

# High Density Housing—Impact on Neighborhood Parking

## A Review of Literature

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### Introduction

Residential parking can account for over a third of the total parking supply of a city (Transport for London 1999 cited in Guo 2013). Parking, especially residential parking, is an amenity that has often been seen as a necessity in the U.S.; however, in thinking about the potential broader social, economic and environmental impacts of residential parking, little is actually known about how it affects our land use and transportation systems. A vast majority of research has been focused narrowly on commuter parking concerns near major traffic generators, like work centers and central business districts, largely ignoring the residential realm (Guo 2013; Weinberger 2012; Marsden 2006). This literature review aims to discuss recent research on the impact of residential parking policies on urban form, vehicle ownership and mode choice.

Off and on-street residential parking influences household decisions on vehicle ownership and mode choice. A review of existing literature and knowledge base is crucial to understanding how current and potential new residential parking policies may affect San Francisco—its families and its transportation system. Much of the available research is constrained either by geography, time and/or scope, but it provides valuable insight into broader patterns and helps guide our study of the impact of high-density housing on neighborhood parking, as will be discussed below. We investigate the connection between residential parking and vehicle ownership, and how off and on-street parking policies may encourage people to make sustainable transportation choices in San Francisco's growing neighborhoods.

### What Broadly Induces Higher Rates of Vehicle Ownership?

The built environment is the space where we live, work and travel—and parking is a defining element, a testament to the complicated relationship between transportation and land use. The way our built environment is planned, developed and regulated has sweeping impacts on a household's choice to drive and the ability or ease of owning a vehicle. Residential parking, as an element of the built environment, is intrinsically related to vehicle ownership and vehicle miles traveled (VMT) (Tian et al 2019). If a household can easily and cheaply store a car at home, owning and driving a car is a convenient choice.

The decision and ability to own a vehicle is driven by a multitude of factors—it goes far beyond the simple question of whether or not a household can afford it. Reasons behind owning a vehicle span from household-level factors to built environment influences. Beyond the personal financial aspect, other important sociodemographic factors are household size, number of people who work, and number of children (Ding et al. 2018; Tian et al. 2019; Christiansen et al. 2017). However, from a policy-based lens, built-environment factors can make operating and owning a vehicle convenient or troublesome, needed or unnecessary. In cities with greater density (both in

jobs and people), mixed land uses, smaller block sizes, and multimodal transportation networks, vehicle ownership rates are significantly lower (Litman 2006; Ding et al. 2018). The built environment has a direct impact on vehicle ownership and, consequently, VMT. Housing type is also a key predictor of vehicle ownership. On average, people living in multifamily dwellings (apartments) owned significantly fewer vehicles than those living in single family homes (0.73 vehicles per person, versus 0.98). (Tian et al. 2019). According to the same study, people living in multifamily dwellings in dense areas were the least likely to own a vehicle (at only 0.56 vehicles per person) (Tian et al. 2019). In Amsterdam, people living in apartments were over sixty percent less likely to own a vehicle than those living in less dense housing (Christiansen et al. 2017).

### How Off-Street Parking Impacts Vehicle Ownership

Residential parking is roughly divided into two categories: off-street (in a private garage or driveway) and on-street (in the public right-of-way). A majority of the limited studies conducted on residential parking focus on off-street parking. Historically, off-street parking requirements (parking minimums for new developments) have resulted in far too much parking availability which induces sprawl, vehicle dependency and higher costs of housing construction (Shoup 2005). Parking minimums require that developers build enough parking to accommodate anticipated vehicle ownership; and these assumptions are often arbitrary and derived from suburban contexts (Shoup 2005). Cities like San Francisco have begun to remove parking minimums and implement parking maximums. A study found that removing parking minimums led to a forty percent decline in the total off-street parking supply (Guo & Ren 2013). However, in areas with no parking requirements (minimums or maximums), developers were more likely to build parking in areas with excellent public transit service as compared to areas with lower density and poorer transit accessibility (Guo & Ren 2013). Thus, research suggests that maximums are an effective means of reducing dependence on vehicles.

Studies have broadly found that the availability of off-street parking alone encourages higher rates of vehicle ownership and driving (Rowe et al. 2013; Weinberger et al. 2008). One study even found that guaranteed access to a private parking spot triples the likelihood of vehicle ownership (Christiansen et al. 2017). Even in transit-oriented developments (TODs), off-street parking was still a significant predictor of vehicle ownership; and while TODs help lower VMT, they do not help decrease vehicle ownership (Chatman 2013; Cervero et al. 2010). So even when accounting for access to high quality transit, off-street parking will encourage people to own cars. Additionally, when the price of parking is included in the price of housing (bundled), rather than paid separately (unbundled), it causes households to own and drive more vehicles (Manville 2016; The Planning Center 2013; Ter Schure 2012). A single underground parking spot may cost around \$70,000 to build in San Francisco- and such costs eventually get passed along to residents in the form of higher housing costs (Shoup 2005). In sum, the presence of off-street parking alone can induce higher vehicle ownership rates, even in developments that have excellent transit accessibility. Furthermore, bundling the costs of off-street parking can worsen housing affordability while increasing dependence on vehicles.

