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UCLA Center for Parking Policy

# Residential Curb Management:
## *A Research Synthesis*



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The UCLA Institute of Transportation Studies and the UCLA Center for Parking Policy acknowledge the Gabrielino/Tongva peoples as the traditional land caretakers of Tovaangar (the Los Angeles basin and So. Channel Islands). As a land grant institution, we pay our respects to the Honuukvetam (Ancestors), 'Ahiihirom (Elders) and 'Eyoohiinkem (our relatives/relations) past, present and emerging.

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REPORT

# Residential Curb Management:
## *A Research Synthesis*

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# Executive Summary



# Executive Summary

As more U.S. cities eliminate parking minimums and encourage infill housing development, competition for residential curb space is likely to become more common. When parking demand exceeds the number of available spaces, cities must decide how to allocate the curb. They can continue with unmanaged first-come, first-served parking, establish permit systems, implement pricing, or use a combination of these approaches. Cities must make trade-offs between availability, access, equity, political acceptability, and administrative complexity.

This report synthesizes evidence from academic research and program evaluations to examine the impacts of unmanaged curb parking in high-demand neighborhoods, the range of residential parking permit (RPP) programs cities have developed in response to these impacts, and the outcomes, distributional effects, and welfare implications of different policy approaches. The report also considers the political economy of residential curb management and the opportunity costs of dedicating public space to parking. Figure 1 summarizes the key research areas covered in the report.

**Figure 1.** Residential Curb Management Policy Impacts and Trade-offs




First, we examine the impacts of unmanaged parking. In neighborhoods with high demand, unregulated and unpriced curb parking can contribute to congestion, cruising, and illegal parking, negatively affecting residential satisfaction and attitudes toward new development. In addition, providing free curb parking effectively subsidizes car ownership while foregoing public revenue that could support other policy goals. Free curb parking can also contribute to inefficient use of parking space: while curb parking is congested, many private off-street spaces — which were often required by the city — go unused.

Cities often adopt RPP programs in response to residents' concerns about curb parking congestion. Programs vary in how permits are priced, whether the supply of permits is limited, who is allowed to obtain a permit, and whether non-permit holders are allowed to park. Some programs prioritize neighborhood residents over non-residents, while others manage demand for curb space from residents themselves.

Across different approaches to residential curb management, the literature reveals three recurring issues:

1. Overcrowded curbs and parking congestion
2. Underused parking and inefficient use of space
3. Unequal access and subsidization

In some cases, RPP program outcomes resemble unmanaged curb parking. Low-cost permit programs still forgo potential revenue and provide implicit subsidies for car ownership, and programs that over-issue permits may still fail to incentivize drivers to use off-street parking and fail to reduce curb parking congestion. In other cases, RPP programs effectively reduce curb congestion but may have unintended consequences, including leaving valuable space unused and excluding some drivers who would benefit from access.

Research suggests that demand-based pricing applied to both permits and visitor access can address multiple challenges at once. It can reduce overcrowding, encourage drivers to use available off-street parking, and avoid excluding non-residents altogether, while also generating revenue to improve mobility options or support other public goals.

Residential curb management policies, however, are often shaped more by local political pressures than by technical or revenue considerations, and demand-based pricing remains uncommon. Neighborhood residents have a strong incentive to organize politically for preferential access to curb space, while the potential benefits of demand-based pricing are more widely dispersed. Political challenges, however, are not universal and may vary across contexts and over time. Residents may be more supportive of pricing when parking revenue is reinvested in pedestrian and bicycle infrastructure, mobility wallets, and public transportation, and when they have access to a wider range of transportation options.

Finally, we examine the limited research related to the opportunity costs of dedicating curb space to residential parking, whether managed or unmanaged. Researchers question the assumption that residential streets must always provide parking on both sides of the street, and they highlight how street width requirements can effectively function as parking mandates. Maintaining additional pavement to accommodate curb parking can strain roadway maintenance budgets, and in some cases, residents might benefit more if some curb space were repurposed for green space, expanded frontages, bike parking, community gardens, or other public benefits.

The assumption that curb parking should be free has long shaped parking policy, from minimum parking requirements that seek to ensure abundant off-street parking to traditional low-cost RPP programs that seek to shield certain residents from competition for scarce curb space. Both policies can produce unintended consequences and effectively subsidize car ownership. In recent years, cities have begun to recognize the impacts of minimum parking requirements and repeal them. As minimum parking requirements are eliminated — in part to accommodate more housing — decisions about who can use residential curb space, how much they should pay, and whether that space should be used for parking at all will become increasingly important.

As cities densify and the demand for curb parking intensifies, the research summarized in this report suggests that cities should consider charging for parking in residential neighborhoods — not just on the commercial corridors where meters are already common. Demand-based pricing for permits and visitor parking can help encourage more efficient use of existing off-street parking, improve curb availability, and generate revenue that can be reinvested in transportation initiatives to support a transition to a less car-dependent future.

# Contents



# Introduction

What happens when residential curb parking is unmanaged, and how do residential parking permit programs compare with unmanaged residential curbs?

Residential curb space is a finite public resource. When many drivers compete for a limited number of free spaces, shortages can emerge. Economists describe such a situation as a commons problem: when a shared resource is not effectively managed, users have little reason to limit their consumption, and individually rational decisions can produce collectively undesirable outcomes. In the case of curb parking, when access is free and unrestricted, drivers have less incentive to consider other travel options, own fewer household vehicles, or park in their garages. As a result, access to curb space is often a matter of who arrives first rather than who values it most. For example, some households may leave infrequently used vehicles parked on the street for days or weeks or choose curb parking simply to avoid the inconvenience of tandem parking. Meanwhile, drivers who rely on curb parking for daily transportation may struggle to find a space when they need one. Parking congestion creates frustration and uncertainty for drivers and can diminish the quality of the public realm. It may also encourage undesirable parking behaviors, such as parking on front lawns or in locations that block driveways, sidewalks, or sightlines, reducing safety and accessibility for others.

Cities can address the curb commons problem in several ways: by (1) expanding the supply of parking through off-street requirements, (2) pricing curb parking, or (3) restricting access for certain users through use of permits, or through a combination of these approaches.

Historically, U.S. cities have primarily relied on the first strategy by requiring new buildings and businesses to provide specified amounts of off-street parking. Beginning in the late 1920s, minimum parking requirements spread quickly from city to city and eventually became a standard feature of local zoning codes. In many places, especially in areas of low-density development, the resulting abundance of off-street parking limited the need for active curb management. However, minimum parking requirements do not guarantee curb availability. Some households may value the convenience of parking directly on the street or prefer to use their garages for other purposes, so curb parking can be crowded even when many off-street spaces are available.

Parking mandates also produce numerous unintended consequences, as the late UCLA professor Donald Shoup (2011) explains in The High Cost of Free Parking. Minimum parking requirements contribute to car dependence and urban sprawl, consume valuable urban land, increase impervious surface area, and make neighborhoods less walkable. They also increase development costs, because parking is expensive to build. These higher costs can constrain housing development and undermine economic vitality. As the impacts of parking requirements have become more widely recognized, many cities have eliminated or reduced them, and a growing number of states have adopted legislation limiting their use. As these reforms mature, some neighborhoods may experience greater competition for curb space, increasing the need for alternative strategies to manage the curb.

One alternative to expanding off-street parking is to manage curb demand through pricing. Shoup proposed monitoring occupancy and adjusting prices to maintain about one or two vacant spaces per block, to ensure that parking remains both well used and readily available. Some downtowns and commercial districts have successfully implemented demand-based pricing, but it remains uncommon in residential neighborhoods. Instead, cities tend to rely on residential parking permit (RPP) programs, which often address the commons problem by restricting who can access curb space.

Cities in the United States have primarily introduced RPP programs near major employment centers, commercial districts, universities, or other high-demand destinations. These programs aim to limit competition from

commuters and visitors. By contrast, many European cities were built before widespread minimum parking requirements, and their permit programs more often address demand from the residents themselves. As more U.S. cities eliminate minimum parking requirements, discourage additional off-street parking through strategies such as parking maximums, and continue to densify, research findings from these international contexts are becoming increasingly relevant.

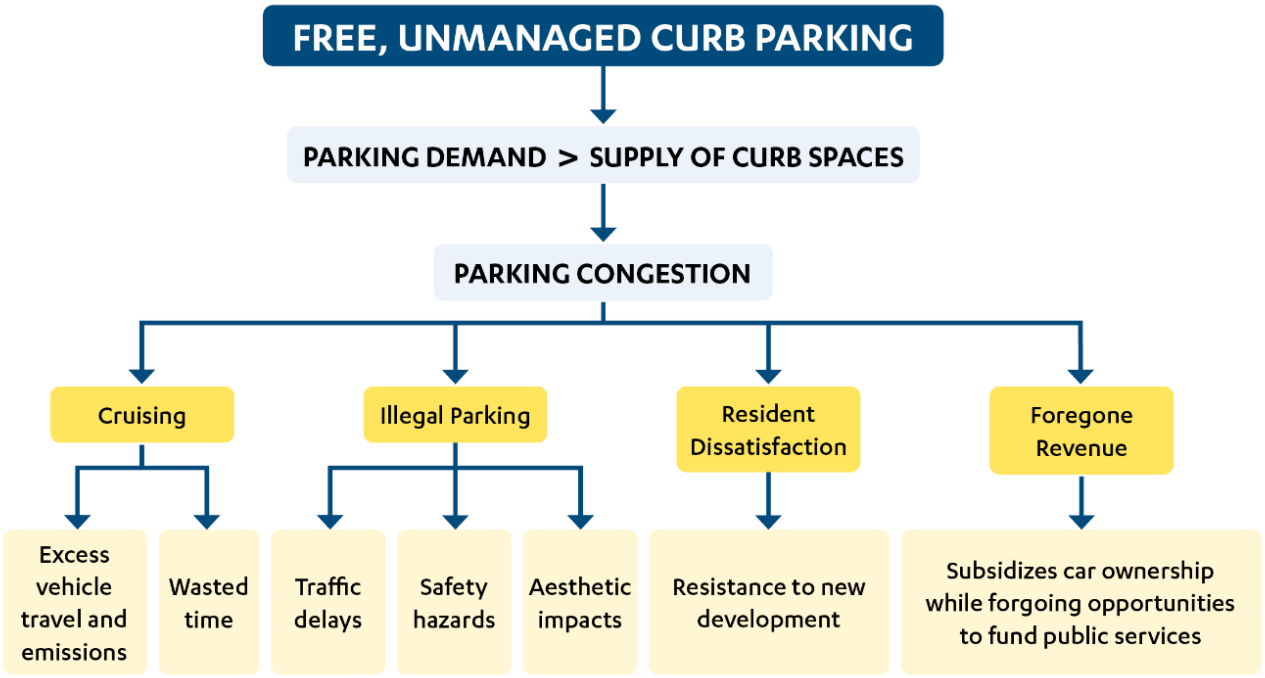
This synthesis examines research literature and local government reports on residential parking, with a particular focus on permit programs. It first summarizes the potential impacts of unrestricted curb parking. It then reviews RPP programs, including their designs, outcomes, and distributional and welfare impacts. It also examines the political and institutional factors that shape policy adoption and implementation, as well as the opportunity costs associated with dedicating public curb space to parking. The synthesis concludes by summarizing key findings and policy implications for residential parking management and identifying remaining questions for future research.

# Impacts of Unmanaged Residential Curb Parking

In neighborhoods with high demand, unregulated, unpriced parking can contribute to congestion, cruising, and illegal parking, negatively affecting residential satisfaction and attitudes toward new development (Figure 2). Parking availability can also influence rates of car ownership and driving. Providing free curb parking effectively subsidizes car ownership while forgoing public revenue that could support other policy goals.

Unmanaged curb parking in low-demand neighborhoods has received less attention from researchers and policymakers because it is rarely viewed as a problem. However, even where on-street parking is readily available, maintaining free curb parking still carries opportunity costs related to land use, infrastructure maintenance, and environmental outcomes (see Opportunity Costs of Providing Curb Parking section).

**Figure 2.** Impacts of Unmanaged Curbs in Neighborhoods with High Demand



# Parking Congestion

## Cruising

In dense areas, unpriced and unrestricted curb parking can result in overcrowding. Overcrowding often leads to "cruising," or excess travel at the end of a trip as drivers search for parking.

Cruising typically happens at certain times of day, or in certain "hotspots", rather than citywide, and even in crowded areas, not all parking searches involve cruising because some drivers who anticipate difficulty finding curb parking may begin their search early and take a parking space before reaching their destination (Millard-Ball et al., 2020). However, where cruising does happen, it wastes drivers' time, adds stress and unpredictability, and generates emissions that affect the broader community. While researchers have generally focused on the cruising that occurs in downtown commercial districts, several studies also document reports of cruising in residential neighborhoods with unmanaged curb parking.

In dense residential neighborhoods of New York City, drivers reported spending an average of about nine minutes searching for parking and then about four minutes walking to their destination (Guo & McDonnell, 2013). In a historic residential neighborhood in Dortmund, Germany, drivers reported spending about five minutes searching for parking and parking about 90 meters from home (Scheiner et al., 2020). A six-month study in a fifteen-block area of Manhattan's Upper West Side found that cruising generated 366,000 excess vehicle miles traveled per year and produced 22 tons of carbon dioxide emissions per block per year (Transportation Alternatives, 2008, as cited in Shoup, 2024). These examples show that in some residential neighborhoods, unmanaged curb parking can burden drivers with uncertainty, wasted time, and additional vehicle travel (Table 1).

**Table 1.** Cruising Studies in Residential Neighborhoods

| Study | Location | Finding |
|---|---|---|
| Guo & McDonnell (2013) | Dense residential neighborhoods of New York City | Drivers reported, on average:<br>● 9 minutes searching for parking<br>● 4 minutes walking home |
| Scheiner et al. (2020) | Historic residential neighborhood in Dortmund, Germany | Drivers reported, on average:<br>● 5 minutes searching for parking<br>● Parking 90 meters from home |
| Transportation Alternatives (2008), as cited in Shoup (2024) | A 15-block area of Manhattan's Upper West Side | Researchers estimated that cruising generated:<br>● 366,000 excess vehicle miles traveled per year<br>● 22 tons of $CO_2$ emissions per block per year |

## Illegal Parking

Some drivers respond to overcrowded curbs by cruising; others give up on finding a legal space and park illegally. Especially when enforcement is limited, drivers who cannot find legal parking are more likely to park on sidewalks or front lawns, park in restricted curb areas near intersections, or double-park in the street (Figure 3). Illegal parking can delay traffic, reduce safety for drivers and pedestrians, and degrade a neighborhood's visual character.

In a historic residential neighborhood of Dortmund, Germany, where curb parking was unmanaged and enforcement was rare, 21% of vehicles were parked illegally; cars frequently blocked crossings and sidewalks, and many front gardens had been converted to parking (Scheiner et al., 2020). In Northwest Westwood Village near UCLA, where curb parking is largely unmanaged apart from weekly street-cleaning restrictions, a curb parking count found that 23% of parked vehicles were parked illegally (Shoup, 2014). Similarly, in Manhattan, where 82% of curb parking on residential streets is unrestricted (aside from street-sweeping hours), delivery drivers often resort to illegal parking when they cannot find a legal space; no-standing and double-parking violations account for about 70% of commercial vehicle citations (Chen et al., 2017).

