaces per dwelling in R1 and R2 zones. No LMRH standard minimum is specified for R3 or R4 zones.

24. Development Control Plans consulted: Bayside, Blacktown, Blue Mountains, Burwood, Camden, Campbelltown, Canada Bay, Canterbury-Bankstown, Central Coast, Cumberland, Fairfield, Georges River, Hawkesbury, Hornsby, Hunters Hill, Inner West, Ku-ring-gai, Lane Cove, Liverpool, Mosman, North Sydney, Northern Beaches, Parramatta, Penrith, Randwick, Ryde, Strathfield, Sutherland, Sydney, The Hills, Waverley, Willoughby, Wollondilly, and Woollahra. All DCPs accessed via PropCode (2026).

25. R1-–R4 are NSW residential zone classifications, ranging from low to high-density residential

For our analysis, townhouses and villas are assigned the multi-dwelling housing rate: the terrace rate is not applied because the underlying data does not adequately distinguish terraces from other multi-unit housing types.

Each property is assigned to an LMRH precinct using data from Propcode, which identify properties within the relevant walking catchment. The LMRH standard is not applied in LGAs where the DCP specifies a maximum rate (see above), nor where the property's zone is outside of the above applicable zone categories.

E.2.4 Apartment Design Guide applicability and GTIA rates

The ADG applies under State Environmental Planning Policy (SEPP) 65 to residential flat buildings with at least three storeys or at least four dwellings. Where applicable, it mandates the lower of the DCP rate or the Transport for NSW Guide to Transport Impact Assessment (GTIA) rate.

The GTIA rate applies only to sites within 800 metres of a railway station or light rail stop in the Sydney Metropolitan Area, or on (or within 400 metres of) land zoned B3 Commercial Core, B4 Mixed Use, or equivalent in a nominated regional centre.

Storey count and dwelling count are estimated as follows:

- **Estimated storeys**: Derived from the maximum permitted building height under the LEP Height of Buildings control mapped to the property's location, using the formula $\lfloor(\text{height limit} - 1.0)/3.1\rfloor$, where 1.0m is deducted for roof structure and 3.1m is the floor-to-floor height consistent with the ADG minimum ceiling height standard for habitable rooms.[26]
- **Building unit count**: Counted per building using Cotality data, which groups units within the same development.

GTIA rates vary geographically by SA2, based on public transport accessibility and bedroom count. Rates are drawn from the published GTIA rate schedule (see Appendix A for GTIA reference rates).[27]

E.2.5 Sydney minimum application

For each property, the final minimum parking requirement ($r_{min,i}$) is determined by the following hierarchy:

$$r_{min,i} = \begin{cases} 0 & \text{if LGA has DCP max only} \\ \min(r_{DCP,i},\, r_{LMRH,i}) & \text{if LMRH applies; GTIA does not}^{28} \\ \min(r_{DCP,i},\, r_{GTIA,i}) & \text{if GTIA applies; LMRH does not} \\ \min(r_{DCP,i},\, r_{GTIA,i},\, r_{LMR,i}) & \text{if both GTIA and LMRH apply} \\ r_{DCP,i} & \text{otherwise} \end{cases}$$

26. Actual building height or storey count is not recorded in the Cotality data, necessitating this approach. Using the maximum permitted height will overestimate actual storeys where buildings are constructed below the height limit, causing some properties to be incorrectly classified as ADG-applicable. This errs in the conservative direction: affected properties are assigned the lower GTIA rate rather than the higher DCP minimum.
27. NSW Government (2024).
28. GTIA does not apply when: the property is outside the GTIA geographic catchment; the property is not ADG-applicable (not an apartment, or fewer than 3 estimated storeys, or fewer than 4 dwellings in the building); or no GTIA rate is recorded for that property's parking category.

E.3 Adelaide, Perth, and Brisbane

For Adelaide, Perth, and Brisbane, we do not have property-level data comparable to the Cotality microdata used for Melbourne and Sydney. Instead, we construct a building-approvals-weighted average minimum for each city using the following approach:

1. **SA2 boundaries**: We obtain 2021 SA2 boundaries for the relevant Greater Capital City Statistical Area from the *absmapsdata* R package.
2. **Centroid-to-zone spatial join**: The centroid of each SA2 is spatially joined to the relevant planning zone polygon layer to assign each SA2 a planning zone.
3. **Rate lookup**: Each SA2 is assigned a minimum parking rate based on its zone, dwelling type, and bedroom count, using the applicable planning scheme rules described in Figure A.1 and Figure A.2.
4. **Weighting**: We average rates across SA2s weighted by ABS building approvals ('new other residential' dwellings) for the 2024–25 financial year, sourced from the ABS Building Approvals data at the SA2 level.[29] We exclude SA2s with zero or suppressed (confidentialised) approvals.

