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Parking Requirement Impacts on Housing Affordability

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Current development practices result in generous parking supply at most destinations, which reduces housing affordability, increases vehicle ownership and stimulates sprawl. This is regressive, since lower-income households tend to own fewer than average vehicles, and unfair, because it forces residents to pay for parking they don't need. Alternative policies can increase housing affordability and help achieve other transportation and land use planning objectives.

Abstract

Most zoning codes and development practices require generous parking supply, forcing people who purchase or rent housing to pay for parking regardless of their demands. Generous parking requirements reduce housing affordability and impose various economic and environmental costs. Based on typical affordable housing development costs, one parking space per unit increases costs approximately 12.5%, and two parking spaces can increase costs by up to 25%. Since parking costs increase as a percentage of rent for lower priced housing, and low income households tend to own fewer vehicles, minimum parking requirements are regressive and unfair. Various parking management strategies can increase affordability, economic efficiency and equity.

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Preface

Hey, I've got a terrific idea! Let's pass a law requiring all residential buildings to have gasoline pumps that provide free fuel to residents and their guests. Fuel costs would be incorporated into residential rents. Think of the benefits! No more worry about money to pay for gas. No delays at gas stations. Everybody would be better off, especially poor folks. Great idea, right?

Wrong. It's a foolish idea. Somebody would have to pay for the pump and gasoline. It would increase everybody's housing costs. It would be unfair to anybody who drives less than average, who would be forced to subsidize their neighbors' gasoline consumption.

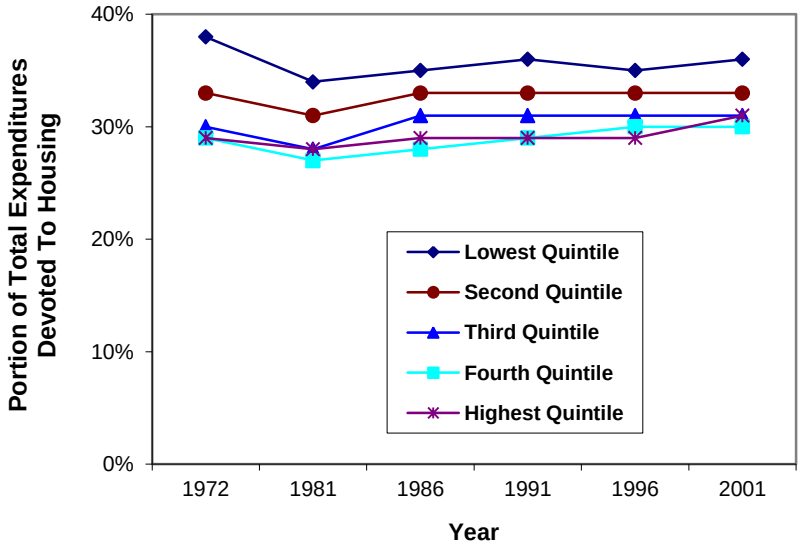
Free gasoline would also encourage wasteful habits. It would increase motor vehicle use, leading to more congestion, pollution, accidents, and sprawl, and it would continue the decline in non-automotive transportation choices, leaving non-drivers worse off. The gasoline tanks would take up space. Gasoline spilled from the pumps would degrade the environment.

Although requiring free gasoline is obviously unfair, wasteful and foolish, it is economically little different from current residential parking standards. Both residential parking and gasoline typically cost about $50 per month per automobile. Current practices of requiring generous free residential parking contradict society's goals to provide affordable housing, reduce environmental impacts, conserve resources and develop a more efficient and diverse transportation system.

Introduction

Adequate housing is essential for individual and community welfare. There are few trends more tragic than the growing housing problems many people face. An unacceptable number of people are homeless, and many lower-income households devote an excessive portion of their income to housing.

Figure 1 **Housing Portion of Consumer Expenditures** (BLS, Various Years)



This figure shows the portion of household expenditures devoted to housing by income quintile. Housing averages more than a third of expenditures for the lowest income quintile households.

This report examines the impacts of residential parking requirements (the number of off-street parking spaces mandated at a particular location) on housing affordability. Increasing parking requirements increase housing development costs, which has reduced the supply of lower priced housing and raised costs to consumer. This report does not question the need for some off-street parking. The question issue is how best to determine parking requirements and manage available parking supply. It describes more efficient and equitable strategies that support social and environmental goals.

The parking problem is ultimately simple. Motorists have come to expect generous amounts of free parking at most destinations, and planning practices attempt to provide this. The result is more-than-adequate parking supply at most destinations, but high costs in terms of resources consumed and distortions to development patterns. Current parking practices are comparable to about a 10% tax on development, and much more for lower-priced housing in areas with high land costs. These practices are regressive because lower-income people tend to own fewer than average vehicles, which forces five lower-income households to purchase more parking than they need, to insure that one higher income household can park all of its vehicles with no extra cost. Described more positively, more efficient parking practices can provide large savings, increased affordability and improved community design.

Current Residential Parking Requirements

Automobiles typically spend 95% of their existence parked, using either on-street parking supplied free by the community or privately supplied off-street parking. Since on-street parking is an expensive and limited public resource it seems fair to mandate off-street parking. Most local governments require building owners to provide a certain minimum amount of parking based on the assumption that buildings create parking demand. Building owners are forced to include parking costs when selling or renting housing.

Table 1 **Typical Parking Standards** ("Parking Evaluation," VTPI, 2005)

Housing Type	Spaces Per Unit
Single family	2.0
"Efficiency" apartments	1.0
1 to 2 bedroom apartments	1.5
3+ bedroom apartments	2.0
Condominiums	1.4

These standards are considered sufficient to meet typical residential parking

These parking requirements are based on recommended standards published by professional organizations such as the *Institute of Transportation Engineers* (www.ite.org) and the *American Planning Association* (www.planning.org). Table 1 shows typical recommended off-street standards. Many municipalities impose even higher parking requirements than these recommended standards, as illustrated in Table 2. These standards tend to be excessive in many situations, resulting in parking facilities that are seldom or never fully used, particularly in areas where per capita vehicle ownership and use tends to be low (Shoup, 1999).

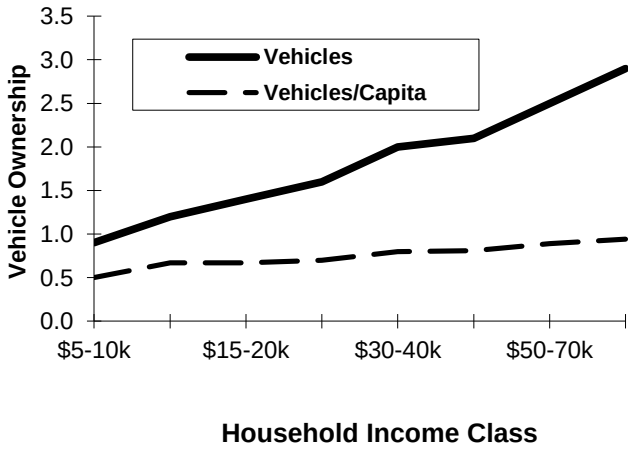
Table 2 **Typical Residential Off-Street Parking Standards** (Stover & Koepke, 2002)

Multifamily, Studio "One space per dwelling unit." (Orange Co., CA) "1.2 spaces per unit." (Bellevue, WA) "1.25 per dwelling unit." (Savannah, GA) *Multifamily, One Bedroom* "One space for each dwelling." (Bay City, MI) "1.5 spaces for efficiency units." (Schaumburg, IL) *Multifamily, Two Bedrooms* "1.6 spaces per unit." (Bellevue, WA) "1.75 spaces per dwelling unit." (Savannah, GA) "Two spaces per dwelling unit." (Hillsborough, FL) *Multifamily, Three Bedrooms* "1.8 spaces per unit." (Bellevue, WA) "2.33 spaces per unit." (Lake Forest, IL) *Multifamily, Four Bedrooms* "Two spaces per unit." (Albany, OR)	*Manufactured Housing* "One space per unit." (Fairbanks, AK) "1.25 spaces per mobile home site."(Durham, NC) "1.5 spaces per unit." (Albemarle Co. VA) "Two spaces per unit, plus one per five units for guest parking." (Prescott, AZ) *Townhouse* "1.5 spaces per dwelling unit." (Clifton Forge, VA) "Two spaces per dwelling unit." (Lexington Co. SC) "2.25 spaces for each dwelling unit." (Plano, TX) *Single Family* Nearly all codes require two off-street spaces per unit. "Detached two spaces per dwelling if access to the lot is on a public street; 2.5 spaces per dwelling if access to the lot is from a private street, common drive, or common parking court." (Leesburg, VA)

Parking Demand by Households

Automobile ownership varies significantly, and is affected by demographic, geographic and management factors ("Parking Evaluation," VTPI, 2005; Hexagon Transportation Consultants 2008; San Diego 2011; Metro Vancouver 2012). Twelve percent of U.S. households do not own a motor vehicle, with higher rates of zero-vehicle households in larger cities and lower-income communities (BLS, 2003). Motor vehicle ownership rates tend to increase with income and household size, as indicated in figures 2 through 5 (also see Rice, 2004; CNU, 2008).

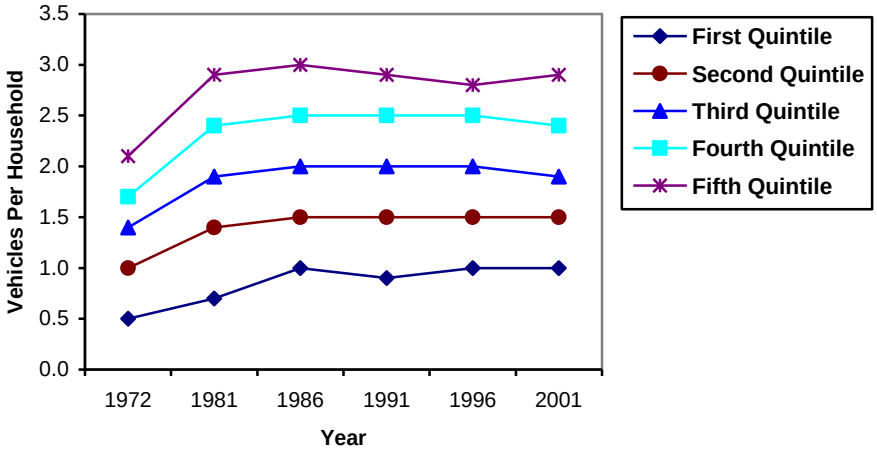
Figure 2 **Vehicle Ownership by Household Income** (BLS, 2003)



Lower income households own fewer automobiles than wealthier households.

