VICTORIA Transport Policy INSTITUTE
EFFICIENCY • EQUITY • CLARITY

www.vtpi.org
Info@vtpi.org
250-508-5150

Parking Requirement Impacts on Housing Affordability

The Costs of Residential Parking Mandates and Benefits of Reforms

17 June 2025

Todd Litman
Victoria Transport Policy Institute

Residential parking regulations define the number of parking spaces that must be provided for each home. They force many households to pay for costly parking facilities they don't need, and increase housing costs, vehicle ownership and sprawl. Many communities are reforming these policies to be more efficient and equitable.

Abstract

Most jurisdictions require a certain number of off-street parking spaces at most homes. This study investigates the benefits and costs of these requirements, and identifies ways to make them more efficient and equitable. Parking minimums increase parking supply beyond what property owners would voluntarily provide, in order to improve motorists' convenience and reduce spillover problems. They force many households to pay for expensive parking facilities they don't need, and increase total housing costs. They also increase vehicle travel and sprawl, which exacerbate traffic and environmental problems. There are other ways to satisfy parking demands. Eliminating parking minimums does not eliminate parking supply; it simply allows developers to provide parking based on market demands. It leads to unbundling (parking rented separately from building space) so households only pay for the number of spaces they need, and encourages more efficient management so fewer spaces are needed to serve parking demands. Many jurisdictions are reforming parking policies for equity and efficiency sake. These reforms can typically reduce the costs of basic, lower-priced housing by 10-20%, and provide additional savings and benefits by increasing affordable housing in high-opportunity multimodal neighborhoods. This report includes recommendations for implementing such reforms.

Most jurisdictions require one or two parking spaces per apartment, which is more than what occupants demand, particularly for lower-priced housing in compact, multimodal neighborhoods. As a result, many required parking spaces are seldom or never used.

Contents

Note: unless indicated otherwise the economic analysis in this report reflects U.S. dollars.

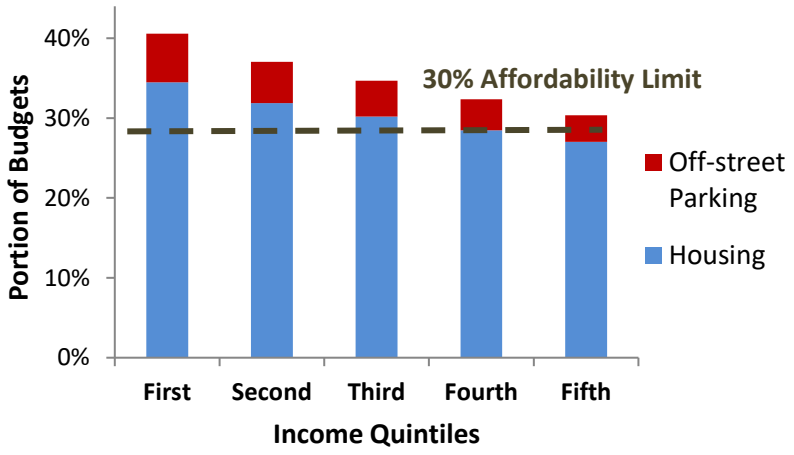
Introduction

Transportation engineers often say that buildings "generate" parking demands, but of course that is incorrect; parking demands are actually generated by vehicles, and the number of vehicles owned by building occupants can vary significantly. For example, a two-bedroom apartment could be occupied at various times by households that own zero, one, two or three vehicles. To ensure sufficient parking to serve their needs, zoning codes often require two parking spaces for a two-bedroom apartment although that will sometimes be too many and sometimes too few for occupants' actual demands. These requirements (also called *mandates, minimums* or *ratios*) are inefficient and unfair: they increase housing costs, vehicle ownership and sprawl, and force many households to pay for costly parking spaces they don't need.

Many people want better parking policies. Eliminating mandates does not eliminate parking; it simply allows property owners to decide how many spaces to provide based on market demands. This tends to result in unbundling (parking rented separately from housing), and more efficient management, so fewer spaces are needed to satisfy motorists' needs. Without minimums motorists can still find parking but may need to walk farther and pay directly for parking instead of these costs being bundled into rents and mortgages.

This is a timely issue. Most low- and moderate-income families spend more on housing than is considered affordable; parking mandates are a major cause of this, as illustrated below.

Figure 1 **Average Transport and Housing Costs (BLS 2011-2020)**



Most lower-income households spend more than 30% of their budgets on housing, which is considered unaffordable. Residential parking mandates impose a large but often overlooked portion of housing costs, particularly for lower-priced housing on high-priced land. Parking policy reforms can increase affordability and fairness.

This report investigates these issues. It describes typical residential parking requirements, estimates the costs of various types of parking facilities, and their impacts on housing costs, vehicle travel and development patterns. It discusses optimal parking supply and factors that affect parking demands. It describes examples of residential parking policy reforms. This research should be of interest to policy makers, planning practitioners, developers, affordability advocates and anybody who wants more affordable, fair and efficient communities.

The New Parking Paradigm

Parking planning is undergoing a paradigm shift, a fundamental change in how parking problems are perceived and potential solutions evaluated (Belmore 2019; Litman 2021; Pressl and Rye 2020). The old paradigm assumed that the goal was to maximize motorists' convenience by making parking as abundant and cheap as possible, with little regard to cost or other goals. The new paradigm strives to *optimize* parking supply and manage it for efficiency, so fewer spaces are needed to serve motorists' needs. It considers too much parking to be as harmful as too little, and underpricing as harmful as overpricing. The table below compares the old and new.

Table 1 **Old and New Parking Paradigms Compared**

	Old Paradigm	New Paradigm
Definition of transportation	*Transportation* means driving.	Not everybody uses automobiles. Transportation systems are multimodal.
Problem definition	*Parking problem* means inadequate parking supply.	There can be many problem types including inadequate or excessive supply, too high or low prices, and inefficient management.
Goal	Maximize parking supply.	Too much supply is as harmful as too little.
Proximity of parking	Parking demand should be satisfied on-site, with minimal walking distances.	Parking can often be provided off-site, allowing parking facilities to serve multiple destinations.
Parking pricing	Parking should be unpriced or as cheap as possible, funded indirectly.	Users should pay directly for parking facilities, with efficient prices that reflect marginal costs.
Prioritization	Parking should be available on a first-come basis.	Parking should be prioritized to favor higher value users.
Scope of analysis	Analysis should focus on motorists' convenience.	Analysis should consider all impacts, including strategic goals.
Role of parking management	A last resort, to be applied only if facility expansion is infeasible.	Parking management strategies should be implemented whenever cost effective and fair.
Role of innovation	Innovation faces a high burden of proof.	Innovation should be encouraged since even unsuccessful experiments provide useful information.

Parking management changes the way parking problems are defined and solutions evaluated.

The new paradigm expands the range of solutions that can be applied to solving parking problems. For example, if parking is congested in an area, the old paradigm assumed that the solution is for developers and local governments to increase supply. The new paradigm also considers various management strategies, such as more sharing, improvements to non-auto modes, and efficient pricing, which are often quicker to implement, more cost effective, and more consistent with other community goals.

The old paradigm may be appropriate in affluent suburban areas where most travel is by automobile, land is cheap, and properties are dispersed. However, this is inefficient and unfair in communities with multimodal travel, high land prices, and compact development where motorists can use off-site parking facilities, as well as in communities that place a high value on affordability and environmental protection.

Typical Residential Parking Requirements

Table 1 summarizes typical residential off-street parking minimums. Some also require bicycle parking and electric vehicle charging stations.

Table 2 **Typical Residential Minimum Parking Requirements** (Nashville 2023)

Type of Housing	Minimum Off-street Parking Spaces Required
Single-family and duplex	2 per housing unit
Multifamily	1 per bedroom up to 2, and 0.5 for each additional bedroom
Studio or accessory unit	1 per unit
Elderly housing	0.5 per unit
Mobile home	2 per unit, plus 1 guest space for every 4 units
Boardinghouse	1 per unit, plus 1 additional space for owner or manager
Bed and breakfast	1 per guestroom, plus 2 spaces per dwelling unit

This table summarizes parking minimums for Nashville, Tennessee, a typical North American city.

These regulations assume that households own about one vehicle per bedroom, although many bedrooms are occupied by children or adult non-drivers, or are used as home offices or storerooms. The 2020 U.S. Census indicates that 87% of household have two or more bedrooms, so typical zoning codes require most homes to have at least two parking spaces, which is more than many households require, particularly lower-income urban households. Field surveys find that many neighborhoods have far mor parking spaces than needed (Amos 2025).

These minimums are based on recommendations published by professional organizations such as the *Institute of Transportation Engineers* and the *American Planning Association* (Davidson and Dolnick 2002). Such recommendations are designed to ensure that motorists can almost always find an unoccupied off-street parking space, which results in more spaces than needed at most locations and times. For example, they are usually calculated based on an 85th occupancy rate (a parking facility is considered full if 85% of spaces are occupied), an 85th percentile demand curve (85 out of 100 sites will have unoccupied parking spaces even during peak periods), and a 10th design hour (parking facilities are sized to fill only ten hours per year). As a result, most North American communities have three to six parking spaces per vehicle, and many parking spaces are seldom or never used (Litman 2022).

These requirements seldom include adjustments for demographic, geographic or economic factors that affect parking demands or the costs or providing parking facilities. Some jurisdictions reduce parking minimums in downtown and transit-oriented areas, and developers can sometimes obtain reductions for specific projects, but those adjustments are infrequent and face a high burden of proof (Dorsett 2023).

Off-street requirements are not really essential. Without mandates, most property owners still have off-street parking, but often less than mandates require, and those parking spaces tend to be manged more efficiently so fewer spaces serve motorists' needs. Commercial markets often develop for off-street parking, and local governments manage public parking more efficiently (Barter 2014; Taylor 2020). As a result, without parking minimums motorists can still find parking, but may need to walk farther and pay directly, rather than having parking costs automatically incorporated into their mortgages and rents.

Benefits and Costs

This section examines various impacts of parking requirements.

Benefits

Off-street parking mandates increase motorists' convenience by providing abundant parking supply on-site. This reduces spillover problems – conflicts over nearby public parking – and therefore enforcement burdens, and can reduce the traffic caused by motorists cruising for a free parking space. Bundled (unpriced) parking reduces transaction costs (the costs of collecting and enforcing parking fees). Some advocates claim that abundant off-street parking increases local property values and economic development, but that does not justify minimums that increase parking supply beyond what property owners would choose for maximum profitability.