The centroid-based approach means that large SA2s spanning multiple planning zones are assigned the rate of the zone containing their centroid. This is a reasonable approximation given that SA2s are generally smaller than the variation in planning zone requirements, and the building-approvals weighting ensures that SA2s with more new construction receive greater weight.

29. ABS (2025) as part of *Building Approvals, Australia, February 2026*.

E.3.1 Adelaide

Adelaide's parking requirements are set by the South Australian Planning and Design Code (PDCode). We join SA2 centroids in Greater Adelaide to PDCode zone polygons. Planning zone rates follow the two-tier structure of the PDCode:

Table 1 (General off-street car-parking requirements) sets the baseline rate applying in all zones unless varied by Table 2:

- *Residential flat building* (apartments): 1 space per dwelling for 1–2 bedroom dwellings; 2 spaces for 3 or more bedrooms.
- *Row dwelling* (townhouses): 1 space for 1 bedroom; 2 spaces for 2 or more bedrooms.

Table 2 (Designated areas) sets lower rates for residential flats and row dwellings in inner-city and transit-oriented zones.[30]

The following zones have no minimum parking requirement: Capital City Zone, City Main Street Zone, City Riverbank Zone, Adelaide Park Lands Zone, and Business Neighbourhood Zone.[31]

Several further simplifying assumptions are applied to resolve cases where the designated-area classification depends on location or

30. The following zones receive designated-area rates for residential flat buildings: City Living Zone, Urban Corridor (Boulevard, Business, Living, and Main Street) Zones, Urban Neighbourhood Zone, Strategic Innovation Zone, and Urban Activity Centre Zone. Designated-area rates are: 0.75 spaces for 1 bedroom, 1.0 space for 2 bedrooms, and 1.25 spaces for 3 or more bedrooms. Row Dwellings are not subject to designated-area rate reductions (except in the Bowden/Brompton/Hindmarsh precinct of the Urban Neighbourhood Zone, which is not distinguishable at SA2 level and represents a negligible share of total approvals).
31. Strictly, the no-minimum for Business Neighbourhood Zone applies only within the City of Adelaide council area. Instances outside the City of Adelaide use the Table 1 standard rate (1–2 spaces). We apply the no-minimum to all Business Neighbourhood Zone SA2s; the impact on the weighted average is negligible.

transit proximity that cannot be determined at SA2 centroid level. In each case we apply the lower (designated-area) rate, which slightly underestimates the city-wide average:[32]

In practice, the designated-area zones contribute negligibly to the weighted average for Adelaide: only 2 SA2 centroids (37 building approvals out of approximately 3,900 total) fall within designated-area zones. The primary source of downward variation from the Table 1 standard rate is the Adelaide Park Lands SA2, which falls within the no-minimum Adelaide Park Lands Zone and accounts for 93 approvals. The weighted average is therefore close to, but slightly below, the standard Table 1 rate.

E.3.2 Brisbane

Brisbane's parking requirements within the Brisbane City Council area are set by the Brisbane City Plan 2014. Requirements vary by location within three broad areas defined by the City Plan:

- **City core**: No minimum parking requirement for any dwelling type or bedroom count.
- **City frame**: 0.9 spaces (1 bedroom), 1.1 spaces (2 bedrooms), 1.3 spaces (3 bedrooms), 1.3 spaces (4+ bedrooms) for both apartments and townhouses.[33]
- **All other areas**: 1 space (1 bedroom), 2 spaces (2–3 bedrooms), 2.5 spaces (4+ bedrooms) for both apartments and townhouses.

We identify SA2s within the Brisbane City Council local government area and classify each SA2 centroid into one of the three location categories by spatially joining to the City Plan 2014 City Core and City Frame polygon layers. SA2 centroids that fall outside both the City Core and City Frame polygons are classified as All Other Areas.

For simplicity, we use Brisbane City Council rates throughout; other local government areas within Greater Brisbane set their own requirements separately, and in some cases these are higher – see Appendix A.

E.3.3 Perth

Perth's parking requirements are governed by the Western Australian Residential Design Codes (R-Codes). Minimum requirements vary by four factors: location relative to public transport (Location A or B), residential density code (low density R10–R30, medium density R30–R60, or high density R80+ for apartments; low or medium density R30+ for townhouses), dwelling type, and bedroom count (see Figure A.1).

The Perth weighted average departs from the centroid-based approach described above in two respects.