Figure 3 shows how per household vehicle ownership varies by income class and over time. Average vehicle ownership rates grew during the 1970s and 1980s, but this leveled off and even declined in some classes during the 1990s.

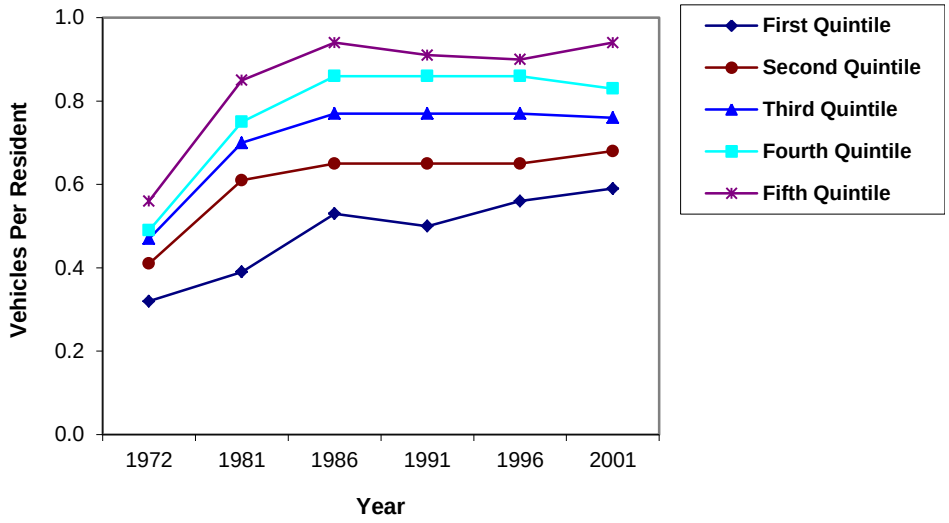
Figure 3 **Vehicles Per Household By Income Class** (BLS, Various Years)



This figure shows how household vehicle ownership varies by income. Vehicle ownership grew during the 1970s, but has since leveled off and even declined for some income groups.

Differences in vehicle ownership between different income classes results, in part, from differences in household size, since household population increases with income. Figure 4 compared vehicle per household resident.

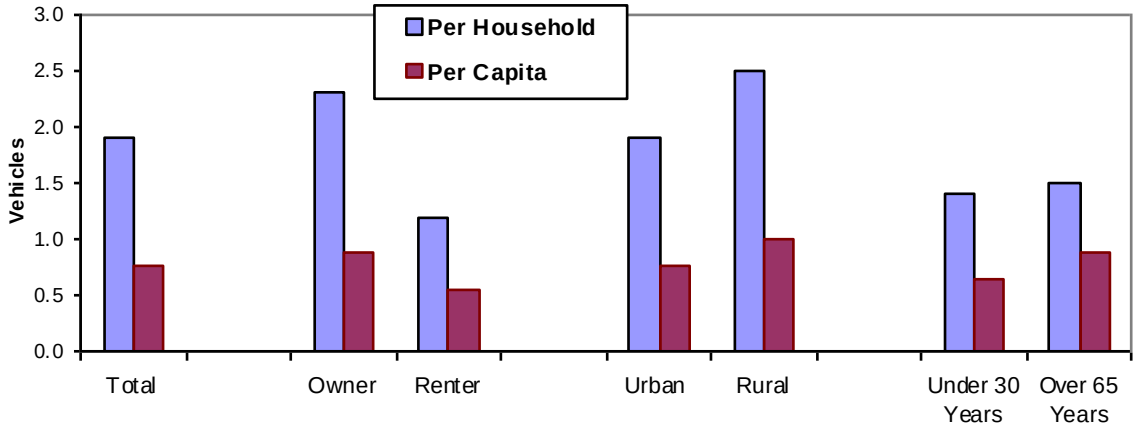
Figure 4 **Vehicles Per Resident By Income Class** (BLS, Various Years)



This figure shows the average number of vehicles per capita by income quintile.

Figure 5 illustrates how factors such as home tenure, location and age affect vehicle ownership and therefore parking demand.

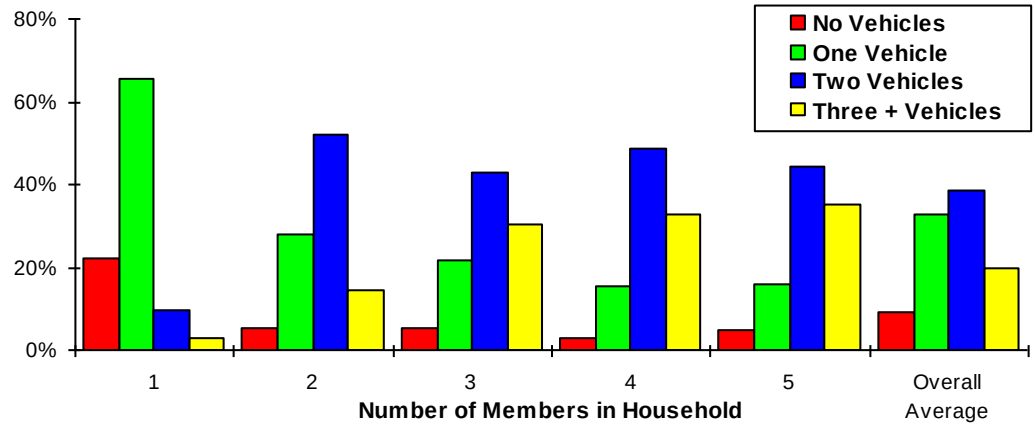
Figure 5 **Vehicles Per Household** (BLS, 2002)



Household vehicle ownership rates vary depending on factors such as home tenure, location and resident age.

Vehicle ownership varies with household size, as illustrated in Figure 6. Even a two or three bedroom home may only require one parking space because it is occupied by an adult who uses an extra bedroom as a study, a single parent with children, or two or three adults who share a vehicle.

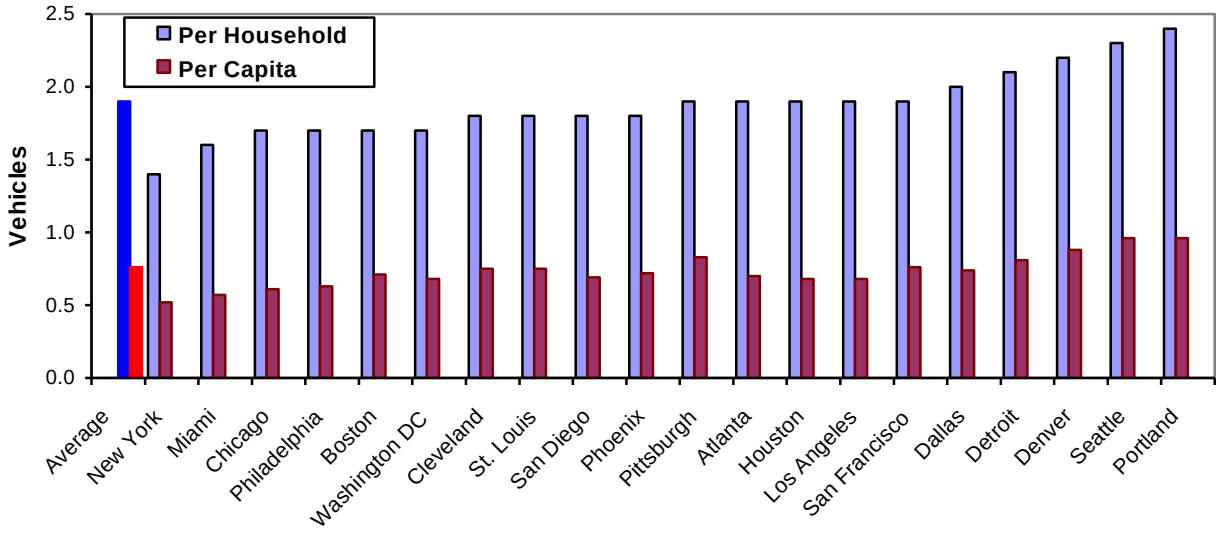
Figure 6 **Vehicle Ownership by Household Size** (Hu and Young, 1993, Table 3.17)



Smaller households tend to own fewer vehicles than larger households.

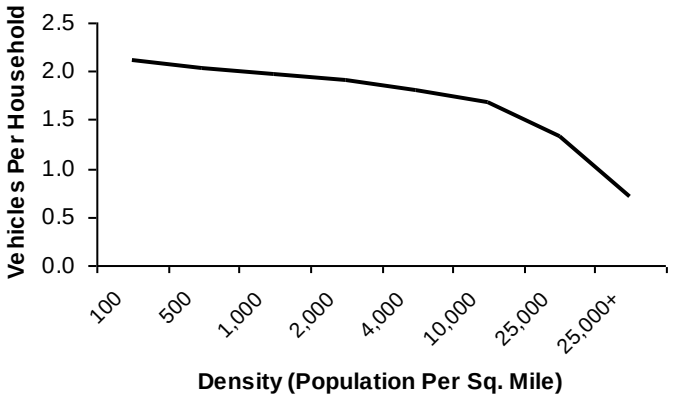
Automobile ownership is also affected by geographic factors such as city size, population density and transit service quality ("Land Use Impacts On Transportation," VTPI, 2005). Figure 7 shows how vehicle ownership rates vary between different U.S. cities. Figure 8 shows how vehicle ownership is affected by population density.

Figure 7 **Vehicles Per Household For Various U.S. Cities** (BLS, 2002)



Vehicle ownership varies from one city to another. Even greater variations exist within an urban region, such as between central and suburban neighborhoods.