**Figure 3.** Illegal Parking in Residential Neighborhoods




*Photo credits: Evan Goldin (upper-left two photos); Ellen Schwartz (bottom left photo and right-column).*

## Resident Dissatisfaction

Residents generally want street parking to be reasonably available near their homes for themselves and their visitors. When curb parking becomes scarce, parking concerns can affect how residents feel about their neighborhood and their attitudes toward neighborhood change. Research finds that parking scarcity reduces residential satisfaction (James III et al., 2009) and, in some cases, leads households to move elsewhere (Marsden, 2006; Kim & Yang, 2017; Scheiner, 2006, as cited in Scheiner et al., 2020). It can also increase resistance to new housing development (Okashita & Willson, 2019). In Melbourne, Australia, for example, parking issues appeared in roughly half of all planning appeals (Taylor, 2013).

One indicator of dissatisfaction with unrestricted curb parking is residents' willingness to pay for preferential access. Over half of New York City residents surveyed were willing to pay for a residential parking permit, and they were willing to pay an average of $408 per year (Guo & McDonnell, 2013). Residents were more willing to pay when they viewed parking problems as arising from competition among residents rather than intrusion from non-resident commuters.

## Foregone Revenue and Social Equity Impact

In neighborhoods with high parking demand, keeping street parking free means forgoing public revenue. For example, Donald Shoup (2024) estimated that free curb parking amounted to a subsidy of $9,230 per space per year in New York City’s Upper West Side, based on the market price of off-street parking in the area. However, with only about one unmetered space for every 18 residents in the neighborhood, not everyone benefited, and those who did were disproportionately affluent. Only 27% of households owned a car, and their average income was $200,000, compared with $105,000 for households without cars (Table 2). Shoup suggested that pricing curb parking would generate over $100 million in net revenue that could support public services, such as sidewalk cleaning, planting street trees, or public transit benefits.

A similar pattern appears in Beijing. Shoup et al. (2017) examined North 7th Alley, a typical hutong in central Beijing with approximately 660 residents and an alley with 52 parking spaces. Monthly rents at nearby garages were approximately $80 per space. Using this as an estimate of the market value of curb parking, the authors estimated that providing the spaces for free represented an implicit subsidy of approximately $960 per space per year. As in New York, the benefits were concentrated among a minority of households: only 35% of households owned a vehicle, and their median household income was $15,600, compared with $5,600 among households without vehicles.

**Table 2.** Parking Subsidies, Car Ownership, and Income in New York City and Beijing

| Location (Study) | Annual Implicit Subsidy per Parking Space | Car Ownership | Share of Households | Median Household Income |
|---|---|---|---|---|
| New York City Upper West Side (Shoup, 2024) | $9,230 | No vehicles | 73% | $105,000 |
| | | One or more vehicles | 27% | $200,000 |
| Beijing North 7th Alley (Shoup et al., 2017) | $960 | No vehicles | 65% | $5,600 |
| | | One or more vehicles | 35% | $15,600 |

*Data sources: New York City data adapted from Shoup (2024), based on American Community Survey, 5-Year Estimates Public Use Microdata Sample, 2016–2020; New York City Planning Department (2022); SpotHero (2021); U.S. Census (2020); New York City Department of City Planning (2022); Yaruss (2020); Arango (2022). Beijing data adapted from Shoup et al. (2017), based on 2013 Beijing Statistical Yearbook; 2013 Beijing Economic and Social Development Statistical Reports; Xicheng District Statistical Information Website; The Xisi North 6th Alley Community Residents' Committee.*

## Underuse of Off-Street Parking

When curb parking is free, some residents park on the street even when they have driveway or garage space, so neighborhood curbs may be crowded even while many off-street spaces go unused (Figure 4).

**Figure 4.** Unused Tandem Parking Spaces at an Apartment Building in Venice, CA

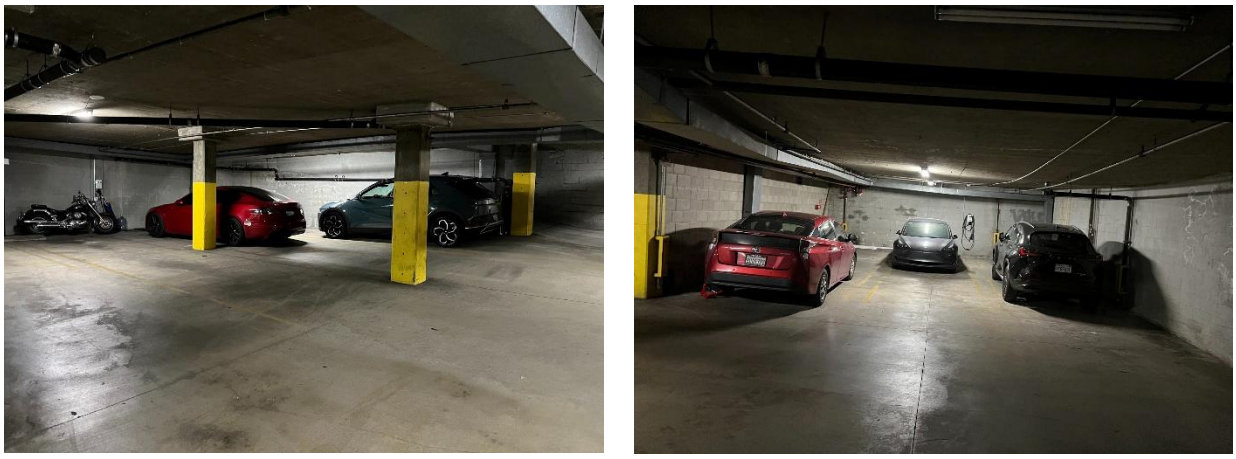
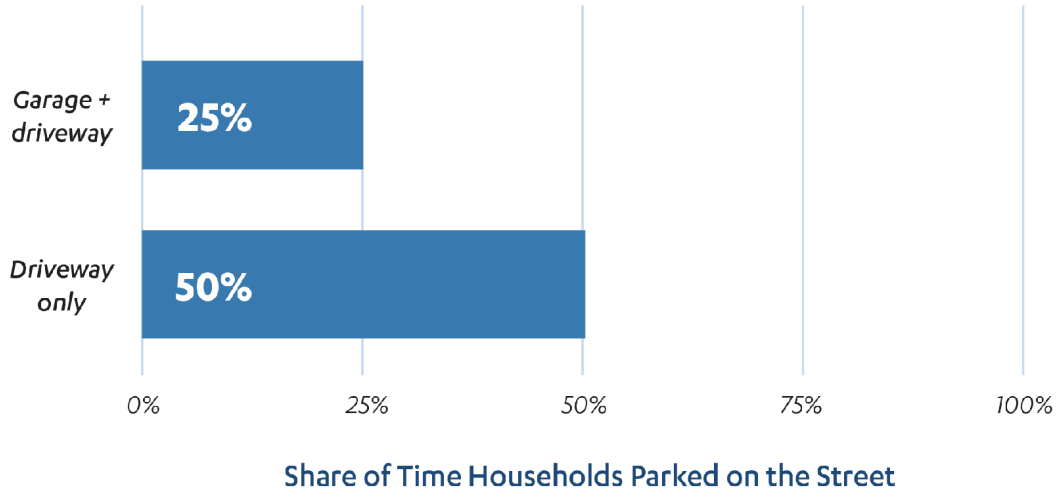


*Photo credit: Ellen Schwartz*

Multiple studies document this pattern. In the New York City region, a study of 403 households found that households with garages and driveways parked on the street 25% of the time, and households with driveways but not garages did so about 50% of the time (Guo, 2013; Figure 5). In Dortmund, Germany, residents who parked at the curb instead of in their garages gave various reasons for doing so, including difficult garage access, wanting to keep private spaces available for guests, easier loading and unloading at the curb, time

savings, short-term parking needs, and use of the garage for other purposes (Scheiner et al., 2020). The researchers estimated that consistent use of available private parking could reduce illegal parking in the neighborhood by 28–49%.

**Figure 5.** Households Park on the Street Despite Off-Street Parking Availability




*Data source: Guo (2013).*

Many residents use their off-street parking spaces for purposes other than storing cars. In a national survey of 97 cities, 88% of transportation officials reported that repurposing residential garages for non-parking uses, such as storage, was common in their jurisdictions (Guo & Schloeter, 2013). Across studies of cities in the United States, the United Kingdom, and Australia, the share of residential garages used for vehicle parking ranged from 13% to 63%, while the share of garages used exclusively for storage ranged from 18% to 75% (Volker & Thigpen, 2022). Using a garage for non-parking purposes is not necessarily inefficient; the space may provide greater value as storage or workspace. However, when curb parking is free, residents are less likely to use off-street parking, and curbs are more likely to become overcrowded, which can lead to cruising, dissatisfaction, and reduced availability for households who rely on street parking.

## Car Ownership and Driving

In dense neighborhoods, free street parking can result in congested curbs, leading some residents to own fewer cars and drive less. For example, in New York City neighborhoods, one-third of survey respondents reported that parking availability influenced their vehicle ownership decisions; half postponed car ownership, and half chose not to own a car at all (Guo & McDonnell, 2013). Similarly, across eight survey sites in south England, 2–10% of respondents reported that increased parking congestion would lead them to reduce car ownership (Balcomb & York, 1993, as cited in Marsden, 2006).

When curb parking is congested and difficult to find, car owners may also drive less. For example, in south England, 50% of survey respondents reported walking for some trips to avoid losing their parking space

(Balcomb & York, 1993, as cited in Marsden, 2006). Across three New York City boroughs, where street parking is often hard to find, households who relied on street parking or neighborhood parking facilities were more likely to commute by transit than those with private off-street parking (Weinberger, 2012). However, intentionally maintaining parking scarcity in order to discourage driving would create significant trade-offs, including increased cruising and lower resident satisfaction, as discussed above.

Conversely, when street parking is free and *not* congested, residents tend to own more cars and drive more often. In the New York City region, the availability of free residential street parking was associated with a 9% increase in car ownership, accounting for roughly one in eleven cars owned (Guo, 2013). Residents may perceive street parking as more convenient than garage parking, which can require additional time or maneuvering. Among households in the New York City region with access to both garage parking and street parking, those who parked on the street made 39% more unlinked car trips and drove 37% more miles, an effect referred to as the "parking ease effect" (Guo, 2013).

Overall, free and unmanaged residential curb parking may influence travel behavior in opposite directions, depending on its availability (Figure 6).

**Figure 6.** Free Residential Parking Can Influence Travel Behavior in Opposite Directions




*Data sources: Guo & McDonnell, 2013; Balcomb & York, 1993, as cited in Marsden, 2006; Weinberger, 2012; Guo, 2013.*

# Residential Parking Permits: Who Gets the Curb?

When residential curb parking is unrestricted and many drivers compete for a limited number of spaces, curbs can become overcrowded. In response, many cities establish residential parking permit (RPP) programs that provide residents with preferential or exclusive access to street parking. In the United States, RPP programs first emerged in the 1970s and were later affirmed in the 1977 U.S. Supreme Court case *Arlington County Board v. Richards* (Shoup, 2011). Many European cities developed similar programs during the same period (Rye et al., 2006; Brudner, 2023; Eliasson & Börjesson, 2022).

Some researchers examine whether RPP programs effectively manage parking, while others emphasize that, as with free parking, permits often provide below-market access to valuable public space, creating implicit subsidies with unintended consequences and opportunity costs of foregone revenue.

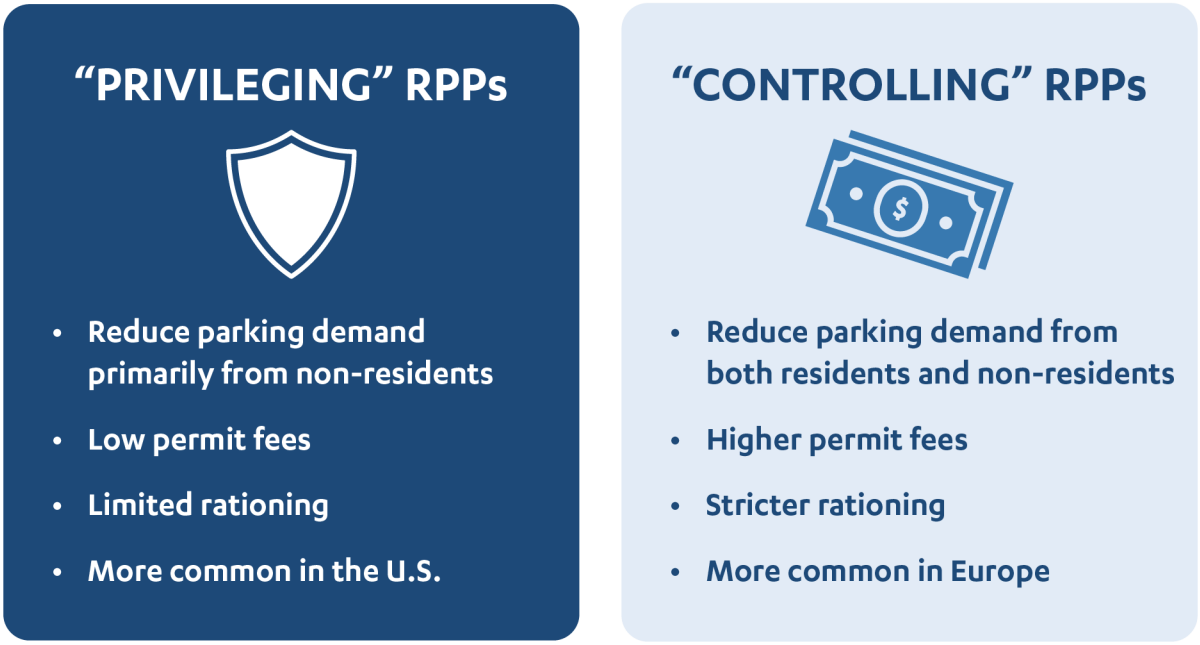
Research on RPP programs draws heavily on international cities, many of which developed before the widespread adoption of minimum parking requirements. Because these cities generally had less off-street parking and a greater need to manage residential curb space, their experiences offer valuable insights for U.S. cities facing increasing pressure on residential street parking.

The studies in this section examine a wide range of RPP program designs and outcomes, including parking management performance, distributional impacts, and welfare effects. Although the evidence base remains uneven — not all metrics are available for every city, and many findings rely on a relatively small number of well-studied programs — the literature sheds light on how RPP programs allocate curb space, who benefits from them, and the conditions under which they are most effective.

## RPP Program Designs

In the United States, most RPP programs are designed to protect residents from “parking intrusion” or “spillover parking” associated with commuters, commercial areas, or other nearby destinations. For example, San Francisco, California; Portland, Oregon; Boston, Massachusetts; Washington, D.C.; Cambridge, Massachusetts; and Arlington, Virginia established programs to shield residential neighborhoods from commuter parking (Brewer, 2019; Chang, 2014; Shoup, 2011). Chicago, Illinois initially created its program in response to student parking associated with Northeastern Illinois University, and other cities later expanded their permit programs to address parking pressures near hospitals, universities, and transit stations (Brewer, 2019). Brudner (2023) classifies such RPPs as “privileging” programs, in contrast to “controlling” RPP programs designed to manage high parking demand from the residents themselves, which are more common outside of the United States (Brudner, 2023; Figure 7).

**Figure 7.** Types of Residential Parking Permit (RPP) Programs




*Source: Typology adapted from Brudner (2023).*

Differences in the goals behind RPP programs shape how cities design them, including how they set prices, ration permits, define permit area boundaries, and manage access for visitors and non-residents.

