February 2026

The Impacts of Minimum Parking Requirements

A Research Synthesis

UCLA Center for Parking Policy

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The UCLA Institute of Transportation Studies supports and advances cutting-edge research, the highest-quality education, and meaningful and influential civic engagement on the many pressing transportation issues facing our cities, state, nation and world today. The institute is part of the University of California Institute of Transportation Studies, a four-campus consortium that includes UC Berkeley, UC Davis and UC Irvine. UCLA ITS is also a proud partner of the Pacific Southwest Region 9 University of Transportation Center, a federally funded research network with seven other universities.

About the UCLA Center for Parking Policy

The UCLA Center for Parking Policy supports policymakers and practitioners navigating parking policy decisions by translating academic research into accessible resources. The center synthesizes existing academic work, documents real-world examples of reform, identifies gaps in the literature, and develops practical tools to help inform evidence-based parking policy. The center's work builds on decades of expertise at UCLA in parking policy and honors the legacy of Professor Donald Shoup.

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The Institute of Transportation Studies and the Center for Parking Policy at UCLA 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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EXECUTIVE SUMMARY

Executive Summary

Across the United States and around the world, cities are increasingly reconsidering, and often repealing, minimum parking requirements. They are doing so to align their parking policy with their housing, climate, and mobility goals. While minimums can help increase parking availability and prevent curb parking from becoming overcrowded, they can also impose substantial costs. This report synthesizes what we know about the impacts of parking infrastructure, the effects of minimum parking requirements, and what happens when cities repeal them. Figure 1 summarizes the key research areas reviewed.

Figure 1. Key Research Areas Examining the Impacts of Parking and Minimum Parking Requirements

We examine the substantial research literature examining the relationship between parking and travel behavior, as well as the smaller set of studies exploring how parking infrastructure affects housing affordability, urban design and walkability, environmental outcomes, public health, and public finance. Our review suggests that parking infrastructure increases the cost of housing, detracts from the aesthetic of urban environments, undermines walkability, reduces space for parks and natural areas, contributes to urban heat islands, and generates stormwater runoff that pollutes water, increases flooding risks, and degrades habitats. Parking infrastructure also limits tax revenues, reduces urban density, and generates supply chain emissions during its construction that are harmful to respiratory and cardiovascular health. Finally, there is substantial evidence that more parking leads to more vehicle ownership and driving. Collectively, this research demonstrates that excessive parking infrastructure has many unintended consequences.

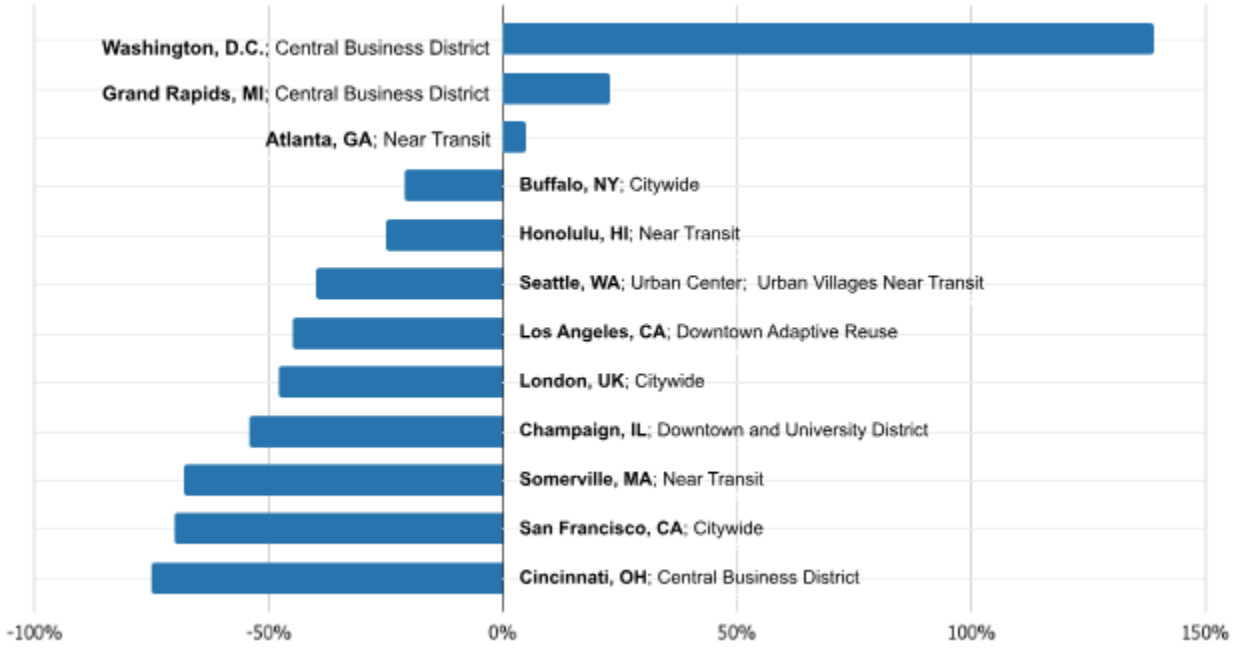
After summarizing parking's impacts, we draw on studies of various cities and building types to show how much land it occupies and how many spaces sit empty, even during peak demand. The research makes clear that parking is often oversupplied, in part because of minimum parking requirements. Minimums are often, though not always, binding on developer decisions. Commercial chains, banks, grocery stores, and luxury housing frequently provide more parking than required, while service-oriented retail and affordable housing projects tend to stick to

the minimum. In general, whether minimums bind depends on their stringency, the type of development, and the urban context. Minimum parking requirements do not fully explain parking oversupply, but they do play a significant role.

Minimum parking requirements also limit the construction of new homes and businesses. Obtaining additional land for surface parking or building parking structures significantly increases development costs, which, in some cases, can leave buildings vacant or parcels undeveloped, especially in infill areas. Research also shows that minimums reduce the number of housing units per building, by (1) requiring parking that takes up space that could otherwise house residents and (2) incentivizing developers to create fewer, larger units to avoid constructing additional parking — especially when adding one or two more units would trigger the need for another level of costly structured parking. By constraining development, minimums also decrease density and lower land values. Because it is difficult to track homes never built or businesses never started, research on parking requirements and development relies more on anecdotal evidence and logical reasoning than other areas of study, but the findings remain compelling, with consistent patterns emerging across multiple studies.

Recent parking reforms have created new opportunities to study the impacts of lifting parking requirements. A key finding is that eliminating parking *requirements* does not eliminate *parking*. Developers generally continue to supply spaces, but usually fewer than the prior mandates required (see Figure 2 below and Table 7 on page 47). In some cities and for certain types of projects, developers provide as much — or more — parking than previously required. Where minimums were low to begin with, or where developers anticipate high demand for parking, lifting minimums makes little difference. In contrast, lifting minimums is more impactful for projects in dense or transit-accessible areas, or where surplus parking is already available nearby.

Figure 2. Percent Increase or Decrease in New Parking Provision Compared to Former Minimums



Data sources: Sohoni & Lee, 2025; Nelson et al., 1997; Hess & Rehler, 2021; Gabbe et al., 2020; Manville, 2013; Guo & Ren, 2012; Sohoni & Lee, 2024.

A few studies examining the repeal of minimum parking requirements also look at outcomes beyond reduced parking supply. These studies find that eliminating minimums encourages adaptive reuse, boosts housing development in areas where minimums are removed, and expands housing options by enabling smaller units and units without on-site parking. Repeal is also associated with more active street frontages and increased municipal parking revenue.

Eliminating minimum parking requirements does not eliminate the environmental, social, and economic harms of parking, but it can reduce their severity. Research indicates that the early effects of repeal are modest rather than dramatic. After requirements are lifted, drivers make more efficient use of existing parking infrastructure, and developers also continue to supply new parking. As a result, the total number of spaces and vehicles citywide may continue to grow while the number of parking spaces per capita declines over time. Minimum parking requirements exert a long shadow, having been entrenched in U.S. cities for more than 75 years. Even after repeal, cities will be dealing with the legacy of an oversupply of parking for many years to come.

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Introduction: The Rise of Minimum Parking Requirements and Donald Shoup's Critique

Zoning codes across the United States require each new building and business to provide a minimum number of off-street parking spaces. These requirements often mandate more space be devoted to parking than to the building itself. For example, before the City Council in San Jose, California voted to abolish minimum parking requirements in 2022, the city had required 25 parking spaces per 1,000 square feet of dining area for restaurants. Since each parking space requires roughly 330 square feet, the code had required a restaurant's parking lot to be eight times the size of the restaurant itself (Shoup, 2018). Cities prescribe strict parking minimums for hundreds of land uses, encompassing everything from dance halls and skating rinks to laundromats and day cares. These detailed minimum parking requirements, now standard in nearly every U.S. city, have a history stretching back nearly a century.

Minimum parking requirements first appeared in U.S. zoning ordinances in the late 1920s and early 1930s, when cities were grappling with the rapid rise of automobile ownership and growing concerns about overcrowded curbs and congestion caused by cars cruising for parking. From these early beginnings, minimum parking requirements spread quickly, as cities often copied parking ratios from the ordinances of other cities (Willson, 2000). One survey found that 17% of cities had off-street parking requirements in 1946, and five years later, the share had jumped to 70% (Shoup, 2011). Over time, the practice became further standardized through professional guidance, most notably the Institute of Transportation Engineers' Parking Generation manual and the American Planning Association's Parking Standards, which offered ready-made sets of ratios that cities across the country incorporated into their codes (Institute of Transportation Engineers, 1987; American Planning Association, 2002; Willson, 2000).

For years, parking received little attention from academics. Despite the large share of urban land devoted to parking and parking's central role in transportation, parking requirements were never even mentioned in the leading transportation or land use planning textbooks (Shoup, 1999b), perhaps because transportation scholars considered parking a land use issue, while land use scholars considered parking a transportation issue. This began to change with the work of Donald Shoup.

Shoup highlighted numerous flaws with the widespread practice of using parking ratios from the Parking Generation manual to set minimum parking requirements (Shoup, 1999b). First, Shoup pointed out how the manual reported parking generation rates with inappropriately high levels of precision; for example, restaurants had a parking generation rate of 9.95 spaces per 1,000 square feet of floor area. Such precision implied a degree of accuracy the data could not support, since half of the parking generation rates were based on four or fewer studies, and 22% were based on a single study. Second, parking demand varied widely across sites, so even larger sample sizes did little to improve accuracy. For instance, the restaurant rate relied on 18 studies, yet across these studies, the number of parked cars per 1,000 square feet of floor area ranged from 3.55 to 15.92, and floor area explained only 4% of the variation in parking demand. This is a large range in ratios, a small amount of predictive power, and perhaps most of all: a ratio of 3.55 or 15.92 implies that planners can know the demand for parking down to one one-hundredth of a parking space, which strains credulity even in the best of circumstances.

Finally, because almost all parking is free, the rates reflect only the demand for free parking (Shoup, 1999b). If drivers paid for their own parking, as they pay for their own cars and fuel, they would likely choose to use less parking.

Minimum parking requirements can often solve the problems they set out to address — overcrowded curb space and drivers circling for parking — but they do so at a high cost. In most places, the requirements have led to an oversupply of parking and ensured that it is invariably given away for free. As this report explains, a large volume of research demonstrates how minimum parking requirements worsen congestion and pollution, encourage sprawl, increase housing costs, degrade urban design, undermine walkability, damage the economy, and penalize people who cannot afford or choose not to own a car.

Since Donald Shoup first began publishing about parking, scholarly interest in the topic has grown considerably. Researchers have examined the wide-ranging impacts of parking infrastructure, including effects on housing affordability, the environment, and travel behavior. They have measured how much urban land is dedicated to parking and how many spaces remain unused, and they have analyzed how minimum parking requirements contribute to excess supply. Other studies have estimated the monetary costs of parking mandates and demonstrated how they can limit new homes and businesses. This body of work has shaped planning practice, and over the past decade, an increasing number of cities have repealed their minimum parking requirements. In several cases, enough time has passed for researchers to observe the early effects of these reforms.

This report synthesizes current knowledge on the impacts of parking infrastructure, the effects of minimum parking requirements, and the outcomes of their repeal. By integrating these findings, it builds on Shoup's pioneering work and highlights how parking policy shapes many different urban outcomes.

The synthesis is organized into the following sections:

1. **Impacts of Parking Infrastructure:** Parking infrastructure negatively affects a wide range of urban outcomes.
2. **Impacts on Car Ownership and Travel Behavior:** Parking affects car ownership, driving, and transit use.
3. **Parking Oversupply and the Role of Minimum Parking Requirements:** Parking is often provided in excess, and parking requirements often contribute to oversupply.
4. **Parking Minimums as Constraints on Development:** Parking requirements can limit the development of new homes and businesses, reducing density and decreasing land values.
5. **Effects of Repealing Minimums:** Eliminating minimums generally slows the growth of new parking supply and often produces the intended effects.

Impacts of Parking Infrastructure

Parking infrastructure negatively affects a wide range of urban outcomes. While parking serves a necessary function in modern cities, it also comes with negative side-effects — externalities. Provided unwisely or in excess, parking can needlessly increase housing costs, undermine walkability, degrade urban design, reduce space for parks and natural areas, contribute to urban heat, and generate stormwater runoff that pollutes water, increases flood risk, and degrades aquatic habitats. Parking construction also produces emissions harmful to respiratory and cardiovascular health. Unless it is built underground (which is enormously expensive), parking also competes for land with other uses, including businesses and homes. A proliferation of parking can in this way reduce urban density and can limit tax revenue. While the benefits of additional parking may sometimes justify these outcomes, rules like minimum parking requirements — which mandate that large quantities of parking be provided regardless of their cost — are likely to exacerbate all these problems, while delivering relatively smaller corresponding benefits.

A substantial body of research now examines parking and its impacts. Much of this work focuses on how parking influences car ownership and travel behavior. Researchers have paid less attention to the non-travel impacts of parking infrastructure, perhaps because scholars in other fields view parking primarily as a transportation issue or see its non-travel effects as either too difficult to isolate or too obvious to study. For example, only a handful of studies directly address the urban design impacts of surface parking. Similarly, many studies address the environmental impacts of impervious surfaces, but few focus on parking specifically. However, the evidence that does exist suggests that excess parking supply has significant consequences.

Many parking infrastructure studies provide strong empirical evidence, though they may focus on only a single geographic area or identify associations rather than causality. Some parking impacts also prove difficult to measure. For example, broader economic and land use trends can complicate efforts to isolate the impacts of parking infrastructure, and parking shapes urban design and the pedestrian experience in ways that resist easy measurement. Overall, theory and empirical evidence point in a consistent direction, but they do not always clarify the magnitude of parking infrastructure impacts or how impacts vary across different urban contexts.