Figure 8 **Vehicles Per Household by Population Density** (NPTS, 1995)



Vehicle ownership rates decline with population density.

Residents of communities with more diverse transport systems tend to own fewer cars and take fewer vehicle trips than in more automobile-dependent areas (Litman 2005). Holtzclaw (1994) developed a model for predicting how density and transit service availability affect vehicle ownership and use, summarized in the box below. This formula is incorporated in the *This View of Density Calculator* (www.sflcv.org/density).

Household Vehicle Ownership and Use By Land Use Formula (Holtzclaw, 1994)

Household Vehicle Ownership = $2.702 * (\text{Density})^{-0.25}$

Household Annual Vehicle Miles Traveled = $34{,}270 * (\text{Density})^{-0.25} * (\text{TAI})^{-0.076}$

Density = households per residential acre.

TAI (Transit Accessibility Index) = 50 transit vehicle seats per hour (about one bus) within ¼-mile (½-mile for rail and ferries) averaged over 24 hours.

Bunt and Joyce (1998) surveyed parking demand around the city of Vancouver's SkyTrain stations. They found:

- Nearly a quarter of households living near transit stations own no vehicles.
- Households located within 300 metres of a station owned about 10% fewer vehicles on average than households located more than 1,000 meters from the station.
- Average household vehicle ownership is 31% lower within the SkyTrain corridor than at suburban locations a few miles away.

Carsharing (vehicle rental services designed to substitute for private vehicle ownership) tends to reduce vehicle ownership and parking demand (Filosa, 2006). Cervero and Tsai (2003) found that when people join a San Francisco carsharing organization, nearly 30% reduce their household vehicle ownership and two-thirds avoided purchasing another car, indicating that each carshare vehicle in that program substitutes for 5-10 private vehicles.

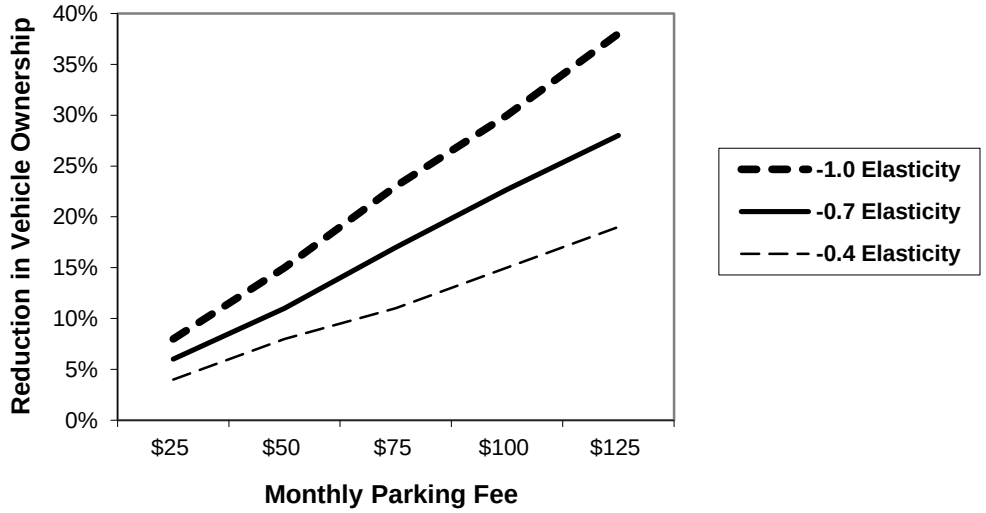
The elasticity of vehicle ownership with respect to price is typically -0.4 to -1.0, so a 10% increase in total vehicle costs reduces vehicle ownership 4-10% ("Transportation Elasticities," VTPI, 2005). Table 3 and Figure 9 indicate the reduction in vehicle ownership that can be expected from various residential parking fees and unbundling. Unbundling allows residents to choose how much parking to rent with building space, rather than automatically including a set number of parking spaces. For example, rather than renting an apartment with two parking spaces for $1,000 per month, the apartment could rent for $850 per month, plus $75 per month for each parking space the renter chooses. This is more equitable and efficient, since occupants are not forced to pay for parking they do not need. It allows consumers to adjust their parking supply to reflect their needs. For example, a $600 annual residential parking fee is likely to reduce vehicle ownership by 8-15%, and a $1,200 annual fee reduces vehicle ownership 15-30%, assuming free parking is unavailable nearby.

Table 3 **Vehicle Ownership Reductions From Residential Parking Pricing**

Annual (Monthly) Fee	-0.4 Elasticity	-0.7 Elasticity	-1.0 Elasticity
$300 ($25)	4%	6%	8%
$600 ($50)	8%	11%	15%
$900 ($75)	11%	17%	23%
$1,200 ($100)	15%	23%	30%
$1,500 ($125)	19%	28%	38%

This table indicates reductions in vehicle ownership resulting from various residential parking fees, assuming that total vehicle ownership costs average $4,000 per year.

Figure 9 **Reduction in Vehicle Ownership From Residential Parking Prices**



This figure illustrates typical vehicle ownership reductions due to residential parking pricing, assuming that the fee is unavoidable (free parking is unavailable nearby). Based on Table 3.

Parking Facility Costs

If a municipal government doubled residential property taxes to finance free public parking there would surely be considerable debate about the efficiency and equity of such a tax. At least some critics would probably suggest that such taxes are inefficient and unfair, and there would surely be arguments over the facilities' aesthetic and environmental design features. A 2-space per residence parking standard imposes similar costs yet there is often little discussion when city officials set such requirements. Parking requirements are a large but nearly invisible cost that is seldom evaluated as a separate expense. The total cost of parking consists of several components.

1. Land

Each off-street parking space requires about 300 square feet of surface area (including access lanes). One acre of land can hold about 125 spaces, fewer if major landscaping and screening are provided ("Parking Evaluation," VTPI, 2005). Land costs are about $4,200 per space, assuming 120 parking spaces and $500,000 per acre. Parking consumes a major portion of developed land, typically equal to or exceeding the land devoted to the buildings it serves. Expenses that occur early during project development, such as increased land acquisition and preparation costs, add construction financing costs, so parking facility expenses tend to incur higher financing costs than expenses incurred later in the development process.

Residential parking standards are calculated per unit, so parking land costs are a greater percentage of total costs for smaller units. For example, increasing parking from one to two spaces per unit increases land requirements for a small 1,000 square foot, two-story apartment or condominium from 800 to 1,100 square feet per unit, a 37% increase, resulting in more land devoted to parking than to housing. The same doubling of parking requirements only increases the land requirement for a 2,400 square foot one story house by 12.5%.

3. Construction and Maintenance

Paving costs average about $1,600 per parking space in 1994 dollars, excluding land costs. Parking structure costs average approximately $10,000 per space, and underground parking $15,000 to $20,000 per space, which makes these options uneconomic except where land prices are very high. Annual maintenance costs range from about $20 to $100 per year.

Table 4 illustrates the total cost per space for parking facilities in various conditions. Typical off-street residential parking costs range from about $400 annually in suburban locations where land is considered to have no opportunity cost, to more than $2,000 per year where underground parking is provided. Annual costs of $800 to $1,200 per space is probably typical for urban residential parking. Gabbe and Pierce (2016) estimate renter households' garage parking costs average approximately $1,700 per year, or an additional 17% of rents, imposing $440 million annually in total costs to carless renter households.

Table 4 **Typical Parking Facility Financial Costs** ("Parking Evaluation," VTPI, 2005)

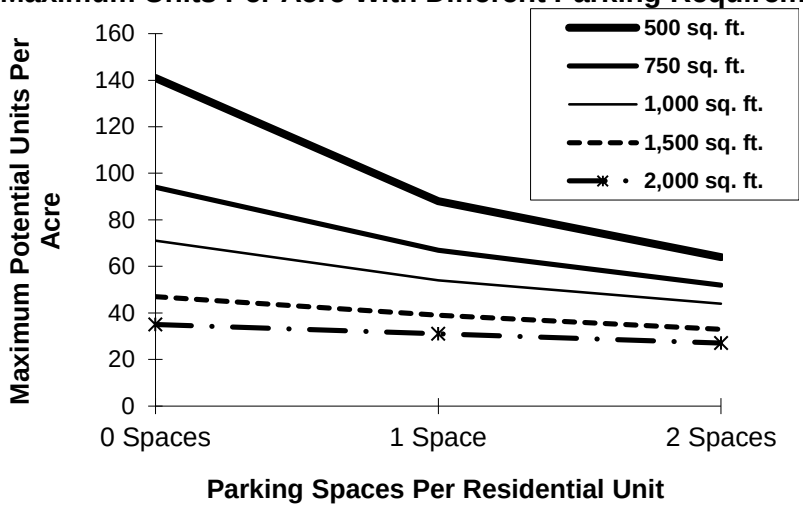
Type of Facility	Land Costs	Land Costs	Construction Costs	O & M Costs	Annual Cost	Monthly Cost
	Per Acre	*Per Space*	*Per Space*	*Annual, Per Space*	*Annual, Per Space*	*Monthly, Per Space*
Suburban, On-Street	$50,000	$200	$2,000	$200	$408	$34
Suburban, Surface, Free Land	$0	$0	$2,000	$200	$389	$32
Suburban, Surface	$50,000	$455	$2,000	$200	$432	$36
Suburban, 2-Level Structure	$50,000	$227	$10,000	$300	$1,265	$105
Urban, On-Street	$250,000	$1,000	$3,000	$200	$578	$48
Urban, Surface	$250,000	$2,083	$3,000	$300	$780	$65
Urban, 3-Level Structure	$250,000	$694	$12,000	$400	$1,598	$133
Urban, Underground	$250,000	$0	$20,000	$400	$2,288	$191
CBD, Surface	$2,000,000	$15,385	$3,000	$300	$2,035	$170
CBD, 4-Level Structure	$2,000,000	$3,846	$15,000	$400	$2,179	$182
CBD, Underground	$2,000,000	$0	$25,000	$500	$2,645	$220

This table illustrates the costs of providing a parking space under various conditions. (CBD = Central Business District; Assumes 7% annual interest rate, amortized over 20 years)

4. Reduced Development Density

By increasing the land needed per residential unit, increased surface parking reduces the maximum potential development density (units per acre). In other words, parking squeezes out housing. This impact is proportionally greatest for smaller units. For example, increasing parking requirements from one to two spaces per unit reduces the maximum potential density for two story, 500 square foot bachelor apartments from 88 to 64 units per acre, representing a 37% decline, but only causes a 13% reduction in maximum density for 2,000 square foot townhouses. Figure 10 illustrates this impact.