## Pricing

Residential parking permit prices vary substantially across cities, ranging from no charge, to modest cost-recovery fees, to more than $1,500 annually (Brudner, 2023). Many U.S. cities maintain relatively low fees, reflecting the "privileging" function of providing residents with preferential access. For example, permits are free in Boston, and Los Angeles charges just $34 per year, or less than a dime a day (Brewer, 2019; Manville & Pinski, 2021). At $395 per year, residential parking permits in Portland's Central Eastside are among the most expensive in the U.S. (City of Portland, 2026a; Brudner, 2023). In many international cities, however, permit fees are substantially higher.

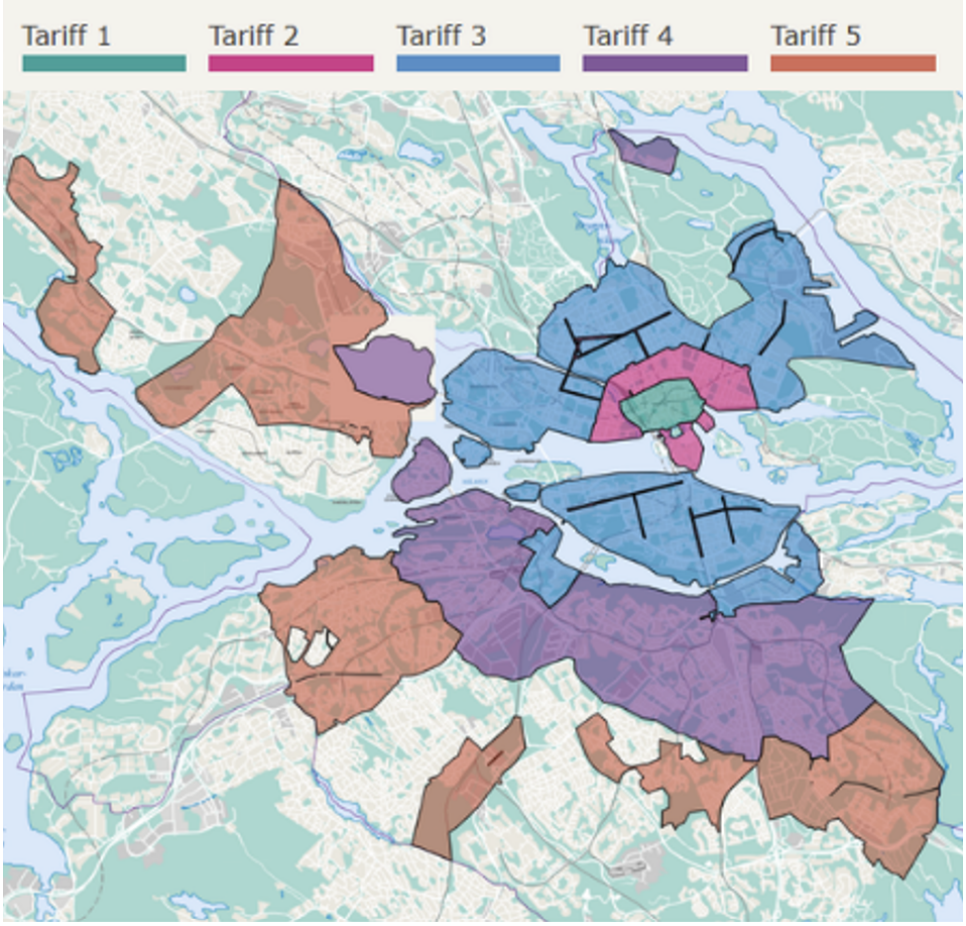
In some places, legal limits may constrain how much cities can charge for residential permits. For example, the San Francisco Municipal Transportation Agency has noted that California's Proposition 26 limits the use of parking fees as a demand-management tool by requiring local government fees to be tied to the cost of providing the associated service (SFMTA, 2017). However, Okashita and Willson (2019) identify legal gray areas surrounding Proposition 26 and describe two arguments for exempting permits from classification as a tax requiring voter approval: (1) Proposition 26 exempts the rental of state and local property, which could potentially include the use of public curb space through a parking permit; and (2) residents voluntarily choose whether to purchase permits. Germany historically capped residential permit fees at about 30 euros per year through a federal fee schedule (Brudner, 2023); however, reforms effective in 2021 removed the nationwide cap and allowed states to authorize municipalities to set higher fees for resident parking permits (54. StVRÄndV, 2020).

Where cities have flexibility to adjust permit prices, they have used a variety of differentiated pricing strategies to manage demand and advance other policy objectives. Common approaches include charging higher prices in high-demand neighborhoods, varying fees based on the number of household vehicles or vehicle characteristics, and offering different permit rates based on resident characteristics such as income or length of residency (See Figure 9).

### *Location-Based Pricing*

Cities often vary permit prices by location, charging more in areas with higher parking demand or more central locations. This approach can reduce competition for scarce curb spaces in the most crowded areas and better align the number of permits issued with available curb capacity. For example, Stockholm varies permit prices significantly by zone (Brudner, 2023; Figure 8); annual fees reach 19,200 SEK (approximately $2,000 USD) in the central district while remaining as low as 3,600 SEK (approximately $375 USD) in peripheral areas (City of Stockholm, 2026). Residential permit prices in Portland are higher in neighborhoods with high demand, and some London boroughs vary permit fees based on street-by-street demand (Brewer, 2019).

**Figure 8.** Map of Tariff Zones in Stockholm, Sweden




*Source: City of Stockholm, 2026.*

### *Uniform-Price Auctions*

Most RPP programs that vary prices by location use relatively simple approaches to set permit prices, such as increasing fees in areas where parking is frequently congested. While these approaches can be relatively effective and easy to administer, they may not always identify the most efficient price. If permits cost too little, they may be over-issued, or cities may need to rely on waiting lists, which do not necessarily ensure permits go to those who value them most. If permits are too expensive, they may be under-issued, unnecessarily limiting access to the curb. To better identify the market value of curb space, some researchers have proposed allocating residential parking permits through a uniform price auction (Shoup et al., 2017). In this approach, residents submit bids for a limited number of identical permits; the bids are ranked from highest to lowest, and permits are awarded to the highest bidders. All winning bidders pay the same price: the lowest accepted bid. Uniform-price auctions have been used to allocate parking permits on college campuses, but municipal residential parking programs have yet to pilot this approach. While uniform-price auctions may have once been administratively impractical for cities, advances in digital permitting and payment technology could make them increasingly feasible.

### *Household-Based Pricing*

Another common strategy is to charge higher fees for each additional household vehicle. By increasing the cost of storing multiple cars on the street, escalating fees can reduce parking demand and discourage excessive car ownership where curb space is limited. For example, Washington, D.C. charges a household $50 for its first permit, $75 for the second, $100 for the third, and $150 for any additional permits (Brudner, 2023). Prague, Czech Republic uses an even steeper price escalator, charging $45–90 for the first permit but more than $1,265 for a third vehicle (Brudner, 2023).

### *Vehicle-Based Pricing*

Cities may also charge higher fees for vehicles that create more pollution, occupy more curb space, or increase road wear. In London, several boroughs vary permit fees by engine size and $CO_2$ emissions (Guo & McDonnell, 2013). In Montreal, many boroughs offer reduced rates for electric vehicles and charge higher fees for heavier vehicles (City of Montreal, 2026). Norwich, England charges higher fees for longer vehicles (Brudner, 2023). In Newham, a borough of London, permit fees vary by both vehicle length and height, with surcharges for larger vehicles (London Borough of Newham, 2026).

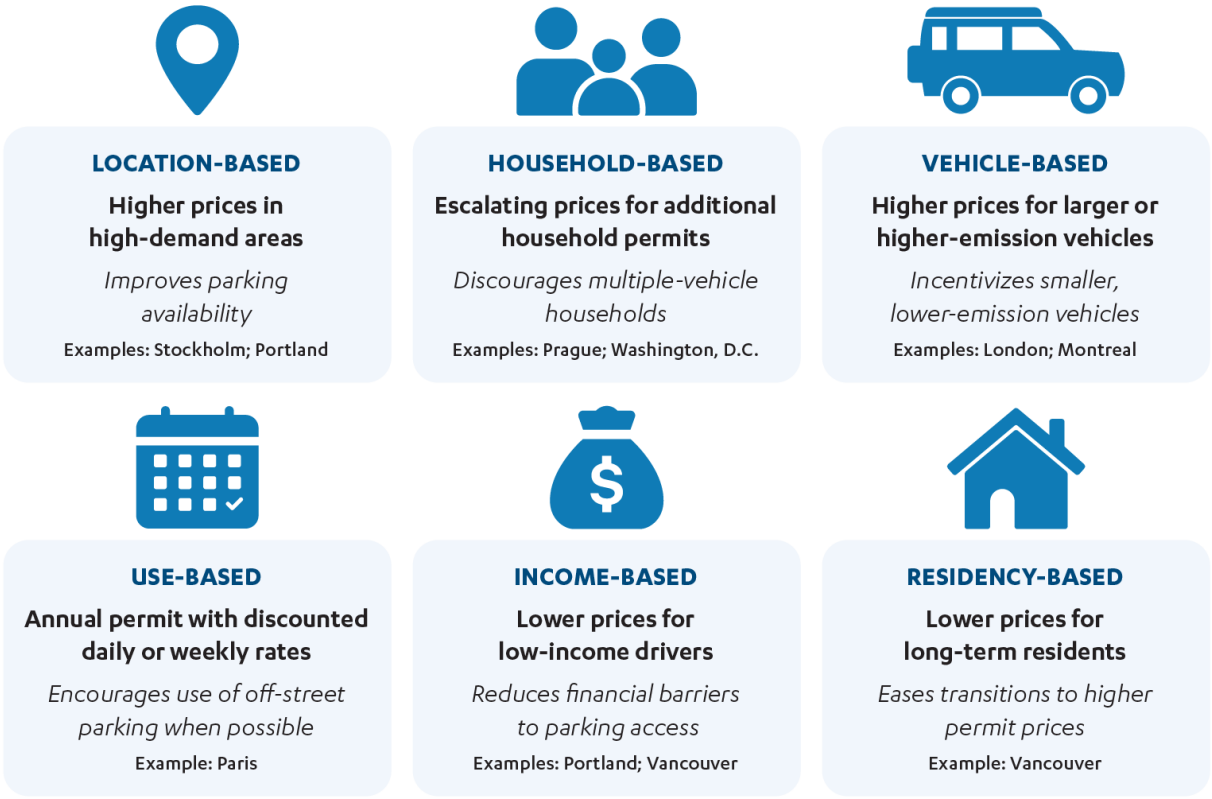
### *Use-Based Pricing*

One novel approach ties parking costs more closely to actual curb use. In Paris, residents pay a modest annual permit fee that grants eligibility for reduced daily or weekly rates (Brudner, 2023). This approach can encourage residents to use available off-street parking when possible and reserve curb parking for times when it is most needed.

### *Resident-Based Pricing*

Some cities vary permit prices based on resident characteristics, such as income, age, or length of residency. These approaches can ease the transition to higher permit prices and reduce financial barriers for low-income residents while preserving pricing signals that help manage parking demand. In Portland, discounted residential permits are available for those with financial hardship or reduced income (City of Portland, 2026a). In Washington, D.C., seniors receive discounted permits, and part-time residents pay higher rates than full-time residents (Brewer, 2019). In Vancouver's West End, both low-income households and long-term residents with "legacy" permits pay reduced rates, while newer applicants pay higher market-based fees (Brudner, 2023).

**Figure 9.** RPP Pricing Strategies




## Permit Rationing and Demand Management

Some cities allow residents to obtain an unlimited number of low-cost permits, provided vehicles are registered to an eligible address. Others limit permit issuance to avoid issuing substantially more permits than there are available curb spaces. Although higher permit prices can manage demand, political constraints often make market-rate pricing difficult (Albalate & Gragera, 2020; Anirudh et al., 2023; Smith & Yu Faxér, 2026). Instead, cities often use household caps, area-wide caps and waiting lists, or building-specific eligibility restrictions to limit the total number of permits issued (See Figure 10).

### *Permit Caps and Targets*

Many cities limit the number of permits each household may obtain. A review of RPP programs in 19 U.S. cities found that 10 had household permit limits (Roth, 2016). San Francisco and Amsterdam set lower caps in higher-demand areas (Brudner, 2023). A prior version of Eugene, Oregon's program linked household permit limits to the length of a property's street frontage (Brown et al., 2020). In Melbourne, Australia, some neighborhoods apply different caps for households in single-family and multifamily housing, or vary limits based on a building's year of construction (Taylor, 2020). Stockholm, Sweden limits permits to one per person (Brewer, 2019).

Some cities cap permits across an entire district and use waiting lists to allocate newly available permits. For example, Toronto sets permit caps at 110% of the number of curb spaces and notifies residents when a space becomes available (SFMTA, 2017). Amsterdam adds another constraint by requiring residents to already own a

car before joining the waiting list, requiring them to arrange and pay for off-street parking while they wait (de Groote et al., 2016). Rather than impose strict caps, Portland and Vancouver set target occupancies or target permit levels and adjust prices based on observed demand.

#### *Building-Specific Eligibility*

Some cities ration permits by limiting eligibility for specific buildings. For example, Stockholm denies permits to occupants of newly built units (Brudner, 2023). In Portland's Northwest District, newer buildings are limited to 0.3 permits per unit (City of Portland, 2026b). Several London boroughs exclude residents of "car-free" developments from for on-street parking permit eligibility (Li & Guo, 2017). Under California's state law AB 2712 (2024), certain new residential developments in the City of Los Angeles that are exempt from minimum parking requirements are excluded from preferential parking districts, and their occupants are ineligible for permits (Cal. Gov't Code § 65863.2.1).

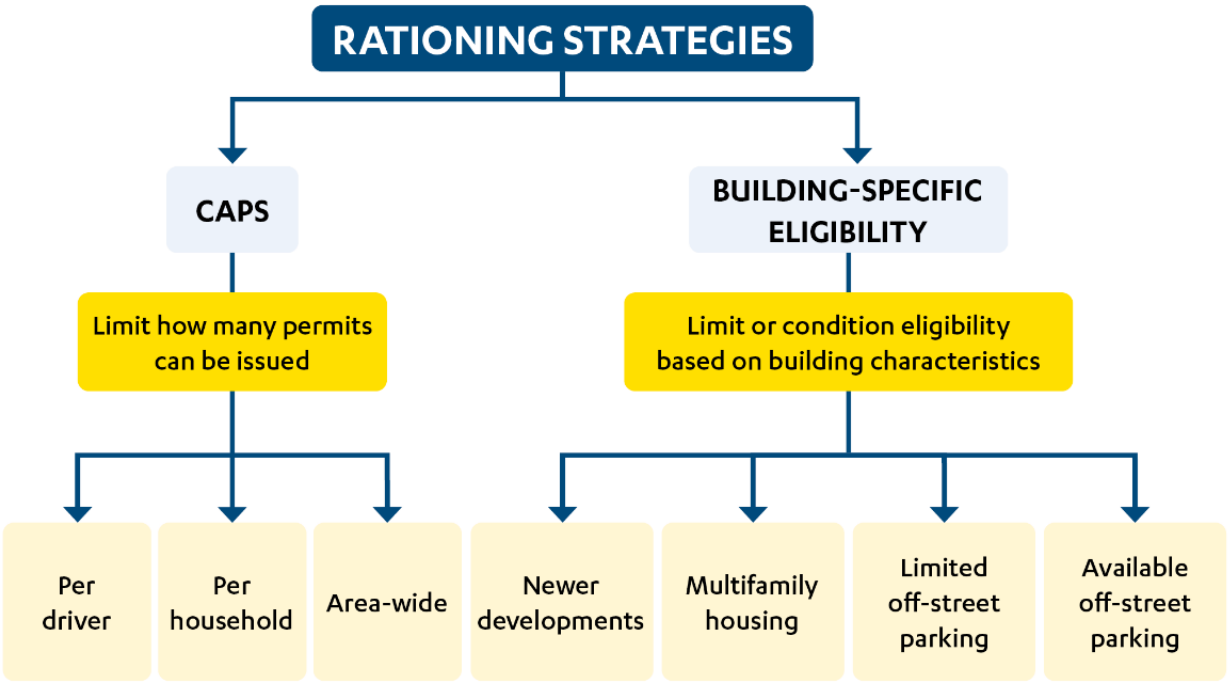
While some RPP programs *restrict* access for residents of buildings with limited on-site parking, others *favor* residents without access to off-street parking. For example, in the four largest metropolitan areas of Netherlands, street parking permits are available only to residents who live in properties without off-street parking (Ostermeijer et al., 2019), Edmonds, Washington limits permit eligibility to residents who have insufficient off-street parking (Edmonds City Code § 8.52.020), and Toronto charges a 350% premium for households that already have access to off-street parking (SFMTA, 2017).

