PARKING & HOUSING: BEST PRACTICES FOR INCREASING HOUSING AFFORDABILITY AND ACHIEVING SMART GROWTH

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1. INTRODUCTION

In the Bay Area, there has long been considerable concern about providing an adequate supply of housing at a reasonable cost. More groups and communities are intensifying efforts to address what is widely perceived as a housing crisis. Housing coalitions region wide are getting involved housing elements of city and county general plans to insure that local policy, primarily through the control of land use, facilitates the production of an adequate and affordable housing supply.

While expensive housing affects all Bay Area residents, most of us do not think about parking, and the policies related to it, as one of the impediments to creating a more affordable supply of housing. Generally, building parking increases the cost of the development, reduces the number of units attainable on a given site and creates difficulties in creating an attractively designed development. Parking requirements can cause biases towards development on only large lots, at lower densities, and at the urban fringe. Because city and county zoning codes require newly constructed housing to build parking on-site, parking and housing affordability are intertwined. This may seem a necessary evil given the fact that most Bay Area households own at least one vehicle. However, as detailed in this report, parking requirements, while politically popular, can be crudely designed and costly in their impact on regional goals of affordable housing and efficient transportation. Parking requirements can detract from our ability to develop within urban areas, making it harder to serve those with special needs such as seniors, people with disabilities, and persons with mental illness, which require proximity to wide variety of supportive services.

This report explores the linkage between parking policy and housing affordability by assessing the costs of parking, evaluating existing parking policy, and suggesting a portfolio of strategies to ensure that parking is not a barrier to meeting regional goals and needs. It also highlights innovations and success stories that can serve as models for other Bay Area communities.

1.1 PARKING & TRAFFIC IN THE HOUSING DEVELOPMENT PROCESS

This study grew out of the common experience of the region's non-profit affordable housing development community. This community of housing professionals is responsible for a large portion of the affordable housing[1] that is created within the region. Based upon experience, often these developers have the sense that the future residents of their development will need less parking than is required in a given jurisdiction's local zoning code. The lower need is usually based on two general factors of their housing development:

- *the characteristics of the populations to be served by the housing* (e.g. lower income, disability, and age); and
- *the location of the site* (e.g. the availability of neighborhood services accessible by foot, the proximity of the site to quality transit service, the area-wide availability of parking.)

[1] The term "affordable housing" can either refer to housing that is legally restricted to be available for households of certain income levels or can be a more general term that includes new and existing housing on the market that can be afforded by those with low to moderate incomes. In this report, "affordable housing" refers to the former usage, while the term "housing affordability" is used to reference the general price of housing.

Expecting lower demand and hoping to reduce costs, developers often request a reduction in the citywide mandate of off-street parking. The arbiters of the request are usually one or all of the following local actors: planning department staff, traffic engineers, planning and zoning commissioners, and locally elected officials. These local actors, who have to answer to neighboring residents' concern about congestion and parking spillover, are often reluctant to accommodate the request without convincing evidence that parking after the proposed reduction will be "sufficient." In response, non-profit developers may commission parking demand studies or they may build the required parking for expediency purposes. In either case, final development costs are increased. In worse cases, affordable housing development becomes financially infeasible at given parking ratios.

In addition to parking impacts, concerns over local traffic impacts can lead to a reduction in project size or undermine it altogether. Unfortunately, the local impacts also tend to be crudely forecasted with little or no consideration of a development's unique and significant characteristics. As explored below, local traffic impacts can actually be exacerbated by higher parking ratios by increasing the number of local vehicles. In addition, local traffic impact studies generally do not consider regional benefits of an infill development, such as shorter trip lengths.

1.2 PARKING AND HOUSING AS A BROADER REGIONAL ISSUE

The issues of housing affordability and supply are increasingly seen as intertwined with transportation, the environment, and regional economic vitality. The high cost of housing forces some households to live farther from the region's job-centers, where commute and travel by automobile is usually the only option. Expensive urban land and local barriers to housing supply growth in areas near job- and activity-centers forces the development of new housing into the region's open space and agricultural lands. In addition, for Bay Area employers, exorbitant housing costs increasingly serve as a barrier to obtaining workers at all skill levels. A state- and region-wide consensus is building around "Smart Growth" – that is higher intensity development within and adjacent to the urbanized region, closer to transportation alternatives and employment centers – as a solution to congestion, air quality, open space, and economic concerns. As a result, it is increasingly important to look to urban sites and infill as potential development sites. Therefore, our concern with the impacts of minimum parking requirements and other parking policy extends beyond the issue of housing affordability. Since minimum parking requirements evolved as a planning tool before the acceptance of Smart Growth strategies for regional success, a reevaluation of their appropriateness is timely.