Costs

1. Parking Facility Land, Construction and Operation Costs (Litman 2022)

A typical parking space is 8-10 feet (2.4-3.0 meters) wide and 18-20 feet (5.5-6.0 meter) long, totaling 144-200 square feet (13-19 sq. meters). Off-street parking also requires driveways (to access streets) and access lanes (to circulate within a lot), which typically totals 300-400 square feet (28-37 square meters) per space, allowing 100-150 spaces per acre (250-370 per hectare). Because parking must be located near destinations it tends to occupy relatively valuable land. Typical land costs range from $8,000 per space in suburban areas with one million dollar per acre land prices, up to $40,000 per space in urban areas with five million dollar per acre prices.

In the short-term, land devoted to parking may seem to have little cost, but over the long run it could be rented, sold or used for other purposes. In high-value urban areas, parking regulations often constrain the amount of development that can occur on a parcel.

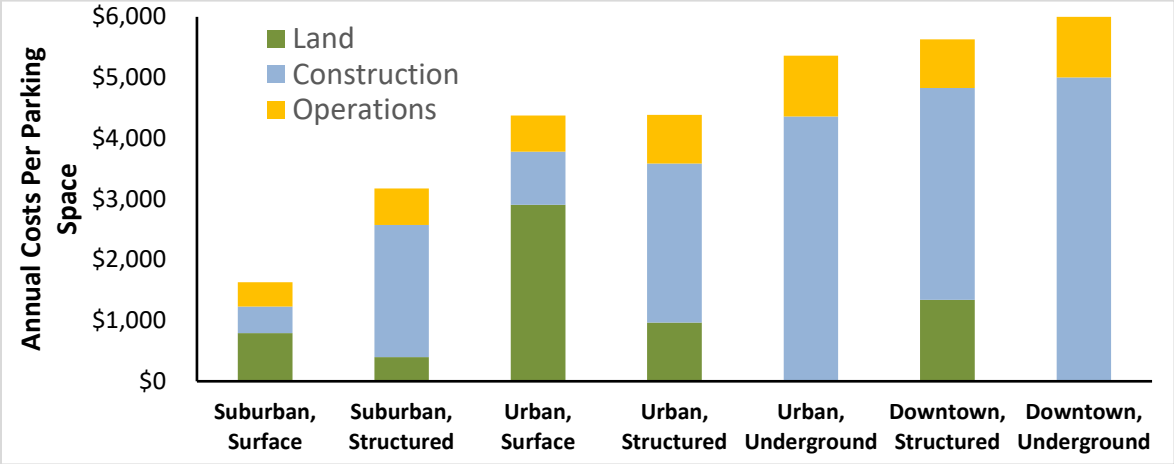
Driveway and parking lot construction usually require design, surveying, curb cuts, stormwater drainage and landscaping costs. Paving typically costs $3-5 per square foot for asphalt and $4-7 for concrete (Home Advisor 2023), and more for higher quality design or challenging conditions. This indicates that constructing a basic parking lot typically costs $3,000 to $6,000 per space, and sometimes more. Building a carport typically costs $3,000 to $5,000 per space, and building a garage typically costs $10,000 to $30,000 per space, and often more for higher quality design or challenging conditions (Abraham and Tynan 2023). Building multi-story structured and underground parking typically cost $20,000 to $80,000 per space (Smith 2020). Such facilities have 20-40 year operating lives after which they require major reconstruction or replacement.

Operation costs can include cleaning, maintenance and repairs, lighting, security, landscaping, snow removal, access control, fee collection (for priced parking), enforcement, insurance, labor and administration. Structured parking may require elevators, mechanical ventilation and fire suppression. Commercial parking facilities must pay taxes and provide profits. Typical annual operating costs per space range from $200 annually for surface lots up to $800 for high amenity structured parking.

Parking for small car and motorcycles costs slightly less than standard spaces. Because of their small size and light weight, bicycle parking costs an order of magnitude less than automobiles, but may need security and weather protection. Electric vehicle charging station installation costs thousands of dollars, but these costs may be repaid by users fees in the future.

Most people never purchase individual parking spaces, they are usually included in building costs and therefore mortgages and rents. The figure below illustrates typical annualized costs for various parking facility types. Considering land, construction and operating expenses, including for driveways, an off-street parking space typically costs from $1,500 annually for surface lots to more than $5,000 annually for structured or underground parking.

Figure 2 **Typical Annualized Parking Facility Costs (Parking Calculator)**

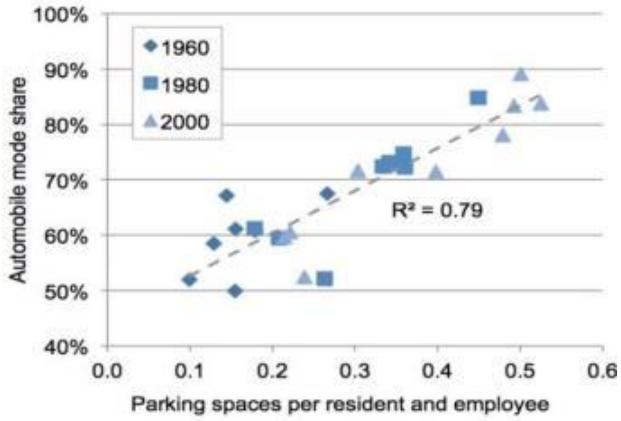


This figure illustrates typical annualized costs for various types of parking facilities.

2. Increased Automobile Ownership and Use

Residential parking requirements increase vehicle ownership and use. Compared with cost-recovery parking pricing (fees pay total parking facility costs), bundled parking typically increases parking demands 10-30% (Lehner and Peer 2019). Manville (2013) found that a 10% increase in minimum parking requirements is associated with a 5% increase in vehicles per square mile. Statistically sophisticated analysis by Millard-Ball, et al (2022) found that buildings with at least one on-site space per unit have more than twice the car ownership rates of buildings without parking. The graph below shows how increasing parking supply tends in increase automobile travel. Lower-income urban households are particularly sensitive to pricing and so tend to reduce their vehicle ownership if parking is priced (Seya, Nakamichi and Yamagata 2016).

Figure 3 **Parking Versus Automobile Mode Shares (McCahill, et al. 2016)**

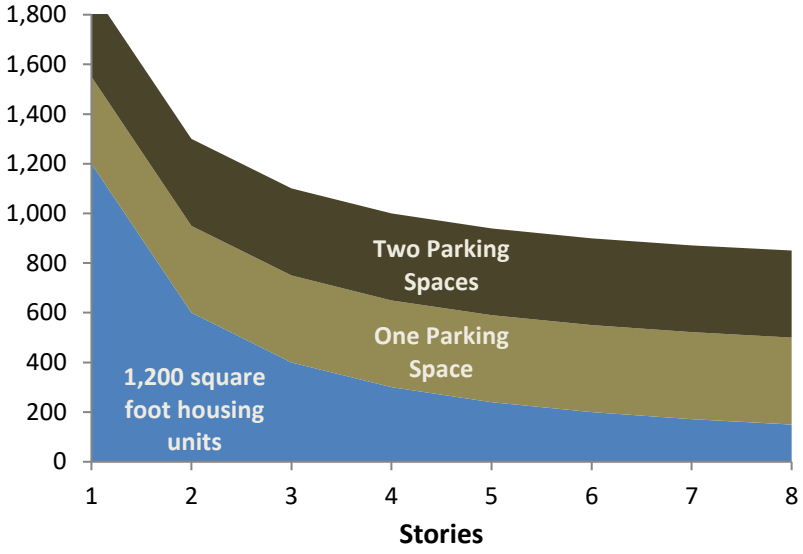


This graph shows the strong positive relationship between parking supply and automobile mode shares. It indicates that an increase from 0.1 to 0.5 spaces per resident or employee is associated with a 30 percentage point increase in automobile commute mode share. The study found that parking supply is one of the most important factors affecting automobile travel.

3. Increased Sprawl

Parking minimums increase the amount of land required per housing unit. For example, two surface parking spaces require more land (700 square feet) than a two-story 1,200 square home (600 square feet), and one surface parking space requires more land (350 square feet) than a four-story 1,200 square foot home (300 square feet). The figure below illustrates this.

Figure 4 **Housing and Surface Parking Land Consumption**



Surface parking requires large amounts of land. It often consumes more land than the housing it serves, particularly for multifamily housing.

This encourages sprawled development, which increases the costs of providing public services (roads, utilities, emergency response, stormwater management costs, etc.) and the distances that people must travel to access services and activities (Hurd 2014). This increases per capita vehicle travel and local traffic problems, and reduces non-auto travel options, which increases transportation costs, further reducing affordability.

4. Environmental Costs.

Parking lots often replace ecologically active lands with pavement which increases water pollution, flooding and heat island effects (higher local temperatures), and reduces wildlife habitat, community aesthetics and adjacent property values.

5. Driveway Costs Impacts

Offstreet parking requires driveways. A typical driveway curb cut displaces one on-street parking space, so a one-space driveway provides no net increase in parking supply and changes a public space that serves multiple destinations into a private space that only serves one property. For example, assume 50 houses on a street have 40-foot frontages that can accommodate two on-street spaces, but only one with a driveway. Without driveways they can park 100 cars, and during the day, and if half are driven to work, 50 spaces are available for visitors. With driveways there are 50 on-street (public) and 50 private off-street (private) spaces; when half of vehicles are at work only 25 public spaces are available so delivery and service vehicles have half the chance of finding a space near each house.

Driveways also degrade the pedestrian environment by causing vehicle traffic across sidewalks, and tends to be particularly harmful for people using wheelchairs, strollers and handcarts.

The table below indicates who benefits or is harmed by parking mandate.