Several Australian cities also restrict eligibility for residents of newer or higher-density developments. In the Melbourne metropolitan area, several municipalities restrict or condition permit eligibility for newer and higher-density developments to preserve limited on-street supply for incumbent residents. For example, the City of Yarra excludes post-2003 developments that increased dwelling units on a lot; the City of Boroondara excludes residents of multi-unit housing built after 2011; and the City of Manningham limits households in multi-unit developments to a single paid permit, while allowing households in detached dwellings to obtain up to two free permits (Taylor, 2020).

In California, however, state law may constrain building-specific eligibility rules. In a 2016 opinion, the California Attorney General concluded that, "in issuing long-term residential parking permits, local authorities may not distinguish among residents based on the type of dwelling in which they live" (Office of the Attorney General, State of California, 2016). Several studies also document building-specific exclusions that may no longer be in effect. For example, Berkeley, California excluded residents who lived in accessory dwelling units from its RPP program, and Bremerton, Washington excluded residents of multifamily buildings (Brown et al., 2020; Roth, 2016).

These examples illustrate three common forms of building-specific exclusions: restrictions for newer developments, restrictions tied to on-site parking supply, and restrictions for certain types of housing, most commonly limiting permit access for residents of multifamily buildings.

**Figure 10.** RPP Rationing Strategies



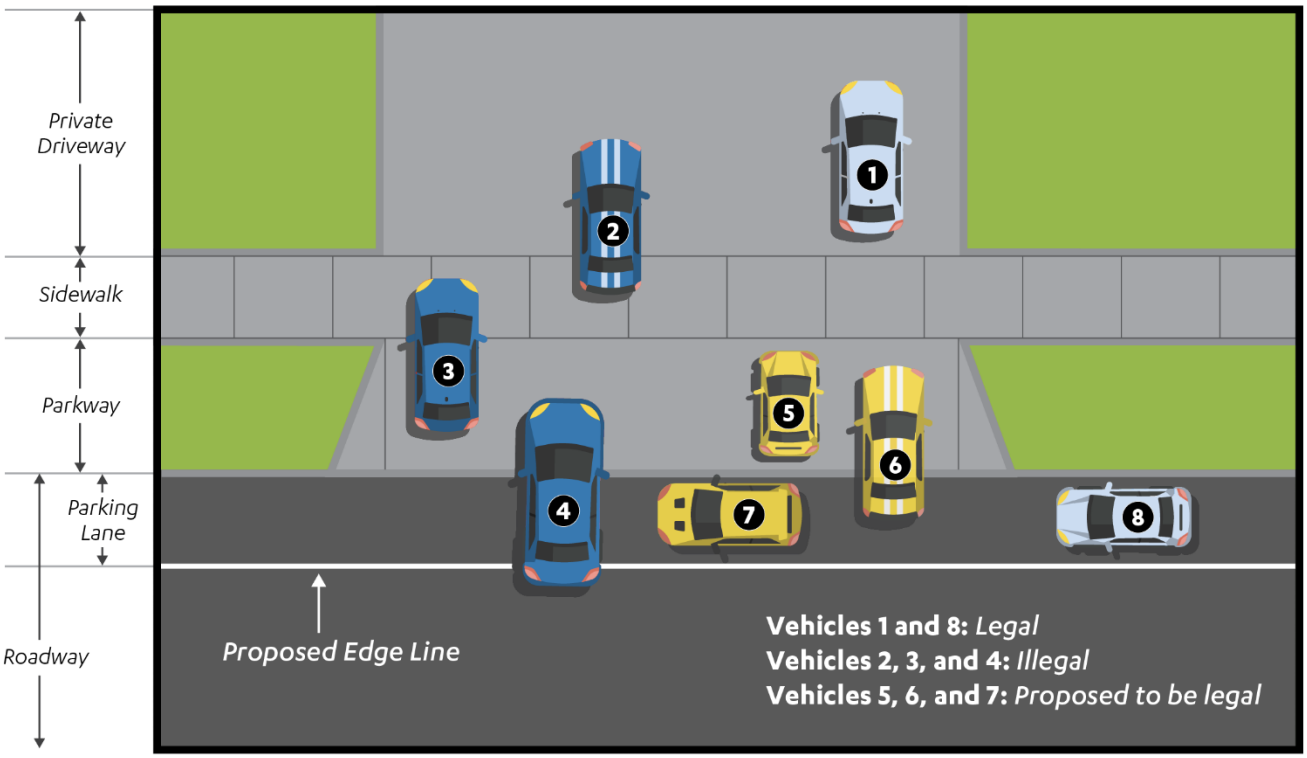

### *Other Demand Management Strategies*

Other ways of managing residential curb parking demand include incentivizing permit holders to give up their permits, allowing permit holders to also park in public lots and garages, reserving curb spaces for car share vehicles, and allowing residents to park in front of their own driveways. For example, Portland offers a "transportation wallet" with transit and bike-share benefits to residents who give up or decline a parking permit. Between 2017 and 2025, in Portland's Northwest Parking District, which has 5,264 curb parking spaces, 447 residents traded in their permits for transportation wallets, and 309 new residents opted to receive a wallet instead of purchasing a permit (Portland Bureau of Transportation, 2026). Hoboken, New Jersey's "Corner Cars" program reserves curb spaces for car share vehicles throughout the city. Following the program's introduction, many members reported giving up a car or forgoing a purchase, and the number of residential parking permits declined (UCLA Center for Parking Policy, 2026; Flegenheimer, 2012, as cited in Shoup, 2014).

Cities can also reduce competition for curb parking by making use of alternative spaces that might otherwise remain empty. For example, Ventura, California, allows residential parking permits to be used at nearby city-owned parking facilities, including public lots and garages (SFMTA, 2017). Hermosa Beach, California issues permits that allow residents or business owners to park on the street directly in front of their own driveways (Brown et al., 2020; Hermosa Beach Municipal Code, § 10.32.080). San Francisco allows vehicles to block private driveways without a permit, provided the vehicle's license plate is registered to the building's address and the driveway serves no more than two dwelling units (San Francisco Transportation Code, § 1004). Shoup (2014) also proposed allowing residents to park perpendicular to the street in driveway "aprons," with part of a

vehicle extending into the curb lane, as long as it does not block the sidewalk or extend into the travel lane (Figure 11).

**Figure 11.** Proposed Driveway Parking Regulations




*Note. Donald Shoup (2014) proposed allowing residents to park in the curb lane in front of their own driveways or perpendicular to the street in driveway "aprons," with part of a vehicle extending into the curb lane, as long as it does not block the sidewalk or extend into the travel lane.*

*Source: Adapted from Shoup (2014).*

Although state laws commonly restrict parking across driveways, some states, including California, Washington, and New Jersey, explicitly authorize local governments to permit it under certain conditions (CVC § 22507.2; RCW § 46.61.570(1)(b)(i); NJ Rev Stat § 39:4-138.3). Policies allowing parking in front of private driveways can free up curb spaces for other users while providing a guaranteed parking option for residents or their guests.

Some cities also require new developments to provide transportation demand management (TDM) measures, such as transit passes, car-share memberships, and bicycle facilities, intended to reduce reliance on private vehicles. These requirements may also reduce demand for residential curb parking in some contexts, but an analysis of their effectiveness is outside the scope of this synthesis.

## Permit Area Boundaries

Permit areas vary in size from city to city. At one end of the spectrum, Seoul, South Korea has used systems that assign vehicles to designated curb spaces on a one-to-one basis (Sunghoe et al., 2019). At the other end,

Cambridge, Massachusetts, allows residential permit holders to access RPP-designated street parking throughout the city (Chang, 2014). Assigning vehicles to specific curb spaces can be inefficient because spaces may sit vacant when assigned vehicles are away. Citywide permit systems may fail to prevent localized parking shortages and may encourage vehicle travel among permit holders. More commonly, RPP programs define neighborhood zones.

Even among neighborhood-based RPP programs, cities vary considerably in the size of permit areas. The size of RPP areas reflects trade-offs among several objectives, including responding to local parking demand, minimizing administrative complexity, and influencing travel behavior (Figure 12). Some cities define minimum spatial requirements for permit zones; for example, Seattle sets a threshold of 20 contiguous block faces (Roth, 2016). In San Francisco, permit area sizes vary substantially, ranging from under one-tenth of a square mile to over one square mile (Brewer, 2019). SFMTA recommended subdividing some of the larger permit areas into smaller zones to avoid inadvertently encouraging residents to drive for short trips that could otherwise be made on foot, such as accessing transit stations (SFMTA, 2017). On the other hand, larger RPP areas may be more effective at discouraging commuters from outside a neighborhood from driving and parking (Rye et al., 2006).

**Figure 12.** Permit Area Size Trade-offs




## Visitor and Non-Resident Parking

Cities take various approaches to allowing non-permit holders to park in residential permit areas, reflecting trade-offs between access, demand management, and administrative and enforcement simplicity. Non-resident parking may be restricted during certain times of day or in certain spaces within a permit area, subject to time limits, require hourly payment or a visitor parking permit, or managed through some combination of these measures. It may also be prohibited altogether.

### *Time-Based Restrictions*

Some cities do not allow any visitor parking during certain times of day. Most commonly, peak demand for residential parking occurs overnight. Boston, Massachusetts and Dublin, Ireland do not allow any visitor parking overnight (SFMTA, 2017). Programs in Bellevue, Washington also restrict visitor parking during school pickup and dropoff hours in permit zones near schools, and during business hours and weekends in zones near commercial areas (Roth, 2016).

### *Reserved Spaces*

Some cities reserve certain spaces for permit holders, while keeping other spaces available to anyone. For example, areas of Barcelona, Spain with a “severe supply shortage” are designated “green exclusive zones” and restrict non-resident parking, while “mixed use zones” allow both resident and visitor parking (Albalate & Gragera, 2020). The Kensington and Chelsea borough of London reserves 82% of its curb parking spaces for permit holders (van Ommeren et al., 2014). In Germany, federal rules for residential permit areas require that 50% of spaces remain available to anyone during weekdays, while 25% must remain available overnight and on weekends (Scheiner et al., 2020). Before Vancouver’s West End revised its parking program, only two on-street spaces per 100 households were available for visitors, who reported driving an average of 10 minutes, or nearly three kilometers, in search of parking (Parking Reform Network, 2026). By contrast, Portland's Northwest Parking District does not reserve spaces exclusively for permit holders. Instead, about 20% of spaces are reserved exclusively for paid visitor parking, while the majority of spaces are available to either permit holders or paying visitors (Portland Bureau of Transportation, 2025).

### *Hourly Time Limits and Fees*

Other programs allow visitors to park in permit zones, but only for a limited time and/or by paying an hourly rate. For example, Berkeley allows visitors to park for two hours free of charge (Moylan et al., 2014). Cities such as Portland, Oregon; Glendale, California; Hermosa Beach, California; Ventura, California; Seattle, Washington; Toronto, Ontario; and Amsterdam, Netherlands have “pay-and-permit” systems, where non-permit holders may park but must pay an hourly rate (SFMTA, 2017; de Groote et al., 2018).

### *Short-Term Visitor Permits*

Some cities issue temporary parking passes for visitors to park in permit areas. In some cases, residents must apply for daily parking permits for their guests; in other cities, visitors can purchase their own pass. For example, in Chicago and Washington, D.C., daily visitor permits are typically issued to residents rather than directly purchased by visitors (Brewer, 2019). San Francisco offers households the option to purchase short-term permits in two-, four-, six-, or eight-week increments in addition to daily permits. In Bellevue, residents can obtain up to four free transferable guest hang tags per home (Roth, 2016). In Aspen, Colorado, any nonresident may purchase a parking day pass (Shoup, 2011).

### *Commuter Permits*

Unlike visitor permits, which manage short-term access, commuter permits allocate daytime use of residential curb space to non-residents such as workers or businesses. Because many spaces are vacated during the daytime when residents drive to work, cities have developed commuter permit programs to increase parking access and generate additional municipal revenue. A review of RPP programs in 22 U.S. and international cities found that 11 allowed businesses to purchase quarterly or annual parking permits, often restricted to daytime hours and priced substantially higher than residential permits (SFMTA, 2017).

Specific approaches to managing commuter permits vary across cities. For example, Boulder, Colorado sells up to four commuter permits per block, but only on blocks with a vacancy rate above 25% (Shoup, 2011). Okashita and Willson (2019) note that the waitlist for these permits suggests they are priced below the market-clearing rate. Portland issues business parking permits based on the number of employees, with limits varying by zone. (SFMTA, 2017). Palo Alto, California caps on-street business parking permits at approximately 2,000 citywide (SFMTA, 2017). Tucson, Arizona offers nonresident daytime permits in residential neighborhoods near the University of Arizona, with prices that increase closer to campus (Shoup, 2011). San Francisco also issues

permits for specific categories of service providers, including teachers, medical caregivers, and childcare providers (SFMTA, 2017).

## Formation Process

The formation of RPP zones typically involves resident requests, technical evaluation, public engagement, political approval, and implementation.

### *Resident Initiation*

In many U.S. cities, the process begins when residents experiencing parking shortages petition the city for permit parking restrictions. Programs often require evidence of neighborhood support before a formal study can begin. For example, San Francisco requires signatures from at least 50% of households in the proposed area or 250 households, whichever is less, while Chicago requires support from 65% of residents in the proposed zone (Brewer, 2019). Requiring residents to initiate permit programs through petitions may make permit districts more difficult to establish in denser, more diverse neighborhoods than in smaller, more homogeneous communities.

Resident requests may also play a role in the formation of parking permit programs internationally. For example, in Utrecht, the Netherlands, residents can trigger the introduction of residential parking regulation through a non-binding referendum, while in Amsterdam, resident complaints have often driven the expansion of permit zones (de Groote et al., 2018). Researchers describe this pattern as a "snowball effect": when cities introduce paid parking in central areas, some drivers begin parking in adjacent unregulated neighborhoods. Residents then complain about parking intrusion, prompting local authorities to extend permit and paid-parking boundaries into those areas (Mingardo et al., 2015).

### *Technical Studies*

After a petition or request is submitted, transportation departments typically study parking conditions to determine whether restrictions are needed. Many cities require a certain level of parking demand and/or non-resident parking before a permit zone can be approved. Among eight cities with both types of requirements, the most common standard was a minimum of 75% occupancy, with at least 25% of spaces used by non-residents (Roth, 2016). In Chicago and Los Angeles, studies must find that at least 85% of parking spaces are occupied before a permit zone can be created, and a similar rule of thumb is commonly used by local councils in European cities (Brewer, 2019; Okashita & Willson, 2019; Mingardo et al., 2015).