There is no single answer to address parking and housing issues. While this study considers the issue regionally, local considerations make each case somewhat different; suburban communities are a different context than more urban communities. Furthermore, local conditions vary greatly within most jurisdictions – many suburban communities have higher density downtown areas and nodes of higher quality transit service while urban jurisdictions have areas with less density and weak transit links. However, it is possible for all local jurisdictions to pick from a portfolio of strategies that can improve the interaction between parking and housing. The major finding of this study is that local zoning codes are too uniform and inflexible to reflect neighborhood conditions, locational features, and the resident populations served by a development. There are a number of opportunities to leverage existing data and research to improve the interaction between parking and housing development.

While local conditions warrant tailored strategies, concerns over housing, congestion, and the environment cross city and county boundaries and there is a responsibility of local and regional bodies to take these issues into account. Local planning and development decisions will determine whether we address regional concerns. At the regional level, major public investments such as transit extensions are attempting to address some of the issues. An effective strategy includes concurrence between local policy and regional investments. At the local level, minimum parking requirements is one of the essential local policies to consider.

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2. THE BENEFITS AND COSTS OF OFF-STREET PARKING

This section first explores the benefits of *providing* off-street parking and the rational behind *requiring* off-street parking. Then we detail the costs of providing and requiring off-street parking, in particular for housing developments in the Bay Area context. While an exact cost-benefit analysis is neither feasible nor the goal of this section, identifying the tradeoffs being made when minimum parking requirements are adopted is essential to making informed local and regional policy decisions.

Much of this report focuses on minimum parking requirements. Minimum parking requirements are land-use regulations, set by local governments within their zoning ordinances that require new development, usually including rehabilitation, to provide parking within the development (known as off-street). Parking requirements exist for nearly every land-use imaginable, from funeral parlors to fast-food restaurants and are based on a of ratio of parking spaces to some detail of the development (e.g. one space per 4 seats, 4 spaces per 1000 square feet, etc.) In housing, particularly multi-family housing, minimum parking requirements are usually based upon the size of a unit in bedrooms. Some cities also mandate additional parking per unit for visitors. For reference, Table I shows the minimum parking requirements for multi-family housing in 44 municipalities in the Bay Area. The ratios incorporate guest-parking requirements. As shown in the table, the ratios range widely, from 1 per unit (of any size) in San Francisco to 2.8 spaces per two-bedroom unit in Dublin.

2.1 THE BENEFITS AND RATIONALE OF OFF-STREET PARKING

Providing off-street parking spaces provide a number of benefits. Requiring off-street parking was one of the most rapidly accepted and popular land-use regulations adopted by municipalities. In 1946, 17 percent of 76 cities surveyed had established minimum parking requirements, five years later, 70 percent of the same cities had adopted or were in the process of adopting them.[2] Minimum parking requirements were based on the principle that a given land use generates a certain demand for parking, and as such, the developer of the land use should accommodate the demand for that parking.

[2] Shoup, 1997

In theory, developers would provide an adequate amount of on-street parking, with or without minimum parking requirements, since developers need users to access a site. Government regulation rather than developer initiative was rationalized based on a local government's interest in maintaining property values over the long term. By comparison, a property is developer more concerned about the short-term use of the property.

The goal, usually explicitly stated in a city or county's zoning code, is to prevent congestion in the on street parking supply. This congestion is known as "spillover" parking. To prevent spillover, it is standard to set parking requirements "to accommodate recurrent peak-parking demands."[3] However, except at the lowest densities, congested on-street parking has more to do with a reluctance to charge market prices for scarce curb spaces.[4]

Housing developers consulted for this research concurred that fear of spillover often drives the housing development process. Neighborhood concern often results in refusals to lower the parking ratio for an affordable housing development or even demands that developments provide more parking than required. To note, it is often difficult to extricate a neighborhood's concern over parking spillover from other concerns (explicit and implicit) such as traffic impacts, loss of views, and fears of the residents themselves, particularly where housing for low-income households are concerned.