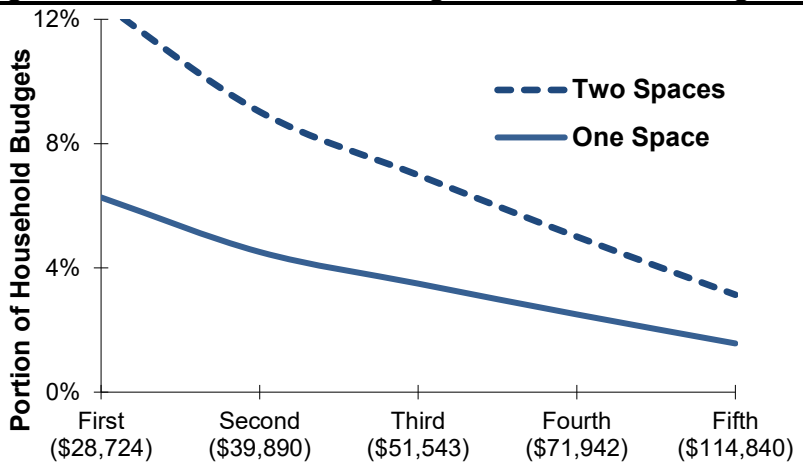
Table 3 **Distribution of Parking Mandate Impacts (Benefits and Costs)**

Impacts	Who is Impacted
Motorists' convenience	Motorists who value convenience and would pay extra for on-site parking.
Reduced spillover problems	Nearby motorists who want public parking, and city officials who want to avoid conflicts.
Parking facility costs	Households that own fewer than mandated vehicles overpay their costs, while those with more than average vehicles underpay and benefit from subsidies.
Increased vehicle traffic	More traffic congestion, crash risk and pollution imposed on communities.
Increased sprawl	Municipal governments, and therefore taxpayers, bear higher infrastructure costs. Transportation costs increase, particularly for non-drivers.
Environmental damages	Increased pavement, hydrologic disruptions, heat island effects, habitat loss and pollution emissions harm humans and the natural environment.
Curb cut impacts	Harms motorists who want public on-street parking, and pedestrians (particularly those with disabilities) who want comfortable and safe sidewalks.

Parking minimums increase residential parking supply beyond what occupants would voluntarily choose. This tends to benefit higher-income motorists who value convenience but harms lower-income households that want to save money, plus nearby residents who experience more traffic problems.

Lower-income households tend to have low vehicle ownership rates and must spend a much larger portion of their household budgets on parking, as illustrated below. For example, for the first income quintile, requiring one parking space represents about 6%, and two spaces represent about 12%, of their $28,724 annual budgets. This is particularly unfair because many of these households do not own vehicles. This indicates that parking minimums tend to be regressive and unfair to lower-income households.

Figure 5 **Residential Parking Costs as a Percentage of Total Household Budgets**



Lower-income households have lower vehicle ownership rates and spend a larger portion of their budgets on parking facilities. As a result, regulations that force households to spend more on parking than they would voluntarily choose tend to be unfair and regressive.

(Based on $150 per month cost per residential parking space.)

Optimal Parking Supply

This section describes principles that help define optimal residential parking supply, and factors that affect vehicle ownership rates and parking demands (Litman 2023; Sabouri, et al. 2021).

Principles

The following principles can be used to define the efficient and equitable amount of parking to supply at a particular location.

1. **Consumer sovereignty.** This means that policies should respond to consumer demands, including latent demand (options that consumers would use if available). For example, this justifies unbundling so households can choose cheaper parking-free apartments.
2. **Parking demands and costs.** According to this principle, parking supply should respond to user demands and production costs. This implies that parking minimums should decline with factors that reduce vehicle ownership, such as poverty, density and quality of non-auto modes, and be reduced where parking is more costly to provide.
3. **Willingness to pay (efficient pricing).** According to this principle, optimal residential parking supply is the number of spaces that occupants would choose if they are charged cost-recovery prices (parking fees could pay the total costs of providing that space).
4. **Strategic goals.** According to this principle, parking regulations should support strategic goals such as affordability, equity, efficient mobility, traffic safety, emission reductions, and habitat protection. This implies that parking mandates should generally be minimized to support various strategic goals.
5. **Equity objectives.** According to this principle, residents should "get what they pay for and pay for what they get" unless subsidies are specifically justified, and policies should favor disadvantaged groups. This implies that residential parking should generally be unbundled, so motorists pay directly for the parking spaces they use, with exemptions or discounts for motorists who have disabilities or low incomes.

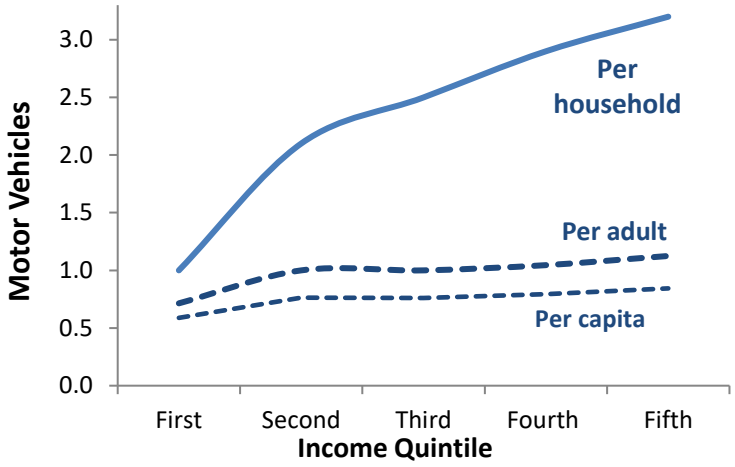
Parking regulations violate these principles: they fail to provide options (such as cheaper parking-free housing), require more parking than residents would be willing to pay if efficiently priced, they do not generally adjust for variations in demand or costs, they contradict many strategic goals, and they tend to be unfair and regressive. These principles tend to justify parking policy reforms that improve affordable housing options, reduce minimums and result in more efficient parking management, more optimal parking supply, and reduced parking subsidies.

The following section identifies specific factors that affect parking demands and therefore optimal parking supply.

Demographics

Vehicle ownership rates increase with income, and is particularly low for the lowest income quintile as indicated below.

Figure 6 **Vehicle Ownership by Household Income** (BLS 2020, Table 1101)



Vehicle ownership rates increase with income and are particularly low for first income quintile households. Lower-income households are likely to be particularly responsive to pricing and other TDM incentives that reduce vehicle ownership.

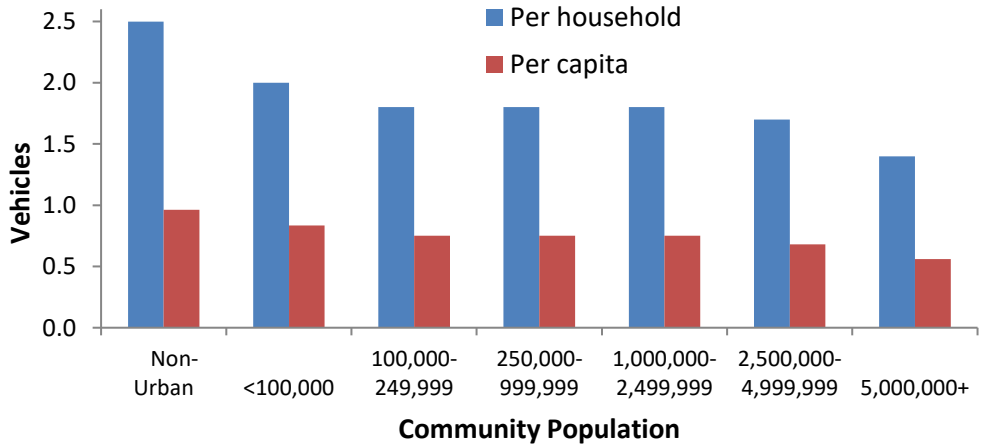
This indicates that parking minimums tend to be unfair to lower-income households and regressive (they force many lower-income households to pay for costly parking facilities they don't need).

About 30% of first income quintile households and 10% of second income quintile households are car-free, but these rates are much higher in urban areas (BLS 2020). Renter households average about half as many vehicle (1.1) as overall average (2.2) (BLS 2022, Table 1710). People under 25 years, over 65 years, and with disabilities also tend to have low vehicle ownership rates. Field surveys (CNT 2016) indicate that lower-priced urban households only use 0.3 to 0.5 parking spaces, and these demands can be reduced further if parking is unbundled, so households save more money when they reduce their vehicle ownership, and buildings have convenient car- and bike-sharing services, and other TDM incentives.

Location

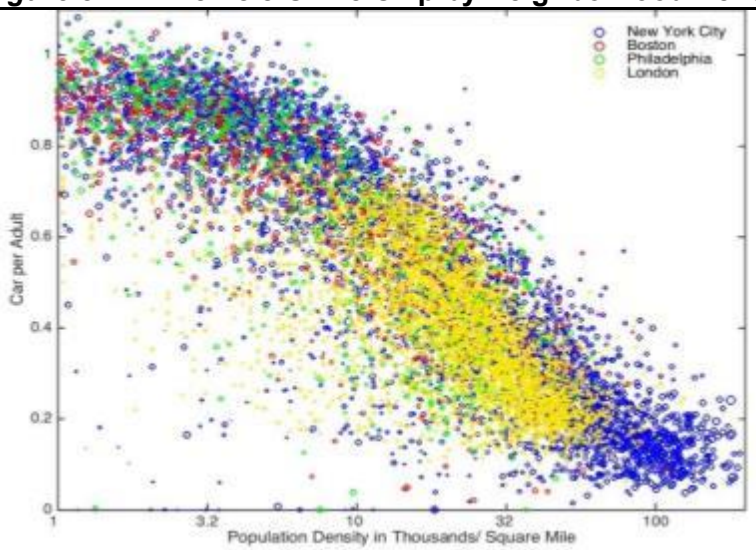
Vehicle ownership and use tend to decline with city size, density, mix and the quality of non-auto modes (Litman 2018; Sabouri, et al. 2021), as illustrated in the following graphs.

Figure 7 **Vehicle Ownership by Community Size** (BLS 2022, Table 2400)



Vehicles per household and per capita tend to decline with community size and density, and are typically 30-50% lower in cities than suburban and rural areas.

Figure 8 **Vehicle Ownership by Neighborhood Density** (Alpert 2018)



Vehicle ownership rates tend to decline as urban population density increases from less than 3,200 residents per square mile (5 residents per acre) to 32,000 residents per square mile (50 residents per acre).

Figure 9 **Vehicle Ownership by Neighborhood** (CNT 2022)

This map produced by the H+T Affordability Index website shows that residents of central, multimodal neighborhoods tend to own about half as many vehicles per capita than in automobile-dependent, urban-fringe locations.

This reflects several factors including more non-auto accessibility (better walking, bicycling and public transit), lower traffic speeds, less parking convenience and higher parking prices.

Households in transit-oriented developments typically own about half as many vehicles as in automobile-dependent areas (Arrington and Sloop 2009). Telework (telecommunications that substitute for physical travel, including telecommuting, e-commerce, e-medicine, etc.) and mobility as a service (MAAS) can also reduce vehicle ownership, as can pedestrian and bicycling facility improvements, an effect that is likely to increase as e-bikes become more common. This indicates that optimal parking supply is lower in more compact, mixed and multimodal areas, and these effects are likely to increase in the future as new transportation options develop.