### *Legislative Approval and Implementation*

After technical review, proposed permit zones usually move through a formal approval process. Public hearings or community meetings give residents, businesses, and other stakeholders a chance to comment before a decision is made. Final approval is typically made by the city council. Some cities, such as Palo Alto, California and Tacoma, Washington, also include pre-approved "buffer zones" that allow staff to expand permit areas without needing additional council approval (Roth, 2016).

Once new permit zones are approved, cities install signage, begin issuing permits, and establish enforcement procedures. Many modern programs now rely on digital permit systems tied to license plate numbers rather than physical stickers or placards, allowing for more efficient administration and enforcement (Brudner, 2023).

Researchers and municipal staff evaluating program outcomes have analyzed a variety of metrics related to RPP program outcomes, including the share of spaces occupied by residents, on-street and off-street parking

occupancy rates, resident satisfaction, price effects on permit sales, and effects on car ownership and vehicle use. Research findings vary across cities, reflecting differences in neighborhood context, sources of parking demand, and approaches to pricing, eligibility, and enforcement.

# RPP Program Outcomes

Researchers and municipal staff evaluating program outcomes have analyzed a variety of metrics related to RPP program outcomes, including the share of spaces occupied by residents, on-street and off-street parking occupancy rates, resident satisfaction, price effects on permit sales, and effects on car ownership and vehicle use. Research findings vary across cities, reflecting differences in neighborhood context, sources of parking demand, and approaches to pricing, eligibility, and enforcement.

## Observed Users of RPP Spaces

Research and program evaluations across global cities have examined who parks in RPP spaces. These studies provide examples of how curb space is allocated among residents, visitors, and non-compliant parkers under different program designs. Overall, occupancy patterns across RPPs suggest that programs can accommodate resident and non-resident access, but outcomes vary by neighborhood characteristics, eligibility rules, and enforcement.

### *Resident and Non-Resident Occupancy Patterns*

Some studies, mostly in neighborhoods that allow both paid and permit parking, compare the share of RPP parking spaces occupied by permit holders and visitors. When programs also allow non-permit holders to park for a fee, these visitors can account for a substantial share of curb users. For example, in Portland's Northwest District, most parking spaces are shared between permit and paid parking, allowing visitors to pay the meter and park for up to four hours. During peak daytime hours, only 51% of parked vehicles displayed an active permit, with the remaining vehicles paying to park or otherwise not displaying permits (Portland Bureau of Transportation, 2025). Similarly, about 65% of parked vehicles in Stockholm's inner suburbs displayed a residential permit (Eliasson & Börjesson, 2022). The authors noted some commuters park their cars in outer neighborhoods and take transit for the final portion of their trip, while some central-city residents regularly store vehicles in suburban areas to avoid higher parking costs in central districts.

In cities that allow both resident and non-resident parking, the balance varies by neighborhood context and time of day. In San Francisco's more residential neighborhoods, such as Nob Hill and Telegraph Hill, resident vehicles typically accounted for roughly 75–80% of parked vehicles throughout the day (SFMTA, 2017). By contrast, on RPP blocks in the mixed-use Dogpatch neighborhood, the resident share was more time-sensitive, accounting for roughly 80% of parked vehicles in the early morning, declining to approximately 50% by midday as visitor and commuter parking increased, and rising again in the evening (SFMTA, 2017). Similar temporal patterns also appear in other cities. In Tel Aviv, visitors accounted for approximately 20% of parked vehicles during the day but only around 5% overnight (Benenson et al., 2008).

### *Curb Parking Use by Housing Type*

RPP program eligibility rules may create access disparities among residents themselves. In Melbourne, Australia, where many local councils have introduced rules that restrict or ban residents of newer higher-density housing from participating in RPP programs in order to protect existing residents from "spillover" parking demand from

new developments, residents of detached housing account for 77–83% of on-street residential parking, while apartment residents make up less than 10% (Taylor, 2020). Taylor (2020) explains that such rules effectively limit apartment residents' access to on-street parking and thus result in unequal access to public curb space.

#### *Non-Compliance*

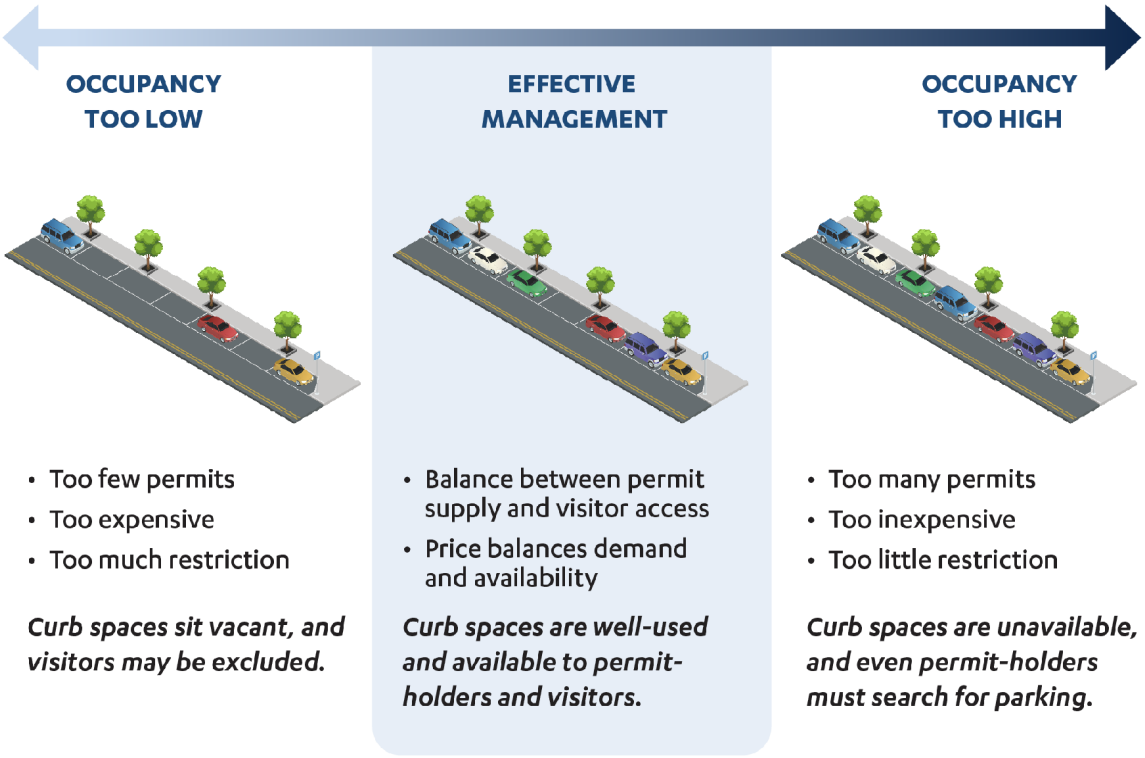
The available evidence suggests that enforcement is necessary to ensure that permit-only spaces serve their intended users. For example, Kim et al. (2019) found that in a residential permit zone in Seoul, unauthorized vehicles outnumbered permitted vehicles in permit-only spaces. In Berkeley, the average self-reported visitor parking duration was three hours and twenty minutes, with 56% of respondents staying beyond posted two-hour time limits (Moylan et al., 2014).

Payment requirements are often easier to monitor than time-limit violations, and longer time limits give visitors more flexibility to park legally. Portland's Northwest Permit District provides evidence of how time limits may affect compliance. Among metered visitor stalls, non-compliance was generally highest where time limits were most restrictive: 34% of vehicles were non-compliant at 75 stalls with 30-minute time limits, compared with 18% at 152 stalls with two-hour limits and 10% at 534 stalls with four-hour limits. Most stalls in the district allow both permit holders and paying visitors to park, with permit holders able to park without time limits while visitors must pay the meter and comply with posted four-hour limits. Across these 2,807 "metered or by permit" stalls, the non-compliance rate was 11% (Portland Bureau of Transportation, 2025).

## On-Street Parking Availability

RPP programs are often intended to improve parking availability, but how well they do this is driven in part by how much of an area's parking demand comes from non-residents versus from the residents themselves. When curbs are crowded because of resident vehicles parked on the street, and too many permits are issued, an RPP program can be ineffective, and parking conditions may resemble those of an unmanaged curb. When restrictions are too tight, however, curb space may go underused while visitors and other users are pushed out (Figure 13). Overall, the studies of program outcomes highlight the challenge of striking a balance between maintaining parking availability and ensuring efficient use of curb space.

**Figure 13.** How RPP Program Designs Affect Curb Occupancy




### *Managing Non-Resident Demand*

In practice, the effects of RPP programs vary depending on the source of parking demand. When many vehicles parked in a residential area are associated with commuters, commercial activity, or other nearby destinations, programs that reserve curb parking for residents can improve availability on the restricted streets. Early studies have shown that after an RPP program is introduced, many non-residents shift to parking on streets just outside the permit zone or in off-street facilities, and some shift modes (Rye et al., 2006; Olsson & Miller, 1980; Meyer & McShane, 1981, as cited in Roth, 2016). However, overly restrictive RPP programs may also lead to inefficient use of curb space. Research in Berkeley, CA, found that 98% of RPP blocks had at least one space available during enforcement hours, but also that 81% of the block hours had occupancy rates below 75% (Moylan et al., 2014). The authors noted that fewer blocks had low occupancy rates outside of the RPP enforcement hours and concluded that the RPP program needlessly excluded outsiders with legitimate reasons to park in the area, including visitors, household workers, repair technicians, teachers, and neighborhood business owners and employees.

### *Competition Among Permit Holders*

In some neighborhoods, high parking demand is generated primarily by residents rather than visitors. One metric researchers use to assess this is the “saturation rate,” or the ratio of issued permits to permit-regulated spaces in an area. When saturation is high, residents may find that paying for a permit is merely paying for a "hunting license" rather than a guaranteed spot. For example, in Boston — where residents may obtain an unlimited number of free permits — some neighborhoods issued four times as many permits as spaces, and residents

have reported insufficient parking for permit holders (Manville & Pinski, 2021; Brudner, 2023). In San Francisco's most saturated zones, 40% of residents reported spending over 16 minutes circling for a spot despite having a permit, 22% reported spending over 30 minutes, and 41% reported having to park more than three blocks from their home (SFMTA, 2017). Before Vancouver's West End revised its permit program, permit holders reported spending about five minutes searching for parking, driving approximately one additional kilometer in the process (Parking Reform Network, 2026). Similar issues of permit-holders cruising for parking have been documented in RPPs in Tel Aviv, Israel and London's Tower Hamlets borough (Benenson et al., 2008; Brewer, 2019).

#### *Managing Resident Demand*

Programs designed to manage high parking demand from the residents themselves may do a better job improving availability. For example, Stockholm introduced paid and permit parking in its residential suburbs with permit prices of €30–€50 per month and a target occupancy rate of 85%. After the program was introduced, the share of over-occupied blocks decreased from 61% to 31% in multifamily areas, from 15% to 5% in single family areas, and from 20% to 8% in other areas, despite a simultaneous reduction in total curb parking supply (Eliasson & Borjesson, 2022). Similarly, in Vancouver's West End, the share of over-occupied blocks declined from 14 of 22 to 4 of 22 after the city introduced market-rate residential permit prices and gradually increased permit costs each year (Parking Reform Network, 2026).

Portland's Northwest District provides another example of more active demand management. In the program's first year (FY 2016-2017), the city issued 9,775 total permits for an inventory of only 5,264 spaces (Portland Bureau of Transportation, 2017). In response to this high saturation rate, the city increased permit prices from $60 to $180, eliminated yearly guest permits, introduced tighter caps on permits for businesses and residential buildings, and offered "Transportation Wallets" to residents who chose not to renew their permits. These changes helped the city reduce issuance to 7,000 permits the following year and brought demand closer to available curb capacity (Portland Bureau of Transportation, 2018). Between 2016 and 2025, permit sales declined even as the district's population grew from 11,868 to 13,674 (UCLA Center for Parking Policy, 2026). The city's more recent analysis, based on data from October 2025, found that 37% of block faces in the study area still exceeded the 85% occupancy target during peak hours, though this represented an improvement from previous years (Portland Bureau of Transportation, 2025).

## Off-Street Parking Use

Several studies have also examined how much off-street parking is used in RPP neighborhoods. Findings vary across contexts, but they generally suggest that private off-street parking is often underused in denser neighborhoods with crowded curb parking, while lower-density neighborhoods are more likely to have ample capacity both on and off street.

#### *Gaps Between On-Street and Off-Street Occupancy*

It is fairly common for residential curb parking to be crowded while many off-street spaces remain empty (Table 3). Evidence from Vancouver's West End demonstrates this mismatch: before the city increased permit prices in 2017, curb parking occupancy regularly exceeded 90%, while off-street occupancy was often below 50%, despite the availability of approximately 22,000 off-street residential spaces for 16,000 registered vehicles. At the time of the study, curb parking permits cost about $6 per month, compared with a median price of roughly $50 per month for off-street parking, creating a strong incentive for residents to park on the street rather than use private garages (City of Vancouver, 2017; Abbott & Bigazzi, 2017).

Similarly, in Cambridge, Massachusetts, night counts across three RPP neighborhoods found that 75–95% of on-street spaces were occupied, while only 6–45% of off-street spaces were used (Chang, 2014). And in Boston's Back Bay neighborhood, off-street residential parking was only slightly above 60% occupied, while the adjacent streets were full and residents reported insufficient parking (Brudner, 2023).

Research from Melbourne, Australia, found that even though curb parking is often crowded, one-third of apartment parking spaces typically go unused, and 50% of RPP users had off-street parking available to them. About half of on-street parkers with garage access used their garage space for storage or other household purposes instead (Taylor, 2020).

**Table 3.** On-Street and Off-Street Parking Occupancy in Free or Low-Cost RPP Areas

| Study | Location | On-Street Occupancy | Off-Street Occupancy |
|---|---|---|---|
| City of Vancouver, 2017; Abbott & Bigazzi, 2017 | Vancouver, British Columbia | Regularly exceeded 90% | Often below 50% |
| Chang, 2014 | Cambridge, MA | 75–95% | 6–45% |
| Brudner, 2023 | Boston, MA | Often fully occupied | Slightly above 60% |
| Taylor, 2020 | Melbourne, Australia | Often crowded | 50% of RPP users had off-street parking available |

In Vancouver's West End, city staff undertook a labor-intensive effort to compare each building's off-street parking supply with the number of vehicles registered to its residents. The analysis revealed that many buildings had excess parking capacity, often next to buildings with more vehicles than available spaces. Staff noted that changing zoning in residential neighborhoods to allow commercial parking could help make better use of existing off-street parking (Parking Reform Network, 2026).

#### *Lower-Demand Neighborhoods*

By contrast, some lower-density neighborhoods with RPP programs may experience relatively little competition for curb parking. In Bellevue, Washington, 85% of residents reported parking off-street in garages, driveways, or carports, and on-street parking occupancy in permit areas averaged just 14% (Roth, 2016).

## Resident Satisfaction

Relatively few studies examine resident satisfaction with RPP programs in detail. Those that do generally focus on program beneficiaries and report moderate to high levels of satisfaction. For example, in Berkeley, California, 79% of residents reported being satisfied with the RPP program, with an average satisfaction score of 3.36 out of 5 (Moylan et al., 2014). Satisfaction was slightly higher among residents with access to off-street parking compared to those relying entirely on on-street parking.