Figure 10 **Maximum Units Per Acre With Different Parking Requirements**



Maximum potential density declines as the number of surface parking spaces increases. This impact is proportionally largest for smaller units. (Assumes 300 sq. ft. per parking space, 90% land coverage, 10% common areas, 2 story buildings.)

5. Higher Retail Price Targets

Construction financing agencies often require that new building retail prices be at least 3 times original land costs. Each additional dollar of land costs for parking therefore increases housing prices by three dollars. Developers cannot afford to build a simple, lower priced housing when their land costs increase, so they target higher end markets.

6. Environmental and Aesthetic Costs.

Undeveloped land, farmland and urban landscaping (greenspace) provide a variety of environmental and aesthetic benefits, both to the land's owners and to society in general (Litman, 1997). Paved land, biologically barren and unattractive, tends to reduce adjacent property values, increases water pollution and stormwater flooding, reduces visual and acoustic privacy, and causes urban heat island (increased local temperatures).

7. Urban Sprawl and Increased Automobile Dependency.

Increased parking requirements increase land costs per area of developed floor space, making development at the urban periphery relatively more attractive due to lower land costs (Willson, 1995). Some studies suggest that such regulations discourage urban infill development (Burby, 2000). Increased parking also creates lower density urban and suburban land use patterns that are unsuitable for walking, bicycling and transit. Development densities under about 12 units per acre cannot effectively support public transit service and neighborhood amenities such as small shops within walking distance that substitute for driving. Since off-street parking is a fixed cost (households must pay it whether or not they own a car), fixed parking standards encourage automobile ownership and use.

Each of these impacts contributes to urban sprawl and automobile dependency (defined as increased automobile ownership and use, reducing travel choices, and increasing disadvantage of non-drivers compared with drivers. See "Automobile Dependency," VTPI, 2005). These exacerbate problems such as congestion, accidents, and pollution. Automobile dependency is highly inequitable to non-drivers.

8. Increased Curb Cuts

Offstreet parking requires curb cuts. This imposes at least two specific costs. It degrades the pedestrian environment (and therefore the retail environment in commercial areas) by causing vehicles to cross sidewalks, and it reduces capacity for on-street parking. A typical curb cut uses almost the same amount of curb space as a parked car, so a single-vehicle off-street parking space provides no net increase in parking capacity if it eliminates an on-street parking space. A double off-street parking space provides a net gain of one space.

Development Cost Example

Each increment of increased parking increases all of the costs described above as demonstrated by the following example: A developer wishes to construct 2 bedroom, 1,250 square foot, two-story, wood frame multi-family housing with $100,000 per unit construction costs on a $500,000, 1 acre parcel. Her costs are summarized in Table 5.

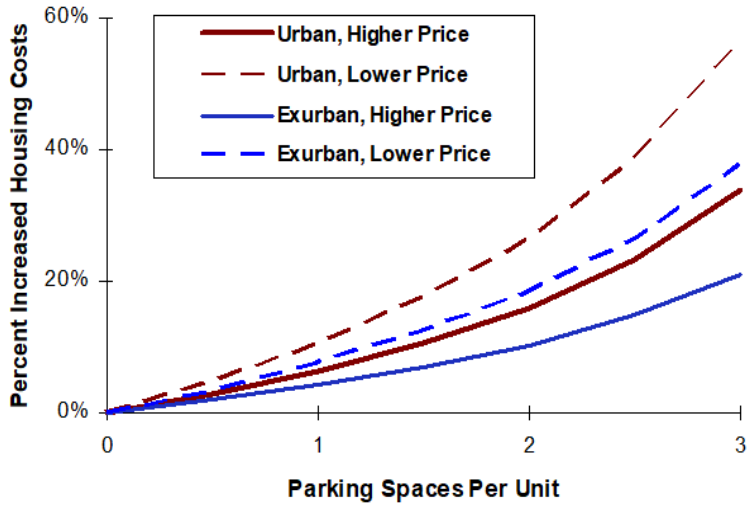
Table 5 **Parking Impacts on Development Costs**

Parking Spaces Per Unit:	0	1	2	3
Units / Acre	20	16	12	8
Land Cost / Unit	$25,000	$31,250	$41,667	$62,500
Paving costs.	$0	$1,600	$3,200	$4,800
Housing construction costs / Unit.	$100,000	$100,000	$100,000	$100,000
Land, parking & construction costs.	$125,000	$132,850	$144,867	$167,300
Construction financing (12%).	$15,000	$15,942	$17,384	$20,076
Total construction costs.	$140,000	$148,792	$162,251	$187,376
Developer's profit (10%).	$14,000	$14,879	$16,225	$18,738
Retail price per unit.	$154,000	$163,671	$178,476	$206,114
Parking as percentage of retail price.	0%	6.3%	15.9%	33.8%
Developers' profit per acre.	$280,000	$238,067	$194,701	$149,901

(Assuming Two-Story, 1,200 Square Foot, Multi-Family Housing)

Requiring one off-street parking space adds about 6% to the unit cost, two spaces add about 16%, and 3 spaces adds about 34% compared with no parking. These percentages vary depending on construction and land costs. Figure 11 illustrates incremental costs of parking for standard and affordable housing ($100,000 and $50,000 per unit construction costs), with urban and suburban land costs ($500,000 and $250,000 per acre).

Figure 11 **Increased Per Unit Housing Price Due to Parking Costs**

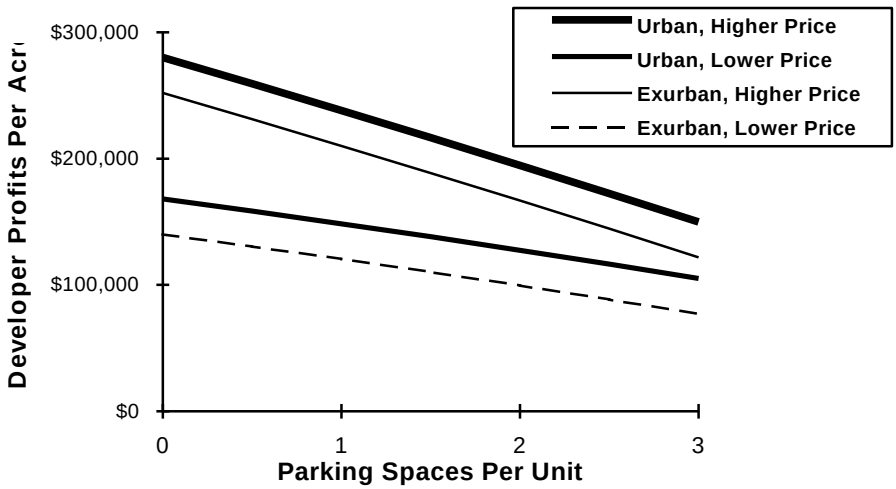


This shows parking costs as a percentage of housing costs for different construction and land costs. The percentage is greatest for lower price urban housing. This does not include additional indirect costs and non-market, such as reduced greenspace.

This indicates that conventional parking minimums significantly increase housing costs, especially when land prices are high and housing construction costs are relatively low, such as affordable, urban infill housing. Based on typical affordable urban housing development costs, one parking space per unit increases total development costs by about 12.5%, and two parking spaces increase costs by about 25%.

Parking requirements reduce developers' profits per acre, as illustrated in Figure 12. In this case, a developer is equally rewarded for producing 10 high priced housing units with 3 parking spaces per unit or 20 affordable housing units with no parking spaces, but has 30% less profit for lower priced housing with 3 parking spaces. Parking requirements reduce developers' incentive to produce affordable housing.

Figure 12 **Effect of Parking Costs on Developer Profits Per Acre**



Developer profits per acre decline with increasing parking due to increased costs and reduced units. This reduces developers' incentive to build affordable housing.

According to a study by Shoup, these generous parking requirements are the largest of all regulatory burdens placed on developers, about four times greater than all other development fees combined, such as levies for schools, parks and roads (Shoup 1999).

Developers' most common response to the high incremental costs of increased parking is to build less affordable urban housing (Lehe 2018). One case study from the early 1960's found that requiring one off-street parking space per unit reduced dwelling units per acre in new multi-family developments by 30%, and increased construction costs by 18% (Smith 1964). This significantly reduced the amount of urban land available for infill housing and gave developers an incentive to develop fewer, larger and lower quality units. The resulting reduction in affordable housing construction increased local rents (Shoup, 2005 contains more examples of parking requirement cost impacts).

Parking imposes similar costs for non-profit developments. To provide housing that can be purchased at $80,000 per unit (for a monthly mortgage of about $700, the maximum recommended house payment for a family earning $30,000 annually), a subsidy of only $4,000 would be needed if no parking is required, a $12,792 subsidy is required for one parking space

per unit, $26,251 for two parking spaces, and $51,376 for three (based on Table 5 values). In this case a given housing budget could benefit about 6.5 times as many households that don't have parking spaces compared with 2 spaces per unit.

Empirical research indicates that excessive parking requirements really do affect housing supply and affordability. Manville (2010) found that when parking requirements were removed in downtown Los Angeles, developers provide more housing and less parking, and a greater variety of housing types: housing in older buildings, in previously disinvested areas, and lower-priced housing with unbundled parking that is marketed toward non-drivers. The research also indicates that allowing developers to provide parking off-site can allow more affordable infill housing.