Table I

Summary of Bay Area Minimum Parking Requirements for Multi-Family Housing

	Studio	1 BR	2 BR	3 BR
Alameda County	2	2	2	2
Benicia	1	1	1.5	1.5
Berkeley	1	1	1	1
Burlingame	1.5	1.5	2	2.5
Campbell*	1.7	1.7	2.2	2.2
Concord*	1.83	1.83	2.33	2.33
Cotati	2	2	2	3
Cupertino	2	2	2	2
Daly City	1	1.5	2	2
Dublin	1.8	1.8	2.8	2.8
East Palo Alto	1	1.2	1.5	2
Emeryville*	0.75	1.25	1.75	1.75
Fairfield*	1.2	1.53	1.7	2.2
Foster City*	1.5	2	2.5	2.5
Fremont	2	2	2	2
Hayward	1.5	1.7	2.1	2.1
Healdsburg	1.5	1.5	1.5	1.5
Livermore	1.5	1.5	1.75	1.75
Los Gatos*	2.5	2.5	2.5	2.5
Menlo Park	2	2	2	2
Millbrae	1	1.5	2	2
Milpitas*	1.2	2.2	2.2	2.2
Morgan Hill*	2.2	2.2	2.2	2.2
Mountain View*	2.15	2.15	2.15	2.15
Oakland	1.5	1.5	1.5	1.5
Palo Alto*	1.35	1.6	2.1	2.1
Petaluma	1	1	2	3
Pleasant Hill*	2	2	2.5	2.5
Pleasanton*	1.89	1.89	1.89	2.14
Redwood City	2.25	2.25	2.25	2.25
Rohnert Park	2	2	2.0	2.0
San Francisco	1	1	1	1
San Jose	1.5	1.5	1.8	2
San Leandro*	1.75	1.75	2.5	3.75
San Mateo	1.50	1.80	2.00	2.20
San Mateo County*	1.2	1.4	1.7	2.2
Santa Clara County	1.25	1.5	2	2
Santa Rosa	1.5	1.5	2.5	2.5
Sonoma County	1.5	1.5	2.5	2.5
Sunnyvale	1.5	1.5	2	2
Union City*	1.75	1.75	2.25	2.25
Vacaville*	1.14	1.14	2.14	2.14
Vallejo*	1.7	1.7	2.2	2.2
Walnut Creek	1.25	1.5	2	2.5

*Guest parking requirement incorporated (range: .12 to 1.0 spaces/unit)
Source: Cook, J., et. Al. And zoning codes available on the Internet.

[3] Weant, 1990. Note that this implicitly advocates using land and financing resources to create spaces that will be unused except for times of peak demand.
[4] Shoup, 1997

Off-street parking has benefits for residents of the development as well as policy-makers and communities. For residents (and guests) at each development, having parking makes access by car more convenient than searching for curb parking. Off-street parking, especially in garages, can protect automobiles from theft and damage. For policy makers and communities accepting development, a large supply of off-street parking can lessen congestion in on-street parking, and appear to address concerns over traffic. Since parking requirements tend to reduce density of new development, their perceived benefits are similar to other forms of growth control. Unfortunately, the costs of these benefits, from free and available curb parking to lower growth within communities are high as detailed below.

2.2 THE COST OFF-STREET PARKING: DOLLARS, DENSITY, DESIGN, AND DEPENDENCE

Minimum parking requirements impact the functioning of both the real-estate market and the setting for making travel choices. Depending on the circumstances, the impacts of an individual requirement can be small or large. Locational factors, individual site factors, and other regulations (such as height, floor-area-ratio, etc.) interact in their impacts. The costs are intertwined and tend to be difficult to tease out. To clarify this analysis, the costs of off-street parking have been categorized into "Four D's": Dollars, or the financial cost, Density, which represents the impact on our ability to supply housing, Design, which is the aesthetic impact on development of parking requirements, and Dependence, a cumulative cost of auto-dependency.

2.2.1 Dollars: Construction Costs and Beyond

A parking space is expensive to build. Thus, when built in conjunction with housing, parking inherently raises the cost of housing. Parking costs include the costs of land consumed by the space, construction costs (including design, engineering, etc) and the compounding of all of these through financing costs which are related to the timing between outlay for land, engineering, construction and the time the property is operational.

Construction costs vary widely among the variety of types of parking – surface parking, above ground structures, and below ground structures. In all cases, surface parking is the least expensive while underground parking, with its requirements for ventilation and sprinkler systems, tends to be the most costly. Parking construction costs are higher in the Bay Area than in most parts of the country. Within the region, construction costs vary due to local factors and the individual characteristics of each site. Parking in denser, urban places is more expensive due to more complex construction tasks and smaller lots, which reduce economies of scale.