Bundled Parking Raises Rents and Home Prices

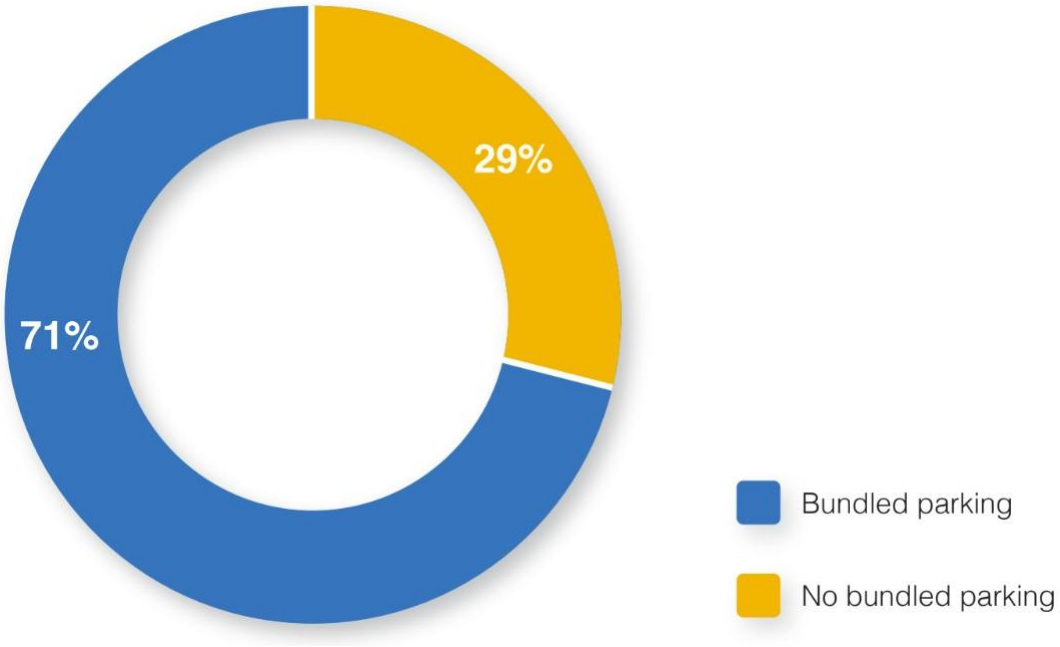
As with any other amenity, on-site parking increases the price of housing. If the renter or homeowner wants that amenity, there is no issue with bundling it into the rent or sales price. However, households with fewer cars than parking spaces end up paying for an amenity they cannot use, and households who might prefer less expensive off-site parking lose the chance to save money. Three studies show that housing units with bundled parking have higher costs per square foot of living space than similar units without it (see Table 1 on page 16). Two of the studies analyze specific neighborhoods, and one uses national survey data.

In downtown Los Angeles, bundled parking added, on average, $283 per month to rents and $61,000 to condominium prices (Manville, 2013; amounts inflated to 2025 dollars). In San Francisco, bundled parking added $79,000 to the purchase price of a condo and $95,000 to the cost of a single-family home (Jia & Wachs, 1999; amounts inflated to 2025 dollars). The San Francisco researchers calculated that without bundled parking, 20% more households could afford a condo, and 24% more households could afford a single-family home. Evidence from the American Housing Survey supports the patterns seen in specific cities. Nationally, renters with bundled

garage parking pay 17% more for rent — an average of $204 more per month, or roughly $2,450 more per year (Gabbe & Pierce, 2017; amounts inflated to 2025 dollars).

Households who value on-site parking may be willing to pay these higher costs, but the widespread bundling of parking, when viewed alongside car ownership data, suggests that some households would benefit from the option to choose housing with less parking. Among carless households, who presumably attach little or no value to on-site parking, 71% still have a bundled space (Gabbe & Pierce, 2017; see Figure 3). Most homes without parking are older, while almost all new housing comes with bundled parking. Housing without parking is also unevenly distributed geographically: for example, 77% of the new homes without bundled parking built between 1999 and 2003 were in the New York metropolitan area, even though this region accounted for just 1% of all new housing nationwide (Manville, 2016).

Figure 3. Share of Carless Households with Bundled Parking



Data source: Gabbe & Pierce (2017).

Although some unbundled options exist, the ubiquity of bundled parking greatly limits the availability of housing without parking and results in many carless or one-car households paying for spaces they cannot use. These added costs accumulate across the housing market, contributing to higher overall housing expenses, which in turn have been linked to a range of downstream effects, including impacts on public health and homelessness (Garber et al., 2024).

Table 1. Housing Cost Increases Associated with Bundled Parking

Study	Location	Type	Cost Increase Associated with Bundled Parking
Gabbe & Pierce, 2017	United States	Rent	$204/month ($2,450/year, a 17% increase)
Manville, 2013	Downtown Los Angeles	Rent	$283/month
		Condos	$61,000 higher selling price
Jia & Wachs, 1999	Six San Francisco neighborhoods	Condos	$79,000 higher selling price
		Single-family homes	$95,000 higher selling price

Note. All values adjusted to September 2025 dollars using CPI-U (FRED series CPIAUCSL).

Off-Street Parking Reduces Public On-Street Parking

Driveway access to private parking lots and garages requires curb cuts, which remove public parking spaces from the street (see Figure 4). For example, in San Francisco's Mission District neighborhood, curb cuts eliminated 356 out of 878 public street spaces, or roughly 30% of the total curbside length (Brown, 2007).[1] Adding a curb cut to provide access to a single off-street space often reduces use of the area's total parking supply, since it removes curb parking while creating a private space that others cannot use when empty (Shoup, 2011). Some cities, including San Francisco and Hermosa Beach in California, allow residents to park in front of their own driveways, but even when curb cuts do not fully remove street parking spaces in front of private driveways from circulation, they still privatize what was formerly public space.

Figure 4. Curb Cuts for Private Parking Access in San Francisco, California

Source: Photo by Mary Brown, from her 2007 MA thesis Shifting Landscapes of Mobility: Reconfiguring Space in the Mission District for Automobiles, San Francisco State University. Licensed under CC BY-NC 4.0.
Available at: https://marybrown.wordpress.com/wp-content/uploads/2008/01/findingspart2.pdf

[1] Since there were only 883 cars registered in the study neighborhood, all but five of them could have parked on the street simultaneously if garages and curb cuts had not been added.

Parking Infrastructure Undermines Walkability and Degrades Urban Design

Walkable urban neighborhoods are characterized by storefronts and other active uses, safe sidewalks, and an abundance of other pedestrians. Research demonstrates the specific mechanisms through which parking undermines these characteristics. First, curb cuts reduce pedestrian safety and comfort by introducing frequent vehicle crossings along sidewalks (Loukaitou-Sideris et al., 2007). Second, abundant parking lots expand the distances between destinations (Mukhija & Shoup, 2006). Third, parking facilities that are directly connected to major trip generators drain streets and public spaces of pedestrian activity. For example, Shoup (2011) compares Disney Hall in Los Angeles with Louise Davies Hall in San Francisco. Los Angeles requires, at a minimum, 50 times more parking for concert halls than San Francisco allows as a maximum. Concertgoers in San Francisco emerge onto busy sidewalks with active storefronts, while those in Los Angeles must navigate a six-level underground parking garage and may never step out onto a sidewalk at all.

Visible parking areas can also make sidewalks and streets feel exposed and uninviting, compared with the more welcoming pedestrian environment created by tree-lined sidewalks and active storefronts. Brown (2007) documents the widespread removal of front yards, gardens, and stoops of Victorian homes in San Francisco (see Figure 5) and the substitution of active storefronts with mandatory garages, creating an incongruous ground-floor façade and breaking the visual continuity of the street (see Figure 5). In Los Angeles, parking requirements spurred the rise of 'dingbat' apartments — housing built on stilts above parking — which reduce street-level engagement and undermine walkability (Shoup, 2011). Mukhija and Shoup (2006) note how some cities have taken steps to combat these impacts; for example, West Hollywood, California prohibits use of a residential front yard for parking and requires landscaping to screen cars from view.

Figure 5. Urban Design Impacts of Parking Infrastructure in San Francisco, California

Source: Photos by Mary Brown, from her 2007 MA thesis Shifting Landscapes of Mobility: Reconfiguring Space in the Mission District for Automobiles, San Francisco State University. Licensed under CC BY-NC 4.0.
Left photo: https://marybrown.wordpress.com/wp-content/uploads/2008/01/introduction_toc.pdf
Right photo: https://marybrown.wordpress.com/wp-content/uploads/2008/01/discussionandanalysis.pdf

McCahill and Garrick (2010) examine how different approaches to parking and street design shaped urban form and transportation patterns in Cambridge, Massachusetts, and Hartford, Connecticut. The two New England cities had been similar along a number of transportation-related dimensions in the 1960s, before their policies and priorities diverged. In Hartford, vast parking areas were created as part of urban renewal, reflecting the belief that

downtown needed more parking to compete with suburban shopping centers. These new lots separated residential neighborhoods from the downtown core. By contrast, Cambridge built two parking garages but set maximum parking limits for new development and prohibited parking in certain areas, instead investing in walking, biking, and transit. While parking and other transportation policies are only one part of the story — the two cities have very different industrial compositions and have experienced vastly different economic trajectories — the outcomes are striking. Over nearly 50 years, Hartford increased the total area dedicated to parking by 265%, compared with Cambridge's 130% increase. By the end of the study period, the walking rate in Cambridge was twice as high as in Hartford, where it had declined substantially.

Parking Infrastructure Contributes to Urban Heat

Parking infrastructure is typically composed of asphalt and concrete, impervious materials that absorb and store heat, contributing to higher urban temperatures. Higher temperatures discourage people from spending time outdoors, reduce productivity, and contribute to a growing number of heat-related deaths each year. Urban heat is often most intense in disadvantaged communities, disproportionately affecting lower-income residents who may have limited access to air conditioning (Manware et al., 2022; Romitti et al., 2022). The heat also strains urban infrastructure: roads rut more quickly, water pumps are more likely to fail, and water quality can decline, while energy use, air conditioning demand, and water consumption all increase. A study conducted in Phoenix, where parking covers roughly 10% of the land, found that parking infrastructure accounts for 29% of the region's total heat emitted from pavements and vehicles on a typical day (Hoehne et al., 2022). Parked cars, especially dark-colored ones, can further raise air temperatures (Matias et al., 2025).

Strategies to alleviate the heat that parking lots generate come with trade-offs (Hoehne et al., 2022). For example, reflective pavements can reduce urban heat at the city scale, but these reflective surfaces also increase radiant heat exposure at street level, making conditions less comfortable for pedestrians (Middel et al., 2020). Hoehne et al. (2022) find mixed evidence on whether solar panels covering parking lots also absorb and radiate heat. They also describe how planting trees could provide shade, but parking lots are difficult places to maintain large, healthy shade trees, as the surrounding pavement raises soil temperatures, accelerating evaporation and increasing water needs.

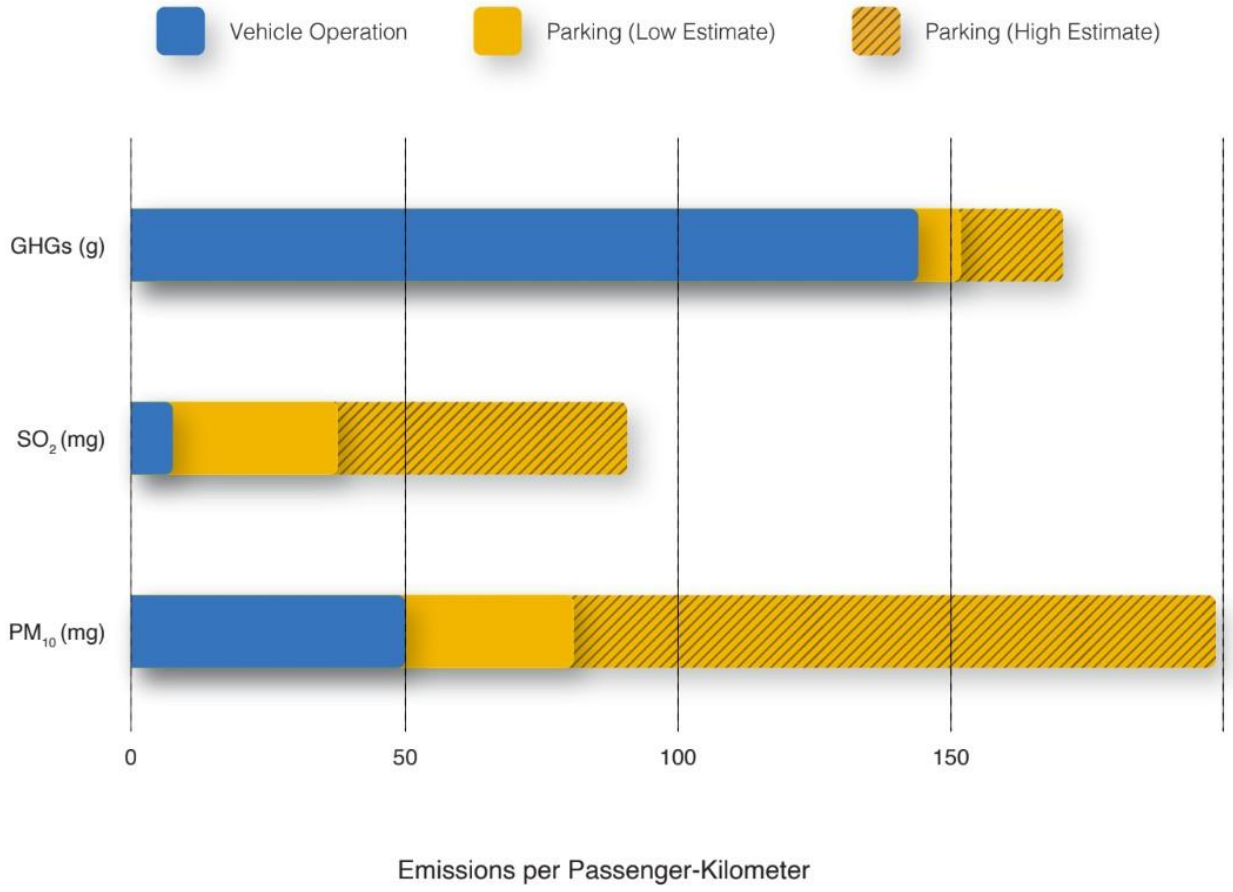
Parking Lots Contribute to Water Pollution, Flooding, and Habitat Degradation

When it rains, a variety of pollutants from parking areas — including heavy metals, oils and fuels, radiator fluids, and plastic debris — enter streams and other watercourses. As impervious surfaces, parking lots generate stormwater runoff, which is the nation's leading threat to water quality (Arnold & Gibbons, 1996). Impervious surfaces also exacerbate flooding (Garber et al., 2024), and damage aquatic habitats through eroding stream banks and increasing sediment (Albanese & Matlack, 1998). Most studies find it challenging to isolate the specific contribution of surface parking to flooding and water quality, as opposed to roads, paved yards, and other impervious surfaces. One notable exception (Davis et al., 2010a) estimated that surface parking lots (excluding driveways, parking for single family homes, and street parking) in Tippecanoe County, Indiana increased stormwater runoff by more than 900%.