Similar patterns appear in Bellevue, Washington, where residential satisfaction was identified as the primary goal of the RPP program (Roth, 2016). Overall satisfaction was relatively high, with an average rating of 3.8 out of 5; 41% of residents reported being satisfied and 34% were neutral. Residents who supported the program often emphasized improved neighborhood conditions, including reduced commuter parking and quieter residential

streets. Criticisms focused less on the existence of the program itself and more on enforcement challenges and perceptions that program costs should be covered through general taxation rather than permit fees.

Research from Amsterdam estimates the benefits to residents in monetary terms. Van Ommeren et al. (2011) find that residents are willing to pay up to approximately €10 per day for a parking permit in constrained neighborhoods. They derive this figure from differences in housing prices across areas with different levels of parking access, which reflect the implicit costs of searching for parking, walking from distant spaces, and uncertainty in availability. This willingness to pay is far higher than the actual permit fee of €0.40 per day at the time, suggesting substantial value to permit holders and providing indirect evidence of high satisfaction.

This literature is limited, but it suggests that residents who have permits generally view RPP programs favorably. This may reflect the fact that most programs prioritize residents' access to curb space while limiting access for nonresidents.

## Price Effects on Permit Sales

Selling fewer permits can help improve curb availability. As discussed above, permit sales in Portland decreased as prices increased, but increasing prices was only one of several strategies the city used to better align the number of permits issued with the number of available spaces (Brewer, 2019). In other cities, RPP pricing also appears to influence permit demand, although the size and persistence of these effects vary depending on local context. Evidence from several cases suggests that higher permit prices can reduce permit sales in the short term and, in some cases, may influence decisions about vehicle ownership.

Brudner (2023) identifies Vancouver's West End as one of the clearest examples of permit price increases reducing demand. As part of Vancouver's broader strategy to reduce automobile use, the city conducted surveys beginning in 2015 to better understand parking behavior before reforming residential permit pricing. Until September 2017, permits cost only C$6 per month. After the reform, new residents were charged C$30 per month, while existing residents retained a legacy rate. Permit demand declined immediately: total permits issued fell by 18% in the first year, and legacy permits declined by 28%. In subsequent years, roughly 20% of legacy permits were not renewed annually (Brudner, 2023). By 2026, despite slight population growth, city staff reported that total permit sales had declined by 54% and legacy permit sales had declined by 75%, as prices for both market-rate and legacy permits had gradually increased over time (Parking Reform Network, 2026). These outcomes suggest pricing can meaningfully reduce demand even when incumbent residents have access to lower cost permits. However, the West End's context may have contributed to the rapid decrease in legacy permit sales: approximately 80% of housing units are rented, residential turnover is high, and only about 25% of residents commuted by car prior to the permit price increase, compared with roughly 45% citywide (Brudner, 2023).

Helsinki, Finland's experience suggests that price effects may evolve over time. The city's residential permit system, which covers 15 permit areas, shifted in 2014 from symbolic pricing toward active demand management. Permit prices increased from €105 annually in 2010 (about €8.75 per month) to €120 in 2013, then rose sharply beginning in 2015 to €18 per month with annual €2 monthly increases, reaching €30 per month by 2021 (Brudner, 2023). Permit demand declined steadily through the initial years of reform: permit issuance fell 17.2% between 2010 and 2017, even as vehicle ownership increased elsewhere in the city. After 2017, however, permit demand rebounded, leaving permit sales only 2.5% below 2010 levels by 2021. Brudner (2023) examined whether discounts for electric and low-

emission vehicles could explain this reversal but found limited evidence of substantially greater adoption in permit areas. Another possible explanation is that permit demand became less price-sensitive over time.

London provides an example of how pricing may influence not only the number of permits purchased but also vehicle choices. In 2007, the Richmond-upon-Thames borough introduced emissions-based permit pricing, with annual permit fees ranging from free for the lowest-emission vehicles to £300 for the highest-emission vehicles (Mingardo et al., 2015). Within three years, the share of permits issued to vehicles in the highest emissions category declined from 16% to 13% of all permits issued, while permits for vehicles in the lowest emissions category increased from 25% to 32% (Brewer, 2019). However, without a control group, the observed changes cannot be attributed solely to the policy and may reflect broader trends in vehicle fleet composition.

Taken together, these cases show that increasing permit prices can reduce permit demand, but the magnitude of the effect depends on the local context and the size of the price increase. The extent to which decreases in permit sales reflect changes in vehicle ownership, shifts to off-street parking, or other adjustments is not always clear.

## Car Ownership and Driving

Some studies examine how RPP programs influence car ownership and driving. By changing the cost, convenience, and availability of residential parking, RPP programs can affect how many cars households own, how often they drive, and where they choose to park. Programs can influence travel behavior decisions through multiple mechanisms and in opposite directions.

One pathway through which RPP programs may reduce car ownership is by increasing the cost of storing a car on the street. The declines in permit sales following price increases in Vancouver and Helsinki described in the previous section are consistent with reduced vehicle ownership, although they may also reflect shifts to off-street or unregulated parking. More direct evidence comes from the Netherlands, where Ostermeijer et al. (2019) estimate that differences in residential parking prices explain roughly 30% of observed differences in car ownership rates between central and peripheral neighborhoods. Their analysis further suggests that increasing permit fees in central Amsterdam to market rates could reduce car ownership by 19–24% under scenarios with autonomous vehicles.

Managing permit demand through waiting lists can also reduce vehicle ownership. Some households may give up a car rather than arrange alternative parking while they wait, since off-street options may be more expensive or less convenient. For example, researchers estimated that, in Amsterdam, each additional year of waiting reduces the probability that a household owns a car by approximately 2 percentage points (de Groote et al., 2016).

However, RPP programs that provide residents with inexpensive and convenient access to curb parking can encourage higher rates of car ownership. For example, Albalate and Gragera (2020) found that Barcelona's low-cost RPP programs, which reallocated curb space from visitors to residents, increased residents' car ownership by 2.9% relative to comparable control areas, with effects strengthening over time. This finding is consistent with the earlier discussion of how unrestricted residential parking impacts travel behavior: easier access to street parking can increase car ownership and driving, while congested conditions can have the opposite effect.

In neighborhoods near major employment centers, limiting commuter access to residential curb parking may encourage shifts to other transportation options. For example, an RPP program in the neighborhood surrounding a hospital in San Francisco reduced the share of hospital employees commuting alone by car from 63% to 55% (Dowling et al., 1991, as summarized in Brudner, 2023). Similarly, after a residential permit zone was implemented in Virginia, 12% of commuters shifted to bus or carpool, while most others responded by changing where they parked, primarily by moving to off-street facilities (Olsson & Miller, 1980). Establishing RPP programs in residential areas may also increase participation in employer parking cash-out programs (Evangelinos et al., 2018).

Similarly, modeling evidence of hypothetical RPP zone expansions suggests that limiting commuter parking can reduce driving when programs cover a sufficiently large area. Simulations of a 1.5-mile expansion of Edinburgh, Scotland's controlled parking zone estimate up to a 21% reduction in car use for city center work trips, with corresponding increases in bus and walking trips (Rye et al., 2006). Smaller expansions, however, primarily shift parking into nearby neighborhoods rather than reducing car use.

In summary, RPP programs can influence car ownership and driving in different ways depending on how they change parking costs, availability, and access. High permit prices and wait lists may reduce resident car ownership, while inexpensive permits that prioritize residents over other curb users can increase it. Allowing curbs to remain congested may reduce resident driving, while restricting commuter access can reduce commuter driving. Overall, the net effect of RPP programs on car ownership and driving remains uncertain.

## Distributional and Welfare Impacts of RPP Programs

Residential curb space is a scarce resource, and allocating it inevitably involves trade-offs. Most RPP programs manage this scarcity by prioritizing residents over other users. While permit holders tend to view these RPP programs favorably and often benefit from preferential access to curb space in their neighborhoods, not everyone benefits equally. Studies focused on the extent to which RPP programs achieve their intended goals do not always capture the trade-offs involved in prioritizing some users over others. Understanding these trade-offs requires examining two additional questions: how the costs and benefits of RPP programs are distributed among different groups of users and whether curb space is allocated in ways that generate the greatest overall public benefit.

### Distributional Effects

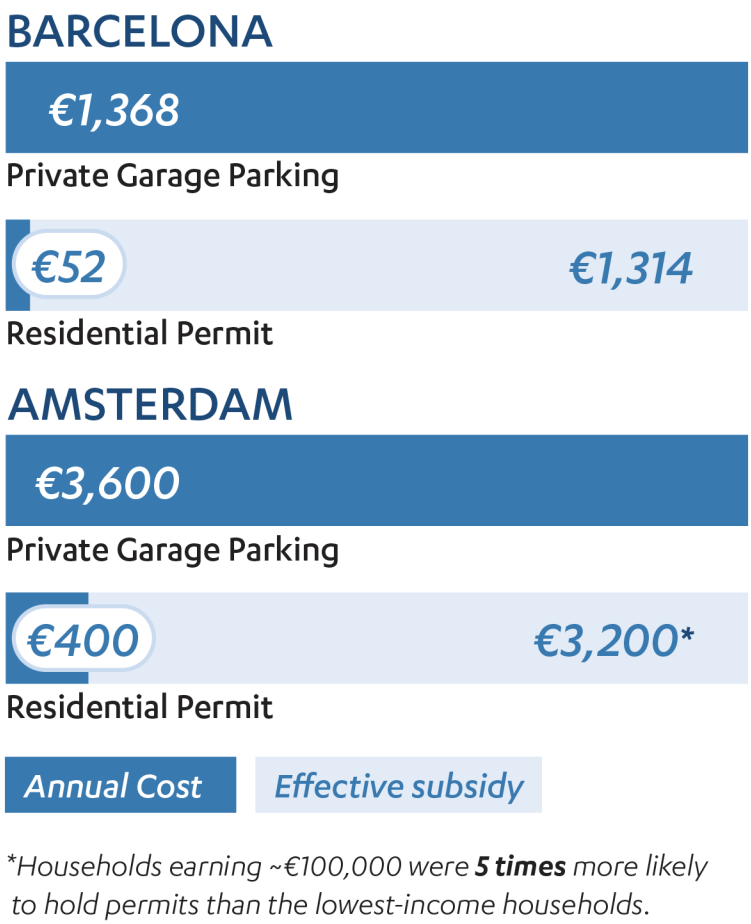
Distributional effects can arise both from intentional policy choices and as unintended consequences. Some effects are inherent in the design of RPP programs; for example, prioritizing residents over visitors or privileging long-standing residents over occupants of newer developments are deliberate choices that favor some groups over others (Moylan et al., 2014; Taylor, 2020). This section focuses on less visible distributional effects, particularly those associated with how access to curb space is priced. Below-market permit fees create implicit subsidies that may disproportionately benefit favored groups, while market pricing can reduce these subsidies, shift more of the costs of curb access to users, and allow public resources to be redirected toward services and improvements that benefit the larger community.

### *Below-Market Permit Pricing*

When residential permits provide access to curb parking at a price far below the value of comparable off-street parking in the area, they act as a targeted implicit subsidy. For example, in Barcelona, researchers estimated that each residential parking permit represents an annual subsidy of about €1,316, since storing a car in a private parking garage cost about €1,368 per year, while the city's annual permit fee was only €52 (Albalate & Gragera, 2020). Because garage and curb parking differ in attributes such as convenience and security, these estimates are approximate measures of the implicit subsidy.

In Amsterdam, the implicit subsidy is even larger (Figure 14). At about €3,200 per parking space per year, the annual subsidy is equivalent to roughly half the annual cost of owning a car and about 18% of the gross annual income of the poorest households (de Groote et al., 2016). Higher-income households were far more likely to receive this benefit: households earning around €100,000 annually were about five times more likely to hold permits than those in the lowest income category. Much of this difference reflects differences in car ownership rates. Because higher-income households were more likely to own cars, they were also more likely to receive permits (de Groote et al., 2016). Similar patterns may occur in other RPP programs; for example, Okashita and Willson (2019) document a comparable pattern in the Beverly-Kingsley neighborhood of Los Angeles.

**Figure 14.** Subsidies Created by Below-Market Residential Permits




*Data sources: Albalate & Gragera, 2020; de Groote et al., 2016.*

Income-based disparities may arise even among car-owning residents. Because lower-income residents are more likely to live in crowded housing, household permit caps may disproportionately affect them. Eligibility rules can also exclude some residents entirely; RPP programs generally require proof of residence, limiting access to legal overnight parking for people who live in their vehicles (Giamarino et al., 2023).

Distributional concerns arise not only from who receives a permit, but also from where RPP programs are established. Evidence from Los Angeles suggests that RPP programs may be disproportionately concentrated in higher-income and whiter neighborhoods. Most census tracts (74%) do not contain a permit district, and tracts with permits are not substantially denser than those without them. However, the median household income in tracts with at least one permit district is more than $15,000 higher than in tracts without permits, and tracts with permit districts are, on average, 45% white, compared with 14% in tracts without permit districts (Manville & Pinski, 2021). These disparities may partly reflect the collective action required to establish an RPP district.

The benefits of RPP programs are concentrated among permit holders, but program costs may be spread across the broader tax base when permit revenues do not cover administrative and enforcement expenses.

Evidence from Berkeley, California shows that the city's annual permit fees ($45 in 2013) were insufficient to cover administrative and enforcement expenses (Moylan et al., 2014). Similarly, in Los Angeles, where a residential permit costs approximately $34 per year, permit revenues cover only about half of administrative costs (Manville & Pinski, 2021). Other cities such as Bellevue, Washington, charge no fee for residential parking permits, leaving programs entirely dependent on the city's general fund (Roth, 2016).

Overall, the evidence suggests that RPP programs often have income-based distributional effects, with higher-income households tending to benefit more than lower-income households. These effects are most pronounced when permits are priced below market value and do not fully cover program costs. As noted above, unrestricted curb parking also tends to favor high-income households, so RPP programs will not necessarily worsen these inequities but may cement them in place.

#### *Market-Based Permit Pricing*

Many distributional concerns stem not from permit systems themselves but from pricing permits far below the value of the curb space they provide access to. Demand-responsive permit pricing may address many of the distributional concerns typically associated with RPP programs. By aligning permit fees more closely with the value of curb space, cities can reduce implicit subsidies for car ownership and reliance on general fund revenues to cover program costs. Although the primary purpose of demand-based pricing is to address curb congestion, pricing reforms may also generate surplus revenue. For example, in Stockholm, a recent permit pricing reform generated revenues nearly four times greater than annual enforcement costs (Eliasson & Börjesson, 2022).

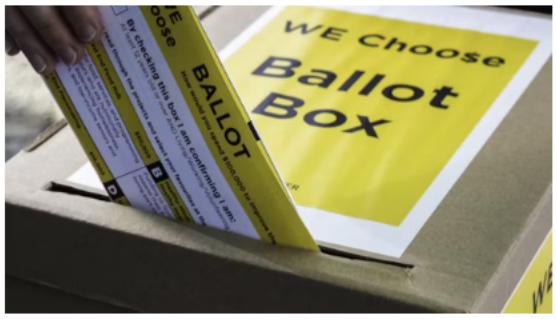
However, market-rate pricing can impose a disproportionate burden on lower-income households that purchase permits because the fee represents a larger share of their income. In a simulation of market-based residential permit pricing in Los Angeles, Okashita and Willson (2019) found that total transportation expenditures increased by 10.47% for permit-purchasing households earning $0–$15,000 annually, compared with 2.66% for those earning $100,000–$150,000. When considering all households in each income group, however, the modeled effect was not regressive, because lower-income households are less likely to own cars: collectively, their transportation expenditures increased by 1.18%, compared with 1.30% for the highest-income group. The authors suggest offering targeted subsidies for low-income households that do purchase permits.