Generally, it is difficult to quantify construction costs per parking space. Most examples come from single purpose parking garages that are somewhat difficult to compare to residential construction. Table II provides some examples of per space parking costs. While surface parking is the least expensive to construct, it does not allow other use of the land, so it is most expensive in land terms.

Table II

Examples of Parking Space Costs		
Cost per Space	**Cost of....**	**Description (Source)**
$10,000	Construction costs of surface parking. (Excludes land.)	Average from national survey of public garage costs, adjusted for Bay Area costs. (RS Means, p. 562, 648)
$14,000	Construction costs of above ground structures. (Excludes land and architectural fees.)	Average from national survey of public garage costs, adjusted for Bay Area costs. Does not include costs of sprinkler and ventilation systems that are required for underground parking. (RS Means, p. 471, 475, 648)
$9,450	Land costs per space.	For surface parking, land cost equal the size of the space. If a parking lot averages 315 square feet per space (includes circulation) and land costs $30 a square foot (which it regularly reaches in Bay Area suburbs), land alone for parking costs nearly $10,000 per space. (Calculated)
$25,600	Parking Garage. Per space added (Includes land.)	Average cost per space added (in 1998 dollars) of six parking structures built on the UCLA campus since 1977. (Shoup, 1999a)
$17,848 $16,373 $13,000 $6,751 $8,500 $10,000	Palo Alto Walnut Creek Mountain View Mill Valley Concord Berkeley	*In-Lieu Parking Fees*. These cities sometimes allow developers to pay the amount listed at left per space they are required to build as per the zoning code in-lieu of building the space. Since in-lieu fees fund public parking construction, they are a proxy of cost per space, however most cities reported that the fees were less than all costs of parking construction. (Shoup, 1999b)
$39,000 or $46,000	Price of housing (condominium and single family unit.)	Holding other factors equal, this is the increase in the market price of a housing unit in San Francisco if it includes a parking space compared to housing that does not include a parking space. (Jia, 1997)
$50,700	Design, administration, construction and financing.	The anticipated cost of two new parking garages in downtown Palo Alto. The two garages will add at a total of 905 spaces at a cost of $45.9 million. (Snow, 2001; Fein, 2001)

To assess the cost of parking, one can look at also look at market price instead of supply cost. Because significant amounts of housing were developed prior to minimum parking requirements, San Francisco contains comparable housing both with and without parking. Since parking is in limited supply in San Francisco, housing with parking sells at a premium. A 1998 study found that housing prices in San Francisco increased an average of $39,000 (13 percent) for condominiums, and $46,000 (12 percent) for single-family units if they included off-street parking, after controlling for other factors.[5] The lower price for condominiums and houses without parking meant they were affordable to 20 percent and 24 percent more San Francisco households than units without parking.

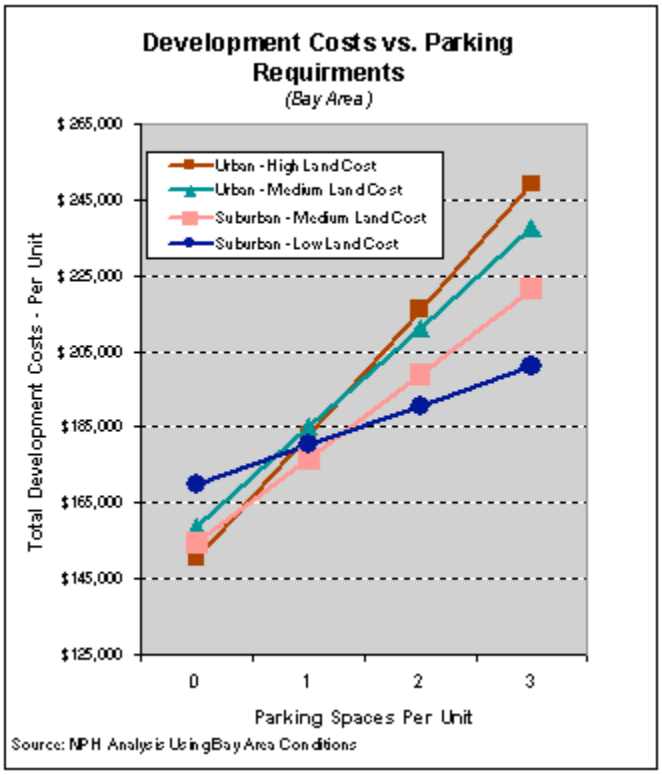
In order to try to better understand the interaction between minimum parking requirements in local zoning codes and housing costs, we constructed generic development scenarios for four categories of areas in the region: urban, high land cost and density settings (such as many parts of San Francisco), urban medium land cost and density (such as Oakland and San Jose), suburban medium land cost and density, and suburban low land cost and density. We used approximations of key inputs into the development process: land costs, construction costs, zoning restrictions (lot coverage and maximum height), and parking

[5] Jia and Wachs, 1997

typology (surface, structured or mixed). Obviously, there is high variability in the factors that impact the costs of every development, but these estimations are nonetheless useful.