The Life Cycle of Parking Construction Harms the Environment and Public Health

Life cycle analyses show that the construction of parking can generate pollution comparable to driving itself (Chester et al., 2010). For example, sulfur dioxide (SO_2) emissions cause respiratory problems, and the SO_2 emitted from energy use in the supply chain exceeds the SO_2 emitted from driving. Hot-mix asphalt plants and the mixing and laying of asphalt produce particulate matter (PM_{10}), which is harmful to cardiovascular health. Parking construction generates PM_{10} emissions comparable to those from driving. Parking construction also generates greenhouse gas emissions, though at lower levels than vehicle use. Figure 6 compares per-passenger-kilometer emissions from driving with those from parking construction.

Figure 6. Life Cycle Emissions from Driving Versus Emissions from Parking Construction



Data source: Chester et al. (2010).

Surface Parking May Limit Property Tax Revenue Potential

Parking infrastructure, particularly surface parking, often generates less property tax revenue than land used for buildings. Blanc et al. (2014) analyzed parking in the central business districts of six U.S. cities and found a consistent pattern: where the share of surface parking increased, the local property tax base weakened. However, the research does not establish the causal role of parking; a large share of land used as surface parking may simply reflect preexisting urban decline.

Parking Supply Undermines Density

Urban density–having more people, jobs, and activities concentrated in a given area–offers a wide range of economic, social, and environmental benefits, including enabling more efficient and sustainable travel patterns (Stevens, 2017). Parking mechanistically reduces density through occupying land, and so a first-order estimate of its impact depends on how much land parking occupies (see section beginning on page 30). Manville et al. (2013) compared Los Angeles and New York City, as well as different neighborhoods within New York City, and found that the differences in population density between different areas partly reflected variation in residential parking supply.

However, urban economic models highlight a second-order impact: when parking infrastructure is abundant and most households expect free parking, households exhibit a greater preference for more distant housing locations, further undermining density and increasing sprawl. For example, Franco's (2017) spatial general equilibrium model indicates that more downtown parking lowers the cost of driving, leading households to live farther from the city center in lower-density surroundings.

Impacts on Car Ownership and Travel

More parking means more cars, more driving, and less transit use. A large body of research examines how parking affects car ownership and travel behavior. Evidence consistently shows that parking availability and convenience strongly influence whether households own vehicles and how much they drive. This section summarizes studies that link residential parking to car ownership and studies that link residential, workplace, or citywide parking to travel behavior.

Residential studies focus mainly on the availability of parking, rather than its price. Workplace studies focus primarily on price, but pricing generally arises only when parking is scarce and therefore also serves as an indicator of limited supply.

Overall, the research on the relationship between parking supply and travel behavior has become increasingly robust. Both residential and workplace parking studies draw on detailed observational data, natural experiments, and regression models to identify causal effects. Studies of citywide or area-wide parking supply can rarely establish causality to the same extent, given the many confounding variables, but they do identify consistent correlations between parking supply and travel behavior. However, most studies focus on urban areas; additional research could clarify whether and to what extent similar patterns may hold in less densely populated places. Even so, the cumulative evidence is compelling, and findings across diverse settings and methods are remarkably consistent: greater parking supply substantially increases vehicle ownership and driving. Perhaps most surprisingly, several studies in major urban areas find that transit ridership seems to depend more on parking supply than on transit service quality.

Home Parking Supply Impacts Car Ownership

Parking spaces are often worth more than the cars that use them (Shoup, 2014). When spaces are bundled into the cost of rent, the opportunity cost of owning a car falls: households pay for parking whether they use it or not, so not owning a car doesn't save them any money on parking. Even if parking costs are not bundled, on-site parking makes car ownership and use more convenient. As a result, households are more likely to purchase additional vehicles when the building provides parking. Research from both neighborhood-level surveys and national datasets consistently shows a strong relationship between parking availability and vehicle ownership. Some of this effect is due to self-selection: car owners tend to choose homes with parking. Even when researchers account for self-selection, however, the pattern holds: the more parking there is, the more cars people own.

To see how parking availability affects car ownership, three studies surveyed residents by mail. In San Francisco, an affordable housing lottery, open to households earning up to 120% of the area median income, created a "natural experiment": since winning the lottery provides such a major housing benefit, recipients typically accept any available unit, regardless of parking or transportation options. In buildings without on-site parking, only 38% of households own a car (and presumably park on the street or pay to rent an off-street space nearby). By contrast, in buildings with at least one parking space included per unit, more than 81% of households own a car. Similar results were found even after accounting for income and the level of access to other modes of transportation (Millard-Ball et al., 2021). Because these findings come from a natural experiment, the study provides particularly strong evidence that bundled parking causally increases vehicle ownership.

The other two studies that used mail surveys did not control for self-selection, but did control for other variables, and found similar patterns. Chatman (2013) found that parking supply was the greatest predictor of vehicle ownership in transit-oriented neighborhoods in New Jersey. Households with fewer than one off-street space per adult owned 0.16 fewer vehicles per adult, and those with low off-street *and* on-street parking availability owned 0.29 fewer vehicles per adult. Meanwhile, doubling the number of bus stops within a mile radius corresponded to only 0.08 fewer vehicles per adult. In Australia, a survey of 1,316 residents across three cities found a similar pattern: households without bundled off-street parking owned an average of 0.27 vehicles, compared with 1.06 vehicles for households with one parking space and 1.51 vehicles for households with two spaces (De Gruyter et al., 2025).

Guo (2013a) used aerial photography and survey data to examine the relationship between parking and car ownership in the New York City region. The study found that 80% of the households with off-street parking owned cars, compared with 49% for households that relied solely on street parking. The ease of finding street parking also influenced car ownership even among households that had off-street parking: where street parking was free and readily available, car ownership was 9% higher, which translated to roughly 165,000 additional cars in the study area (Guo, 2013b).

Studies using American Housing Survey data show a similar relationship between parking supply and car ownership that extends beyond the local study areas mentioned above. Manville (2016) found that households with bundled parking were two to three times more likely to own a car, even after accounting for other household characteristics and self-selection. He found similar results among public housing residents, whose limited ability to choose their housing unit provides a “natural experiment,” (similar to the San Francisco example above) reinforcing the finding that bundled parking directly causes vehicle ownership. Using more recent survey data, Manville and Pinski (2020) found consistent results: households without bundled parking were more than three times as likely as those with bundled spaces to have no vehicles. Ding and Manville (2025) combined data from the American Housing Survey and the California Household Travel Survey and found that households with bundled parking owned, on average, 0.23 more vehicles per household.

Manville et al. (2013) analyzed parking and vehicle ownership across and within Los Angeles and New York City and found a clear relationship, though not an explicitly causal one, between car ownership and parking supply. Differences in parking supply mirrored differences in minimum parking requirements, and within New York City, each 10% increase in minimum parking requirements was associated with a 5% increase in vehicles per square mile and a 4% increase in vehicles per person. Bundled parking was more common where parking requirements were higher, and the effect of minimum parking requirements on car ownership was greater even than the effect of household income. Drawing on data from 56 Swedish cities, McAslan and Sprei (2023) also found higher parking requirements were associated with greater car ownership, but the association was not statistically significant.

Table 2 summarizes the key findings from the research above. Specific findings vary based on location and study methodology, but the pattern is clear: bundled off-street parking and readily available on-street parking increase car ownership.

Table 2. Research Linking Parking Availability to Increased Car Ownership

Study	Location/Sample	Key Findings
Millard-Ball et al., 2021	San Francisco affordable housing lottery	With at least 1 off-street space per unit: 81% of households had a car Without off-street parking: 38% of households had a car **Controlling for self-selection*
Chatman, 2013	Transit-oriented neighborhoods, New Jersey	Under 1 off-street space per adult: 0.16 fewer vehicles per adult Under 1 off-street parking space per adult *and* scarce on-street parking: 0.29 fewer vehicles per adult
De Gruyter et al., 2025	Perth, Melbourne, and Sydney, Australia	No off-street spaces: average 0.27 vehicles per household 1 off-street space: average 1.06 vehicles per household 2 off-street spaces: average 1.51 vehicles per household
Guo, 2013a	New York City region	With off-street parking: 80% of households had a car Without off-street parking: 49% of households had a car
Guo, 2013b	New York City region	Among households with off-street parking, car ownership was 9% higher when on-street parking was also free and readily available.
Manville, 2016	National (American Housing Survey)	Households without bundled parking were 2-3 times more likely to be car-free. **Controlling for self-selection*
Manville & Pinski, 2020	National (American Housing Survey)	Households without bundled parking were more than 3 times more likely to be car-free.
Ding & Manville, 2025	California (California Household Travel Survey + American Housing Survey)	The presence of bundled parking was associated with 0.23 more vehicles per household.
Manville et al. 2013	New York City urbanized area	Differences in parking supply mirrored differences in minimum parking requirements. Each 10% increase in residential minimum parking requirements was associated with 5% more vehicles/square mile and 4% more vehicles/person.

Residential Parking Availability and Convenience Affect Driving and Transit Use

It follows that if greater parking availability increases car ownership, it will also increase driving. Car-free households drive an average of 3,800 miles per year, compared with 12,300 miles for households with cars (Manville, 2016). Many of the studies cited in the car ownership section above also find that a greater parking supply results in more driving. When parking is free and convenient, driving also becomes cheaper and more convenient. Conversely, when parking is limited, people have stronger incentives to consider alternatives. Multiple well-designed studies show that parking availability affects transit use, often with effects exceeding those of transit accessibility.

Parking availability influences travel even among car-owning households. Several studies have isolated the effect of bundled parking or parking convenience on vehicle travel. Among otherwise similar households with the same car ownership levels, those with bundled off-street parking drive more. Additionally, among similar households with off-street parking, those with more convenient access to their spaces drive more. This suggests that in neighborhoods where curb parking is scarce, a household may think twice about driving for a given trip if it means giving up a coveted on-street space.

The “natural experiment” created by San Francisco’s affordable housing lottery revealed that driving frequency rose with parking supply: every 0.43 additional parking spaces per household made residents 7% more likely to drive to work and 7% less likely to take transit (Millard-Ball et al., 2021). The same study found that access to a parking space has an effect on transit use three times as large as the effect of living in a neighborhood with good transit access, and that parking access significantly reduces the frequency of walking. Similarly, Chatman (2013) found that parking availability affected driving more than any of the other factors he examined did, including transit access. Limited off-street parking (under one space per household) was associated with a 40% reduction in auto commuting, and households with constrained on- and off-street parking took 25% fewer vehicle-based grocery trips.

Manville et al. (2013) found that differences in parking supply (which mirrored differences in minimum parking requirements) predicted transit use more than the quality of transit access did; within the New York City urbanized area, transit use was more powerfully associated with parking than with proximity to the subway. Each 10% increase in residential parking requirements was associated with a 4% increase in auto commuting and a 2% decrease in transit commuting. The study also attributed Manhattan’s extraordinarily low drive-alone commute share (only one-eighth that of Los Angeles) largely to its lower parking supply and lower prevalence of bundled residential parking. Weinberger (2012) also studied the effects of parking in the New York City region. She estimated the residential off-street parking supply for three New York City boroughs and found that the effect of residential parking on auto commuting was more than twice as large as the effect of transit accessibility. Even after controlling for car ownership, households with off-street parking at home showed higher rates of auto commuting into Manhattan.

Using a national dataset, Manville (2016) found that bundled parking was strongly associated with more driving to work; much of that association was likely via the intermediate channel of encouraging vehicle ownership. A later study showed that bundled parking is associated with more driving even beyond its effect on car ownership: overall, households without bundled parking spent about 50% less on gasoline; after controlling for car ownership, they still spent 17% less — equivalent to driving roughly 4,000 fewer miles per year — than similar households with bundled parking (Manville & Pinski, 2020). The households without bundled parking were also more than twice as likely to use transit; in fact, transit use was more closely tied to unbundled parking than to poverty. In California, compared with otherwise similar households (controlling for factors other than car ownership), those

with bundled parking drove an average of 14.6 more miles per day — more than 20% of the average daily household vehicle travel (Ding & Manville, 2025). The association between increased vehicle travel and bundled parking was even larger than the association between vehicle travel and an additional household vehicle. Households with bundled parking also took an average of 0.45 fewer daily transit trips.

Guo (2013a) defined home parking convenience to encompass both parking certainty and parking ease. Certainty comes from having a guaranteed off-street space, while ease refers to the ability to find and access parking without difficulty, such as on uncrowded streets or without needing to navigate narrow or fenced driveways and garages. To examine the impact of parking certainty, Guo compared car use among households based on different types of parking access: garage parking, driveway parking, or street parking only. After controlling for land use, transit, and household characteristics, the households without the certainty of an off-street space used their cars only half as often as those with driveway or garage parking. To examine the impact of parking ease, Guo compared driving among households with the same parking options. After controlling for car ownership, Guo found that among households with garage access, those who parked on the street made 39% more unlinked car trips and traveled 37% more miles than those who parked on-site, suggesting that they perceived street parking as more convenient than garage parking. For households with driveway access, driving did not differ significantly between those who parked on the street versus in their driveway.

Currans et al. (2023) used survey data and a statistical model to link parking supply not only to mode share, but also to vehicle miles traveled. They examined the relationship between residential off-street parking and driving in Los Angeles County, assuming that parking affects driving primarily by influencing vehicle ownership. Their model estimated that households living in buildings with constrained parking (under 1 off-street space per unit) drove 10–23% fewer miles, even after controlling for household and neighborhood characteristics.

While policymakers may wish to decrease the share of trips made by automobile, lower numbers of total trips could reflect limited access to opportunities, rather than a simple shift of some vehicle trips to other modes of transportation. Two studies examined whether limited parking was associated with decreased travel or access to opportunity. In a study of parking and travel behavior in Norway, Christiansen et al. (2017) found that the likelihood of driving decreased as the distance to the home parking space increased; a farther away parking spot encouraged some car owners to choose another mode but did not reduce the total number of trips. Similarly, low parking access in San Francisco did not harm commute length, ability to switch jobs, or employment outcomes (Millard-Ball et al., 2021).

Table 3 summarizes the key findings from the research above. Findings vary based on the sample and study methodology, but the pattern is clear: off-street parking increases driving and undermines transit.