Analysis of 23 recently completed Seattle-area multifamily housing developments reveals that parking subsidies increase monthly rents approximately 15% or $246 per month for each occupied unit; that approximately 20% of occupants own no motor vehicles, and during peak periods 37% of parking spaces are unoccupied (London and Williams-Derry 2013). The authors conclude that "the practice of providing abundant "cheap" parking actually makes rental housing more expensive."

A study found that San Francisco housing prices increased significantly (an average of $39,000 or 13% for condominiums, and $46,000, or 12% for single-family units) if they include off-street parking (Jia and Wachs 1998). Only unit size and number of bathrooms have a greater effect on sales price. Based on standard mortgage requirements, a typical household would need to earn $76,000 annually to purchase a single-family home with off-street parking, compared with $67,000 for the same housing without parking.

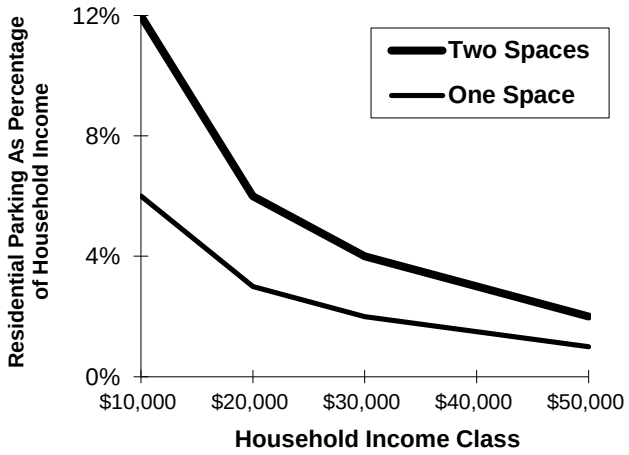
Similarly, Jung (2009) used hedonic pricing to estimate the marginal effect of an additional parkade-style parking space on condominium prices. His results indicate that the value of a parking space is statistically significant but substantially less than the typical cost of supplying that space. The results suggest that if the retail price is increased to include the costs of additional parking spaces, the higher price does not fully reflect the cost to the developer of providing those parking spaces. This adversely affects housing affordability because developers must charge more per unit, and to the degree that the additional parking costs cannot be recovered by higher prices, are likely to provide less housing, leading to a higher market-clearing price, particularly in lower price ranges.

Impacts on Lower Income Households

Who is disadvantaged most by generous parking requirements? Since they are based on average parking demand they represent approximately what middle income, able-bodied households would choose. Various groups tend to own fewer than average automobiles, value the potential savings that result from reduced parking requirements, and live in higher-density, multi-family housing, including low-income households, young adults, single parents, first time home buyers, older people, and people with disabilities.

As discussed earlier, vehicle ownership and use tends to increase with income. Lower-income households are directly harmed by generous off-street parking requirements, since they tend to own fewer vehicles and pay more for parking as a percentage of housing costs. For example, the $100 per month direct cost of two parking spaces represents only 5% of a $2,000 per month luxury condominium rent, but 20% of the $500 per month rent of a basic apartment. Poor households also spend a greater share of their income on housing than wealthier households, as shown in Figure 1. Parking costs represent a proportionally greater burden for lower income households, as illustrated in Figure 13.

Figure 13 **Residential Parking Costs as a Percentage of Household Income**



Parking costs typically constitute a greater portion of household expenditures for poor than for wealthier households, indicating they are regressive. (Based on $50 monthly parking space cost.)

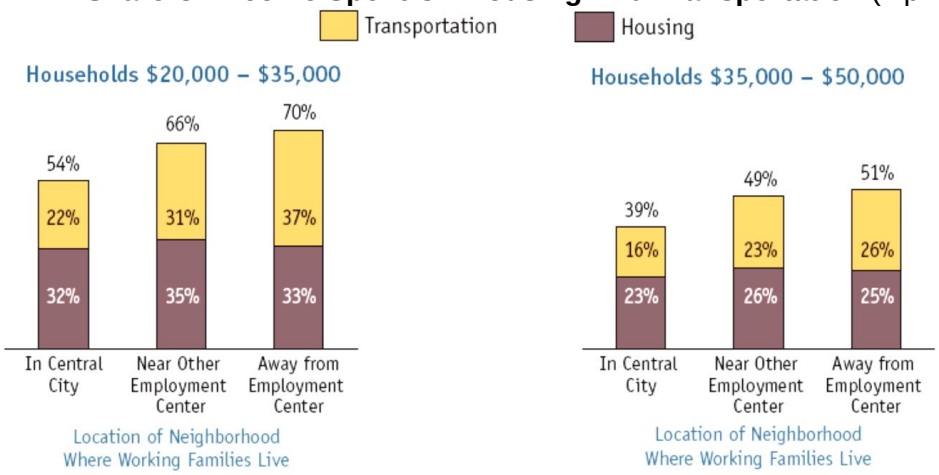
Since vehicle ownership increses with income, low-income households tend to be particularly harmed by parking minimums, since it forces them to pay for parking spaces they don't need, and these costs are regressive.

On-street parking policies also tend to be regressive. Many jurisdictions restrict on-street parking in residential neighborhoods, providing free or inexpensive parking permits to residents, but these are often only available to occupants of single-family houses, who tend to be wealthier, not apartment dwellers who tend to have lower incomes. Yet Taylor (2020), found that the majority (77–83%) of on-street residential parking use is by detached housing residents, most of whom have sufficient off-street parking but use their garages for storage. Residents of apartments account for disproportionately little on-street parking use.

Some communities use restrictive zoning laws to exclude lower-income households, because they are considered "undesirable" neighbors. This is inequitable. As researcher Jonathan Levine concludes, "Land use controls enforcing low-density, large-lot, automobile dependent development styles are a subsidy for those who choose to and can afford to live in the housing produced; by reducing the prevalence of other forms of residential development, they increase the supply of the standardized product. Those who pay the cost of this subsidy are those who would have chosen to – and might have afforded to – reside in those locales if more alternative housing forms had been allowed there," (Levine, 1998, p. 147).

Current housing markets harm lower-income households by forcing them to choose between urban residential locations, which tend to be either in undesirable neighborhoods or have high prices, and suburban or exurban residential locations, which have lower housing costs but much higher transportation costs (CTOD and CNT, 2006; Lipman, 2006). Many lower income households would be financially better off if affordable housing were available in more accessible, multi-modal urban locations where their combined housing and transportation costs were lower. More flexible parking requirements can help provide such housing by reducing housing development costs in areas with higher land prices.

Figure 14 **Share Of Income Spent On Housing And Transportation** (Lipman, 2006)



Urban fringe housing is often cheaper, but these savings are offset by higher transport costs.

Impacts on Automobile Ownership and Use

Forcing households to pay for residential parking increases vehicle ownership rates. Average income households spend an average of $3,800 annually per vehicle, and lower-income households spend an average of $3,000 annually per vehicle (BLS, 2002). Assuming that residential parking spaces cost $800 per year, parking costs add 21% to vehicle costs for an average income household, and 27% to the cost of a lower-income household. Assuming a vehicle price elasticity of –0.7 for average income households and–0.1 lower income households (Table 3), generous minimum parking requirements increase urban vehicle ownership about 14% overall and about 25% among lower-income urban residents. The resulting increase in vehicle ownership and use increases various external costs such as congestion, traffic accidents and pollution.

Some people might conclude that poor households are better off owning these cars. This is a misreading of the analysis. The additional automobiles owned as a result of parking requirements are marginal vehicles that the owners would give up if they had the option. It is comparable to a law forbidding the sale hamburger, forcing poor families to eat more steak. Steak may taste better than hamburger, but its higher cost means that households must forego other goods that it values more. If poor families really valued steak that much they would not have bought hamburger in the first place, so no law would be needed. From a household's perspective, minimum residential parking requirements remove flexibility and choices that can make the family overall better off. This constraint is experienced most by lower income households that tend to own fewer than average automobiles, and value highly potential savings in housing and transportation costs.

Possible Mitigating Factors

Some people may be skeptical of this analysis. After all, most low-income families do own vehicles and most do find housing. Are there mitigating factors that reduce the impacts described here? Yes, but they create their own set of problems.

1. Even poor families, *can* afford $500 to $1,500 per year to pay for residential parking, but it significantly reduces their wealth and options.
2. Urban decay reduces property values in some locations, which creates virtually no-cost parking. Poor households can therefore afford to meet generous parking requirements provided they live in undesirable neighborhoods. But such "throw-away" land use patterns impose tremendous costs. They force poor households to live in dangerous and hopeless neighborhoods, creating class and racial segregation.
3. Public agencies subsidize some housing to maintain affordability. But this creates significant financial and social costs. Few communities can afford to provide good housing to all low-income households. Generous parking requirements reduce the amount of affordable housing that can be provided with a given budget.
4. An abundance of used automobiles and low fuel prices in North America allow even low-income families to buy an "old beater" and live in the suburbs where land values (and therefore parking costs as an increment of housing expenses) remain low. This, however, exacerbates various problems, including increased environmental impacts, a lack of travel options for non-drivers, and household dependency on unreliable private transportation. Poor drivers often have no insurance, imposing financial and legal costs on other road users.

Although these mitigating factors reduce some impacts of parking requirements on housing costs, they are economically inefficient and inequitable. They fail to actually reduce the cost and increase the productivity with which housing is provided, and they exacerbate social and environmental problems.

Solutions

There is much that can be done to manage parking to increase housing affordability. For more information see Arigoni, 2001; Russo, 2001; SPUR, 2002; VTPI, 2005; CTOD, 2008.

A paradigm shift (a change in the way problems are defined and solutions evaluated) is occurring in transportation planning. The old paradigm relied primarily on supply-oriented solutions (expanding road and parking facility capacity). It assumed that parking problems should generally be solved by increasing parking supply, usually by raising the minimum parking requirements for new development. From this perspective, parking demand is an unchangeable force that must be satisfied, and parking should generally be provided free, with costs incorporated in building and roadway construction budgets. The new paradigm places more emphasis on management solutions. It recognizes the need to provide adequate parking, but values strategies which result in more efficient use of parking resources and reduce the amount of parking needed at a particular location. From this perspective, too much parking supply is as harmful as too little. With this approach, parking demand can often be managed in ways that reduce costs and the need to subsidize parking facilities.