Figure I shows the interaction between per unit-development costs and the number of parking spaces built per unit for the four area types. The impact of requiring additional parking spaces is most significant in the two urban categories. This is generally due to the need to move to structured parking as a result of higher land costs. In the urban high and medium land cost and density settings, requiring one additional parking space per unit serves to increase the development cost by approximately $33,000 and $26,000 per unit, respectively. The incremental per unit costs are not insignificant in the suburban categories. Costs increase by $22,000 and $10,000 per unit with each parking space for the suburban medium cost and density and the suburban low cost and density, respectively. Table III shows the percentage increase in development costs as parking ratios increase in each development scenario.

Figure I



The costs of parking are ultimately paid in some way. That can mean housing will serve higher income households. It could also mean that households must spend a higher proportion of its income on housing. In the case of affordable housing, higher costs mean a larger subsidy per unit (reducing the housing "buying power" of available subsidies.) In the housing market, developers may respond to required parking and its requisite cost increase by choosing to serve the higher end of the market (via larger units and luxury amenities.) Other things equal, parking costs will have a disproportionate impact on smaller units, which are generally more affordable.[6] Thus parking costs can have a leveraging impact on housing affordability. The only study of housing development before and after the introduction of minimum parking requirements found that developers in Oakland reacted as expected, developing fewer and larger units. Overall construction costs per unit increased by 18%.[7]

Table III

Percent Changes in Total Costs / Unit			
	Change in Required Spaces per Unit		
Development Condtions	0 to 1	1 to 2	2 to 3
Urban - High Land Cost	22%	18%	15%
Urban - Medium Land Cost	16%	14%	12%
Suburban - Medium Land Cost	14%	13%	11%
Suburban - Low Land Cost	6%	6%	5%

Parking requirements also affect where housing is built. In Figure I, at zero spaces per unit, urban high-density areas are the least expensive per unit for housing development. Once parking is

[6] Litman, 1999
[7] Bertha, 1964

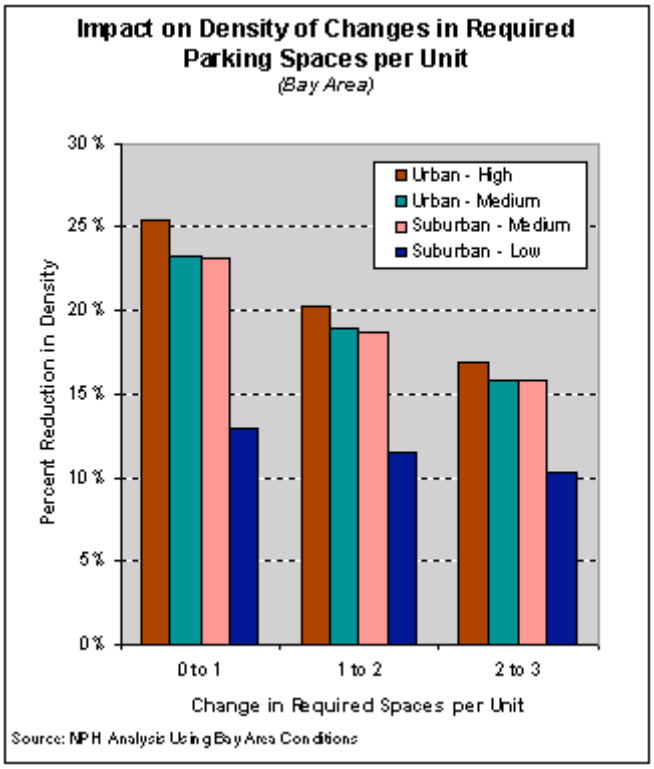
required, the most favorable location to develop housing is in suburban low cost and low-density settings. Thus urban parking requirements make infill development less competitive compared with development on the urban fringe. These scenarios have profound implications on how reducing minimum parking requirements can impact where housing is developed in the region.