Table 3. Research Linking Residential Parking to More Driving and Less Transit Use

Study	Location/Sample	Driving-Related Findings	Transit-Related Findings
Millard-Ball et al., 2021	San Francisco affordable housing lottery buildings	Every 0.43 additional parking spaces per household made residents 7% more likely to drive to work.	Every 0.43 additional parking spaces per household made residents 7% less likely to take transit. The effect of parking supply on transit commuting was over 3 times as large as the effect of transit accessibility.
Chatman, 2013	Transit-oriented neighborhoods, New Jersey	Under 1 off-street space per adult: 40% reduction in auto commuting Under 1 off-street parking space per adult *and* scarce on-street parking: 25% fewer vehicle-based grocery trips	Driving was more influenced by parking availability than by transit access.
Manville et al., 2013	New York City urbanized area	Differences in parking supply mirrored differences in parking requirements. Each 10% increase in residential parking requirements was associated with a 4% increase in the share of auto commuting.	Differences in parking supply mirrored differences in parking requirements. Each 10% increase in residential parking requirements was associated with a 2% decrease in the share of transit commuting. Transit use was more powerfully associated with parking requirements than with proximity to the subway.
Weinberger, 2012	Brooklyn, Bronx, and Queens neighborhoods in New York City	Even after controlling for car ownership, more off-street parking per unit was associated with more driving.	The effect of off-street parking access on auto commuting into Manhattan was more than twice as large as the effect of transit accessibility.
Manville & Pinski, 2020	National (American Housing Survey)	Households with zero bundled parking spaces spent roughly 50% less on gasoline. Even after controlling for car ownership and other characteristics, households without bundled parking spent 17% less on gasoline.	Even after controlling for car ownership and other characteristics, households without bundled parking were more than twice as likely to use transit.
Ding & Manville, 2025	California (California Household Travel Survey + American Housing Survey)	Bundled parking was associated with 14.6 more household daily vehicle miles traveled.	Bundled parking was associated with 0.45 fewer household daily transit trips.
Guo, 2013a	New York City Region	Households without an off-street space used their cars only half as often as those with driveway or garage parking. Controlling for car ownership, households with garage access who parked on the street made 39% more unlinked trips and drove 37% more miles than those who parked on-site.	N/A
Currans et al., 2023	LA County	Under 1 off-street space per unit was associated with an estimated 10–23 percentage point decrease in vehicle miles traveled.	N/A

The Price and Availability of Parking at Work Impact Commute Choices

Across studies, employer-paid parking was tied to more solo driving, whereas charging employees for parking shifted travel toward walking, biking, and transit. Most research on workplace parking focuses on pricing rather than supply. However, pricing generally emerges only where parking is scarce. Where parking is plentiful, it is difficult to charge for, since drivers could easily find free spots nearby.

Shoup (1995) compiled seven case studies documenting how employer-paid parking reduces solo driving to work. Some studies compared matched samples of employees with and without free parking, while others compared commuting behavior before and after employers stopped offering free parking. On average, when employees paid for their own parking, the share of solo drivers fell by 25 percentage points, and 19 fewer cars were driven to work per 100 employees.

Later studies showed a similar pattern. Using a travel behavior survey that included both the cost of parking at work and commute mode choice to downtown Portland, Hess (2001) developed a model predicting that a six-dollar daily parking charge would reduce drive-alone commuting by 16 percentage points and carpooling by 12 percentage points, while increasing transit commuting by 28 percentage points. The model also predicted that for every 100 commuters, 21 would stop driving alone to work, reducing annual vehicle travel by 39,000 miles. More recently, Ding and Manville (2025) found that, all else equal, free parking at work in California was associated with 10.4 more daily vehicle miles per household.

Other studies examine the combined impact of parking charges, transit subsidies, and other incentives to shift modes. Bianco (2000) studied actual changes in commuting after the city installed parking meters and provided discounted transit passes to some employees in downtown Portland's Lloyd District. Even though only free street parking was reduced, long-term meters charged only $0.35/hour, and many employees continued to park free at work, drive alone commuting decreased 7%. Hamre and Buehler (2014) studied how free workplace parking and other transportation benefits — such as public transit subsidies, shower and locker facilities, and secure bike parking — affected commuting in Washington, D.C. Their analysis found that employees who received free parking but no other benefits would be 20 percentage points more likely to drive alone than those who received no benefits of any kind. In contrast, employees who received public transportation and bike/walk benefits — but no free car parking — would be 50 percentage points less likely to drive alone than those with no benefits. Notably, offering free parking alongside walking, biking, or transit incentives largely negated the effect of those other benefits.

A study in Norway found that employees with free parking at work were more likely to drive than those without any employer-managed workplace parking: four times more likely when the free parking was plentiful, and twice as likely when it was limited. When workplace parking was available, requiring employees to pay for it reduced the odds of driving to work by 11–30% (Christiansen et al., 2017).

The studies discussed above mainly compare free versus paid parking. Related research examines how employees respond when given the option to receive the cash value of a parking subsidy instead of a free space. In California, state law requires large employers who rent parking spaces for their employees to give them this cash-out option. Shoup (1997) studied eight firms that implemented the policy and found that the number of solo drivers decreased 17%, the number of carpoolers increased 64%, transit ridership rose by 50%, and walking and biking increased by 39%. Vehicle miles traveled fell by 12%.

Table 4 summarizes the key findings. Findings vary based on the sample, price of parking, and study methodology, but the general pattern is clear: free workplace parking increases driving and undermines transit.

While this section focuses primarily on empirical research, modeling studies reach similar conclusions (e.g., Abou-Zeid et al. 2023; Brueckner & Franco, 2018).

Table 4. Research Linking Workplace Parking Benefits to Commuting Behavior

Study	Location/Sample	Key Findings
Shoup, 1995	7 case studies, U.S. and Canada	Driver-paid parking decreased drive-alone commuting 25 percentage points, and 19 fewer cars were driven to work per 100 employees.
Hess, 2001	Downtown Portland	The model predicted that a $6 daily parking charge would reduce drive-alone commuting by 16 percentage points and carpooling by 12 percentage points, increasing transit commuting by 28 percentage points.
Bianco, 2000	Lloyd District, Downtown Portland	Installing parking meters ($0.35/hour) and offering some employees discounted transit passes decreased drive-alone commuting by 7%.
Ding & Manville, 2025	California (California Household Travel Survey + American Housing Survey)	Free parking at work was associated with 10.4 more daily vehicle miles traveled per household.
Hamre & Buehler, 2014	Washington D.C. urban core and inner suburbs	Employees who received free parking but no other transportation benefits were 20 percentage points more likely to drive alone than those who received no benefits. Free car parking also largely offset effects of public transportation benefits, lockers and showers, and secure bike parking.
Christiansen et al., 2017	Norway	Employees with employer-paid parking at work were 2–4x more likely to drive than those without any employer-managed parking at work. Requiring employees to pay for parking reduced the odds of driving to work by 11–30%.
Shoup, 1997	8 California firms	When employees were offered the equivalent cash value in-lieu of free work parking, the number of solo drivers decreased 17%, the number of carpoolers increased 64%, transit ridership rose by 50%, and walking and biking increased by 39%.

Higher Citywide Parking Supplies Increase Driving

Most studies focus on either residential or workplace parking, but a smaller body of research examines the relationship between *area-wide* or *citywide* parking and travel behavior. Parking is more likely to be priced where its supply is limited, and such places also tend to have lower levels of car ownership, as discussed earlier. Urban economics models (e.g. Franco 2017) predict that higher downtown parking supply will lower the costs of driving, leading to higher rates of auto commuting, and empirical work generally confirms these predictions. However, as the authors of the below-mentioned studies note, their studies show correlations rather than proving a causal relationship between higher areawide parking supply and increased auto commuting. Cities with more parking are also likely to have other characteristics that encourage driving, and it is challenging to control for differences such as economic development trajectories.

McCahill and Garrick (2010) examined parking supply and commuting behavior over time in Cambridge, Massachusetts, and Hartford, Connecticut — two cities that had similar shares of transit commuters in the 1960s before their approaches to parking and transportation diverged. Between 1960 and 2007, Hartford's parking supply per worker grew by 194%, while Cambridge's increased by only 20%. Over the same period, the share of drive-alone commuters in Hartford rose from 53% to 73%, while in Cambridge it fell from 42% to 38%.

Hartford and Cambridge were also included in three subsequent studies that expanded the analysis to additional cities and further solidified the connection between parking supply and driving. Across nine medium-sized U.S. cities, an increase in citywide parking provision from 0.1 to 0.5 parking spaces per resident or employee was associated with an increase in automobile commute mode share of roughly 30 percentage points (McCahill et al., 2016). In a later study, McCahill et al. (2019) tracked changes in parking supply between 1960 and 2000 for six cities. In the three cities with the highest minimum parking requirements, parking supply ratios increased by 221%, on average, and the share of commuters driving to work rose, on average, by 31%. In contrast, in the three cities with lower parking requirements, parking supply ratios decreased by 26%, on average, and the share of commuters who drove to work decreased, on average, by 4%. An earlier study by the same authors found that differences in parking supplies explained 70% of the variation in automobile commuting across 12 cities (McCahill & Garrick, 2012).

Parking Oversupply and the Role of Minimum Parking Requirements

Parking Oversupply

Parking is often oversupplied. Research finds that parking typically occupies between 5% and 14% of urban land and that the supply exceeds what drivers actually use, across many cities and building types. Studies that measure occupancy reveal large numbers of empty spaces, even during the busiest hours, and even when most parking is free to drivers. Other studies highlight indirect signs of oversupply, such as garages repurposed for non-vehicle uses, or the share of car-free households with a bundled parking space. Taken together, these studies provide clear evidence that parking is frequently overbuilt and consumes a needlessly large share of urban land.

Researchers and planners commonly use the term “oversupply” for situations where a lot or garage is rarely or never fully occupied, even when parking is offered for free, and that is how this section uses the term. However, from an economic perspective, oversupply can still occur if the marginal costs of a space exceed its marginal benefits, regardless of peak occupancy.

A Substantial Share of Land Is Devoted to Parking

Measuring the share of land devoted to parking is challenging; there is no single accepted approach. Estimates vary by whether researchers include only surface lots or also driveways, garages, and on-street spaces. Using comparable methods (combining minimum parking requirement data, assessor data, and curb data) accounting for both on-street and off-street parking, studies in Los Angeles County, the Phoenix metropolitan area, and the San Francisco Bay Area found that parking occupied roughly 14%, 10%, and 8%, respectively, of the incorporated land area (Chester et al., 2015; Hoehne et al., 2022; Li et al., 2022). Some locations had considerably more; for example, in the Bay Area, parking covered roughly 44% of downtown Burlingame, 40% of downtown Walnut Creek, and 40% of industrial zones in Concord (Li et al., 2022).

Gabbe et al. (2021) analyzed the share of land devoted to parking in the seven most productive cities in Santa Clara County, California, the region otherwise known as Silicon Valley. They estimated that 13% of the land area was devoted to parking, including more than half of the average commercial parcel. They also noted that about 90% of housing units in Silicon Valley include a bundled parking space, compared with just 70% in San Francisco and under 30% in New York City and Boston, where more development predates minimum parking requirements.

One common method uses aerial images to quantify parking supply. In four Upper Great Lakes states, researchers estimated that parking lots cover roughly 5% of urban land; in Tippecanoe County, Indiana, the figure is about 7%, counting only lots with at least four spaces and excluding driveways, garages, and street parking (Davis et al., 2010b; Davis et al., 2010a). Consistent with other research, for Upper Great Lakes states, parking lot coverage was greatest near urban centers (Davis et al., 2010b). Recent work applies machine learning tools to satellite imagery to quantify land devoted to off-street parking, which can scale up estimates to many more cities than possible with manual counts. Notably, Qiam and Lehe (2025) estimate parking as a share of taxable parcel land rather than of total incorporated land area. Analyzing 15 cities, they found that the share of parcel land dedicated to off-street surface parking ranged from 3 to 11% citywide and from 2 to 32% within central business

districts. Unlike other studies, which often include the top level of parking garages when calculating parking area, their analysis counted only surface parking. Table 5 displays the results from these parking coverage studies.

The Parking Reform Network (2025a) has also used aerial photographs to map the parking coverage, including surface parking and above ground garages, for dozens of “central cities” across the United States. The boundaries used for these central cities largely correspond to zoning districts, such as central business districts, with some adjustments based on prominent physical or infrastructural features, such as rivers or highways. In cities with urbanized areas exceeding 500,000 residents, parking occupied a median of 26% of land in the central city. Rapidly growing cities tend to have less surface parking than cities with stable or declining populations. Figure 7 on page 33 shows an aerial photograph of the “central city” in Anchorage, Alaska, where parking occupies 34% of land.

While parking infrastructure reduces the space available for *all* other potential uses, several studies have directly compared the land area devoted to parking with the land area devoted to parks and green space within a region. For example, Brown (2007) estimated that the land required to store San Francisco’s automobiles covers an area equivalent to three and a half Golden Gate Parks. Similarly, Davis et al. (2010a) found that in Tippecanoe County, Indiana, urban parking lots, which were mostly empty, occupied three times more land than urban parks. They calculated that converting these parking areas to wetlands would increase the ecosystem service value (an estimate of the benefits humans derive from natural ecosystems) by $22.5 million.

Table 5. Studies Estimating Share of Land Devoted to Parking Infrastructure

Study	Location	Area of Analysis	Parking Type(s) Included	Coverage Rate Estimate	
				Area-wide	Central Business District
Chester et al., 2015	Los Angeles County	All incorporated land area	On-street and off-street parking	14%	N/A
Hoehne et al., 2022	Phoenix metropolitan area			10%	
Li et al., 2022	San Francisco Bay Area			8%	
Gabbe et al., 2021	Silicon Valley (7 most productive cities in Santa Clara County, CA)	Commercial, industrial, and multifamily residential parcels	Off-street parking	13%	
Davis et al., 2010a	Tippecanoe County, Indiana	Urban areas	Off-street lots with at least four spaces	7%	
Davis et al., 2010b	Illinois, Indiana, Michigan, and Wisconsin			5%	
Qiam & Lehe, 2025	Anaheim	Taxable parcel land	Off-street surface parking (excludes land covered by a parking garage)	11%	10%
	Atlanta			6%	19%
	Boston			5%	2%
	Chicago			6%	3%
	Dallas			8%	21%
	Indianapolis			7%	20%
	Los Angeles			6%	22%
	Memphis			7%	18%
	Minneapolis			7%	14%
	Oakland			3%	10%
	Phoenix			8%	16%
	Riverside			6%	14%
	San Diego			5%	9%
	Seattle			5%	8%
	Tulsa			7%	32%

Figure 7. Share of the "Central City" Devoted to Off-Street Parking in Anchorage, Alaska

Source: Parking Reform Network, 2025a. Used with permission.

Many Parking Spaces Go Unused, even at the Busiest Times

Numerous surveys across different building types have shown that, even though parking is generally free to drivers, much of it sits empty. These studies are relatively straightforward. Some studies in residential areas look at vehicle ownership data relative to parking supply; other studies use manual counts of vehicles relative to spaces. The evidence consistently shows an oversupply of off-street parking.

For example, Smith (2013) surveyed 13 shopping centers along transit routes in San Jose, California, and found that on a December Saturday at noon, one of the busiest times of the year, their parking lots were only between 29–78% occupied. Likewise, Willson (1995) found that five suburban office buildings in Southern California devoted 60% of their parcel land to parking, and those spaces were, on average across buildings, only 56% occupied. Weinberger and Karlin-Resnick (2015) reviewed parking studies from 27 mixed-use districts across the country. Using a conservative benchmark that "sufficient supply" would leave 15% of spaces available, they found that, on average, the districts had 65% more parking than necessary. Even in areas that identified parking shortages, supply exceeded demand by an average of 45%.