The distributional effects of market-based permit pricing also depend on how cities use the resulting revenue. Demand-responsive pricing can become more progressive overall when program revenues benefit both drivers and non-drivers. Donald Shoup proposed the concept of parking benefit districts — reinvesting revenue in the neighborhoods where it is collected through local improvements or public services (Shoup, 2011). Although parking benefit districts have most commonly been created in commercial areas, several cities have adopted similar approaches in residential neighborhoods. For example, in Portland, parking permit revenue helps fund the Transportation Wallet program, which provides residents with transit, bike-share, and car-share benefits (Brudner, 2023). In Vancouver's West End, parking revenues supported a participatory budgeting process through which community members chose to use the revenue for local sidewalk improvements, a memorial gift for student music and sports equipment, and a calisthenics park (City of Vancouver, 2022; Figure 15). Because the participatory budgeting process requires significant staff time, the city found it more efficient to let West End Parking Reserve funds accumulate rather than administering the process annually (Parking Reform Network, 2026).

**Figure 15.** Parking-Funded Participatory Budgeting in Vancouver's West End

## Participatory budgeting in Vancouver's West End

In late 2017, City staff proposed the first ever participatory budgeting (PB) process in the West End to distribute additional revenue collected through permit parking fees. A total of $100,000 of this parking revenue was approved by Council for the purpose of this pilot project.




In fall of 2018, staff helped convene the WE Choo$e Impact Team, a community-led steering committee, to guide and oversee the process. The Impact Team then led the community idea collection and project proposal development.

## Community Vote Results Announced

14 Feb 2020



On February 8, the WE Choo$e Impact Team shared the results of the community vote at a community celebration in Gordon Neighbourhood House. More than 8,500 individuals who live, work, or volunteer in the West End voted between January 25 and February 4 on their preferred projects from a shortlist of 14. The projects with the highest number of votes and top ranks, that fit within the $100,000 budget, will be put forward for implementation over the next 18 months.

The three recommended projects are:

1. West End Calisthenics Park - $50,000
2. Sidewalk Improvements - $30,000
3. Christine Fretwell and Kathryn Gibbons Memorial Gift to West End Students - $20,000 in grants (note: this grant will require a final City Council approval).
   Honorable Mention: The West End Food Hub - $50,000. While this project received the third highest amount of votes, it did not fit within the $100,000 budget allocated for this project. This selection process was predetermined by the Impact Team as a part of the voting process.

*Source: Screenshots from West End participatory budgeting pilot, by City of Vancouver (n.d.), Shape Your City Vancouver (https://www.shapeyourcity.ca/participatory-budgeting).*

## Economic Efficiency and Welfare

Researchers have also examined the economic efficiency of RPP programs. While permit programs can improve parking availability for residents, several studies suggest they may reduce overall welfare, particularly when permits are priced far below or above market value. Underpriced permits can encourage residents to make greater use of curb parking while limiting access for visitors, whereas overly restrictive or expensive permit systems can discourage use by both residents and visitors, leaving curb space underutilized. In either case, reduced visitor access may lower economic activity in mixed-use districts and contribute to broader welfare losses.

### *Welfare Losses from Misallocation*

When access to curb parking is restricted through residential permit systems and waiting lists, parking spaces are not necessarily allocated to those who value them most highly. Although permit holders may benefit from preferential access, drivers who are excluded may lose more than permit holders gain, reducing overall social welfare.

Van Ommeren et al. (2014) examine residential permit parking in Dutch shopping districts and find that permit programs can reduce welfare by restricting non-resident access to curb space. In these areas, residents' willingness to pay for permits (€9–€10 per day) is substantially lower than visitors' willingness to pay for parking (at least €5 per hour), implying that curb space is often allocated to lower-valued uses. Approximately half of permit-holding households in western Amsterdam use their cars no more than once per week, and roughly 70–80% of on-street parking spaces in shopping districts are used by residents. As a result, visitors are crowded out and shifted toward more expensive off-street garage parking. The authors estimate that this misallocation generates an annual welfare loss of about €275 per permit, with 80–90% of the loss reflecting reduced visitor consumer surplus.

De Groote et al. (2016) focus instead on how residential parking subsidies affect car ownership decisions in Amsterdam's city center, finding that low-cost permits lead some households to buy and keep cars they otherwise would not own if they had to pay market rates. The authors estimated annual deadweight loss of about €270 per permit, or roughly €3.5 million per year in the city center.

The Amsterdam studies show how residential parking permits priced below market rates can reduce welfare by increasing residents' car ownership and shifting visitors to more expensive garage parking.

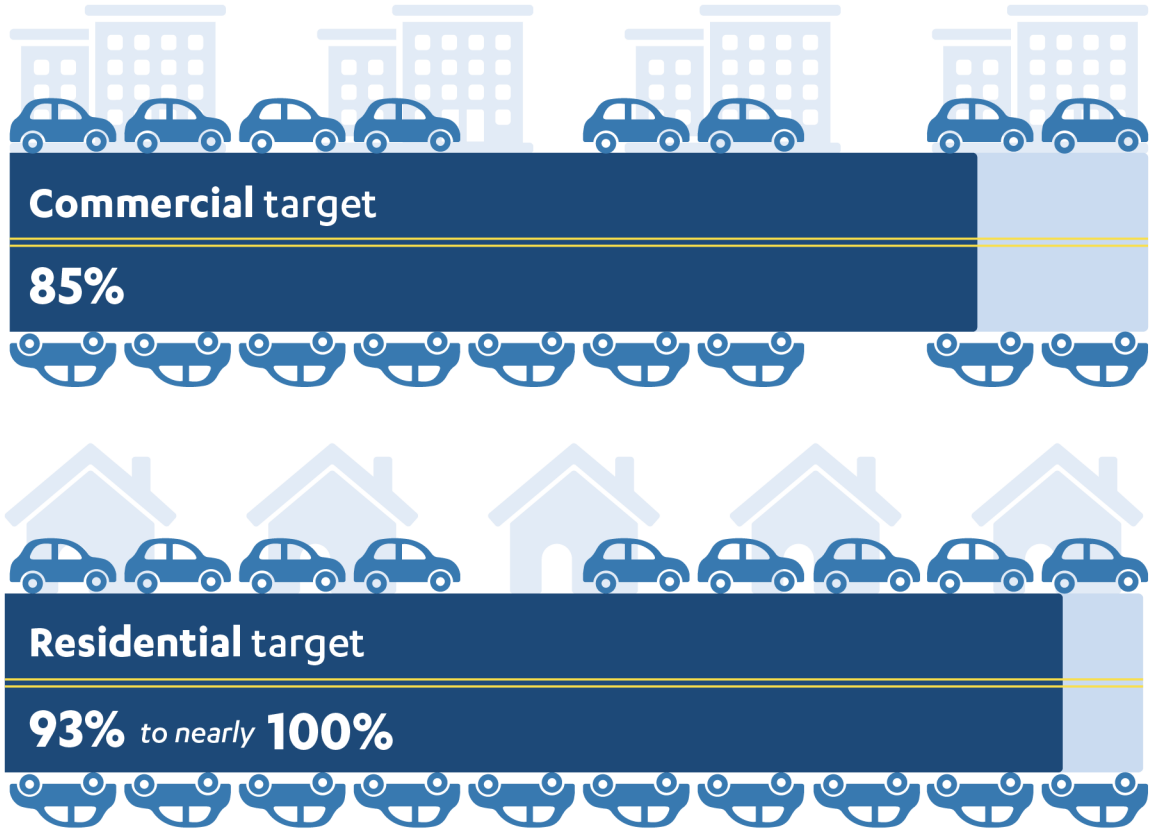
### *Welfare Losses from Underuse*

Overly restrictive or expensive RPP programs can also reduce welfare by leaving curb space underused. For example, research from Stockholm found that introducing pricing (€30–€50/month) in low-occupancy residential suburbs had a net negative impact on welfare (Eliasson & Börjesson, 2022). Parking use fell and more blocks had unused capacity, with the share of heavily occupied (>85%) blocks dropping from 61% to 31% in multifamily areas. The authors estimate a welfare loss of about €5 million per year, as the benefits of reduced search time were outweighed by lower use and added enforcement costs.

While such overpricing is likely uncommon, overly restrictive RPP designs that prevent visitor use of otherwise available curb space may result in similar welfare losses.

Research also suggests that RPP districts using occupancy targets to guide pricing or permit caps may benefit from setting targets that reflect the unique characteristics of residential parking. While an 85% occupancy rate is commonly viewed as the benchmark for efficient parking management in commercial districts, residential streets may operate efficiently at higher occupancies. Researchers often recommend targets as high as 93% to nearly 100% because overnight parking has limited turnover, demand is distributed across many residences rather than concentrated at a single destination, and the benefits of accommodating additional resident parking may outweigh the additional search costs created by higher occupancy levels (Martens et al., 2010; de Vos & van Ommeren, 2018; Eliasson & Börjesson, 2022; Figure 16).

**Figure 16.** Recommended Curb Occupancy Targets




*Data sources: Martens et al., 2010; de Vos & van Ommeren, 2018; Eliasson & Börjesson, 2022.*

### *Effects on Commercial Activity*

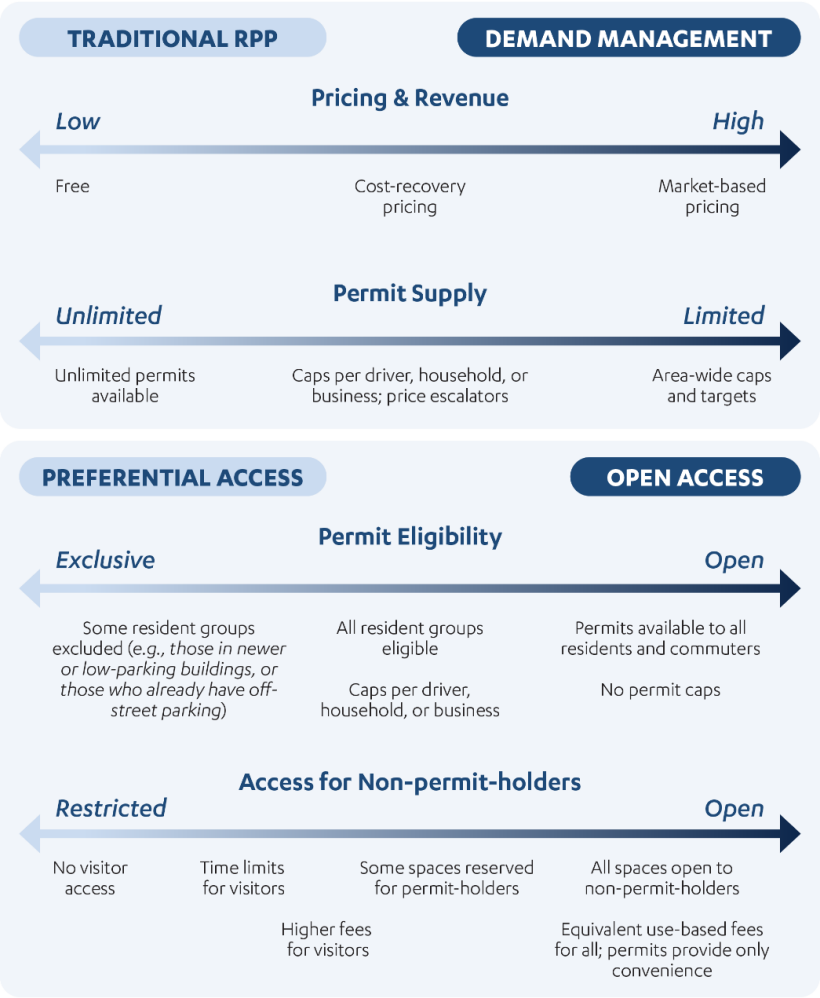
Overly restrictive RPP programs may also affect welfare by reducing local economic activity, meaning that even permit holders can be affected. Molenda and Sieg (2013) develop a model showing how privileging resident parking in mixed-use districts can reduce visitor traffic to commercial areas, as some potential visitors are deterred by reduced parking availability or higher costs. Reducing visitor traffic can reduce the variety of goods and services offered by local businesses, lowering overall economic vitality and welfare for both residents and non-residents.

## Key Dimensions of RPP Program Design

Overall, RPP programs are neither inherently effective at addressing parking scarcity nor inherently a subsidy to permit holders; their outcomes and implications depend on program design. The research literature and RPP program evaluations shed light on the potential costs and benefits associated with different design options. These findings can help cities tailor RPP programs to reflect local priorities and balance multiple goals, including improving parking availability, managing curb space efficiently, supporting resident and visitor access, advancing climate and transportation goals, reducing barriers to new housing development, and addressing equity concerns.

Cities can adjust several policy levers to influence who has access to curb space, how intensively it is used, and who bears the costs and receives the benefits (Figure 17).

**Figure 17.** Key Dimensions of RPP Program Design



# Political Economy of Residential Curb Management

Overall, the literature suggests that residential curb management policies are shaped more by local political pressures than by technical or revenue considerations. These political dynamics influence both whether cities price curb parking and who receives access to it. Parking management policies arising from political pressure are more likely to limit access to public curb space and less likely to adopt efficient pricing strategies. Unpriced curbs may benefit some drivers, and low-cost RPP programs may benefit permit holders, but often at the expense of broader transportation, economic, and equity goals.

## Political Constraints on Pricing

One manifestation of these political dynamics is the limited use of demand-based pricing. In principle, pricing could better align curb management with multiple urban policy goals by allocating curb space more efficiently across users and time and generating revenue for public services. However, demand-based pricing remains uncommon in residential areas and RPP programs. Researchers attribute this both to implementation challenges and institutional inertia (Button, 2006; Barter, 2010) and to political incentives: when local residents oppose pricing, elected officials may hesitate to implement changes even when they could allocate space more efficiently.

In commercial areas, some businesses may see pricing as a way to encourage turnover and improve parking access for their customers. In residential neighborhoods, however, pricing may be particularly challenging because residents may feel a sense of ownership over the curb space in front of their homes.

Manville (2018) highlights the political challenges associated with introducing pricing in previously unpriced residential and mixed-use areas. In 2011, San Francisco attempted to expand its pricing program into four new neighborhoods. The neighborhoods experienced measurable parking scarcity: only 26% of vehicles parked on the street were registered in the neighborhoods' zip codes, and some drivers circled for up to 30 minutes to find spaces. Despite the proposal's potential to improve parking conditions for residents, it generated strong local opposition. Residents had purchased homes with the expectation that street parking would remain free, and "removing the free parking may have looked not like an improvement, or even the end of a subsidy, but instead like a punishment" (Manville, 2018, p. 116). Political pressure from residents eventually led officials to cancel the expansion.

Comparing curb parking to other public utilities, Manville and Pinski (2021) argue that it is unusually susceptible to political decision-making in part because it lacks an institutional structure that requires user fees to recover the costs of providing service. Electric and water utilities, for example, have high fixed costs, including plants and distribution infrastructure, as well as ongoing marginal costs of delivery. Curb parking differs in both respects: the curb is a byproduct of street construction rather than a stand-alone service, and once a street is built, accommodating one more parked car requires little or no additional expenditure by the city. Although cities must fund a wide range of services, they can do so through multiple channels, so parking is only one of many

possible revenue sources. As a result, people are more likely to view pricing as unnecessary, leaving decisions more exposed to political pressures.

## Why Residents Receive Preferential Access

The political pressures that limit the use of pricing in residential neighborhoods also help explain why RPP programs typically give residents preferential access to curb space. Even when programs use pricing to manage demand, residents often pay lower prices than other users, and, in some cases, some or all curb space is reserved for their exclusive use. As noted in the literature, this preferential treatment can reduce overall welfare, benefiting one group of residents at the expense of others who may value curb access more highly. Although permits could, in theory, improve parking convenience for residents without granting them preferential access, preferential treatment is a defining feature of most RPP programs.