Rather than establishing generous parking requirements to satisfy the maximum potential demand that may occur during a facility's lifetime, parking management allows contingency-based planning, which means that various solutions are idenfitied and deployed if needed. For example, rather than providing 150 parking spaces at a 100 unit apartment building, as required by conventional standards, the developer might initially supply 80 spaces, along with various parking management strategies, and perhaps some land banked for constructing additional parking if needed. This approach saves costs and is more responsive to community needs.

Parking management involves both government agencies (which reduce parking minimms, and enforce parking management agreements) and building developers and managers (which develop and implement parking management programs). An effective parking management plan usually involves several components. Examples of parking management strategies are described below. For more information see VTPI, 2005.

Reduce, Eliminate or Adjust Parking Minimums

Minimum parking requirements can be eliminatied, reduced or made more accurate and flexible to better reflect the demand at a particular location and time. Eliminating parking minimums does not eliminate parking, it simply allows property owners to supply parking based on users' demand. This tends to shift from oversupply (most parking lots are never fully occupied and parking is generally unpriced) to optimal supply (parking is efficiently managed, shared and priced). Standards can be adjusted to reflect demographic, geographic and management factors. For example, standards can be reduced for housing that serves lower-income people, students and elderly; for housing in more accessible locations (such as near transit stations and in mixed-use neighborhoods); in buildings that have carshare services, and where parking is priced. This gives developers and building operators an incentive to use parking management solutions, by allowing them to save money when they reduce parking demand.

Gabbe, Pierce and Clowers (2020) found that when parking minimums were reduced in some central Seattle neighborhoods, developers built about 40% fewer spaces.

Shared Parking

It is often possible for motorists and buildings to share parking facilities, to increase efficiency and flexibility. For example, 100 residents or employees can often share 70-80 parking spaces, since at any period in time some are likely to be away. Similarly, an apartment and an office building can share parking facilities, since the office peak demand occurs during weekdays, while the apartment's peak occurs during evenings and weekends.

Local governments can allow developers to pay "in lieu" fees, which help fund off-site municipal parking facilities, as an alternative to providing on-site parking (Shoup, 1999). This gives developers more flexibility (allowing better site design and preservation of unique and historic resources that cannot otherwise accommodate on-site parking), allows parking facilities to be located where they most optimal for the sake of urban design, and results in more efficient and cost effective shared parking facilities.

Unbundling

Rather than automatically including a certain amount of parking with building space, parking costs can be borne directly by users by "unbundling," which means that parking is rented or sold separately. For example, rather than renting an apartment with two parking spaces for $1,000 per month, the apartment could rent for $850 per month, plus $75 per month for each parking space. This is more equitable and efficient, since occupants are not forced to pay for parking they do not need, and allows consumers to adjust their parking supply to reflect their needs.

Parking can be unbundled in several ways:

- Facility managers can unbundle parking when renting building space.
- Developers can make some or all parking optional when selling buildings. For example, a condominium can be sold with no parking or just one space, with additional spaces available for purchase or rent if desired.
- In some cases it may be easier to offer a discount to renters who use fewer than average parking spaces, rather than charging an additional fee. For example, an office or apartment might rent for $1,000 per month with two "free" parking spaces, but renters who only use one space receive a $75 monthly discount.
- Lease agreements can itemize parking costs. To facilitate unbundling some communities require that parking be a separate line-item in lease contracts, even if spaces are automatically included. Once renters become aware of what they pay for parking they may decide to negotiate changes, perhaps renting fewer spaces or trading parking spaces with other residents.
- Minimum parking requirements can be reduced for developments with unbundled parking, which recognizes that, given a choice, many residents will reduce their parking demand.
- An informal approach to unbundling parking is to help create a secondary market for available spaces. For example, office, apartment and condominium managers can maintain a list of residents who have excess parking spaces that are available for rent.

Location Efficient Development

Current lending policies mistakenly treat automobiles owned by a household as financial assets rather than liabilities, which encourages home buyers to choose automobile-dependent suburban location over urban locations. Owning one less vehicle saves a household an estimated $3,000 annually in vehicle costs and $50 per month in parking costs (Hare, 1993). "Location Efficient Mortgages" recognize these saving in housing loans, eliminating a bias that makes suburban housing appear more affordable than urban housing, despite greater total (transport and housing) expenses. Cevero (1996) finds that there is unmet market demand for such housing, particularly near transit stations. CTOD (2008) describe various ways to maximize the value of transit-oriented, infill development.

Carsharing

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

Carfree Planning ("Car-Free Planning," VTPI, 2005)

Some planners are experimenting with "car free" housing developments specifically designed to accommodate households that do not own a motor vehicle and take advantage of community benefits of reduced vehicle traffic (such as using land that would be needed for parking in an automobile-dependent area for common greenspace).

Overflow Parking

It is often possible to reduce parking requirements by identifying ways to manage occasional peak demands. For example, a building operator may provide information to residents on "overflow" parking options for guests (for example, when they have a party), or for residents who purchase addition vehicles, such as a trailer or collector car. This may involve sharing agreements with other buildings nearby, or information on commercial parking and storage facilities in the area.

Transportation Management Associations

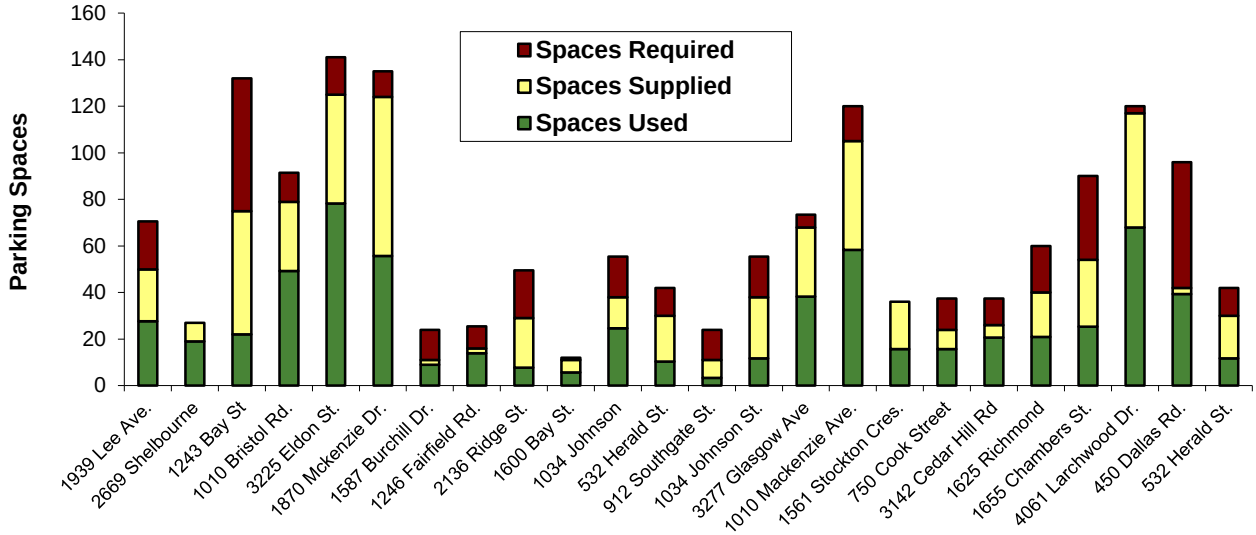
Transportation Management Associations (TMAs) are private, non-profit, member-controlled organizations that provide transportation services in a particular area. TMAs provide an institutional framework for transportation and parking management programs, including parking brokerage services which help building operators share, trade, lease and rent parking facilities. They are usually more cost effective than programs managed by individual businesses.

Parking Utilization Studies

To evaluate the appropriateness of current parking requirements it is useful to perform parking utilization studies, that is, surveys of parking facilities to determine how many spaces are occupied during peak demand periods. For information on such studies see *Parking Generation* (ITE, 2004). For residential uses, peak demand occurs during weekday evenings or on weekends.

Students in a University of Victoria planning course performed residential utilization studies of multi-family residential buildings as an assignment (this was easy since most lived in such buildings or had friends that did). These surveys indicate that, for the 33 buildings studied, only 54% of the available parking spaces were occupied during peak periods, and if these buildings had the number of parking spaces required by current minimum parking requirements (based on a standard of 1.5 parking spaces per unit), only 46% of those parking spaces would be occupied. Figure 15 illustrates the results.

Figure 15 **Parking Utilization Versus Supply and Requirements**



This figure shows the number of parking spaces used, currently supplied, and required for new construction at various multi-family residential buildings in Victoria, British Columbia.

Several sites have peak-period parking utilization below 50%, and many parking facilities have spaces that are obviously never used. Investigators reported that some motorists park on the street to avoid using less convenient spaces behind buildings. Only five of the 33 sites report frequent conflicts over parking, and these often involve particular spaces (i.e., those considered most convenient or safe), not overall parking supply. Some investigators reported, based on their own or friends' experiences, that some residents will use a parking space if it is supplied with the unit, but if a fee is charged they will reduce their vehicle ownership or storing their vehicle at their family home during the school year.

Affordable Housing Opportunities

There are many possible ways to make housing more affordable, including direct housing subsidies for lower-income people, indirect subsidies such as rent controls, and various ways of reducing housing production costs. Some of these strategies are more efficient and equitable than others. Subsidies by themselves tend to be unfair and inadequate. In a typical community 10-20% of households face housing affordability problems, including those who are working poor or on a fixed income. It is unrealistic to provide full subsidies to all who want and deserve more affordable housing. As a result, such programs are often arbitrary, favoring some disadvantaged groups but not others.

A much more effective way to provide affordable housing is to reduce construction costs for moderately-priced new units. This increases housing affordability both directly (by reducing the costs of new housing) and indirectly by increasing affordable housing supply. The added units do not all need to be "affordable" themselves, but they free up the older stock of housing to be truly affordable. In urban area where land costs are high, the best way to increase affordability is to minimize land requirements per unit by increasing density and reducing parking facility requirements. Table 6 illustrates how density and parking affect the amount of land required per unit and the number of units per acre for various number of floors, with and without surface parking. This shows how even modest increases in density (say, from two to three or four stories) and reductions in surface parking can significantly reduce land requirements.