Several studies examining the environmental impacts of parking lots have also noted widespread underuse. In a study of the impact of parking lots on local streams in Hattiesburg, Mississippi, researchers noted that most parking lots were less than half full at peak hours (Albanese & Matlack, 1998). In a study centered on stormwater runoff and the lost potential for parks and wetlands, researchers noted that parking lots across Tippecanoe County, Indiana, were only 28% full overall (Davis, et al., 2010a).

Residential parking, too, tends to be oversupplied, even where cities grant parking reductions for transit proximity or affordable housing. For example, Rowe et al. (2011) examined four buildings near downtown Seattle and found that while the average parking supply was 0.74 spaces per unit, residents owned only 0.52 vehicles per unit. Ewing et al. (2019) compiled results from seven transit-oriented developments and found that the actual number

of cars parked at peak hours was, on average, only 36% of the ITE parking generation rate and only 63% of the site's actual supply. Similarly, Cervero et al. (2010) surveyed 31 multifamily housing complexes near rail stations and found that parking supply exceeded peak demand by an average of 37%, which translates to 73% occupancy. Willson (2012) surveyed 21 affordable housing sites in San Diego, where parking requirements ranged from 1.00 to 2.25 spaces per unit. On average, affordable housing residents owned only 0.68 vehicles per household, and observed overnight occupancy was 0.53 vehicles per occupied apartment.

Additional evidence similarly points to an oversupply of residential off-street parking: many garages serve non-parking uses, many zero-vehicle households still receive a bundled private parking space, and residential streets often have many empty curb parking spaces.

In the New York City region, fewer than 13% of garage owners parked in their garage (Guo, 2013b). In Sacramento, 63% of garage owners used their garage at least partially for parking, and studies from cities in the United States, the United Kingdom, and Australia report garage-use rates that fall between these two cases (Volker & Thigpen, 2022). In the United States, 73% of renter households without a car still have a bundled parking space included with their rent, and in Australia, 65% of carless households have a bundled off-street space (Gabbe & Pierce, 2017; De Gruyter et al., 2025). In Davis, California, only 29% of curb spaces in residential areas were occupied during peak overnight hours (Thigpen & Volker, 2017). In Sacramento, California, single family households have, on average, 1.6 more available parking spaces than cars (Volker & Thigpen, 2022). Overall, these data reveal widespread underuse of parking spaces, suggesting that most buildings supply far more parking than necessary.

Table 6 displays the key findings from parking use studies.

Table 6. Parking Use Studies

Study	Location	Study Focus	Result
Smith, 2013	San Jose, California	Off-street parking for 13 shopping centers along transit routes	29 to 78% full
Willson, 1995	Suburban Southern California	Off-street parking for 5 office buildings	56% full
Weinberger & Karlin-Resnick, 2015	Various, across the United States	Mixed use districts off-street parking	65% more parking than necessary; 45% more in areas with perceived parking shortages
Albanese & Matlack, 1998	Hattiesburg, Mississippi	Parking lots near local watersheds	Less than 50% full
Davis et al., 2010a	Tippecanoe County, Indiana	Off-street parking lots	28% full
Rowe et al., 2011	Seattle, Washington	Off-street parking for downtown apartments	Car ownership was 70% of parking supply
Ewing et al., 2019	Various, across the United States	Off-street parking for transit-oriented developments	63% full
Cervero et al., 2010	San Francisco Bay Area and Portland, Oregon	Off-street parking for apartments near suburban rail stations	73% full
Willson, 2012	San Diego, California	Off-street parking for affordable housing developments	Average 0.53 occupied spaces per unit, while parking requirements ranged from 1 to 2.25
Guo, 2013b	New York City region	Residential garages	Under 13% of garages were used for parking
Gabbe & Pierce, 2017	United States	Residential off-street	73% of zero-vehicle renter households have bundled parking
De Gruyter et al., 2025	Australia	Residential off-street	65% of zero-vehicle households have bundled parking
Thigpen & Volker, 2017	Davis, California	Residential on-street	29% full
Volker & Thigpen, 2022	Sacramento, California	Single family residential on-street and off-street	63% of garages were used at least partially for parking Households have 1.6 more available parking spaces than cars

The Role of Minimum Parking Requirements

Binding minimum parking requirements help explain the oversupply of parking. Developers face clear incentives to align how much parking they provide with individual project needs. Minimum parking requirements are considered *binding* when they require more than developers would supply voluntarily. If a developer already plans to provide as much or more parking than the city requires, the parking requirement would not be binding for that project. For example, if a city required a minimum of 40 parking spaces for a 10,000-square-foot office building, the requirement would be binding for a developer who would have preferred to build just 30 spaces, but non-binding for a developer who wanted to build 50 spaces. When binding, minimum parking requirements can contribute to the oversupply of parking and high prevalence of empty spaces documented above.

The degree to which parking requirements bind is hard to explicitly measure. Researchers cannot directly observe the counterfactual — the number of spaces that developers would have provided in the absence of parking requirements. However, they can assess whether the requirements are binding in several ways: by comparing actual parking provision with mandated minimums, by comparing the cost of providing parking with the value it generates, by observing developers' attempts to seek variances and evade requirements, and by studying how much parking is built after parking minimums are repealed. For each development, minimum parking requirements are either binding or non-binding; by examining many projects, researchers can quantify the share of projects constrained by minimums. Whether a requirement is binding depends both on its stringency (higher requirements are more often binding) and on how much parking developers and their lenders believe is most profitable for a given use in a particular urban context. Evidence shows that minimum parking requirements are binding in many cases — particularly in areas with excess parking, good transit access, or higher construction costs — though not all.

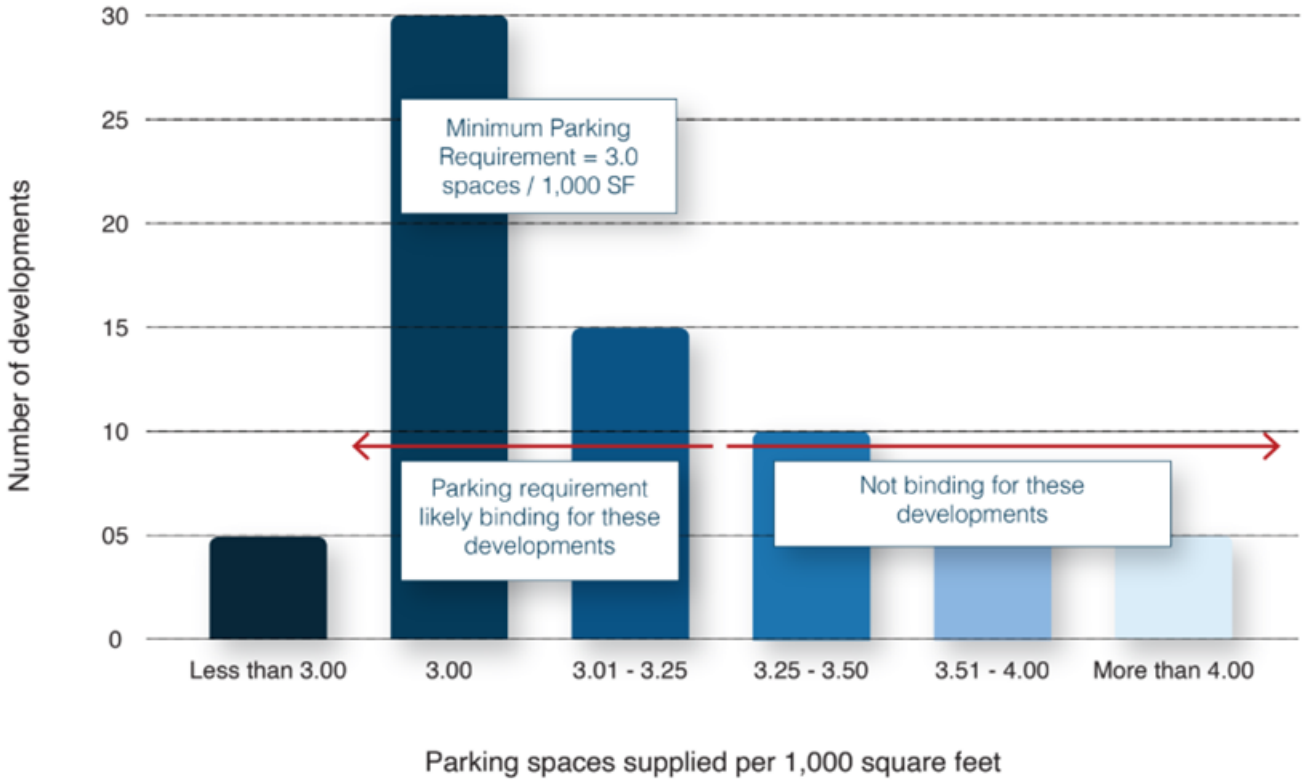
Developers Sometimes Supply Exactly the Minimum Parking Required

When developers build exactly to the minimum, or even slightly above it, this suggests, but does not prove, that the requirements are binding. Constructing exactly the required amount implies that the minimum parking requirement dictated a developer's decision, although it is possible the developer would have provided precisely the same amount voluntarily. Similarly, when developers build just a few spaces more than required, they are often just finishing an already-required level of structured parking. For example, if a city requires 50 spaces and the site accommodates 28 spaces per level, developers may build two levels for a total of 56 spaces. Even when the total slightly exceeds the requirement, the mandate may still be binding if it prompted the developer to construct two levels instead of one.

Sometimes, cities grant variances or exemptions that allow developers to provide less parking than the zoning code requires. This indicates that minimums would bind if the city enforced them strictly, but in practice, the city applies them more flexibly than the zoning code specifies.

With a large sample of developments, the extent to which parking ratios cluster near the minimum allows researchers to estimate the share of projects for which minimum parking requirements are binding, as illustrated in Figure 8. In the Figure's hypothetical example, researchers might report that minimum parking requirements were binding for 50 of the 70 developments in the sample (about 71%): 30 met the minimum exactly, 15 built just above it, and 5 built below the requirement. Others might exclude the developments that built slightly more (or less) parking than mandated and report the minimum parking requirement as binding for 30 of the 70 projects.

Figure 8. Assessing the Extent to Which Minimum Parking Requirements Are Binding



Cutter and Franco (2012) compared actual parking provision with minimum requirements for various commercial developments in Los Angeles. They found that minimum parking requirements equaled (or exceeded) the number of spaces provided, and thus were likely binding, for 65% of office developments and 63% of industrial projects. Their study suggested that reducing minimum parking requirements for office buildings to the lowest requirement in Los Angeles County could have resulted in 50 acres less parking, or 6,226 fewer spaces, for the 249 office developments in their sample area. Engel-Yan et al. (2007) looked at parking provision in Toronto, Canada and found that minimum parking requirements were most likely to bind for general office, medical office, and general retail uses, and least likely to bind for banks and large grocery stores.

Gabbe (2017) found that minimum parking requirements were binding for many housing developments near rail stations in Los Angeles. On average, buildings in the Vermont/Western transit-oriented development area provided 94% of the required parking, and buildings in Koreatown provided 88%. In Koreatown, the minimums appeared to be binding for all building types. In the Vermont/Western area, developers of condominiums, market-rate housing, and mixed-income housing voluntarily provided *more* parking than required, while affordable housing and mixed-use buildings often secured variances or other exemptions that allowed them to build parking below the minimum.

In Seattle, a minimum parking requirement of 0.5 spaces per unit appeared to be binding for 88% of the development projects studied, while 12% supplied more parking than required (Gabbe et al., 2020). A

requirement of 1 space per unit may have been binding for all 168 housing projects studied, since 68% provided exactly the minimum, and 32% provided less. In London, a minimum parking requirement of 1.1 spaces per unit was binding for 74% of developments, with 26% providing more parking than required (Guo & Ren, 2012). McDonnell et al. (2011) examined 38 market-rate housing developments in the Queens borough of New York City. Most buildings provided either exactly the minimum required parking or just one to four spaces above it, as if completing a level of structured parking. Five provided significantly more than required, while four buildings used a variance or waiver to supply parking below the minimum.

Manville et al. (2013) noted that even in New York City, where parking requirements are relatively low, many developers attempt to evade them. Willson (2000) surveyed city planners, who also reported that developers frequently sought reductions in parking requirements. Such attempts to evade minimum parking requirements provide further evidence that the requirements are often binding, unless the exemptions or waivers are readily granted to any developer on request.

The Cost of Additional Parking Often Exceeds Its Value

In addition to directly comparing how much parking cities required with how much was built, Cutter and Franco (2012) developed a model showing that the average marginal cost of parking (land plus construction) exceeded its marginal value by about $21 per square foot. They estimated the value of parking using property sales data and considered minimum parking requirements to be binding in cases where the cost significantly exceeded the value. The model results closely matched their direct comparisons between actual parking provision and requirements, yielding similar estimates of how often parking minimums were binding for office buildings and industrial sites. The model suggested that minimums were binding for 82% of commercial properties in Los Angeles County, including approximately 98% of service retail properties and 19% of shopping retail properties.

When Requirements Are Lifted or Reduced, Developers Often Build Less Parking

Research on cities that have eliminated minimum parking requirements provides useful insight into how much the old requirements actually influenced parking supply. In 9 of the 12 places that have been studied, the old requirements had clearly been binding overall: the total amount of parking built in new developments was lower than what would have been required under the former minimums (see Table 7 on page 47), even though many individual projects still provided parking that met or exceeded the previous standards. In at least three of the locations where minimums had been binding, researchers found that excess parking already present in an area led developers to reduce how much new parking they built (Manville, 2013; Sohoni & Lee, 2024; Sohoni & Lee, 2025). Several studies of repeal also found that the old requirements had most often been binding in dense urban cores, where transit access was better and constructing new parking was more costly (Li & Guo, 2014; Sohoni & Lee, 2025). However, even within these urban cores, minimums were frequently found to be non-binding for larger, more expensive apartments, where developers often provided the additional parking deemed necessary to attract higher-income tenants and maximize profitability (Manville, 2013; Guo & Ren, 2012).

Whether minimum parking requirements were binding depended not only on urban context and project type, but also on the stringency of the former requirements. For example, although Washington D.C. is an urban area with good alternatives to driving, its minimum parking requirements were not binding: developers continued to supply parking well above the previous minimums even after the requirements were removed (Sohoni & Lee, 2025). This was because the minimum parking requirements were already quite low (for example, just .25 spaces per unit) and most developers judged that supplying more parking was important for their projects' success. In Grand Rapids, Michigan, a lower-density urban area, even a higher minimum of 1 space per unit proved non-binding, as

developers continued to provide at least that amount of parking after the requirement was removed (Sohoni & Lee, 2025).

Comparing actual parking provision with two sets of requirements — a new, reduced standard meant to encourage housing near transit, and the former, higher standard applied elsewhere — further demonstrates how stricter requirements are more likely to bind. For example, before California passed state legislation barring cities from imposing parking minimums near transit, Los Angeles adopted a Transit-Oriented Communities (TOC) policy to lower (or eliminate, in certain cases) parking requirements for new development near transit. Overall, mixed-use TOC projects built under these more flexible new standards provided almost twice as much parking as required; however, this provision was still less than what would have been required under the citywide standards (Smith et al., 2021). The new, lower requirements were not binding; the former requirements would have been.