Residents are often able to organize and mobilize political support for preferential parking policies because the benefits of RPP programs are geographically concentrated, while the costs are dispersed across visitors, businesses, future residents, and the broader public, making them less visible and harder to organize around (Shoup, 2004). Furthermore, because residents vote in local elections, elected officials face strong incentives to prioritize resident access to curb space even when doing so reduces overall welfare or efficiency (van Ommeren et al., 2014). For the same reason, some RPP programs privilege current residents over future residents, for example through eligibility rules that exclude residents of new apartment buildings or car-free housing from obtaining permits.

## Support for Curb Reform

Political considerations will continue to shape residential curb management, but political challenges are not universal and may vary across neighborhoods. Support for curb pricing may be higher when residents can see clear benefits from the changes or when they have access to a range of transportation options.

### Parking Benefit Districts

As the San Francisco example above demonstrates, the prospect of improving parking availability alone may not be enough to build support for adopting curb pricing in residential neighborhoods. One way to increase political support may be through parking benefit districts, which, as discussed earlier, dedicate parking revenue to local neighborhood improvements or public services, such as sidewalk improvements, street trees, parks, or transportation programs. This approach may be most feasible in neighborhoods where relatively few residents rely on curb parking — for example, in areas where most car owners have access to off-street parking, or where some households rely on transit, walking, bicycling, or car sharing for everyday travel. In these settings, fewer residents would be directly affected by pricing, while many residents could benefit from local improvements and services funded by parking revenue (Shoup, 2018).

Shoup (2018) proposed piloting parking benefit districts on only one side of each block as a way to reduce political barriers. Although this approach would generate less revenue than pricing both sides of the street, it would allow residents to compare two alternatives: free parking that is difficult to find and paid parking that is readily available and funds neighborhood improvements.

Parking revenue can also fund transportation initiatives that help address the underlying demand for curb parking (Pressl et al., 2017). Zellman et al. (2026) examine eight "Mobility Benefit District" case studies across European cities. For example, in Poland, a 2019 national law required cities with more than 100,000 inhabitants to direct at least 69% of on-street parking fee revenue and all parking fines toward active transportation, green space, and public transportation investments. In 2022, Kraków allocated approximately €9 million in parking revenue toward public transportation. When Kraków expanded its paid parking area, 300 residents signed a petition in support of the measure (Zellman et al., 2026).

Similarly, Portland's Northwest Parking District has used a large portion of meter and residential permit revenue to help fund walking, biking, and transit improvements in the area, a shared parking program, and transportation wallets (Portland Bureau of Transportation, 2023; Figure 18). In Boulder, Colorado, parking revenue funds a Neighborhood EcoPass Program, which provides residents of participating neighborhoods with annual passes for unlimited travel on regional buses and rail services (City of Boulder, 2026). By improving bicycle and pedestrian infrastructure and expanding access to transit and other shared mobility options, these revenue reinvestments can decrease reliance on curb parking over time, potentially reducing opposition to further curb reforms and broadening the constituency that supports them. Pricing itself may play an even larger role in reducing opposition to curb reform over time, by discouraging car ownership and shrinking the constituency that perceives benefits from free or low-cost parking.

**Figure 18.** Revenue Reinvestment in Portland's Northwest Parking District




*Source: Portland Bureau of Transportation, 2023.*

## Access to Diverse Transportation Options

Evidence from Germany's dense Frankfurt-Bornheim neighborhood suggests that support for curb management reforms may be higher when people have access to a range of transportation options and are less dependent on private vehicles and curb parking. In this neighborhood, two-thirds of residents regularly used transit, 70% owned a bicycle, 90% regularly walked, and 20% had a car-share membership. Although 60% of respondents owned a private car, 40% of those car owners rented an off-street parking space rather than relying on curb parking. Support for pricing curb parking was higher among car-free residents and those planning to reduce car ownership. The majority of surveyed residents also supported repurposing curb spaces for wider sidewalks, greenery, seating, playgrounds, bicycle facilities, and car-share parking. Support for these curb reforms was higher among car-free residents, car-share members, and regular bicycle users (Kirschner & Lanzendorf, 2020).

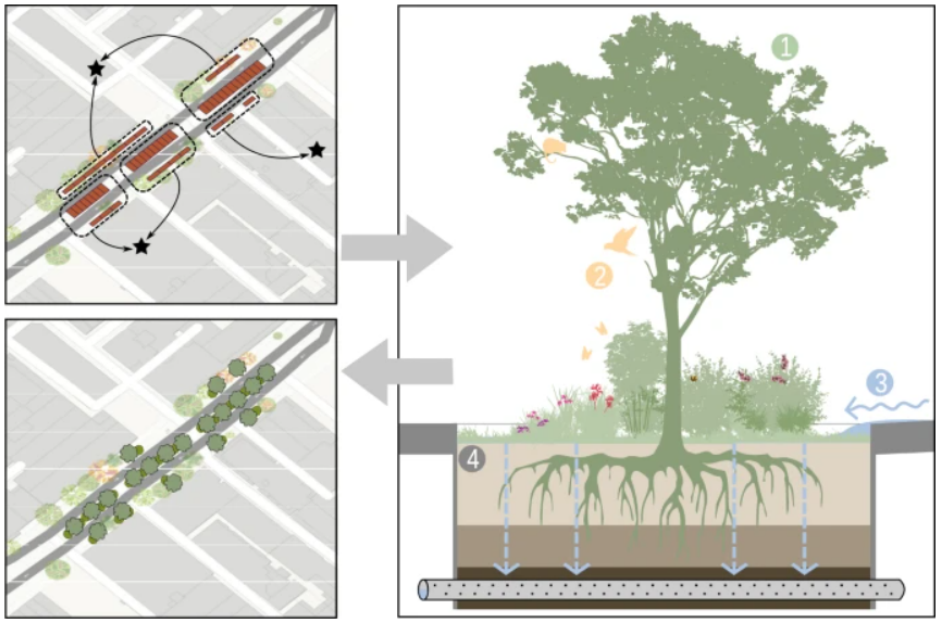
A survey of London residents provides similar evidence suggesting that residents' transportation circumstances can shape their curb parking preferences. Most surveyed residents did not own a car or parked off-street, and they prioritized other uses of the curb lane — including trees, green space, and sidewalks free of clutter — over curb parking (Centre for London, 2020, as cited in Shoup, 2024).

# Opportunity Costs of Providing Curb Parking

The previous sections have primarily focused on residential curb parking management. However, some research addresses a more fundamental question: whether curb space should be dedicated to parking at all. Guo and Schloeter (2013) argue that minimum residential street width requirements effectively function as parking mandates by requiring streets to be wide enough to accommodate parking lanes, and they call for cities to allow narrower streets. For existing streets, residential curb space could instead support green space, bike parking, community gardens, expanded frontages, or other public benefits.

One study in Melbourne, Australia examined the potential to repurpose curb parking for nature-based solutions to reduce urban heat, flood risks, and biodiversity loss (Figure 19). The authors estimated that converting unnecessary street parking spaces into green space would increase the tree canopy cover by 31–59 hectares, even when tree species were selected to prioritize habitat outcomes rather than canopy expansion alone (Croeser et al., 2022).

**Figure 19.** Converting Redundant On-Street Parking into Biodiverse Green Space




*Note. The schematic illustrates how unnecessary street parking spaces can be identified and converted into biodiverse green infrastructure that provides multiple benefits, including (1) street trees, (2) habitat resources such as understory vegetation, (3) stormwater infiltration through rain gardens, and (4) removal of impervious pavement.*
*Source: Adapted from Croeser et al. (2022), licensed under CC BY 4.0.*

In residential neighborhoods with low parking demand, cities may dedicate valuable land and maintenance resources to curb lanes that are rarely used. For example, Thigpen and Volker (2017) found that in Davis,

California, on average, only two out of every seven on-street residential spaces were occupied during peak hours, and approximately 23% of total roadway space consisted of unnecessary pavement. Reducing excess pavement could allow cities with limited maintenance budgets to improve the condition of their remaining roadways, which often require substantial investment. In Davis, achieving a “good” average Pavement Condition Index would have required annual spending roughly four times greater than the city’s maintenance budget at the time of the study. The authors suggested that some curb space could be repurposed for bioswales, gardens, trees, or property line extensions (through sale or lease to adjacent properties) that could allow homeowners to expand landscaping or build accessory dwelling units, potentially generating additional property tax revenue for the city.

Street space is valuable real estate, and curb parking typically comprises 30–50% of street pavement (Guo & Schloeter, 2013). Guerra et al. (2025) estimate that nearly 25% of urbanized land in 316 U.S. metropolitan areas is devoted to roadways, with a total land value of approximately $4.1 trillion. Focusing specifically on residential streets, Millard-Ball (2021) estimates that the land devoted to residential streets in 20 large U.S. counties is worth $959 billion. Much of this valuable land is dedicated to curb parking. Without active curb management, cities often lack a mechanism for accounting for the value of this asset or weighing the benefits of curb parking against other potential uses of public space.

# Conclusion: Key Findings and Policy Lessons

As more U.S. cities eliminate parking minimums, encourage infill development, and continue to accommodate population growth, there is a growing need to understand the implications of residential parking policy decisions. The literature supports this effort by revealing recurring issues in common approaches to residential parking management, highlighting the policy choices cities face, and offering insight into how curb management strategies can support broader urban and transportation policy goals.

Cities with curb parking can allocate access through first-come, first-served parking, a permit system, pricing, or some combination of these approaches.

Across approaches to residential parking, three challenges appear repeatedly in the literature:

1. Overcrowded curbs and parking congestion
2. Underused parking and inefficient use of space
3. Unequal access and subsidization

When scarce residential curb access is given away for free on a first-come, first-served basis, curbs may become overcrowded. Cities often adopt RPP programs in response to residents' concerns about overcrowding; however, programs that over-issue permits may also fail to reduce parking congestion. On the other hand, overly restrictive programs may leave valuable curb space underused.

RPP program eligibility rules can also result in unequal access. When cities offer permits only to residents, place caps on the number of permits available per household, or deny permits to residents of certain buildings, some drivers who would benefit from curb parking may be unable to access it.

Often, permit fees do not reflect the market value of a parking space or even cover the program's administrative and enforcement costs. Researchers have characterized underpriced permits as implicit subsidies for car ownership and raised concerns about whether subsidized parking is the best use of a resource that could otherwise be repurposed or generate revenue to support other community goals.

The literature suggests that combining permit systems with demand-based pricing offers one promising approach to addressing the recurring challenges identified in this synthesis. Cities can increase prices where curbs are crowded and lower prices if many spaces remain empty. Permit systems provide more convenient access for residents or others who park regularly, while metered visitor parking helps manage demand among more occasional users. Income-based discounts can address affordability concerns while preserving the benefits of pricing as a tool for allocating scarce curb space. In addition, pricing generates revenue, which cities can reinvest in transportation improvements and other community priorities.

In *The High Cost of Free Parking*, Donald Shoup (2011) recommended cities (1) eliminate minimum parking requirements, (2) adopt demand-based pricing, and (3) reinvest parking revenue locally through parking benefit districts. Although these recommendations have most often been implemented in commercial districts, recent

examples from Portland's Northwest Parking District and Vancouver's West End illustrate how similar principles can be applied in residential and mixed-use areas to encourage the use of off-street parking, increase curb parking availability, and generate public revenue for initiatives such as traffic safety improvements, sidewalk repairs, or transportation wallets.

## Residential Curb Parking Trade-offs

Whether parking demand is low or high, the literature shows that residential curb parking decisions involve trade-offs. Continuing to dedicate public curb space to parking can improve transportation access and reduce the cost of car ownership, but it also discourages more sustainable travel choices and commits a scarce public resource to vehicle storage rather than alternative uses of public space, including nature-based solutions that address urban heat, stormwater runoff, and biodiversity loss.

Providing curb parking also involves trade-offs in how cities manage access (see Figure 20). Keeping curb parking free and open to all reduces the risk of spaces going unused and avoids administrative and enforcement costs, but it can also lead to overcrowding, cruising, and residential dissatisfaction. Restricting access through RPP programs with limits on visitor parking or strict permit eligibility rules can improve availability for permit holders, but such programs raise distributional and welfare concerns. Strategies that seek to manage demand without pricing may also increase the likelihood that programs require ongoing public subsidy for administration and enforcement.

In neighborhoods with high parking demand, performance pricing that applies to both residents and non-residents has the potential to address many of the most common residential parking issues, including overcrowding, underuse, and unequal access and subsidization. Adjusting prices based on observed demand can help maintain curb occupancy within a desired range, improving parking availability without systematically excluding particular user groups. Such pricing systems can cover management costs and generate additional revenue that can benefit the broader community, and they can also include features such as income-based discounts. However, performance pricing policies require ongoing monitoring, administrative capacity, and supporting technology, and pricing may face political resistance in contexts where curb parking has traditionally been provided at low or no cost.

**Figure 20.** Benefits and Trade-offs of Residential Curb Management Approaches

| APPROACH | EXAMPLE | BENEFITS | TRADE-OFFS |
|---|---|---|---|
| **NO INTERVENTION**<br>No active curb management |  | ✓ No administrative complexity<br>✓ Spaces less likely to go unused | ✗ Curb overcrowding<br>✗ Cruising and driver dissatisfaction<br>✗ Doesn't ensure curb parking is available to those who value it most<br>✗ Foregoes potential revenue |
| **ALLOCATE BY ELIGIBILITY**<br>Residential parking permit (RPP) program |  | ✓ May be simple to administer<br>✓ Often politically popular<br>✓ Reduces overcrowding when most demand is from non-residents | ✗ Excludes some users<br>✗ Doesn't ensure curb parking is available to those who value it most<br>✗ May fail to improve availability<br>✗ May result in underuse<br>✗ Foregoes potential revenue |
| **ALLOCATE BY PRICE**<br>Demand-based pricing via meters and/or permits available to anyone |  | ✓ Most likely to maintain parking availability<br>✓ Allocates parking to those who value it most<br>✓ Supports efficient land use<br>✓ Generates revenue for neighborhood improvements or transportation programs | ✗ Requires administrative capacity, technology, data, and enforcement resources<br>✗ May raise affordability concerns without equity measures<br>✗ Politically challenging |

*Photo credits: Ellen Schwartz (top two photos); SFMTA (bottom photo).*

## Remaining Questions and Future Research

The literature provides insight into how residential parking policies shape curb congestion, efficiency, and distributional outcomes, but several important questions remain unresolved. In particular, little is known about how curb management approaches — including policies that exclude new developments from permit eligibility — may influence developer decisions about where to locate new residential projects and how much off-street parking to provide. Similarly, research does not examine how different parking management policies may affect political support for eliminating minimum parking requirements or how parking requirement reforms influence the need for curb management. Better understanding these relationships would help cities design curb management policies that complement efforts to support new housing while limiting traffic congestion and emissions.

The literature also provides mixed evidence on relationships between curb parking conditions, travel behavior, and car ownership, without clearly identifying which policies most consistently support sustainable travel

outcomes. Free residential curb parking is often associated with higher car ownership and vehicle use, but in some contexts, it can also produce curb congestion that discourages driving.

Finally, although existing studies document a range of implementation challenges, less is known about the governance conditions that shape the feasibility and durability of residential parking reforms. Questions remain regarding how public acceptance evolves over time, how design choices such as parking benefit districts affect support in practice, and how factors such as administrative capacity, technology, and enforcement influence how well programs work and how residents perceive them.

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