Table 6 **Land Area Per Unit**

Housing Type	Without Surface Parking		With Surface Parking	
	Sq. Feet	Units Per Acre	Sq. Feet	Units Per Acre
1/2 Acre Single-family	21,780	2	21,780	2
1/4 Acre Single-family	10,890	4	10,890	4
Small-lot Single-family	5,445	8	5,445	8
Two-Story Duplex	3,630	12	3,630	12
Three-Story Townhouse	1,000	44	1,333	33
Four-story Condominium	450	97	783	56
Medium-Rise Condominium	225	194	558	78
High-Rise Condominium	113	387	446	98

Increased density and reduced parking requirements significantly reduce unit land requirements. This assumes that one-third of parcel is devoted to setback, and 333 square feet per surface parking space.

Table 7 illustrates the cost of providing these units and the number that could be subsidized with a $10 million budget, assuming land costs average $1,000,000 per acre and each units costs $100,000 to construct. The number of units that can be provided with a given subsidy increases more than five hundred percent with increased density and reduced parking. The largest cost reductions occur with shifts from low- to medium-density, indicating that affordability does not require high-density, high-rise housing.

Table 7 **Costs Per Unit and Subsidized Households**

Housing Type	With Surface Parking		Without Surface Parking	
	Cost Per Unit	Subsidized Units	Cost Per Unit	Subsidized Units
1/2 Acre Single-family	$1,100,000	17	$1,100,000	17
¼ Acre Single-family	$600,000	29	$600,000	29
Small-lot Single-family	$350,000	44	$350,000	44
Two-Story Duplex	$266,667	55	$266,667	55
Three-Story Townhouse	$161,203	77	$145,914	81
Four-story Condominium	$135,950	85	$120,661	91
Medium-Rise Condominium	$125,620	89	$110,331	95
High-Rise Condominium	$120,455	91	$105,165	97

Increased density and reduced parking requirements significantly reduce the costs of producing housing and the number of units that can be produced for a given subsidy.

These benefits increase further if subsidy is distributed as a match grand. For example, if we ask occupants to pay $100,000, either toward purchasing the unit or about $400 per month in rent, the number of units that can be provided by the subsidy increases to many hundreds.

Table 8 **Subsidized Household With Matching Grants**

Housing Type	With Surface Parking		Without Surface Parking	
	Subsidy Per Unit	Subsidized Units	Subsidy Per Unit	Subsidized Units
1/2 Acre Single-family	$1,000,000	20	$1,000,000	20
1/4 Acre Single-family	$500,000	40	$500,000	40
Small-lot Single-family	$250,000	80	$250,000	80
Two-Story Duplex	$166,667	120	$166,667	120
Three-Story Townhouse	$61,203	327	$45,914	436
Four-story Condominium	$35,950	556	$20,661	968
Medium-Rise Condominium	$25,620	781	$10,331	1,936
High-Rise Condominium	$20,455	978	$5,165	3,872

Increased density and reduced parking requirements significantly increase the number of households that can benefit, assuming that lower-income residents pay a share of costs. ("Sub. Units" = Subsidized Units)

The benefits of infill, density and reduced parking costs become even larger and more logical if we evaluate affordability in terms of combined housing and transportation costs. Location decisions often involve trade-offs between housing and transportation costs: land and therefore housing costs are often lower at the urban fringe where transportation costs are highest. Residents of such locations typically pay several thousand dollars a year in vehicle expenses. Increased density and reduced parking requirements allow more moderate- and low-income households to choose homes in accessible locations where their transportation costs are minimized, saving thousands of dollars. True affordability is therefore where housing is affordable and automobile ownership and use can be reduced.

Current, generous levels of parking supply in growing urban areas provide an unintended land bank that, with more efficient management could be used to create location-efficient housing (Shoup, 2005). With improved design and management many retail malls, commercial districts and other urban centers could reduce the amount of land devoted to parking facilities by 20-

40%, or even more ("Parking Management," VTPI, 2005). Parking lots are often the largest single largest land use in such areas, typically using 30-50% of land area. In many situations, more efficient management would allow many acres of land to be developed within or near these urban centers, which is ideal for location-efficient, truly affordable housing, that is, housing located in accessible, multi-modal areas where residents can minimize their transportation costs by relying on walking, cycling, public transit, taxi and carsharing. Such locations are also appropriate for people with disabilities or other constraints on their ability to drive. Similarly, land currently used for urban parking may be appropriate for mixed-use residential, commercial and institutional development, allowing more compact retail and employment centers that are more accessible by walking and public transit. This type of infill development reflects *Smart Growth* and *New Urbanist* planning principles ("Smart Growth" and "New Urbanism," VTPI, 2005; King, 2008).

Figure 16 **Urban Land Devoted To Parking**

With better design and management, much of the urban land currently devoted to parking could be used for other purposes. It is ideal for location-efficient infill residential and mixed-use development, creating truly affordable housing where residents can minimize their transport costs. People with limited mobility can particularly benefit by living close to public services.

Examples and Case Studies

Examples of parking management for residential affordability are described below.

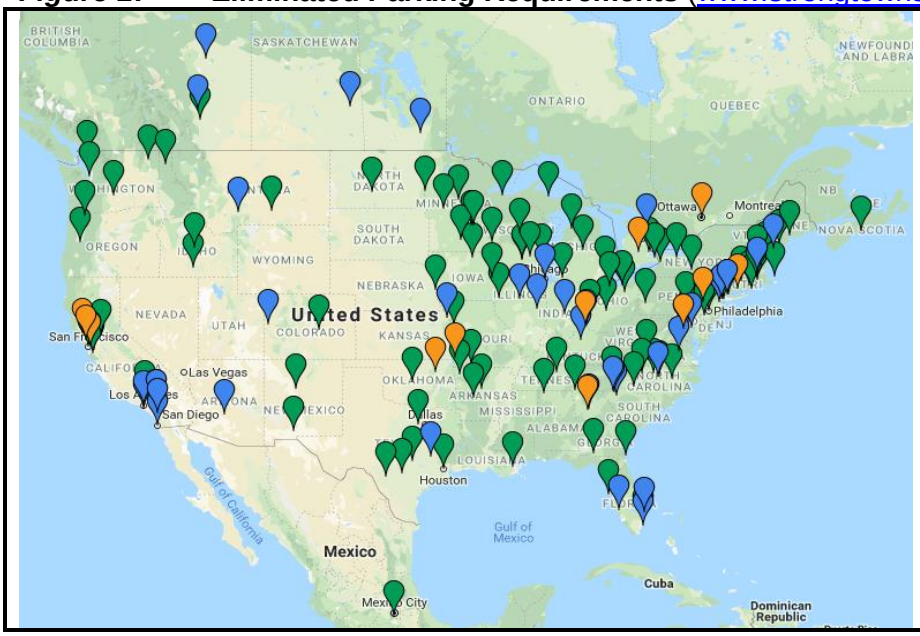
GreenTRIP Parking Database (http://database.greentrip.org)

The GreenTRIP Parking Database measures the number of parking spaces per unit, their occupancy rates, and the cost of that unused spaces for various residential buildings in the San Francisco Bay area. The results indicate that there is a significant amount of unused, costly parking supply which residents must pay for but do not actually want. This reduces housing affordability. This information can help developers, planners and policy makers better determine the number of parking spaces that are actually required in a particular type of development, and therefore avoid unnecessary costs.

Eliminating Minimum Parking Requirements (Baker and Leiben 2019; Strong Towns)

Many local governments have eliminated or significantly reduced minimum parking requirements in order to help increase housing affordability, allow more compact development and reduce traffic problems. Hartford, Connecticut eliminated parking minimums in 2017. Cincinnati, Ohio; Buffalo, New York; New York City; Minneapolis, Minnesota and San Francisco have all eliminated minimum parking requirements for many types of development.

Figure 17 **Eliminated Parking Requirements** (www.strongtowns.org/parking)



This map indicates North American communities that have eliminated or significantly reduced minimum parking requirements in order to increase housing affordability, allow more compact development and reduce traffic problems.

This does not eliminate off-street parking or automobile ownership, it simply allows developers to build the number of parking spaces that occupants demand. This typically reduces parking supply by 20-60% compared with what convenitional zoning codes require, and helps shift the market from subsidized to priced parking. For example, a typical apartment that currently rents for $2,000 per month with one “free” parking space would rent for $1,800 per month plus $200 for each parking space used if parking requirements are eliminate. Similarly, eliminating parking requirements gives employers more incentive to implement commute trip reduction programs.

Condominium Parking Requirements (Energy Pathways 1994)

Since 1979 Mississauga, Ontario's zoning code required 2.0 parking spaces per condominium unit, 1.75 for residents and 0.25 for visitors, estimated to be 7-17% of the total housing costs. A detailed study conducted at 34 typical condominiums tracked parking supply and demand, unit occupancy, transit proximity, surrounding land uses, and concerns about parking. Questionnaires were mailed to all 5,600 residents, of which 800 were returned, and all building managers, of which 16 were returned. It found that parking supply was 20% higher, and the existing standard was 35% higher, than residents' vehicle ownership. The study recommended revised parking standards illustrated in Table 9 which were adopted in 1994.

Table 9 **Recommended Parking Standards**

Unit Type	Resident Spaces	Visitor Spaces	Total Spaces
Studio	1.0	0.25	1.25
Bachelor	1.0	0.25	1.25
One Bedroom	1.16	0.25	1.41
One Bedroom Plus Den	1.3	0.25	1.55
Two Bedroom	1.5	0.25	1.75
Two Bedroom Plus Den	1.70	0.25	1.95
Three Bedroom	1.75	0.25	2.0

Affordable Residential Development (SPUR 1998)

Table 10 illustrates how tradeoffs between housing and parking affect the costs of medium-rise (four stories maximum) housing on a 3-acre parcel in an urban neighborhood. As the number of surface parking spaces increases, the number of housing units declines and costs rise. Using underground parking reduces land requirements but significantly increases construction costs. As a result, it is impossible to provide affordable rents while meeting conventional parking requirements.