The report discusses additional findings from post-reform parking supply research beginning on page 46.

Parking Minimums as Constraints on Development

Minimums prevent the creation of new homes and businesses, undermine density, and reduce land values. By mandating off-street parking, cities influence not only how space is used, but where and whether new buildings can be constructed. In some cases, binding off-street parking requirements simply result in more parking, reducing density by taking space that could otherwise accommodate housing or commercial development. In other cases, minimum parking requirements can prevent new development altogether. The evidence, albeit limited, suggests this is especially common at infill sites, where space is constrained and meeting parking minimums is either physically impossible or would require costly structures or underground excavation. As a result, developers find infill development less viable and increasingly pursue outlying sites, contributing to sprawl and leaving central urban areas underdeveloped. Even when developers do build infill housing, they may downsize projects when additional units would require an entire new level of structured parking. Over time, restricting the production of new housing also drives up the cost of existing housing in desirable areas, as more people compete for a limited number of homes.

Parking minimums can decrease housing density, population density, and commercial development density. Parking minimums may also reduce land values, since parcels restricted by binding minimum parking requirements are less valuable than those that can be fully developed. The research demonstrating these effects relies largely on theory, building-prototype models, developer interviews, and small-scale case studies.

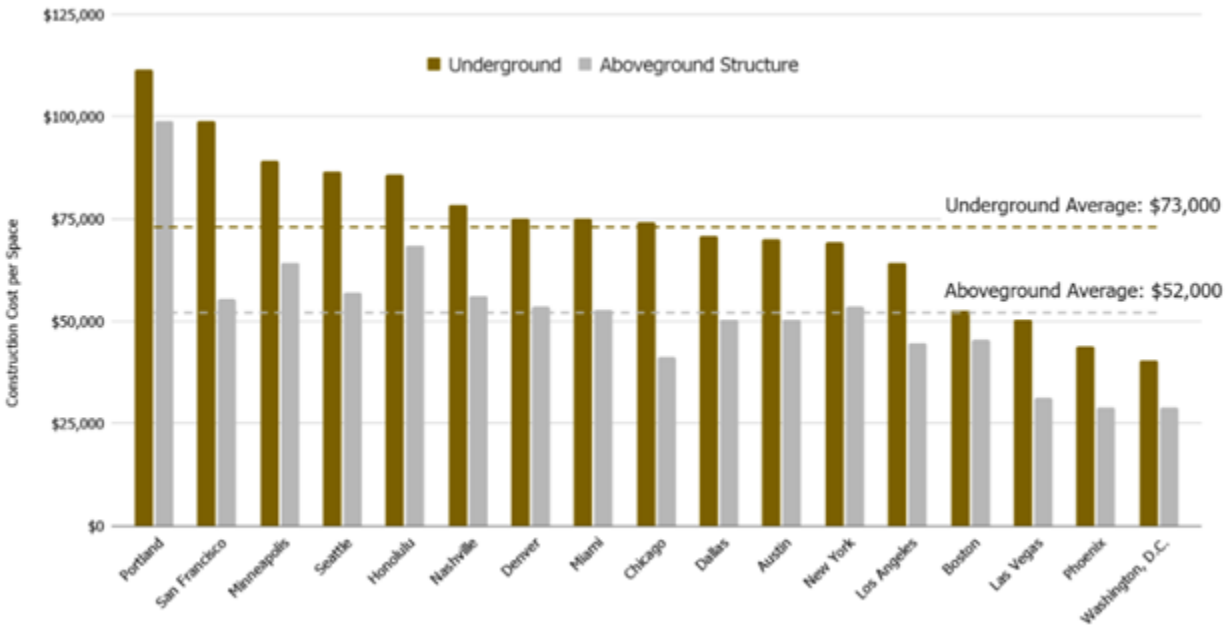
Certain topics in this section merit additional study. For instance, only two studies, and only one of them empirical, investigate how minimum parking requirements decrease land values. Evidence is also scarce on how parking minimums constrain commercial development, even though many cities are working on the assumption that they do. In practice, far more jurisdictions have eliminated parking minimums specifically for commercial uses than have eliminated them for all uses (Parking Reform Network, 2025b).

Parking Minimums Increase the Cost of Construction

Constructing parking adds substantially to development costs. If parking requirements did not exist, developers could weigh these construction costs against the value of providing on-site parking, and might choose to provide less parking where it is expensive to build. In the presence of binding minimum requirements, however, higher construction costs make it less likely that projects can pencil out.

A recent analysis found an average cost (excluding land costs) of approximately $52,000 per space for aboveground structures and $73,000 per space for underground parking across 17 U.S. cities (see Figure 9; Schwartz, 2026). The analysis used per-square-foot cost estimates from Rider Levett Bucknall (2025), an international consulting firm specializing in real estate construction. Parking construction costs have risen faster than general inflation; after adjusting for inflation, the cost per space has increased by roughly 50 percent since 2012. Parking facilities also have operation and maintenance costs.

Figure 9. Construction Cost per Structured Parking Space in 17 U.S. Cities



Source: Schwartz, 2026; calculated using cost estimates from Rider Levett Bucknall (2025).

The analysis also examined construction cost data alongside minimum parking requirements for office buildings, shopping centers, and apartments in seven cities to see how parking mandates affect development costs. For both office buildings and shopping centers, required parking represented, on average, roughly 39% of total construction costs when built underground and 31% when provided in an aboveground structure (Schwartz, 2026). Across cities, required parking generally accounted for a larger share of total costs in cities with the highest mandates.

Minimum parking requirements disproportionately increase the cost of smaller apartments because the required parking area is larger relative to the housing area provided. For a 450 square foot studio apartment, required parking represented, on average, 27% of construction costs when built underground and 20% when built aboveground, compared with 17% and 12%, respectively, for a 1,100 square foot two-bedroom apartment (Schwartz, 2026).

Shoup (2011) provides two examples of residential developments that separated parking construction costs from building costs. At UCLA's Weyburn Terrace apartments, the average construction cost per unit was $139,000. With 1.7 parking spaces per unit, the average parking cost added $35,000 per apartment, increasing the total cost by 25%. Had UCLA been subject to the City of Los Angeles' minimum parking requirements, the required parking would have added $44,600 per unit, or 32% of total costs.

The percentage increase was larger for affordable single-room occupancy housing in Palo Alto, California, despite a lower parking requirement. Because the units were very small, construction costs were just $32,000 per apartment. Even with a reduced requirement of 0.67 spaces per apartment, required parking added $12,100 per

unit, increasing total costs by 38%. If the building had been subject to Palo Alto's standard requirement of 1.25 spaces per apartment, total costs would have increased by 71%.

Parking Minimums Reduce Housing Development

Few researchers examined the impacts of minimum parking requirements when they were first adopted. The only known before-and-after study looked at housing development in Oakland, California before and after the city introduced parking requirements in 1961 (Bertha, 1964). Apartments built in the preceding years included roughly 0.6 parking spaces per unit. After Oakland began requiring 1.0 off-street space per apartment, per-unit construction costs increased 18%, and median profitability fell by 25%, suggesting consumers did not value the additional off-street parking enough for developers to fully recover its cost. Total housing investment per acre also fell by 18%. Off-street parking requirements constrained housing development at the margin, driving out developers who had previously profited from smaller-scale, lower-cost projects. The median lot size of new development increased 15%, as smaller lots became more likely to go undeveloped.

Parcels and Buildings Remain Vacant When Parking Requirements Prevent New Uses

Minimum parking requirements can make small or irregularly shaped parcels effectively undevelopable, by mandating more parking than can physically fit on a site. Requirements especially hinder infill development and adaptive reuse in already built-up areas. When changing the use of an existing building would require additional parking, developers may sometimes acquire adjacent parcels and demolish existing structures to create the necessary spaces, but when this is not feasible, vacant buildings cannot support new uses. Recognizing this challenge, the City of Los Angeles selectively lifted parking minimums in 1999 as part of an Adaptive Reuse Ordinance designed to facilitate the conversion of vacant buildings into housing. The policy enabled the construction of 6,500 new units downtown — more housing in less than a decade than had been built in the previous thirty years (Manville, 2013).

Shoup (2011) further illustrates this idea with an example: a vacant building formerly used as a furniture store, which had met its requirement of 1 parking space per 1,000 square feet, could not be reused by a bicycle shop with a parking requirement of 3 spaces per 1,000 square feet. Dense, transit-rich neighborhoods offer the greatest potential for infill development and building reuse. However, developer interviews reveal the challenge that parking requirements pose in such places: when surveyed, 21 of 24 developers cited parking requirements as an obstacle to constructing compact, walkable development in transit-rich areas (Guthrie & Fan, 2016).

Parking requirements also create obstacles for homeowners who want to build accessory dwelling units (ADUs), including by converting garages into living space (Infranca, 2014; Brown et al., 2017). Garage conversions can create affordable housing in desirable neighborhoods, improve urban design, help homeowners cover mortgage payments, and allow seniors to age in place (Brown et al. 2017). While it is not always physically possible to accommodate both an ADU and the off-street parking it would require, research suggests there is strong demand for this type of housing. Many homeowners have built units without permits or in violation of local regulations. Brown et al. (2017) compared census data with building permit records and found that 37% of new single-family units were unpermitted, with higher shares occurring in cities with more regulatory barriers.

Research on California ADU regulations and outcomes found that cities receiving more frequent ADU applications were less likely to impose parking requirements (Pfeiffer, 2019). Beginning in 2016, California passed multiple bills reducing regulatory barriers to ADU construction, including limiting cities' ability to require parking for these units. As a result, between 2016 and 2022, statewide annual ADU permitting increased 15,334%, for a total of 83,865 new units (Gray, 2024). Infranca (2014) documented regulatory challenges to both ADUs and micro-units

across a geographically diverse set of cities, as well as the rising number of one-person households and the mismatch between housing needs and housing supply. He suggested that reducing barriers to creating appropriately sized units could give individuals the option to live independently and free up larger apartments for families.

Parking Minimums Result in Fewer Apartments per Building

Even if parking requirements do not prevent development altogether, they can still shape what gets built. Developers often choose to provide above-ground parking because it costs less than underground parking. However, above-ground parking consumes valuable space that could otherwise be used for housing, reducing the potential number of apartments on a site (McDonnell et al., 2011). Evidence from Oakland shows that after the city introduced minimum parking requirements, the median number of units per development fell by 36%, even though higher densities remained allowable on paper (Bertha, 1964). Consistent with this finding, most planners surveyed reported that, in their experience, minimum parking requirements reduced project densities (Willson, 2000).

Parking requirements further limit housing supply by encouraging developers to build larger, higher-end apartments rather than a greater number of smaller units. Lehe (2018) modeled how parking requirements discourage small units by making it illegal to build them without parking. Smaller units built for lower-income households would have been profitable without mandatory parking, but once a city requires it, developers find it more profitable to instead build larger apartments for higher-income households who would pay for the parking even if it were optional. Gabbe (2015) used two prototype buildings to show how minimum parking requirements prevented micro-apartments from being built in San Francisco and cited a developer who explained that the rents needed to recoup parking costs for small units would be unaffordable to the potential tenants.

Even when developers would like to build the maximum number of units, minimum parking requirements can lead them to scale back slightly, particularly when the last apartment(s) added would require an entire new level of costly structured parking. For example, one Los Angeles developer reduced a project from eight apartments to seven, because the strict parking requirement of 2.25 spaces per unit would have required two spaces more than could fit on a single underground level (Shoup, 2014). The parking associated with that last unit was as a result wildly expensive. Figure 10 illustrates this example.

Figure 10. How Parking Minimums Can Increase Marginal Costs and Decrease Unit Counts

Parking Minimums Reduce Population Density

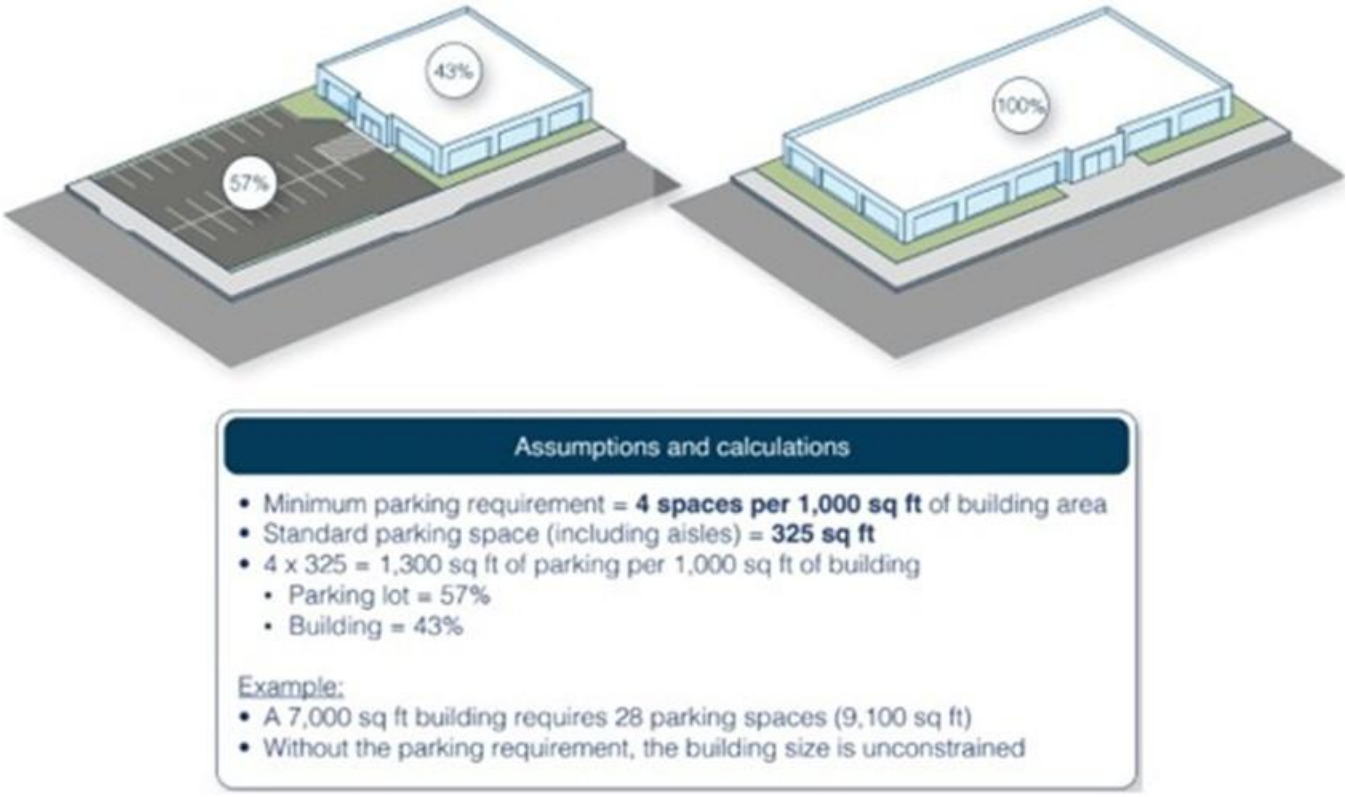
Manville et al. (2013) studied the link between parking and density at a larger scale, in New York City and Los Angeles. Both across and within the two regions, differences in density reflected differences in residential parking supply, which was greater where parking requirements were higher. Within New York City, a 10% increase in minimum parking requirements was associated with a 6% reduction in both housing density and population density.