2.2.2 Density: Density Reductions as a Cost of Parking Requirements

Perhaps more importantly, including parking on a development site will reduce the number of units that can be built on that site. It is true that building envelopes and densities are constrained by a number of factors in zoning codes (height limits, open space requirements, lot coverage, explicit density maximums, etc.). However, parking requirements contribute to "filling" the envelope with parking instead of housing units. In the case of some affordable housing developments, the financial cost of parking will lead to lower densities due to funding constraints. The developers consulted for this study concurred that more units are often sacrificed at the expense of additional parking.

Figure II shows the impact of changes in parking ratios on density according to the generic development scenarios. Again, the impact is most significant in urban high cost and density areas, which experience a 25 percent decline in density when parking ratios increase from 0 per unit to 1 per unit. This impact is nearly comparable to urban medium cost/density areas and suburban medium cost/density areas, which each experience a 23 percent decline in density with a 1 car per unit increase. In the Oakland study, density in new multi-family developments fell by 30 percent after the introduction of minimum parking requirements.[8] This reduction in density has strong implications for housing production. Lower density reduces the feasibility of non-automotive travel; an impact considered in the section on auto dependence. High parking ratios also reduce the public's sense of how much density is possible or desirable, which is an impact explained further in the next section on design.

Figure II



2.2.3 Design: The Design Challenges and Impacts of Parking

Any architect would agree that one of the most difficult issues in the design of multi-family housing is figuring out "how to fit in the parking." Design is a very important consideration in the production of urban housing and especially affordable housing developed by non-profit organizations. Aesthetically unappealing multi-family housing developed in the past, usually by speculative developers or local governments, contributes to a community's reticence to

[8] Bertha, 1964

permit new housing development. Removing the impediments to attractive design can help overcome resistance to new housing. The design "costs" of off-street parking requirements can be manifested in one or all of the following ways in a given development and setting:

- *Inhibiting ground floor uses*: In San Francisco and other more urban settings, a typical construction typology for multi-family housing is wood-frame on concrete parking podium. At most urban parking ratios of 1 space per unit, this requires the entire first story to consist of parking with the housing on top. If less parking were necessary, housing, other ground floor uses, or even height reductions are possible. Non-housing ground floor uses can make a development more visually appealing, pedestrian oriented, and provide neighborhood services.
- *Increasing the "apparent density"*: Communities are often concerned with the massing and bulk of a new development. Mitigating those concerns with less bulky designs at densities that can compensate for high land costs is a major challenge to developers. A development of row houses with less parking can equal the density of an apartment building with more parking. A more intense building typology is required to fit in the parking at certain ratios. This serves to reduce its attractiveness and appeal to a community.
- *Reducing usable open space*: Open space is important to both residents and neighbors of a new development. However, it is difficult to incorporate parking and quality open spaces. The need for parking can reduce open space or result in open space requirements being met in less beneficial or appropriate parts of a development such as on top of the parking podium or on the roof. Ground level open space can help absorb storm water runoff or be used for urban gardens.
- *Decreasing safety and visual appeal (in the case of surface parking lots)*: Parking lots can be unsafe places for people. Justice Department statistics show that approximately 40% of violent crimes occur in parking garages and lots.[9] Surface parking lots in particular are visually unappealing, while ground floor "garage-scapes" detract from the pedestrian appeal from a place.
- *Increased curb cuts*: Some housing typologies like row houses create many curb cuts when parking is attached to each unit. These detract from the quality of the pedestrian experience and, even more, they reduce the supply of curb parking, defeating the purpose off-street parking is intended to serve.

The current strict mandate of a specific amount of parking per unit makes it difficult to mitigate these design costs in the development process. By allowing more flexibility via the strategies presented later in this study, local governments can encourage creativity that can address these issues.

Further, the combined factors of dollars, density, and design ultimately make it difficult to develop on small parcels. In the study of housing development before and after the introduction of minimum parking requirements into Oakland, the median lot size developed fell by 43%, as smaller lots, especially those with frontages of less than 50 feet, went undeveloped.[10] Since, smaller parcels tend to be located in urban areas, parking requirements again serve to bias housing development toward the fringe of the metropolitan area. In addition, smaller parcels are not the only urban properties overlooked due to minimum parking requirements. Zoning codes that require creating parking to meet the new