Management Strategies

Various management strategies can reduce parking demands and the optimal parking supply needed to serve those demands (Litman 2022; Pressl and Rye 2020).

Shared Parking

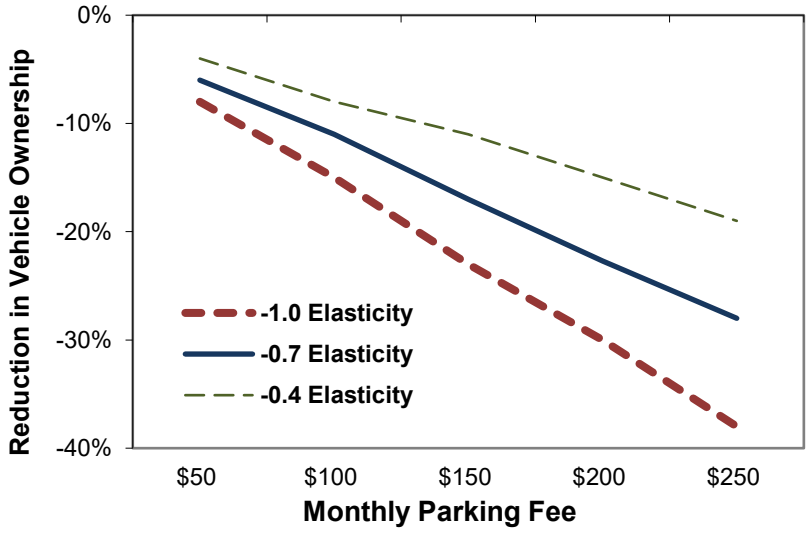
Parking supply can be significantly reduced if facilities are shared, taking advantage of variations in demands. For example, if building occupants share a parking lot rather than being assigned individual spaces, optimal supply can usually be reduced 20-40% since at any one time some households are car-free or vehicles are in use, so a building that would require 100 assigned spaces only needs 60-80 shared spaces. Even larger reductions are possible if parking is shared among different types of land uses. Hess and Rehler (2021) found that mixed-use developments needed about half as many parking spaces as typical zoning codes require. For example, residential parking demands peak during evenings and weekends, and office building parking demands peak during weekdays, so buildings with 100 housing units and 100 office workers that would require 200 parking spaces if provided individually may only need 80 to 120 spaces if shared among all users. Sharing can be optional, so for example, motorists can choose between paying $150 per month for shared parking or $250 per month for a personal space.

Pricing

Parking can be unbundled, sold or rented separately from housing. Cost-recovery pricing (fees that repay total parking facility costs) typically reduces parking demands 10-30% (Lehner and Peer 2019), and more for lower-income households, which are more price sensitive, and in multimodal locations, where private vehicles is less essential (Ostermeijer, Koster and van Ommeren 2019). Parking pricing often reduces households' second and third vehicles. Prices can also be set to maintain occupancy targets, called *responsive pricing*. For example, increased when parking lots are overcrowded but reduced when there is sufficient supply. Property owners can also encourage informal parking pricing by allowing and helping households that have excess parking spaces to rent them to neighbors.

The figure below illustrates the effects of pricing on parking demands.

Figure 10 **Parking Demand Reductions from Pricing**



This figure illustrates typical vehicle ownership reductions due to residential parking pricing, assuming that the fee is unavoidable (free parking is unavailable nearby).

These effects will vary depending on specific conditions including residents' incomes, and the quality of non-auto travel and access. Much of these reductions consist of a household's second and third vehicles.

Overflow Plans

Parking is often oversupplied to serve occasional demand peaks or possible future growth. For example, if a building is expected to need between 50 and 100 spaces, practitioners will often specify the higher value "to be safe." Parking supply can be reduced if a building has a plan that identifies where motorists should park when on-site parking is full. This can involve providing information about off-site parking options, including nearby on-street parking. If parking lots frequently overflow, property owners can rent or build additional spaces, improve pedestrian access to off-site parking, increase prices, and implement other demand management strategies (Spack and Finkelstein 2014).

Improving Walkability and Bicycling Conditions

Parking planning should map local walking conditions, particularly connections to nearby parking, public transit and carshare services, in order to identify and correct obstacles. This can reduce parking demands in three ways:

- They improve access to off-site parking, allowing more sharing.
- Walking and bicycling trips can substitute for some automobile trips.
- They improve access to transit and carshare services, increasing use of these modes.

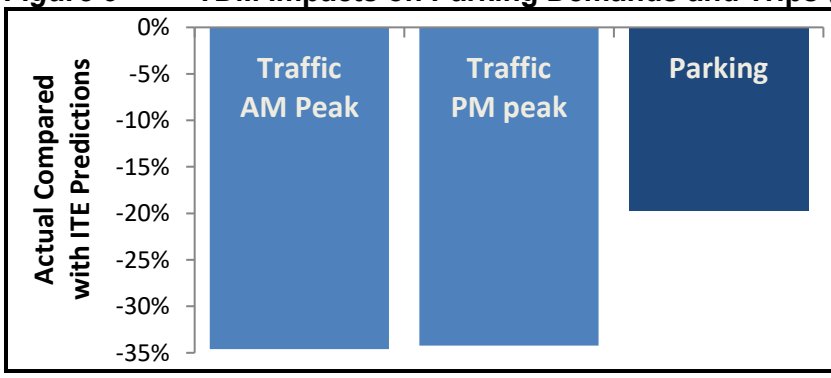
Carsharing

Carsharing refers to automobile rental services intended to substitute for private vehicle ownership. It makes occasional use of a vehicle affordable even for low-income households, while providing an incentive to minimize driving and rely on alternative travel options as much as possible. Where carsharing services are available some households reduce their vehicle ownership (ter Schure, Napolitan, and Hutchinson 2012). Residential developers and building operators can encourage this by providing free or discounted parking for carshare vehicles, or by offering subsidized memberships in carshare organizations to residents (Filosa 2006).

Parking and TDM Management Plans

Developers, property owners, and local governments can develop parking and transportation demand management plans which reduce vehicle trips and parking demands (Litman and Pan 2023). Developments with TDM plans actually generate 34% to 50% fewer vehicle trips and require 17% to 24% fewer parking spaces than average (Galdes and Schor 2022).

Figure 5 **TDM Impacts on Parking Demands and Trips** (Spack and Finkelstein 2014)



Buildings with TDM programs actually generate a third fewer trips and require 20% fewer parking spaces than predicted by Institute of Transportation Engineers' models. This indicates that TDM programs can significantly reduce parking demands and traffic impacts such as congestion, crash risk and pollution emissions.

Parking Minimum Adjustment Factors

The table below summarizes various parking minimum adjustment factors. Of course, these impacts vary and should be adjusted based on local conditions.

Table 4 **Residential Parking Minimum Adjustment Factors** (Litman 2022)

Factor	Typical Adjustments
Demographics. Age and physical ability of residents or commuters.	Reduce minimums 20-40% for housing for young (under 25, such as college students), elderly (over 65) and people with disabilities.
Income. Average income of residents or commuters.	Reduce minimums 30-60% for housing occupied by lowest-income quintile households and 15-30% for second-income quintile families.
Housing Tenure. Whether owned or rented.	Reduce minimums 20-40% for rental housing.
Geographic Location. Vehicle ownership and use rates in an area.	Adjust minimums based on local vehicle ownership and trip generation data. Reduce 40-60% in transit-oriented developments.
Residential Density. Number of residents or housing units per acre/hectare.	Reduce minimums 1% for each resident per acre (e.g. 15% at 15 residents per acre and 30% at 30 residents per acre).
Land Use Mix. Land use mix located within convenient walking distance.	Reduce minimums 5-15% in mixed-use developments. Additional reductions with shared parking.
Transit Accessibility. Nearby transit service frequency and quality.	Reduce minimums 10% within ¼ mile of frequent bus service, and 40-60% within ¼ mile of rail transit stations.
Carsharing. Whether carsharing services are located within or nearby a building.	Reduce minimums 10-20% if carshare vehicles are located onsite, or 5-10% if located nearby.
Walkability and bikability.	Reduce minimums 20-40% in areas with Walk Score over 70.
Pricing. Priced or unbundled parking	Reduce minimums 10-30% for cost-recovery prices.
Sharing/overflow. Ability to share parking facilities with other nearby land uses.	Reduce minimums 10-30% if parking is shared among occupants of multiunit housing, and 20-40% in mixed-use developments.
Management programs. Parking and mobility management programs implemented at a site.	Reduce minimums 10-40% at worksites with effective parking and mobility management programs.
Contingency-Based Planning. Whether a plan exists to deal with possible parking shortages.	Minimize supply if a development has a plan for additional management strategies that can be implemented if needed.
Strategic goals. Align parking policies with economic, social and environmental goals.	Choose lower-bound minimums and support management strategies to achieve affordability, equity, livability and environmental goals.

This table summarizes various factors that affect parking demand and optimal parking supply.

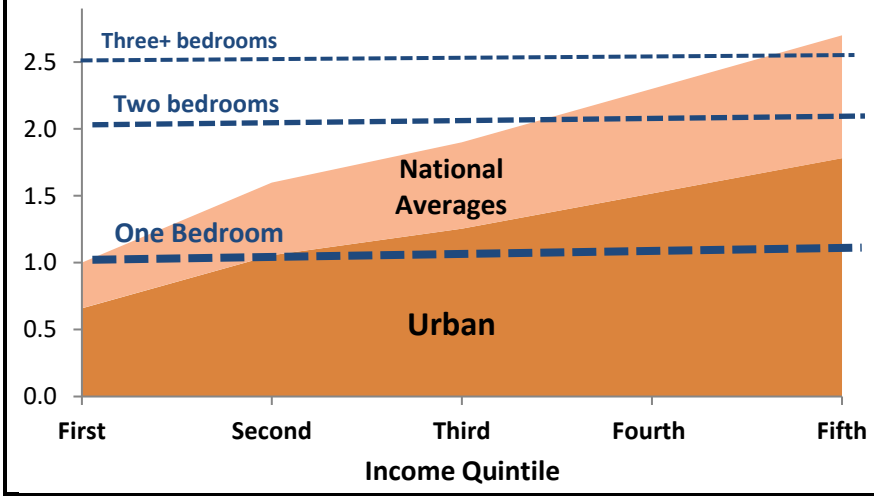
To be efficient and equitable, parking supply should be adjusted based on these factors, particularly if communities have social equity, affordability and environmental goals, in which case planning should favor the lower-range of predicted parking needs. Because theses impacts overlap, judgement is needed to determine truly optimal parking supply in a particularly location. To calculate the total impacts of multiple adjustment factors, multiply the residuals (remaining demands), so for example lower residents' incomes is predicted to reduce demand 20%, density reduces it 15% and on-site carsharing reduces it 10%, the total reduction is 61% (80% x 85% x 90%), not the 45% reduction predicted by adding 20% + 15% + 10%.