Parking Minimums Decrease Commercial Development Density

Required parking also undermines commercial density, consuming valuable land that could otherwise support buildings. Willson (1995) estimated that decreasing parking requirements for offices in Southern California from 3.8 to 2.5 spaces per 1000 square feet would allow a 42% increase in the size of the office buildings. In Silicon Valley, researchers found that minimum parking requirements were binding and that parking occupied more than half of the average commercial parcel (Gabbe et al., 2021). Figure 11 on page 45 demonstrates how this can occur: when developers provide the required parking as a surface lot, a mandate of 4 parking spaces per 1,000 square feet requires about 1,300 square feet of parking for every 1,000 square feet of building, limiting building space to 43% of a parcel's developable area.

By limiting development density, minimum parking requirements constrain agglomeration economies and impose large opportunity costs. Researchers estimated that if Silicon Valley had halved its parking requirements in 2000, the already-successful region could have added 13,000 jobs — a 37% increase over actual job growth — and generated more than one billion dollars in additional annual payroll (Gabbe et al., 2021).

Figure 11. How Minimum Parking Requirements Limit Commercial Development Space



Parking Requirements Reduce Land Values

Land becomes less valuable when owners cannot develop it as they wish (or would need to build costly underground parking to do so), and parking areas are generally less valuable than buildings. Willson (1995) estimated the impacts of parking requirements for office buildings. His findings imply that increasing parking requirements for offices in Southern California from 2.5 to 3.8 spaces per 1000 square feet would reduce land values by 32%. Bertha (1964) found that land values fell by 33% after Oakland established a parking requirement of one space per apartment. Blanc et al. (2014) also indirectly support the idea that minimum parking requirements reduce land values, finding that, across central business districts in six cities, surface parking generated less property tax revenue than buildings.

Effects of Repealing Minimums

Parking Supply Effects

Eliminating minimums sometimes slows the growth of new parking supply. An increasing number of cities have eliminated minimum parking requirements in recent years, either citywide or for specific areas or land uses. In several cases, enough time has passed for researchers to observe the early effects of these reforms. Researchers often compare how much parking developers build after reforms with the amount previous minimums would have required.

The scope of repeal differs across study locations (see Table 7 on page 47). In three of the twelve cases, cities eliminated parking minimums citywide. In eight of the twelve cases, cities eliminated minimums only in specific subareas, such as transit-rich neighborhoods, a central business district, or a university district. One study examined a targeted repeal for adaptive reuse projects downtown.

Eliminating parking *requirements* does not eliminate *parking*. Across all studies, most new developments still include parking even after cities eliminate parking requirements. In most cases, new projects include less than previously required; in others, they provide more. Even in locations where less parking was provided overall, the average reductions sometimes mask substantial variation. Eliminating parking minimums reveals that the requirements had been more binding for certain project types or locations than others.

When considering the results from multiple studies together, patterns emerge in how developers respond to repeal for different project types. Developers often continue to build parking at or above former minimums for luxury housing in central areas, but reduce parking in mixed-use projects, dense areas near transit, and locations where nearby parking can meet demand. More research across a broader set of locations and building types, particularly non-residential buildings, could help confirm these initial patterns.

Overall, early research shows that when cities eliminate minimum parking requirements, developers often build less parking, but the effects are far from uniform. Because most repeals are still fairly recent, it will take time for developers to fully adjust their practices and for researchers to observe longer-term effects.

Eliminating Minimums Has Generally — But Not Always — Curbed Parking Growth

Research examining new developments after cities fully or partially eliminate parking requirements shows how much parking developers provide relative to the former minimums. Among 12 cities or areas analyzed, nine saw a decline in new parking supply relative to the former minimums, while three saw an increase. Table 7 presents the overall results for each of the 12 reform locations. In a few cases, due to variances and reductions, the average parking provision for new developments had already been below the minimum even before minimums were eliminated; even so, projects developed after repeal had lower parking ratios than projects developed before it.

The magnitude of the reductions reflects how binding the former minimums were. In the three locations where post-reform projects supplied *more* parking than previously required, the old minimums were evidently low enough not to influence most developers' decisions. In contrast, when developers build less parking, their choices reflect market conditions and local contexts where doing so is feasible and profitable.

Table 7. Studies of Post-Elimination Parking Provision Compared to Former Minimums

Study	Location	Repeal Scope at Time of Study	Development Type	Approximate New On-Site Parking (vs. prior requirements)	Developments Providing On-Site Parking	Developments Providing Parking Below the Previous Minimum
Guo & Ren, 2012	London, UK	Citywide	Residential	48% less[a]	75%	83%
Hess & Rehler, 2021	Buffalo, NY	Citywide	All	21% less	83%	47%
Sohoni & Lee, 2024	Champaign, IL	Downtown and University District	Residential	54% less	81%	84%
Manville, 2013	Los Angeles, CA	Adaptive Reuse	Residential	45% less	67%	N/A
Gabbe et al., 2020	Seattle, WA	Urban Center; Urban Villages Near Transit	Residential	40% less[b]	70%	
Sohoni & Lee, 2025	San Francisco, CA	Citywide	Residential	70% less	55%	
Sohoni & Lee, 2025	Cincinnati, OH[c]	Central Business District	Residential	75% less	25%	
Sohoni & Lee, 2025	Honolulu, HI	Near Transit	Residential	25% less	N/A	
Sohoni & Lee, 2025	Somerville, MA	Near Transit	Residential	68% less		
Sohoni & Lee, 2025	Washington, D.C.	Central Business District	Residential	139% more		
Sohoni & Lee, 2025	Grand Rapids, MI	Central Business District	Residential	23% more		
Nelson et al., 1997	Atlanta, GA	Near Transit	Commercial	5% more		

Note.

[a]London also established parking maximums, but researchers found that they explained only 2% of the decline in new parking supply; 98% stemmed from eliminating minimums.

[b]The Seattle included 868 developments: 570 with the minimum parking requirement fully eliminated, 130 with the minimum parking requirement reduced to 0.5 spaces per unit, and 168 with the minimum parking requirement reduced to 1.0 spaces per unit. Without these remaining requirements, the observed reduction in parking supply may have been slightly larger.

[c]Cincinnati had a small sample size, with only eight new developments built in the eight years following minimum parking requirements being eliminated.

Some studies also reported the share of new developments that provided parking below the previous minimums or the share that did not provide any on-site parking. In Champaign, 84% of new developments provided less parking than the city previously required; in London, 83%; and in Buffalo, 47% (Sohoni & Lee, 2024; Guo & Ren, 2012; Hess & Rehler, 2021). However, while developers often built less parking than formerly required, most new developments still provided parking. One exception was Cincinnati's Central Business District, where ample public parking was available, and six out of eight new developments provided no on-site parking (Sohoni & Lee, 2025). In San Francisco, 45% of developments provided no on-site parking, compared with 30% in Seattle, 25% in London, 19% in Champaign, 17% in Buffalo, and roughly 33% of buildings created under Los Angeles's Adaptive Reuse Ordinance (Sohoni & Lee, 2025; Gabbe et al., 2020; Guo & Ren, 2012; Sohoni & Lee, 2024; Hess & Rehler, 2021; Manville, 2013). These findings suggest that developers may be more likely to reduce parking more in dense urban areas with access to transit, a finding that also holds true within individual cities, as discussed in the next section.

Some researchers have translated parking supply reductions into construction cost savings. Sohoni and Lee (2024) estimated $43 to $49 million in construction cost savings across 43 new developments after Champaign eliminated minimums in targeted areas. Gabbe et al. (2020) estimated a savings of $537 million in direct construction costs over five years after Seattle's parking reform.

Developers Were More Likely to Use Parking Flexibility in Dense Areas Near Transit and for Mixed-Use Projects

Research suggests that mixed-use projects and developments in dense areas near transit are more likely to take advantage of the new flexibility when parking minimums are lifted. By serving multiple uses with different peak demand times, mixed-use projects can benefit from shared parking. After Buffalo eliminated parking minimums, mixed-use projects provided 53% less parking, driving the overall citywide decrease in new supply, even as residential and commercial projects continued to exceed old requirements (Hess & Rehler, 2021). In Champaign, both residential and mixed-use projects reduced their parking provision, but mixed-use projects saw greater reductions — providing, on average, 33% of what the city formerly required, compared with 43% for residential projects (Sohoni & Lee, 2024). Similarly, across four cities that eliminated minimum parking requirements in their Central Business Districts, mixed-use projects provided less parking than entirely residential projects (Sohoni & Lee, 2025).

Overall, the research suggests that when cities eliminate minimums, developments tend to include less parking in areas with better alternatives to driving (e.g., in neighborhoods with high-quality transit and an abundance of shops and services within walking distance). For example, London's overall decrease in new parking supply was largely driven by declines in inner London, where new developments provided 67% fewer spaces than comparable projects before the reform, while to average reduction in outer London was just 32% (Li & Guo, 2014). After San Francisco and Buffalo eliminated requirements citywide, reductions in new parking provision within their core areas were 1.5 to 1.9 times greater than in other parts of the cities (Sohoni & Lee, 2025). Across Buffalo, Hartford, and San Francisco, developments near transit saw an average reduction of 10 spaces after minimum parking requirements were removed citywide (Sohoni & Lee, 2025). More research could help clarify whether developers build less parking primarily because of nearby transit access itself or because dense urban environments make parking more difficult and expensive to construct.

In Buffalo, most new residential developments still provided parking above the old minimums, but one mixed-use development that did leverage the new flexibility was located near two metro rail stops and within a two-block

radius of eight bus stops. The development included a small grocery store with its own parking lot and 201 affordable housing units (Figure 12). The developer-owner offered residents and grocery store employees a range of mobility benefits, including a guaranteed ride home program and discounts to the local bike shop (Hess & Flowers, 2023).

Figure 12. Grocery Market and Affordable Multifamily Apartment Building in Buffalo

The project took advantage of the city's elimination of minimum parking requirements to build 201 affordable apartments. Source: Photo taken by André Carrotflower on July 23, 2021, via Wikimedia Commons. Licensed under CC BY-SA 4.0. Image License: creativecommons.org/licenses/by-sa/4.0/legalcode.

Developers Were Less Likely to Reduce Parking for Luxury Housing in Central Areas

Developers often provide less parking in mixed-use, transit-oriented areas, but within these areas, luxury developments targeted to higher-income residents are a notable exception. For example, Manville (2013) observed how parking provision varied following Los Angeles' ordinance for adaptive reuse projects downtown: higher-end apartments frequently included two parking spaces, while more affordable housing options were created with no on-site parking. In London, although developments in higher-density areas generally saw greater reductions in parking provision, the urban center (home to the highest median incomes) was the exception: units there were about 30% larger than in the second-densest area, and developers provided roughly three times as much parking as in the second-densest area (Guo & Ren, 2012).

Gabbe et al. (2020) reported a similar finding in Seattle, where, unlike in Buffalo and Champaign, residential units in mixed-use projects were associated with greater parking provision. They attributed this to the fact that mixed-use development was more common in Seattle's higher-density neighborhoods, with higher land values and more regulated on-street parking, which could lead developers to view on-site parking as more profitable or more necessary.

These findings suggest that developers do not respond to the elimination of parking minimums by reducing parking across all projects; rather, they assess demand on a project-by-project basis and offer options with

substantially reduced parking primarily when they anticipate users will either be less car-dependent or have opportunities to park in nearby off-site lots or structures with excess capacity.

In Some Places, Nearby Garages Met Parking Needs

Even after parking requirements are lifted, many developers continue to recognize that guaranteed parking may be necessary to secure tenants. However, in some cases, parking needs can be met more cost-effectively by leasing spaces in nearby garages with excess capacity. For example, when Los Angeles lifted minimums as part of the Adaptive Reuse Ordinance to facilitate the conversion of vacant downtown buildings into housing, developers freed from parking requirements still provided *more* parking for apartments (about 1.2 spaces per unit) than was formerly required, but they provided approximately half of the spaces off-site (Manville, 2013). Similarly, developers voluntarily included about 1.3 spaces per condominium, with roughly one-third of the spaces off-site (Manville, 2013).

When Champaign, Illinois lifted minimum parking requirements for its downtown and university districts, existing garages and lots were used more efficiently as a result. Developers with excess parking in existing buildings began leasing unused spaces to residents of new buildings, and the public parking system increased long-term permit sales, generating record revenues (Sohoni & Lee, 2024). Similarly, after Cincinnati, Ohio removed minimum parking requirements in its Central Business District, new developments became feasible, and the new tenants leased spaces in nearby city-owned garages (Sohoni & Lee, 2025). These findings suggest that in areas with abundant off-site parking, removing minimum requirements allows developers to meet tenant needs without devoting as much land or resources to new parking.

Many Commercial Developments Still Include as Much Parking as Previously Required

When parking requirements were lifted for special public interest districts near transit in Atlanta, Georgia, commercial developments continued to supply 5% more parking than was previously required. Financial institutions considered the parking necessary for a building's competitiveness and required it for lending (Nelson et al., 1997). After minimum parking requirements were eliminated in Buffalo, the four commercial developments included in the first study provided 64% more parking than the city previously required (Hess & Rehler, 2021). Hess and Flowers (2023) interviewed local developers and lending professionals, who noted that national commercial chains are typically subject to their own corporate minimum parking requirements. However, a later study in Buffalo compared parking supplies at fast food developments before and after minimums were lifted. The average fast food parking lot after the policy change was 25% smaller, with coffee and donut shops especially likely to provide less parking (Rehler & Hess, 2024). The study of fast food developments compared parking before and after Buffalo eliminated minimums, but it did not compare the parking relative to previous requirements.

Overall, there is limited evidence on how commercial developers respond when cities repeal minimum parking requirements, and more research is needed.

Other Effects

Eliminating minimums often produces the intended effects. While most research on the repeal of minimum parking requirements has focused on changes in parking supply, a few studies have examined broader impacts, particularly on housing production and affordability. Other documented outcomes include staff time savings, increased public parking revenue, increased transit use, and more active street frontages. Further research would help assess how transferable these outcomes are to different contexts.