Table 10 **Residential Development Options**

	Option 1	Option 2	Option 3	Option 4
Housing Units	50	40	30	50
Parking	25 (surface)	40 (surface)	40 (surface)	50 (underground)
Cost Per Unit	$50,000	$60,000	$75,000	$80,000
Monthly Rent	$312	$375	$468	$500

Excessive minimum parking requirements also impose costs on non-profit developments (Nelson/Nygaard, 2002). To provide housing priced at $80,000 per unit (for a monthly mortgage of about $700), a subsidy of only $4,000 would be needed if no parking is required, a $12,792 subsidy would be required for one parking space per unit, and a $26,251 subsidy for two parking spaces. A given housing subsidy fund can benefit about 6.5 times as many households with no parking spaces compared with 2 spaces per unit.

Parking Impacts On Appartment Affordability (London and Williams-Derry 2013)

Analysis of 23 recently completed Seattle-area multifamily housing developments reveals that the practice of providing abundant "cheap" parking actually makes housing more expensive, particularly for lower-income tenants who don't own cars. This analysis shows that:

- *Seattle-area apartment developers build far more parking than their tenants need.* Across all developments in our sample, 37% of parking spaces remained empty during the night, the time of peak demand for residential parking. Every development had nighttime parking vacancies, and four developments had more than twice as many parking spots as parked cars.
- *Many tenants don't own cars.* On average, the developments in our sample had 20% more occupied apartments than occupied parking spaces—a rockbottom estimate for the share of apartments whose tenants don't park on-site. In all, 21 of the 23 developments had more occupied apartments than parked cars.
- *Multifamily developments lose money on parking.* No development in our sample was able to recover enough parking fees to recover the full estimated costs of building, operating, and maintaining on-site parking facilities. Car-free tenants still pay for parking.
- Landlords' losses on parking—calculated as the difference between total parking costs and total parking fees collected from tenants—add up to roughly 15% of monthly rents in our sample, or $246 per month for each occupied apartment. Because landlords typically recoup these losses through apartment rents, all tenants—even those who don't own cars—pay a substantial hidden fee for parking as part of their monthly rents.

Harris Green Redevelopment (www.city.victoria.bc.ca)

In 1997 the city of Victoria, BC sponsored a community planning project to encourage redevelopment in the Harris Green neighborhood near downtown. Minimum parking requirements were eliminated there. In subsequent years numerous condominiums and apartments were constructed. To minimize costs and accommodate the large portion of residents who own no vehicles, most units are sold or rented without parking. Residents rent parking spaces if they need them. Developers find that they need only about 0.5 parking spaces per unit, as opposed to 1.0 to 2.0 in conventional multi-family buildings.

Redeveloping Transit-Station Area Parking Lots (CNT 2006)

The study, *Paved Over: Surface Parking Lots or Opportunities for Tax-Generating, Sustainable Development?*" (www.cnt.org/repository/PavedOver-Final.pdf), evaluates the potential economic and social benefits if surface parking lots around rail transit stations were developed into mixed-use, pedestrian friendly, transit-oriented developments. The analysis concludes that such development could help to meet the region's growing demand for affordable, workforce, senior, and market rate housing near transit, and provide a variety of benefits including increased tax revenues and reduced per capita vehicle travel. The parking lots in nine case studies are estimated to be able to generate 1,188 new residential units and at least 167,000 square feet of new commercial space, providing additional tax revenues, plus significant reductions in trip generation and transportation costs compared with more conventional development.

9-x-18 Affordable Housing Research (www.pro-arch.com/9-x-18-AFFORDABLE-HOUSING-RESEARCH)

9x18 is a study of how current New York City parking requirements conflict with the City's urban design and affordable housing goals, and it asks whether code change could help create more affordable housing. The project estimates the potential of existing surface parking lots on New York City Housing Authority (NYCHA) land in strategic locations throughout the city as an untapped resource for development. It estiamtes that there is 20,360,000 square feet of surface level parking on NYCHA sites, much of which is under-utilized. The project considers several ways that this land can help address affordable housing goals by reducing parking requirement burdens on developers and generating revenue to help preserve affordable housing. At the same time, strategic infill developments present opportunities to better integrate NYCHA sites into the surrounding urban context and neighborhood. The study visualized an analysis of existing zoning regulations and proposed fine-grained alternatives that consider the size and type of unit, proximity to transit, the level of affordability, and other relevant factors to further refine parking regulations in new construction.

Renter Parking Costs

Gabbe and Pierce (2016), used national American Housing Survey data to investigate parking costs imposed on renter households. They estimate that renter households garage parking costs average approximately $1,700 annually, or an additional 17% of a housing unit's rent, imposing $440 million direct deadweight loss for carless renters. They suggest that cities reduce or eliminate minimum parking requirements, and allow and encourage landlords to unbundle parking costs from housing costs.

Residential Garage Conversions (www.ci.santa-cruz.ca.us/pl/hcd/ADU/adu.html)

Santa Cruz, CA has a special program to encourage development of *Accessory Dwelling Units* (ADUs, also known as *mother-in-law* or *granny* units), which often consist of converted or expanded garages, to increase housing affordability and urban infill. The city has ordinances, design guidelines and information materials for such conversions. *Smallworks* (http://smallworks.ca) is a Vancouver, BC construction firm that specializes in small lane-way (alley) housing, which are often converted garages.

Parking Management for More Affordable Housing (www.huduser.org/rbc/newsletter/vol7iss2more.html)

A variety of parking management strategies are being adopted to increase housing affordability and help achieve other planning objectives. These strategies include reduction or elimination of minimum parking requirements based on density, car ownership rates, and availability of public transit; allowing shared parking; and unbundling parking from housing. Specific examples are discussed below.

San Francisco, California

San Francisco is a transit-friendly city that has retained its historic character and walkable neighborhoods. According to the 2000 Census, 30% of total San Francisco households, and more than 50% of households in transit-rich areas, are car-free. A 1997 University of California study found that single-family housing without off-street parking sold for an average of $46,391 less than housing with off-street parking, and so were affordable to 24% more area households. The city revised its parking requirements to help reduce traffic congestion and increase downtown area housing affordability. Revisions eliminated minimum parking requirements for downtown housing, and established maximum parking of one space for four units. Other strategies include car-sharing programs and requiring developers to unbundle parking from housing costs. Reduced parking requirements for Rich Sorro Commons, a mixed-use project with 100 affordable units for low-income families, resulted in additional space for a childcare center and retail stores, generating about $132,000 in additional revenue. The childcare center is especially beneficial to low-income families, and the additional revenue makes housing units more affordable.

Seattle, WA

Half the households in Press Apartments on Capitol Hill's Pine Street in Seattle, WA own no vehicles, leaving 60% of its parking spots unoccupied. In 2006, Seattle reduced parking required in mixed-use neighborhoods, and eliminated minimum parking requirements in downtown areas to increase housing opportunities and encourage pedestrian-friendly neighborhoods. Minimum parking required for affordable housing was reduced to 0.33 – 1.0 space per unit, depending on location and unit size. The city maximum parking requirements for downtown offices, allows reduced parking for elderly and disabled housing, and for multifamily developments with car-sharing programs.

Portland, Oregon

Portland, Oregon has implemented various parking management strategies designed to increase housing density, promote transit-oriented neighborhoods, and support existing and new economic development. Portland eliminated minimum parking requirements in the central city district and for sites located within 500 feet of a high-capacity transit station. The city's zoning ordinance specifies maximum parking requirements for areas outside the central city district, which vary depending on the use and the distance from a light rail station. Other parking measures include shared parking, and reduction from minimum requirements for car sharing, transit access, and availability of bicycle parking. Two mixed-use projects located outside Portland's central city, Buckman Heights and Buckman Terrace, were able to keep development costs low and increase the number of affordable housing units by utilizing the city's reduced parking requirements.

Conclusions

This report indicates that excessive, inflexible parking requirements are inefficient and inequitable, since they fail to provide an expensive resource (parking) in proportion to need (vehicle ownership). Parking demand varies between households, between neighborhoods, and over time for individual households. Smaller, lower income households located in accessible areas tend to own fewer cars. A typical house or apartment unit may at various times house residents with zero, one, two or three vehicles.

Parking is a costly resource. Parking typically represents 10-20% of the cost of housing. This may be acceptable to most middle and upper income households, which tend to own multiple vehicles and can afford the extra expense, but for lower income families generous parking requirements impose significant financial burdens.

Excessive parking requirements impose several costs on society. They increase development costs of lower-priced housing, reducing housing affordability. Minimum parking requirements are regressive because they force residents to pay for parking facilities, even if they do not own a vehicle. They increase vehicle ownership, and therefore problems such as traffic congestion, accidents and pollution emissions. Generous parking requirements discourage infill development and increase sprawl, increasing impervious surface coverage and per capita vehicle travel. They shift lower-income households to suburban and exurban areas where land prices are low but transport and public service costs are high.

For typical affordable housing in urban locations, where parking represents 20% of residential build costs and parking demand is less than 50% of conventional parking standards, applying more accurate and flexible parking requirements can reduce housing costs by 10%, and even more if additional parking management strategies are implemented. For households that do not own an automobile, more accurate parking requirements and unbundling parking costs can reduce rents by 10-20%.

On-street parking policies also tend to be regressive by providing free or inexpensive parking permits to occupants of single-family houses, but not apartment dwellers.

Most households, including those with low incomes, own at least one vehicle and therefore need residential parking. Even non-drivers want parking for visitors. It is therefore important that parking policy reforms be realistic and avoid creating new problems. Better parking management practices have proven successful at reducing residential parking costs, increasing housing affordability and supporting other strategic land use objectives, such as supporting infill development, improving community accessibility and reducing sprawl. This involves creating more accurate and flexible parking standards, unbundling parking from building space so residents pay for parking facilities based on the number of spaces they actually use, and appropriate enforcement to minimize spillover problems.

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