Summary of Affordability Impacts

This analysis indicates that residential parking requirements reduce affordability in several ways. They increase parking supply and costs beyond what households demand, and discourage property owners from pricing and managing parking efficiently, since that would result in unused spaces. They also reduce housing supply, which further increases housing prices.

Mandates oversupply parking compared with what household demands (De Gruyter, Hooper and Foster 2023; Davis, et al. 2023; Fox Tuttle 2021). They require nearly twice as many spaces for a one-bedroom home, and three times as many spaces for a two-bedroom home, as lower-income urban households' average vehicle ownership rates, as illustrated below. Oversupply is even larger if parking is unbundled (parking is rented separategly from building space) so households save money when they reduce vehicle ownership.

Figure 11 **Parking Mandates Versus Vehicle Ownership** (BLS 2020, Table 1101)



This figure compares typical parking requirements for one, two and three-or-more bedrooms with average household vehicle ownership rates by income class. This indicates that most parking mandates significantly oversupply parking compared with low- and moderate-income vehicle ownership rates and parking demands.

The figure below illustrates ways that parking requirements affect affordability. The following sections examine these effects in more detail.

Figure 12 **Parking Requirement Chain of Effects**

Residential parking requirements increase parking supply beyond what property owners would voluntarily choose, which increases various costs, leading to less affordability.

Increased Housing Costs

The following analysis evaluates how parking requirements affect housing costs for various household types based on typical mandates, parking facility and housing costs, and vehicle ownership rates (parking demands). The table below summarizes assumptions and results.

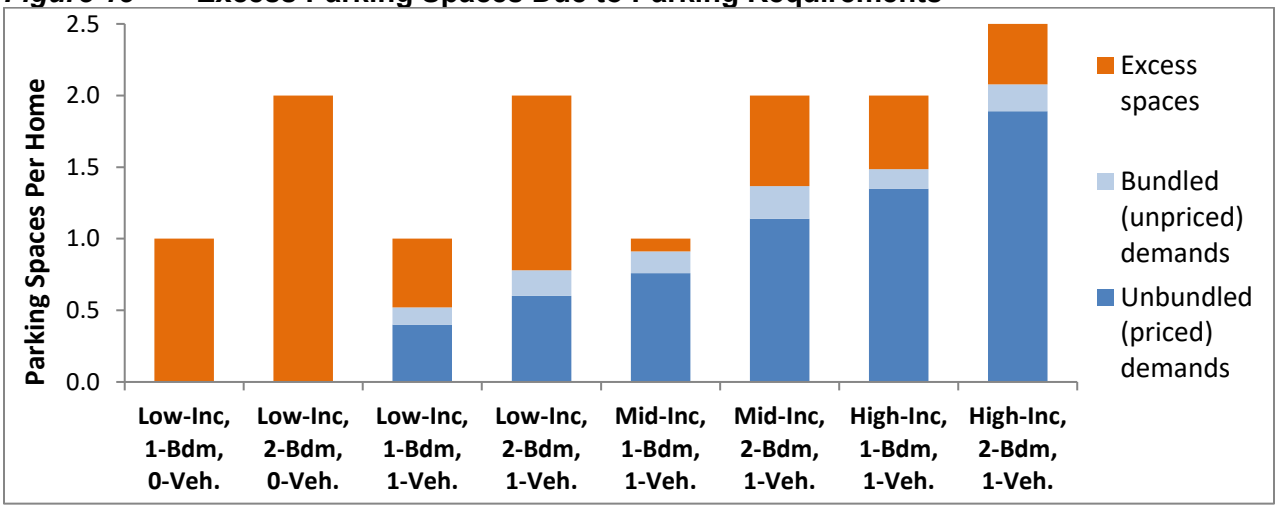
Table 5 **Parking Requirement Impacts on Typical Households** (BLS 2020, Table 1101)

	Low-income Carfree		Low-income Average		Medium-income Average		High-income Average	
Bedrooms	1	2	1	2	1	2	2	3
Mandated parking spaces	1	2	1	2	1	2	2	2.5
Cost per parking space	$150	$150	$150	$150	$200	$200	$300	$300
Monthly rents or mortgages	$1,200	$1,400	$1,200	$1,400	$2,400	$2,800	$4,000	$4,500
Average Urban Neighborhood Vehicle Ownership								
Bundled	0.0	0.0	0.4	0.6	0.8	1.1	1.4	1.9
Unbundled (priced)	0.00	0.0	0.28	0.4	0.6	0.9	1.2	1.7
Excess Parking Supply (Spaces pre Household)								
Bundled	1	2	0.5	1.2	0.1	0.6	0.5	0.4
Unbundled (priced)	1	2	0.6	1.4	0.2	0.9	0.7	0.6
Excess Parking Costs – Potential Savings from Reduced Requirements								
Bundled	$150	$300	$72	$183	$18	$126	$155	$126
Unbundled (priced)	$150	$300	$90	$210	$48	$172	$195	$183
Percent Costs and Savings to Rents								
Bundled	13%	21%	6%	13%	1%	5%	4%	3%
Unbundled (priced)	13%	21%	8%	15%	2%	6%	5%	4%

This table summarizes analysis assumptions and results. It assumes that urban neighborhood households own about half as many vehicles as national averages, and cost recovery parking pricing reduces vehicle ownership an additional 30% for the low-income, 20% for medium-income, and 10% for high-income households.

This figure shows the excess parking supply, beyond vehicle ownership rates, caused by mandates.

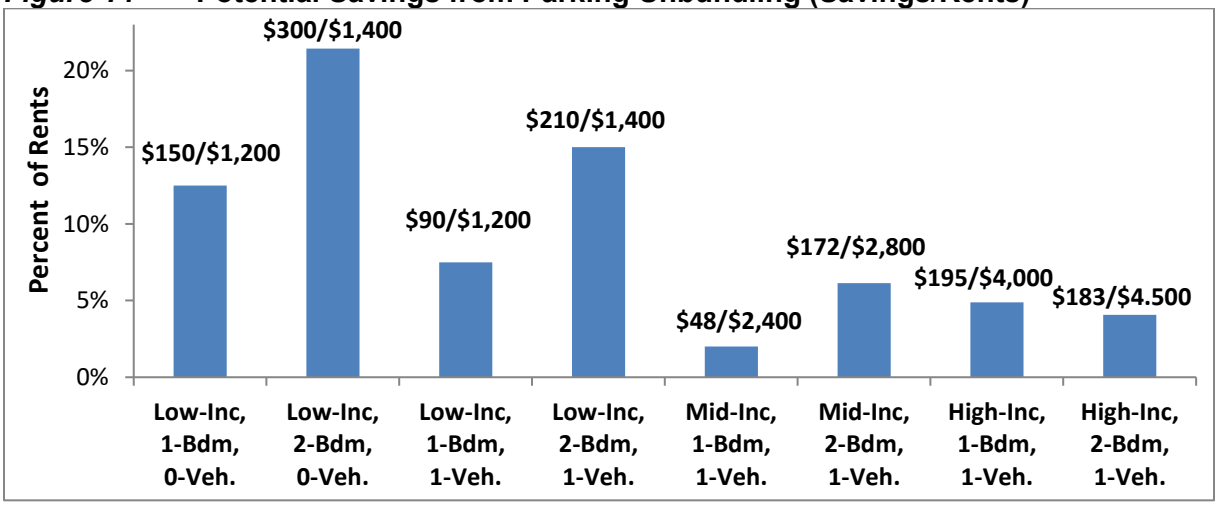
Figure 13 **Excess Parking Spaces Due to Parking Requirements**



This figure shows vehicle ownership rates for unbundled (dark blue) or bundled (light blue) parking, and the number the excess spaces required by typical zoning codes (orange) for various household types.

The figure below shows potential savings from parking unbundling relative to rents.

Figure 14 **Potential Savings from Parking Unbundling (Savings/Rents)**



This figure show potential savings from parking unbundling as a portion of rents.

The following table summarizes parking cost impacts on various household types.

Table 6 **Parking Cost Impact on Various Housing Types**

Household Type	Monthly Income	Monthly Rent	Mandated Spaces	Parking costs	Spaces Used	Over-, Under-payment	Portion of income
0 car, LI, 1-bdrm	$3,000	$1,200	1	$150	0	$150	5%
0 car, LI, two-bdrm	$3,000	$1,400	2	$300	0	$300	10%
1 car, LI, two-bdrm	$3,000	$1,400	2	$300	1	$150	5%
0 car, LI, one-bdrm, UP	$3,000	$1,500	1	$300	0	$300	10%
0-car, LI, two-bdrm, UP	$3,000	$1,800	2	$600	0	$600	20%
1 car, LI, one-bdrm	$3,000	$1,200	1	$150	1	$0	0%
0 car, MI, one-bdrm	$5,000	$2,400	1	$200	0	$200	4%
1 car, MI, one-bdrm	$5,000	$2,400	1	$200	1	$0	0%
1 car, MI, two-bdrm	$5,000	$2,800	2	$400	1	$200	4%
1 car, MI, three-bdrm	$5,000	$2,800	3	$600	1	$400	8%
2 cars, HI, one-bdrm, UP	$10,000	$4,000	1	$300	2	-300	-3%
3 cars, HI, two-bdrm, UP	$10,000	$4,000	2	$600	3	-300	-3%

This table calculates the degree of over- or underpayment of parking costs for various household types, (LI = Low Income; MI = Medium Income; HI = High Income; bdrm = bedroom; UP = Underground Parking)