[9] Childs, 1999
[10] Bertha, 1964

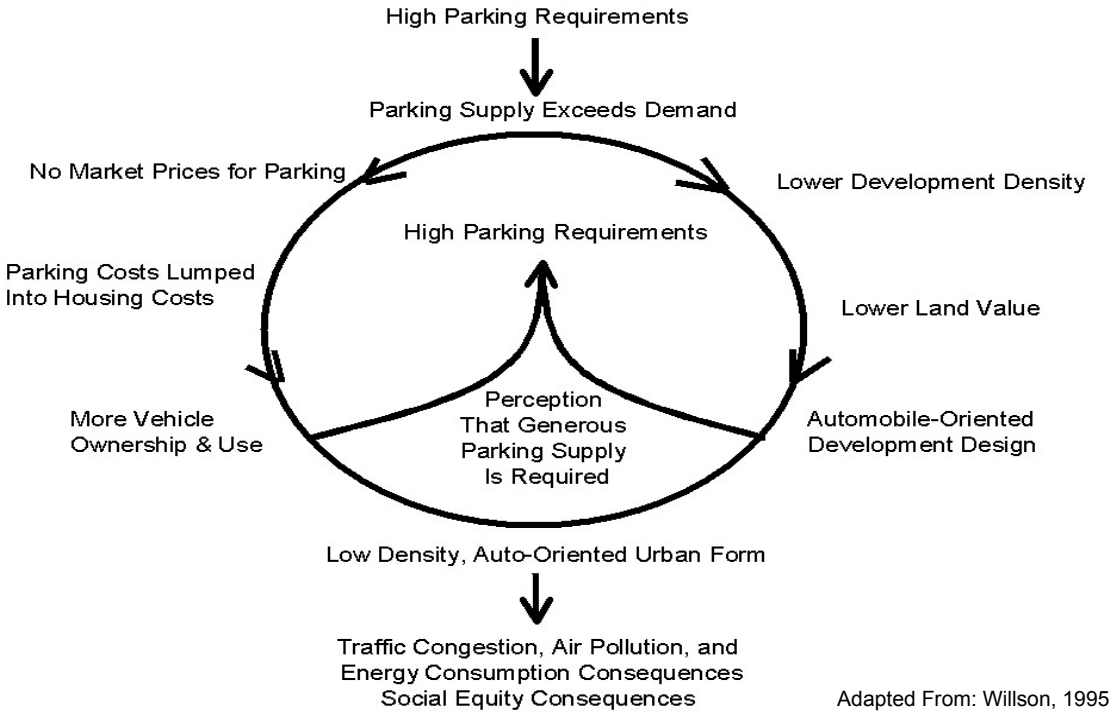
use's standard can block reuse of historic or older structures.[11] In the case of historic rehabilitation or reuse of older structures, zoning often requires that off-street parking be created to meet the new use's standard. This can be a serious impediment to these types of projects.

2.2.4 Dependence on Automobiles

The final D, automobile dependency, is a cumulative cost of minimum parking requirements. Automobile dependency is the reduction of travel choices, the increasing disadvantage of non-drivers compared with drivers, and increases in automobile ownership and use.[12] In particular, auto-dependence is highly inequitable to non-drivers, including those who can't afford the costs, many senior households, and disabled populations.

As shown below, high minimum parking requirements foster auto-dependence in two primary ways. First, by reducing density, excess parking increases the distance between destinations, be it a friend's house, the cleaners, school or a job. As result, non-automotive alternatives, including transit, walking and cycling, become infeasible for most trips. In the case of transit, lower density also reduces its financial feasibility. As other modes lose competitiveness, vehicle ownership and use increases, contributing to perceptions that high minimum parking requirements are appropriate or should be raised.

Figure III: When Cities Over Require Parking



Adapted From: Willson, 1995

[11] Shoup, 1997
[12] Litman, 1999

Second, high minimum parking requirements create a plentiful supply of parking. As a result (despite its high cost), the parking is given away for free. This hides the true cost of vehicle ownership in parking and passes it on to the community at large, in the forms of higher prices for goods and services. In housing, the result is that parking costs are "bundled" into the costs of a housing unit, whether or not the parking is used at all. All households have no choice but to pay for the parking, whether they use zero, one, two or three parking spaces. With a large portion of car ownership paid for and apparently free, a choice not to own a vehicle is nearly irrational.[13] Thus, like the impacts of lower density, vehicle ownership increases, parking at housing developments fills up, and minimum parking requirements are perceived as inadequate or too low.