Location A/B classification. Location A is defined as within 800 metres of a train station or within 250 metres of a bus stop with high-frequency services (at least one service per 15 minutes during either the morning or afternoon peak periods, equivalent to 8 or more services in each 2-hour peak window). We use Public Transport Authority (PTA) stop locations, retaining active stops only.[34] SA2

32. The designated-area rate for Strategic Innovation Zone strictly applies only within the Cities of Burnside, Marion, or Mitcham, or elsewhere when the site is within a high-frequency public transit area. The designated-area rate for Urban Activity Centre Zone applies only when the site is within a high-frequency public transit area. Applying these rates universally slightly underestimates the average minimum.
33. A proposed 2026 amendment ('More Homes, Sooner') would extend reduced parking rates to a new 'Key Locations' area covering land within 400m of major public transport interchanges and high-frequency stops, but is not yet adopted and is not reflected in our classification. The amendment is anticipated to take effect in mid-late 2026.
34. Western Australian Government (2026).

centroids falling within either buffer are classified as Location A; all other centroids are classified as Location B. This part of the classification follows the standard centroid approach.

Density classification. Rather than assigning each SA2 a single density category via its centroid, we compute the proportion of each SA2's area that falls within low-density (maximum R-code below 30), medium-density (maximum R-code 30–60), or high-density (maximum R-code 80 or above) zones. Activity-centre codes (R-AC) are classified as medium density. For apartments, each SA2 is assigned a blended minimum rate: a combination of rates across all three density classes, weighted by the proportion of the SA2's area in each class. For townhouses, which do not have a separate high-density tier in the R-Codes, high-density zones are folded into the medium-density rate. SA2s with no R-code coverage (e.g. industrial or commercial areas) are excluded from the weighted average.

Appendix F: Estimating impacts on the construction sector

This appendix describes the approach used to estimate impacts on the construction sector.

F.1 Avoided construction costs

We define 'unwanted' parking as spaces that would not be built in the absence of parking requirements. As a starting point, for Sydney, Melbourne, Adelaide, Brisbane, and Perth, we take the average minimum parking requirements for apartments and townhouses using the methodology set out in Appendix A. For Tasmania, the ACT, and Northern Territory we apply the average minimum of cities outside of Sydney and Melbourne.

We take 5-year forecasts of dwelling completions from the National Housing Supply and Affordability Council,[35] and estimate apartment and townhouse completions using ABS Building Activity data, applying the 2020 to 2025 share of dwellings delivered as each typology. Apartments vary from 54 per cent of dwellings in NSW to 3 per cent in Tasmania, and townhouses vary from 21 per cent to 5 per cent, also in NSW and Tasmania. We assume the average minimum is provided with each dwelling. This is likely conservative, as in some locations developers willingly provide more parking than is required.

Overall, we estimate that under current policy settings, just over 380,000 parking spaces will be built in townhouses and apartments over a 5 year period.

To this estimated provision, we apply the reductions in parking provision using the method described in Appendix C. For apartments, this results in a smaller reduction in Melbourne and Sydney than other states, reflecting the lower minimums that apply on average in these cities. For townhouses, Sydney sees a much larger decline in provision, reflecting high costs and high minimums. Overall, parking provision reduces by between 22 and 34 per cent in Sydney, 9 and 13 per cent in Melbourne, and 25 per cent in other locations.

To estimate the costs of these unwanted spaces, we apply construction costs for apartments and townhouses as per Figure 2.2 and Figure 2.3, weighted two-thirds towards the upper end of this range. This reflects consultation with industry participants who reported higher costs than captured in our figures.

To convert this to equivalent dwellings we apply the average dwelling construction cost of $569,000 per dwelling from ABS Building Activity data. This implicitly assumes that construction labour and materials are fungible, which is likely to be partially, but not fully accurate. As such it should be interpreted as an upper-limit estimate.

Around $4 billion (80 per cent) of these costs are attributable to parking spaces in apartments, reflecting the much higher construction costs compared to townhouses.

F.2 Productivity uplift

For a high-level estimate of the uplift in construction productivity, we treat this reduction in parking as a hicks-neutral cost shifter. We take the average savings spread across all apartment projects, around $22,000, which represents just under 4 per cent of average apartment construction costs.

With apartments being just over half of residential construction activity, this implies a (multi-factor) productivity uplift of just over 2 per cent.

35. We take these forecasts as representative of a typical 5-year period.

This implicitly assumes that the ‘unwanted’ parking doesn’t provide any value to buyers, but in reality buyers may derive some value, just less than the cost. To account for this, we apply the rule of half. This reflects that some buyers place zero value on the parking space, while the marginal buyer of a parking space that isn’t built values it at just below cost. Under the assumption that preferences are smoothly distributed, the average value is approximately half of the cost. As such, we divide the productivity uplift in half, for an uplift of just over 1 per cent.

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