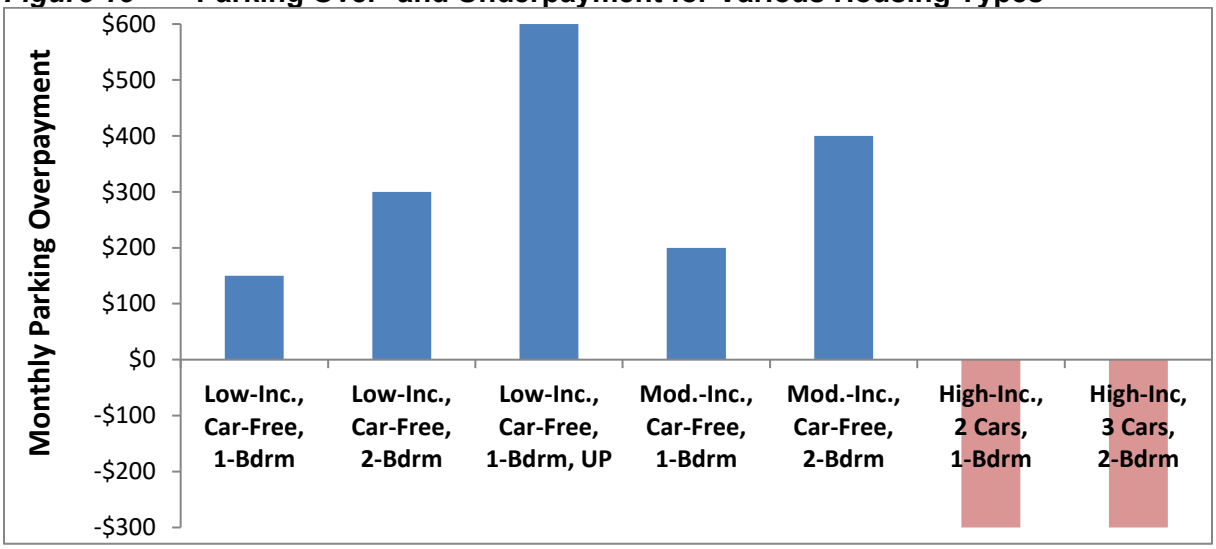
This indicates that:

- A lower-income car-free household that pays $1,200 rent for a one-bedroom apartment overpays $150 per month for an unneeded parking space, about 5% of their total income.
- A lower-income car-free single parent who pays $1,400 rent for a two-bedroom apartment overpays $300 per month for two unneeded spaces, about 10% of income.

- If households want to live in a high-opportunity neighborhood where high land prices require underground parking, their parking costs approximately double; they overpay 10% of total income for a one-bedroom and 20% of income for a two-bedroom apartment. In practice, few lower-income households actually spend such extremely high portions of their income on parking; instead, the high costs of underground parking price most lower-income households out of high-opportunity neighborhoods.
- A moderate-income car-free household overpays $200 per month for a one-bedroom or $400 per month for a two bedroom, about 4-8% of their total income.
- A moderate-income one-car household pays their parking costs for a one-bedroom apartment but overpays $200 per month for a two bedroom, about 4% of their total income.
- A higher-income two-car higher-income household living in a one-bedroom apartment, or a three-car household in a two bedroom apartment, underpays their parking costs by $300 per month, about 3% of their income.

The figure below illustrates these results.

Figure 15 **Parking Over- and Underpayment for Various Housing Types**



This figure illustrates parking minimum cost over and under-payments for various household types. Lower-income car-free households overpay by hundreds of dollars per month, particularly for housing with underground parking (UP). Households that own two or three vehicles often underpay their parking costs.

These illustrate the large cost burdens that parking minimums can impose on lower-income car-free households. In these examples, parking minimums are equivalent to an additional 5% to 20% income tax. When lower-income household are unable to afford basic goods such as healthy food, healthcare or education, the real cause is often excessive housing costs, due in part to excessive parking requirements.

Of course, not every household experiences these effects. Most households own personal vehicles, sometimes more than the parking spaces mandated for their homes. Some households can rent excess parking spaces, although generally below their actual costs, or use excess

parking spaces for non-vehicle storage. Some older housing is affordable because it lacks off-street parking. Some low-income households live in subsidized housing. Some jurisdictions already reduce parking mandates in some areas or for some development types. However, none of these factors eliminate the fact that parking minimums impose large costs on many households, particularly lower-income households that want to live in compact, high-opportunity urban neighborhoods with high land values.

Reduced Housing Supply

Parking minimums also reduce housing supply by limiting the number of homes that can be built on a parcel (CNT 2016; Durning 2013). There are many examples of homeowners that would add a basement suite and multifamily developments that would have more units but lack the land to meet parking requirements. Although parking mandates do not constrain every development, when this occurs the effects can be large, particularly in urban neighborhoods with significant demand for compact infill and high land values. When development capacity is constrained, the most affordable units tend to be eliminated first, since they are least profitable (Lehe 2018). For example, if mandates reduce buildable units from 20 to 16, the four eliminated units are likely to be the cheapest. As a result, parking regulations tend to reduce affordability by reducing supply and raising the price of those that are built.

A major technical study found that in Colorado cities, parking reform can boost homebuilding by 40% to 70% than is feasible with current mandates (EcoNorthwest 2024). The researchers concluded that excess parking requires space that could otherwise be housing, adds costs that are seldom offset by revenues, and limits the housing projects that can fit on a site. These effects are largest in transit oriented developments and other denser urban areas.

Increased Transportation Costs

By reducing affordable infill in multimodal urban neighborhoods, parking requirements create more automobile-dependent, sprawled communities where residents must own more vehicles, drive more, and spend more money on transportation. Surveys indicate that many households would prefer to live in compact, multimodal neighborhoods, in part to reduce their transportation costs, but cannot due to a lack of housing supply (NAR 2022). Such communities typically provide $4,000 to $8,000 annual transportation cost savings per household (CNT 2022).

Impacts on Rents and Mortgages

Several studies demonstrate that housing with off-street parking really does cost more than otherwise comparable homes that do not. For example, “The Hidden Cost of Bundled Parking” (Gabbe and Pierce 2016) used *American Housing Survey* data to study parking rent premiums. Using sophisticated modelling they found that in 2012 an off-street parking space added approximately $1,700 per year, $142 per month, raising average rents about 17%. Other studies find similar results. Jia and Wachs (2019) which found the average single-family unit in San Francisco with off-street parking sold for 12% more and the average condo unit with off-street parking sold for 13% more than the price of comparable units without parking. A 2013 study by Manville (2013) analyzed a sample of downtown Los Angeles buildings that had been converted to housing after the city passed its Adaptive Reuse Ordinance. He found that bundled parking raised the rent for an apartment by about $200 per month and raised the price of a condo by about $43,000. Real estate agents and property appraisers have models that can calculate these premiums for a particular type of housing in a particular area.

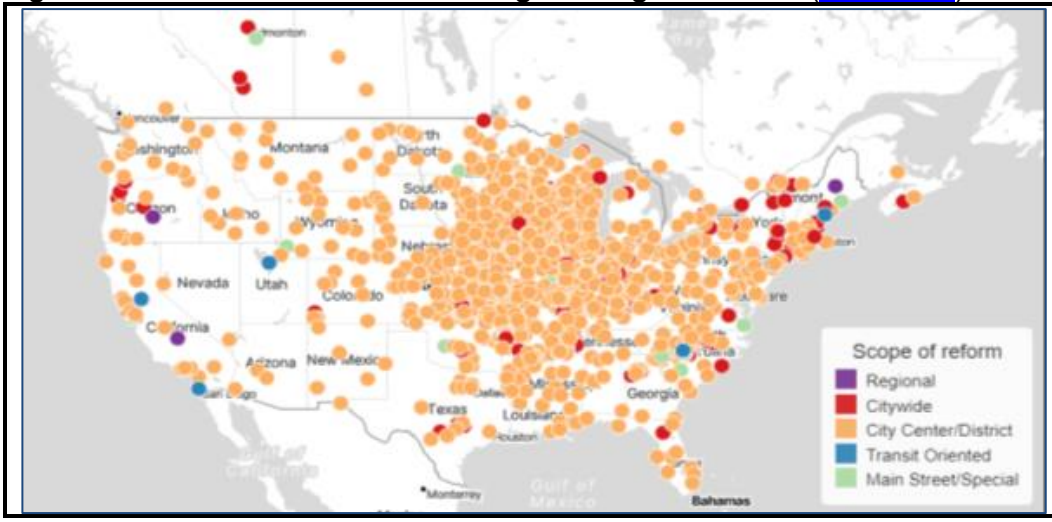
Examples and Case Studies

Examples of parking management for residential affordability are described below. Also see Cohen (2023) and the Parking Reform Network.

Municipal Parking Reforms

The map below shows North American jurisdictions that are reforming their parking policies.

Figure 16 **Jurisdictions Reforming Parking Minimums** (PRN 2022)



Many jurisdictions are reducing or eliminating parking minimums.

Effects of Eliminating Parking Minimums

The study, *Parking Policy Is Housing Policy: How Reducing Parking Requirements Stimulates Affordable Housing Production* (RPA 2022) found that eliminating parking minimums in some New York neighborhoods increased new housing production and increased affordable units compared to areas where parking minimums remained in place. Areas with reduced parking minimums had significantly more developments using Low Income Housing Tax Credits, a mechanism that makes affordable development financially feasible. Parking reforms allow more affordable development on smaller parcels, making affordable housing more feasible.

After Buffalo, New York and Seattle, Washington reduced or eliminated parking minimums 68% of Buffalo developments and 59% of Seattle developments provided less parking than previously required. Overall, they build 20% fewer spaces in Buffalo and 40% fewer in Seattle (Gould 2023; Hess and Rehler 2021).

Parking and Affordable Housing (Fox Tuttle 2021)

A detailed study of Denver-area affordable housing found that parking requirements exceed demands, increase costs, and reduce affordable housing development. Of 19 properties built during the last six years the study found that only 461 of 883 parking spaces built were actually used. The unused spaces were estimated to cost $9.28 million, which could have built 40 more supportive housing units. Parking demands are much lower for smaller and lower-income households and in more multimodal neighborhoods. Detailed surveys found that affordable housing projects in San Diego have about half the parking demands of overall regional averages, and almost half the units are car-free.