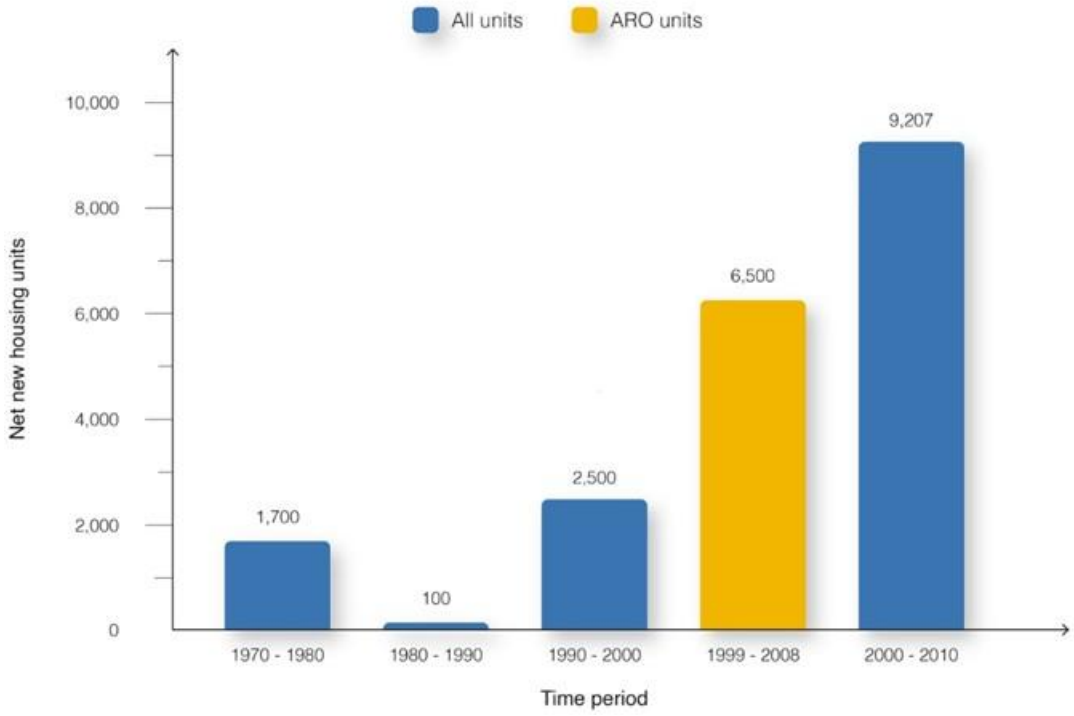
Eliminating parking requirements might also be expected to increase economic vitality, decrease vacancy rates, and avoid many of the other parking-related harms discussed in the earlier chapters of this report. To date, however, the research literature does not offer any direct evidence.

Eliminating Minimums Enabled the Construction of More Housing

Given the earlier findings that parking requirements can increase construction costs, decrease profitability, make some sites unfeasible for development, and limit the number of units per building, it is reasonable to expect that removing them would enable more housing construction. Research across multiple contexts suggests this is the case.

The best example examines the results from Los Angeles' Adaptive Reuse Ordinance, which selectively lifted parking minimums in 1999 as one component of the city's effort to facilitate the conversion of vacant buildings into housing. As shown in Figure 13, this policy enabled the construction of 6,500 new units downtown — more housing in less than ten years than had been built in the previous thirty (Manville, 2013).

Figure 13. Housing Growth in Downtown Los Angeles



Data source: Manville (2013).

Similarly, after Buffalo repealed minimum parking requirements citywide, Hess and Flowers (2023) found that developers and lenders noted new opportunities: small, infill parcels became financially feasible to develop, and walkable, transit-rich areas grew more desirable for new housing projects. In San Francisco and Seattle, developers, architects, and planners reported that eliminating minimum parking requirements enabled higher unit counts, reduced parking provision, and improved project feasibility (Millard-Ball, 2021). In Champaign, eliminating residential parking minimums in the downtown and university districts shifted housing growth closer to campus. Before the policy change, 43% of regional units were in Campustown; afterward, that share rose to 67% (Sohoni & Lee, 2024).

Eliminating Minimums Enabled the Development of Smaller, More Affordable Homes

Research also shows that removing parking minimums expands the variety of housing types available, facilitating smaller-scale and more affordable options that were discouraged under previous regulations.

One of the main reasons Champaign removed parking minimums was to improve housing affordability. After the minimums were eliminated, apartments became smaller, with the average number of bedrooms dropping from 2.6 to 2.1 per unit. At the same time, unit density increased dramatically, rising 79% — from 95 units per acre to 170 units per acre (Sohoni & Lee, 2024). By fitting more, smaller units on each site, developers could offer new housing at lower per-unit costs.

Eliminating minimum parking requirements for adaptive reuse projects in downtown Los Angeles gave residents without a vehicle a new way to save money. Housing units without a bundled parking space were more affordable than comparable units with parking included. Manville (2013) found that, on average, rent was $200 less expensive for apartments without bundled parking, and condominiums without bundled parking cost $40,000 less.

Given the many potential confounding factors, assessing the *citywide* housing affordability impact of a housing supply increase associated with eliminating parking requirements remains challenging, and no researchers have attempted to quantify it.

Eliminating Minimums Saved Staff Time and Increased Public Parking Revenue

Hess and Flowers (2023) interviewed developers from the Buffalo area, who reported that after the city repealed minimum parking requirements, they saved time and resources that they previously would have spent seeking variances. This means city staff also spent less time processing variances and appeals. A Denver planning report estimated that Community Planning and Development staff members spent a total of 654 hours administering parking-related zoning regulations (City of Denver, 2025). Similarly, Manville (2013) noted that the Adaptive Reuse Ordinance in Los Angeles allowed use changes without variances, avoiding lengthy appeals and delays. By reducing how much time staff spend processing variances and appeals, eliminating minimums may also translate into cost savings for the city.

Champaign's public parking structures had excess capacity. After the city lifted minimum parking requirements in certain areas, and developers constructed new buildings with reduced parking, long-term public parking permit sales increased 39%, driving public parking revenue to an all-time high. Meanwhile, in neighboring Urbana, which did not reform its parking requirements, permit sales did not increase, and parking revenue slightly declined (Sohoni & Lee, 2024).

Eliminating Minimums May Have Boosted Transit Use

Many cities seek to encourage transit use over solo driving to reduce congestion, boost fiscal and environmental sustainability, and improve air quality. A large body of research shows how free, bundled, abundant *parking* is associated with more driving. Sohoni and Lee (2024) considered the impact of eliminating minimum parking *requirements* on transit use. After Champaign eliminated residential parking minimums in the university district, Campustown sustained 2014 transit ridership levels and even increased transit ridership until the Covid-19 pandemic, while ridership was dropping in neighboring Urbana and the rest of Champaign.

Eliminating Minimums Enabled More Active Street Fronts

One stated goal behind Champaign's parking reform was to enhance design and aesthetics. Active frontages make streets more engaging and pleasant for pedestrians, but minimum parking requirements often limit these frontages by making it prohibitively expensive to build apartment buildings without devoting the ground floor to parking. Parking requirements can also prevent commercial storefronts on small infill parcels, because the space required for parking reduces the area available for active uses. Developers surveyed by Hess and Flowers (2023) reported that eliminating minimum parking requirements in Buffalo made small infill parcels feasible to develop.

Sohoni and Lee (2024) examined changes in active versus passive frontages before and after Champaign eliminated minimums. They defined active frontages as those occupied by uses other than parking — such as residential units, patios, gyms, or retail spaces — and found that the share of developments with active frontages increased from 43% before reform to 81% afterward. On average, buildings with active frontages provided 56% of the previously required parking, compared with 117% for buildings with passive frontages.

Conclusion

This report assembles research on the impacts of parking infrastructure, the effects of minimum parking requirements, and the initial results from cities that have repealed them. Together, these studies document the consequences of minimum parking requirements and provide emerging evidence on what happens when cities eliminate them.

Parking infrastructure can produce unintended consequences that work against a wide range of urban policy goals, including affordability, public health, environmental protection, and public finance. Research shows that parking significantly increases the cost of housing, and many zero- and one-car households pay for housing with bundled parking spaces they cannot use. Off-street parking also requires curb cuts, which reduce the amount of curb parking available to the public and make sidewalks less safe and less pleasant to walk along. Parking infrastructure further compromises walkability when it spreads destinations farther apart and dominates the streetscape, displacing active storefronts or greenery. Parking lots contribute to urban heat, and, as impervious surfaces, increase water pollution, flooding, and habitat degradation in local waterways. The supply chains that support parking construction degrade the environment, consume large amounts of energy, and generate emissions that harm respiratory and cardiovascular health. Finally, research suggests that surface parking lots generate relatively little public revenue compared with land occupied by buildings, weakening local tax bases. Because developers and property owners typically do not bear these broader social and environmental costs, private markets are likely to supply more parking than is socially optimal, even in the absence of minimum parking requirements.

Increasing levels of car ownership and driving naturally raise the demand for parking, but a substantial body of research shows that the relationship runs both ways: abundant, convenient parking also encourages more cars and more driving. Households with more off-street parking spaces own more cars, and even among car owners, drivers with easier parking drive more often. Employer-paid parking strongly encourages driving alone, while employees who must pay for their own parking are more likely to walk, bike, or take transit. Cities that have added the most parking over time also see the largest increases in the share of workers commuting by car. These findings suggest that minimum parking requirements can trigger a feedback loop: forcing developers to build more parking leads to more cars and driving, which in turn raises citywide parking demand.

Multiple studies show that cities devote a large share of land to parking, and across contexts, even when parking is free, many spaces go unused. When binding, minimum parking requirements contribute to an oversupply of parking, and research finds they are often binding: developers seek variances, build only the minimum, or provide less once requirements are lifted.

Research also shows that parking minimums do more than increase parking supply and the unintended consequences that follow. Minimum parking requirements also prevent the creation of new homes and businesses by raising construction costs, incentivizing developers to build fewer apartments per project, and leaving buildings vacant when a new use would require more parking than a site can physically accommodate.

Figure 14 on page 56 traces the pathways linking minimum parking requirements to multiple urban impacts.

By studying cities that repealed minimum parking requirements, we can observe how developers respond. Research on projects built after parking reform shows how developers' voluntarily provided parking compares with

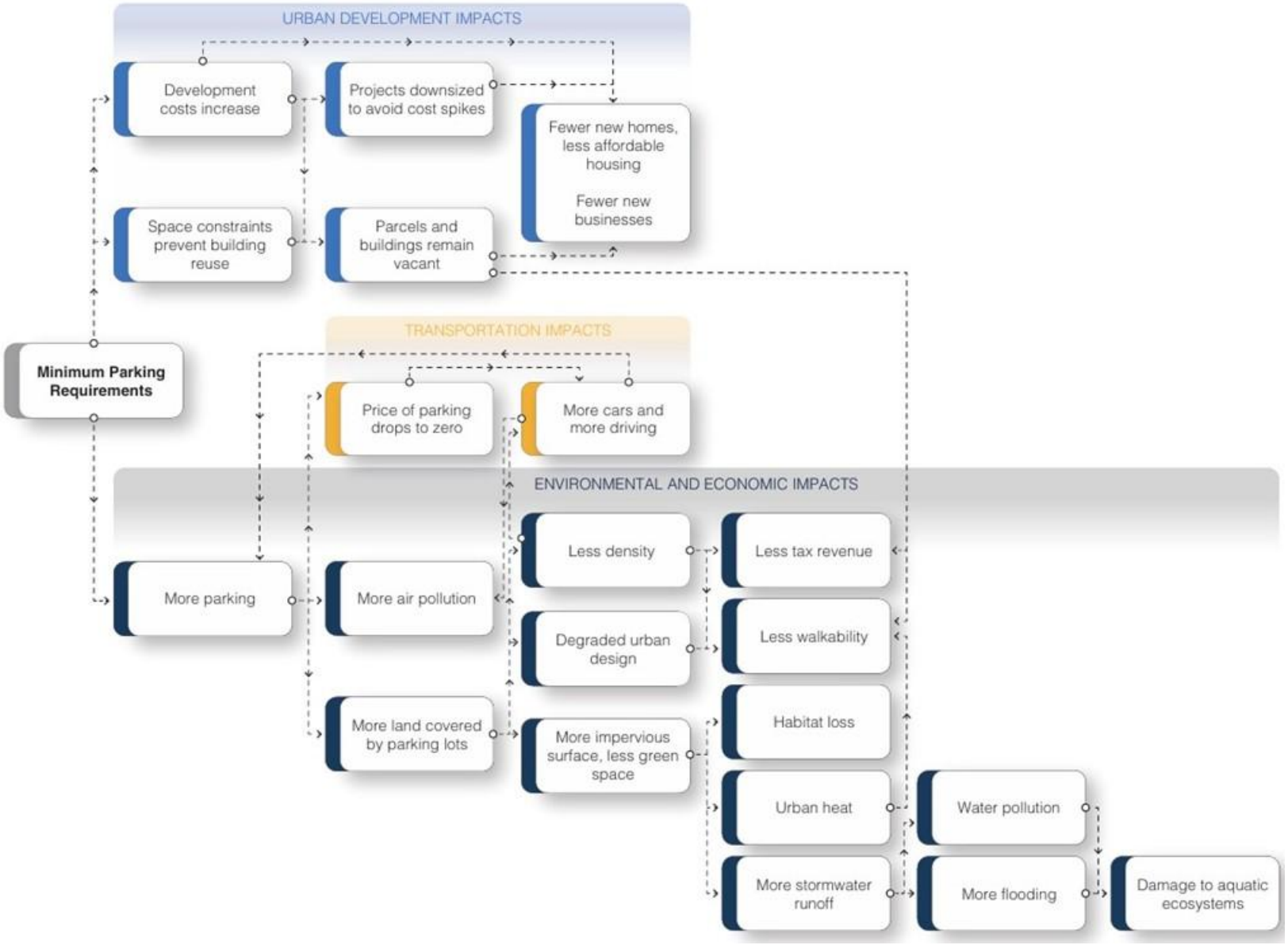
previous requirements. In most cases, developers still provide parking, and in some cases, they provide as much or more than before. Developers often meet or exceed the old minimums for luxury housing in central districts, while they frequently provide less than formerly required for mixed-use developments, in dense or transit-rich areas, or in neighborhoods where nearby parking facilities have excess capacity.

A smaller body of research highlights additional benefits that follow the repeal of minimum parking requirements. These studies find that eliminating minimums not only slows the expansion of new parking but also encourages adaptive reuse, supports more housing development in areas where minimums are removed, and expands housing options by enabling smaller units and units without on-site parking. Some early work also links the repeal of minimum parking requirements to more active street frontages, increased municipal parking revenue, and higher rates of transit use, though further research is necessary to substantiate these relationships.

Until recently, few cities had eliminated minimum parking requirements, and so far, most post-reform studies have focused on how much parking developers provide for new residential developments. Research on other outcomes of repeal remains limited. However, the fact that eliminating minimum parking requirements usually slows the growth of new parking infrastructure is significant when considered alongside the well-documented negative impacts of excessive parking.

The combined evidence on parking infrastructure, minimum requirements, and repeal outcomes provides important context for evaluating parking policy. Researchers who have studied the impacts of parking infrastructure and parking policy generally recommend eliminating minimum parking requirements. Doing so removes a major barrier to new housing and businesses, decreases the likelihood that parking will be oversupplied, and encourages more efficient use of existing spaces. Slowing the growth of parking infrastructure can help improve walkability and urban design, reduce environmental harms, and support more sustainable travel behavior.

Figure 14. Impacts of Minimum Parking Requirements



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