### How On-Street Parking Impacts Vehicle Ownership

In San Francisco, it is unknown how reductions in off-street parking supplied in new housing will impact on-street parking; however, it may be the case that implementing parking maximums, unbundling and reducing parking supply may encourage households to store their vehicles on the

public-right-of-way. This question is being addressed in the San Francisco Municipal Transportation Agency's (SFMTA) study on the impact of high-density housing on neighborhood parking. Compared to the body of research on off-street parking in residential areas, what is known about residential on-street parking and vehicle ownership is based, primarily, from a few studies done in New York City (where there is no RPP or other policy mechanism for pricing residential parking) and Europe (which faces different political and normative challenges). Available research suggests that, like off-street parking, vehicle ownership can be influenced by the availability of on-street parking. In New York City, even after controlling for other variables, households own eighteen percent more vehicles when on-street parking conditions are plentiful and convenient (Guo 2013). Other research has also confirmed that when there is less on-street space for parking and it is priced, households tend to own fewer cars and drive less (Broadbudd 2010; De Groot et al. 2016). Also, free on-street residential parking helps subsidize the cost of owning a car (Guo & McDonnell 2013). When convenient and unpriced on-street parking is available in neighborhoods, households are incentivized to own more vehicles and use vehicles for their transportation needs.

Having guaranteed off-street parking does not mean households will park less on-street. In fact, it may be the opposite. Studies have shown that those with an off-street parking space (either in a driveway or a garage) are more likely store their vehicles on the curb (Taylor 2018; Guo 2013; Brown 2007). Even from a neighborhood sample in San Francisco, it was found that about half of garages were not being used for vehicle storage but rather for alternate purposes such as accessory dwelling units (ADUs) or other storage (Brown 2007). Moreover, in neighborhoods with multifamily dwellings and single-family homes, it was found that households living in single family homes disproportionately parked on-street as compared to those living in denser quarters, despite political perceptions that apartment buildings residents were taking a majority of the on-street supply (Taylor 2018). Another study estimated that free, convenient on-street parking was tied to a nine percent increase in vehicle ownership for households with private off-street parking (Guo 2013). The ease of claiming on-street parking can encourage vehicle-owning residents to utilize curb space even when they have access to their own driveways and garages. Given the constraints of residential supply in dense cities, spaces that were once utilized for vehicles may become increasingly used for housing or other storage needs if on-street parking is convenient, underpriced and/or plentiful (Guo & McDonnell 2013).

Many unanswered questions remain about the relationship between Residential Parking Permit (RPP) programs and vehicle ownership and resulting travel behavior. On San Francisco's streets alone, about thirty-seven percent of all on-street parking falls into an established RPP area (SFMTA 2019). Given concerns about how current residential parking policies, such as unbundling and parking maximums, may impact on-street supply in San Francisco, RPP is an important regulatory tool in managing on-street parking demand. In theory, RPP can increase vehicle ownership because it increases the supply of on-street parking for residents by restricting others from parking in the neighborhood. However, there is no definitive study demonstrating this (Guo 2013; Guo & Ren 2013). In one study performed in Amsterdam, where residents must pay market price for on-street parking prior to obtaining a subsidized residential permit, it was found that for every year households were on the RPP waitlist, vehicle ownership declined by two percentage points (De Groot et al. 2016). In the U.S., it was found that RPP areas close to key destinations increase residential property values (Maas & Watson 2018). In a neighborhood of Fort Collins, CO that is near a university, RPP was responsible for increasing property values by \$31,000, as compared to similarly situated properties outside of the RPP area (Maas & Watson 2018). These studies raise salient, equity questions regarding exclusive curbside parking rights. Despite a lack of

empirical data analysis on whether or not RPP encourages vehicle ownership, existing research highlights how RPP, if not regulated thoughtfully, could exacerbate inequities for those who live outside of RPP areas and for those who live within an RPP area and cannot afford vehicle ownership or private parking.

## Conclusion

One of the biggest determinants of driving, unsurprisingly, is vehicle ownership. Consequently, one major determinant of vehicle ownership is the availability, ease and cost of parking at home. As San Francisco turns towards denser, mixed-use neighborhoods, on- and off-street residential parking will need to be managed comprehensively to discourage local and regional dependency on vehicle travel. This literature review has discussed findings related to the built environment and off- and on-street parking policy. Vehicle ownership can be influenced by density, housing type, parking availability, parking convenience and parking cost—which is a product of parking policies like unbundling, parking maximums and RPP. Municipalities can discourage vehicle ownership by zoning for more mixed-use density, limiting off-and on- street supply and pricing parking appropriately in residential areas. Given a lack of recent and locally-specific research, there remains unanswered questions regarding residential parking management, as most parking studies are focused on trip destinations, such as commercial areas, employment centers and entertainment venues. Our study aims to fill this gap by examining the impacts of the supply, location and type of parking at the origin of most trips—our homes and how research findings may inform future residential parking policy and evaluates how these impacts vary by household income, size of household and presence of children, gender and housing type.

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