Effects of Transportation Demand Management (Galdes and Schor 2022)

The study, *Don't Underestimate Your Property* found that 13 residential and commercial developments with TDM programs actually generate 63% fewer trips than trip generation models predict, more than double the trip reduction targets. As one traffic engineer explained,

> "Overestimating trip generation can have deleterious effects on a neighborhood because trip generation is so closely linked to the amount of square footage that a property is allowed. More than any other feature of a development, vehicle trip generation estimates determine density limits and impacts." (Mike Workosky, traffic engineer and President of Wells + Associates)

Excessive Urban Parking Supply

The study, *Stalled Out: How Empty Parking Spaces Diminish Neighborhood Affordability* (CNT 2016) surveyed parking lots at affordable and market priced multifamily housing in King County, Washington, the San Francisco Bay Area, Washington, D.C. and Chicago, Illinois. It consistently found that one third of those residential parking spots sitting empty, with particularly low occupancy rates for lower-priced housing in multimodal neighborhoods.

GreenTRIP Parking Database (http://database.greentrip.org)

The GreenTRIP Parking Database contains detailed information on parking supply, construction costs and occupancy rates, for dozens of San Francisco Bay area residential buildings. It found large numbers of costly, unused parking facilities.

Figure 17 **GreenTRIP Parking Database Report** (GreenTRIP 2023)

Comparison Report

13,823 Total Spaces | 9,941 Used | 3,882 Unused | Avg. Available Spaces / Unit: 1.16 | Avg. Occupied Spaces / Unit: 0.84

$198,034,400 Construction Cost of Unused Spaces

28% Average % of Unused Spaces

1,164,600 Square Feet of Unused Parking

Building	Place Type	Resident Type	Units	Parking Spaces	Unused Spaces	Spaces Provided per Unit	Spaces Used per Unit	Total Cost of Unused Parking	Traffic Reduction Strategy	Transit Access Score	Affordable Units
101 San Fernando 101 E. San Fernando St., Ste. 100 San Jose, CA 95112	Regional Center		323	557	49%	1.72	0.89	$13,550,000	Bike Parking, Bike Share, Local Shuttle	9	21%
111 Jones Street 111 Jones St San Francisco, CA 94102	Regional Center		108	35	14%	0.32	0.28	$400,000	Bike Parking, Bike Share	10	100%
801 Alma 801 Alma Street Palo Alto, CA 94301	Local Neighborhood	Family	50	60	15%	1.20	1.02	$720,000	Bike Parking	8	100%
Alterra 1640 La Rossa Circle San Jose, CA 95125	City Center		143	239	13%	1.67	1.46	$600,000	Bike Parking, Transit Route Info (Schedules, Maps)	9	0%

The GreenTRIPs database shows that many residential parking facilities are underutilized.

How Much is Enough? (Davis, et al. 2023)

The study, *How Much Is Enough? Parking Usage in New Jersey Rental Units* used various data sources to estimate parking occupancy at numerous multifamily housing sites. It found that low-rise apartment occupants actually own 0.56 fewer vehicles than zoning codes require. These differences vary by unit type, with a discrepancy of 0.82 for Studio and 1-Bedroom units, 0.55 for 2-Bedroom units, and 0.30 for +3-Bedroom units. For example, a typical 145 unit apartment building is required to include 102 more parking spaces than occupants need. For highrise apartments current standards over-provide parking by 0.32 spaces per unit, with an overprovision of 0.24 spaces per unit for Studio and 1-Bedroom units, a slight under provision of -0.10 for 2-Bedroom units, and a notable overprovision of 0.82 for +3-Bedroom units.

Renter Parking Costs (Gabbe and Pierce 2016)

American Housing Survey data indicate that in 2010 renter households paid approximately $1,700 annually for off-street residential parking, adding approximately 17% to their rent, and imposing $440 million in excessive costs on carless renters.

Parking Impacts on Apartment Affordability (London and Williams-Derry 2013)

Analysis of 23 recently completed Seattle-area multifamily housing buildings found:

- *Developers build far more parking than their tenants need.* Across all developments in our sample, 37% of parking spaces remained empty during peak demand periods, and less than half of spaces were occupied at four locations.
- *Many tenants don't own cars.* On average, the developments had 20% more occupied apartments than occupied parking spaces. In all, 21 of the 23 developments had more occupied apartments than parked cars.
- *Multifamily developments lose money on parking.* No development in our sample collected enough parking fees to recover the full estimated costs of building, operating, and maintaining on-site parking facilities. This indicates that car-free households subsidize parking facilities.
- Landlords' losses on parking—calculated as the difference between total parking costs and total parking fees collected from tenants—total approximately 15% of monthly rents, averaging $246 per month for each occupied apartment.

9-x-18 Affordable Housing Research (9 x 18 2020)

The *9x18* study examined how parking requirements conflict with New York City's urban design and affordable housing goals. It estimated the potential for additional housing development on New York City Housing Authority (NYCHA) surface parking lots. It study found 20,360,000 square feet of under-utilized surface parking. It identified ways to reduce parking costs and generate more revenue for affordable housing. The figure below compares the space required for parking (including access lanes) with compact apartments.

Figure 18 **Space for Parking Versus Housing** (9 x 18 2020)

Two 9x18 foot parking spaces use about as much space as a micro apartment, and much more considering driveway and access lanes.

Potential Reforms

The following reforms can reduce residential parking costs and increase overall affordability (Hoyt and Schuetz 2020; Litman 2022; Parking Reform Network; Spivak 2018; Taylor 2020).

- Eliminate parking minimums, so property owners can decide how much off-street parking to provide based on market demands. These changes should be implemented with policies to address potential spillover problems (motorists parking at inappropriate locations nearby) including better management of public parking, and improved wayfinding to help motorists identify nearby parking options.
- If eliminating parking minimums is infeasible, apply maximum adjustment factors, such as those described in Table 4. This can significantly reduce parking requirements for lower-priced housing located in compact, multimodal neighborhoods, and for properties that implement demand management strategies.
- Require or encourage property owners to unbundle parking (rent parking separately from building space), particularly for low- and moderate-priced housing.
- Require or encourage property owners to develop transportation and parking management plans. Support development of transportation management associations that coordinate demand management programs throughout an area.
- Encourage property owners to share parking facilities. Sharing can be optional with lower prices for shared spaces and higher prices for personal spaces.
- Encourage mixed-use developments that include residential and commercial in one building or block to maximize parking sharing opportunities.
- Allow property owners to fund transit, carsharing, bikesharing and taxi/ridehailing fares instead of subsidized parking.
- Encourage or require property owners to provide secure bicycle parking, including some spaces with electrical plugs for e-bike charging.
- Where on-street parking is congested, regulate and price it for efficiency, for example, by selling overnight parking permits that are available to multifamily as well as single-family housing residents. To achieve social equity goals, discount parking fees for motorists with disabilities and lower-incomes.
- Reform development policies to allow property owners that reduce parking demands and manage parking efficiently to build more and larger units.
- Improve neighborhood walkability in order to expand the range of parking facilities that serve a destination.
- Support capacity building for architects, designers, transportation engineers, planners, and developers concerning why and how to reduce parking supply and manage parking for efficiency and equity. Highlight examples of successful parking reduction programs.
- Develop systems to identify and respond to spillover parking problems.

Conclusions

To ensure that automobile travel is convenient and cheap most communities impose off-street parking requirements. This study indicates that these are inefficient, inequitable, and contradict other community goals.

Parking facilities are expensive. Considering land, construction and operating costs a typical parking space costs $1,500 to $5,000 annually, and since most jurisdictions require between one and three spaces per home they increase rents or mortgages by thousands of dollars per year. Parking requirements are a major cause of housing unaffordability. When households cannot afford essential goods such as healthy food, healthcare or education, the real cause is often high housing costs that are partly caused by excessive parking requirements. These policies are unfair; they force many households to pay for costly but unnecessary parking facilities. Since lower-income households have low vehicle ownership rates and value money saving opportunities, these requirements are regressive. They also increase vehicle ownership, sprawl and traffic problems, which further increases transportation costs and environmental problems.

Off-street parking requirements may be appropriate in sprawled areas with high vehicle ownership rates, inexpensive land and dispersed development, but not in compact, multimodal neighborhoods with high land prices. They are also inappropriate in communities that value social equity, affordability or environmental protection.

Various policy reforms can make parking more efficient and equitable. Some jurisdictions are eliminating parking minimums so property owners are allowed to determine how much parking to supply based on market demands. If that is politically infeasible, planning agencies and practitioners can apply more accurate and flexible parking standards, unbundle parking so residents only pay for parking spaces they actually use, and implement management policies to maximize parking efficiency and minimize costs. These policies can typically reduce the costs of basic, lower-priced housing by 10-20%, and thousands of dollars in annual savings and benefits by increasing affordable housing in high-opportunity multimodal neighborhoods. The table below summarizes the distribution of benefit and harms.

Table 7 **Who Benefits and is Harmed by Parking Minimums**

Benefits	Harmed
• Households that own more than average vehicles, which underpay their parking costs. • Nearby motorists who experience less spillover parking. • Politicians who face fewer conflicts over spillover parking.	• Households that own fewer than average vehicles, which overpay their parking costs. • People harmed by increased vehicle traffic and sprawl. • Businesses that want more affordable housing for their workers.

Parking requirements benefit households that own more than average vehicles and harm those that own fewer than average vehicles, which are forced to subsidize their neighbors' parking facilities.

Reforming parking requirements helps achieve many social, economic and environmental goals.

Acknowledgments: Thanks to Donald Shoup, Richard Willson, and Patrick Hare who contributed essential ideas and support for this paper.

References and Resources

Rachel Abraham and Corinne Tynan (2023), "How Much Does It Cost To Build A Garage In 2023?" *Forbes* (www.forbes.com); at https://bit.ly/46fCtA6.

Affordable Housing Design Advisor Website (www.designadvisor.org), by the U.S. Department of Housing and Urban Development, provides information on developing affordable housing.

David Alpert (2018), *Housing and Transportation are the Same, these Graphs Show*, Greater Greater Washington (https://ggwash.org); at https://bit.ly/45WWZWb.

Dave Amos (2025), "Will Increasing Residential Density Decrease Parking Availability? A Method for Practitioners," *Findings* (https://doi.org/10.32866/001c.128202).

G.B. Arrington and Kimi Iboshi Sloop (2009), "New TCRP Research Confirms Transit-Oriented Developments Produce Fewer Auto Trips," *ITE Journal*, Vo. 79/6, pp. 26-29.

David Baker and Brad Leibin (2019), "Toward Zero Parking: Challenging Conventional Wisdom for Multifamily," *Urban Land* (www.urbanland.uli.org); at https://bit.ly/2MPoo42.

Paul A. Barter (2014), "A Parking Policy Typology for Clearer Thinking on Parking Reform," *International Journal of Urban Sciences* (http://dx.doi.org/10.1080/12265934.2014.927740).

Bruce Belmore (2019), "Rethinking Parking Minimums," *ITE Journal*, Vol. 89/2, p. 4 (www.ite.org).

BLS (various years), *Consumer Expenditure Survey*, Bureau of Labor Statistics (www.bls.gov).

CNT (2016), *Stalled Out: How Empty Parking Spaces Diminish Neighborhood Affordability*, Center for Neighborhood Technology (www.cnt.org); at https://bit.ly/2fOBHnW.

CNT (2022), *Housing + Transportation Affordability Index*, Center for Neighborhood Technology (http://htaindex.cnt.org).

Stuart Cohen (2023), Parking *Revolution: Housing Solution*, TransForm (transformca.org); at https://bit.ly/40fQYCS.

Michael Davidson and Fay Dolnick (2002), *Parking Standards*, PAS Report 510/511, American Planning Association (www.planning.org); at www.planning.org/publications/report/9026845.

Morris A. Davis, et al. (2023), *How Much Is Enough? Parking Usage in New Jersey Rental Units*, Rutgers Center For Real Estate (https://realestate.business.rutgers.edu); at https://bit.ly/46qmTT6.

Chris De Gruyter, Paula Hooper and Sarah Foster (2023),"Do Apartment Residents Have Enough Car Parking?, *Journal of Transport Geography*, Vo. 107 (doi.org/10.1016/j.jtrangeo.2023.103542).

John Dorsett (2023), "Parking Requirements for Residential Transit-Oriented Development," *ITE Journal* (www.ite.org).

Alan Durning (2013), *Apartment Blockers: Parking Rules Raise Your Rent*, Sightline Institute (www.sightline.org); at http://daily.sightline.org/2013/08/22/apartment-blockers.

EcoNorthwest (2024), *Colorado Land Use Policy & Greenhouse Gas Co-benefits Study*, The Colorado Energy Office (https://energyoffice.colorado.gov); at https://tinyurl.com/33adktm2.

Gina Filosa (2006), *Carsharing: Establishing its Role in the Parking Demand Management Toolbox*, Thesis, Urban and Environmental Policy and Planning, Tufts University (http://ase.tufts.edu/uep).

Fox Tuttle (2021), *Parking & Affordable Housing*, Shopworks Architecture (https://shopworksarc.com); at https://tinyurl.com/55d95k7d.

G.J. Gabbe and Gregory Pierce (2016), "Hidden Costs and Deadweight Losses: Bundled Parking and Residential Rents in the Metropolitan United States," *Housing Policy Debate* (dx.doi.org/10.1080/10511482.2016.1205647); at https://bit.ly/2ApVELG.

C.J. Gabbe, Gregory Pierce and Gordon Clowers (2020), "Parking Policy: Effects of Residential Minimum Parking Requirements in Seattle," *Land Use Policy*, Vo. 91 (doi.org/10.1016/j.landusepol.2019.104053).

Camille A. Galdes and Justin Schor (2022), *Don't Underestimate Your Property: Forecasting Trips and Managing Density*, Wells & Assoc. (www.wellsandassociates.com); at https://bit.ly/3CW2itO.

Catie Gould (2023), *Parking Reform Legalized Most of the New Homes in Buffalo and Seattle*, Sightline Institute (www.sightline.org); at https://bit.ly/3LPaG2b.

GreenTRIP Parking Database (http://database.greentrip.org) measures parking spaces per unit, occupancy rates, and the cost of unused spaces for various residential buildings.

Daniel Baldwin Hess and Jeffrey Rehler (2021), "Minus Minimums," *Journal of the American Planning Association* (www.tandfonline.com/doi/full/10.1080/01944363.2020.1864225).

Home Advisor (2023), *How Much Does It Cost To Build A Parking Lot?*, Home Advisor (www.homeadvisor.com); at www.homeadvisor.com/cost/outdoor-living/pave-a-parking-lot.

Hannah Hoyt and Jenny Schuetz (2020), *Parking Requirements and Foundations are Driving Up the Cost of Multifamily Housing*, Brookings (www.brookings.edu); at https://brook.gs/3RLvqbZ.

A-P Hurd (2014), *How Outdated Parking Laws Price Families Out of the City*, City Lab (www.citylab.com); at http://bit.ly/1KZZCYq.

ITE (2023), *Parking Generation*, Institute of Transportation Engineers (www.ite.org); at www.ite.org/technical-resources/topics/trip-and-parking-generation.

Wenyu Jia and Martin Wachs (1999), "Parking Requirements and Housing Affordability: A Case Study of San Francisco," *Transportation Research Record 1685*, pp. 156–60.

Nate Jo (2022), *Parking Policy & Housing Affordability*, Whatcom Housing Alliance Policy (https://whatcomhousingalliance.org); at https://bit.ly/3rhwFaZ.

Lewis Lehe (2018), "How Minimum Parking Requirements Make Housing More Expensive," *Journal of Transportation and Land Use*, Vo. 11 (www.jtlu.org); at www.jtlu.org/index.php/jtlu/article/view/1340.

Stephan Lehner and Stefanie Peer (2019), "The Price Elasticity of Parking: Meta-analysis," *Transport. Research A*, pp. 177-191 (doi.org/10.1016/j.tra.2019.01.014); at https://bit.ly/3Cjh4gF.

Todd Litman (2013), "The New Transportation Planning Paradigm," *ITE Journal* (www.ite.org), Vo. 83, No. 6, pp. 20-28; at www.vtpi.org/paradigm.pdf.

Todd Litman (2018), *Land Use Impacts on Transport: How Land Use Factors Affect Travel Behavior*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/landtravel.pdf.

Todd Litman (2019), *Affordable-Accessible Housing in a Dynamic City*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/aff_acc_hou.pdf.

Todd Litman (2021), *Parking Management: Comprehensive Implementation Guide*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/park_man_comp.pdf.

Todd Litman (2022), *Comprehensive Parking Supply, Cost and Pricing Analysis*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/pscp.pdf.

Todd Litman (2023), *Fair Share Transportation Planning*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/fstp.pdf.

Todd Litman (2024), *Transportation Cost and Benefit Analysis*, Victoria Transport Policy Institute (www.vtpi.org/tca).

Todd Litman and Melrose Pan (2023), *TDM Success Stories*, Victoria Transport Policy Institute (www.vtpi.org); at www.vtpi.org/tdmss.pdf.

Jesse London and Clark Williams-Derry (2013), *Who Pays for Parking? How the Oversupply of Parking Undermines Housing Affordability*, Sightline Institute (www.sightline.org); at www.sightline.org/research_item/who-pays-for-parking.

Michael Manville (2013), "Parking Requirements and Housing Development," *Journal of the American Planning Association*, 49-66 (DOI: 10.1080/01944363.2013.785346).

Chris McCahill, et al. (2016), "Effects of Parking Provision on Automobile Use in Cities: Inferring Causality," *Transportation Research Record 2543* (https://doi.org/10.3141/2543-19); at https://bit.ly/49yJT4u; summarized at https://bloom.bg/40Byv3C.

Adam Millard-Ball, et al. (2022), "What Do Residential Lotteries Show Us About Transportation Choices?" *Urban Studies*, 59(2), 434-452 (DOI: 10.1177/0042098021995139).

NAR (various years), *National Community Preference Survey*, National Association of Realtors (www.realtor.org); at https://bit.ly/3EsRNOt.

Francis Ostermeijer, Hans RA. Koster and Jos van Ommeren (2019), "Residential Parking Costs and Car Ownership," *Regional Science and Urban Econ.* (doi.org/10.1016/j.regsciurbeco.2019.05.005); at www.sciencedirect.com/science/article/pii/S0166046219300237.

Parking Reform Network (www.parkingreform.org) promotes various reforms, particularly parking pricing with revenues returned to local communities and businesses.

Robert Pressl and Tom Rye (2020), *Good Reasons and Principles for Parking Management*, Sustainable Urban Mobility Plans (https://park4sump.eu); at https://bit.ly/3pNTw84.

RPA (2022), *Parking Policy Is Housing Policy: How Reducing Parking Requirements Stimulates Affordable Housing* Regional Planning Association (https://rpa.org); at https://tinyurl.com/45a566kk.

Eric Scharnhorst (2018), *Quantified Parking: Comprehensive Parking Inventories for Five U.S. Cities*, Mortgage Bankers Association (www.mba.org); at https://bit.ly/2LfNk4o.

Hajime Seya, Kumiko Nakamichi and Yoshiki Yamagata (2016), "The Residential Parking Rent Price Elasticity of Car Ownership in Japan," *Transportation Research A* (doi.org/10.1016/j.tra.2016.01.005).

Donald Shoup (1999), "The Trouble With Minimum Parking Requirements," *Transportation Research A*, Vol. 33, No. 7/8, Sept./Nov. 1999, pp. 549-574: at www.vtpi.org/shoup.pdf.

Donald Shoup (2005), *The High Cost of Free Parking*, Planners Press (www.planning.org).

Raymond Smith (2020), *Parking Structure Cost Outlook for 2020*, WGI (https://wginc.com); at https://wginc.com/wp-content/uploads/2020/07/Parking-Construction-Cost-Outlook.pdf.

Mike Spack and Jonah Finkelstein (2014), *Travel Demand Management: Analysis of the Effectiveness of TDM Plans*, Spack Consulting (www.spackconsulting.com); at https://bit.ly/2K97eTj.

Sadegh Sabouri, et al. (2021), "The Built Environment and Vehicle Ownership Modeling," *Journal of Transport Geography*, Vo. 93 (doi.org/10.1016/j.jtrangeo.2021.103073).

Jeffrey Spivak (2018), *People Over Parking. Planners are Reevaluating Parking Requirements for Affordable Housing*," American Planning Association (www.planning.org); at https://bit.ly/3wcFu2E.

Elizabeth Jean Taylor (2020), "Parking Policy: The Politics and Uneven Use of Residential Parking Space in Melbourne," *Land Use Policy*, Vol. 91 (https://doi.org/10.1016/j.landusepol.2018.11.011).

Jessica ter Schure, Francesca Napolitan, and Rick Hutchinson (2012), "Cumulative Impacts of Carsharing and Unbundled Parking on Vehicle Ownership and Mode Choice," *Transportation Research Record, 2319*, 96-104 (https://doi.org/10.3141/2319-11).

USEPA (2020), *Smart Location Mapping*, U.S. Environmental Protection Agency (www.epa.gov); at www.epa.gov/smartgrowth/smart-location-mapping.