The contribution of minimum parking requirements to auto dependency also means it contributes to the resulting external consequences: traffic congestion, air pollution, increased energy consumption, and negative social equity impacts.[14]

The most effective way to break the cycle in housing is to "unbundle" parking from housing; by separating the costs of parking from those of housing. This is not only efficient from a transportation perspective, but can serve to reduce the cost of housing. This increases equity in that households are given the choice of whether or not to pay for parking, a cost sometimes as high as the car itself. Currently that choice is not offered as it is estimated that 99% of vehicle trips end in free parking.[15] In our review of 30 affordable housing developments in the region only one charged for parking, and that was only for a second space.

2.3 CONCLUSION

High minimum parking requirements provide mitigated local impacts from development: less congested, free on-street parking and fewer local vehicle trips when density is reduced. In return, the region pays a high cost in the context of housing and transportation. Parking requirements and housing affordability are inversely related, fitting in parking reduces the amount of housing feasible on a given site; and there are significant design consequences of incorporating parking into housing developments. Finally, planning for free parking through minimum parking requirements serves to bundle those costs into housing, forcing all households to pay for vehicles whether they own none or three, creating a cycle of auto-dependency and increasing minimum parking requirements. Another way to put it, is that minimum parking requirements, through their impact in reducing density, are a form of local growth control. Accommodating, local demand for free parking is consistent with a pattern of growth that is horizontal instead of vertical.

Despite the impacts of minimum parking requirements, their political popularity insures that they will be around for a long time. Therefore, the next section takes a closer look at how minimum parking requirements are set and why many of the assumptions that are attached

[13] If a single parking space adds $30,000 to the cost of a housing unit as shown in the urban high land cost/density case, then housing costs attributable to parking equate to $200 per month, or $2,400 per year (assuming a 30 year financing period at 7% interest). This can exceed the traditional costs of vehicle ownership for many low to moderate income households. As a result, households pay 25-75% of the cost of vehicles before making the vehicle ownership choice. With so much of the costs already sunk, foregoing vehicle ownership is irrational.

[14] This section adapted from Shoup, 1997

[15] Shoup, 1997

to them are incorrect. This will lead to recommendations as to how minimum parking requirements and other parking and housing related policies can be improved to further the goals of affordable housing and better transportation options.

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3. UNDERSTANDING VEHICLE OWNERSHIP PATTERNS TO IMPROVE PARKING POLICIES

3.1 HOW MINIMUM PARKING REQUIREMENTS ARE SET

Previous research has shown that most planners and local governments set minimum parking requirements in a few ways: by looking to neighboring cities, consulting a list which samples requirements nationwide, using a manual published by the Institute of Traffic Engineers, called *Parking Generation*, or in rare cases surveying actual properties.[16] Imitating peers and or jurisdictions nationwide are problematic methodologies because they could simply be repeating the mistakes of others and they do not take local conditions into account. *Parking Generation* provides average parking demand for a given land use per some unit (gross floor area, number of housing units, etc.) based on a small number of observations. Unfortunately, the "the vast majority of the data is derived from suburban developments with little or no significant transit ridership…The ideal site for obtaining reliable parking generation data would contain ample, convenient parking facilities for the exclusive use of the traffic generated by the site."[17] This serves to inflate the estimated demand. Also the parking generation rates usually have little statistical validity and it is almost certain that parking at surveyed sites is free.[18] Using local surveys is a better way to assess demand, but again, this usually ignores price and can miss more specific aspects of a future development. Probably more than a manual or survey, parking requirements are set and increased via the local political process. Parking requirements increase via the political process because they preserve free parking for existing residents (who have many votes) and shift costs to new residents (who don't yet vote) or property owners whose property is devalued (who get only one vote.)

3.2 AN IGNORED BODY OF KNOWLEDGE: VEHICLE OWNERSHIP DATA AND RESEARCH

For land uses other than housing, such as a commercial or retail center parking demand is derived from the *number of visitors and how those visitors choose to arrive*. Counting the number of vehicles that arrive is the standard way of determining parking ratios. For housing, the same method is used. However, parking demand is mostly created by residents' decisions as to *whether or not to own a vehicle*. This distinction is important because what is understood about patterns of vehicle ownership is not used in planning for parking and setting minimum parking requirements.

Ironically, while local planners use questionable means to set minimum parking requirements a wealth of data and research exists on vehicle ownership rates. Households

[16] Cook, 1997
[17] ITE, 1987, vii-xv
[18] See Shoup, 1999a and Shoup, 2000 for a detailed analysis of the shaky foundation of the methodology of setting minimum parking requirements.

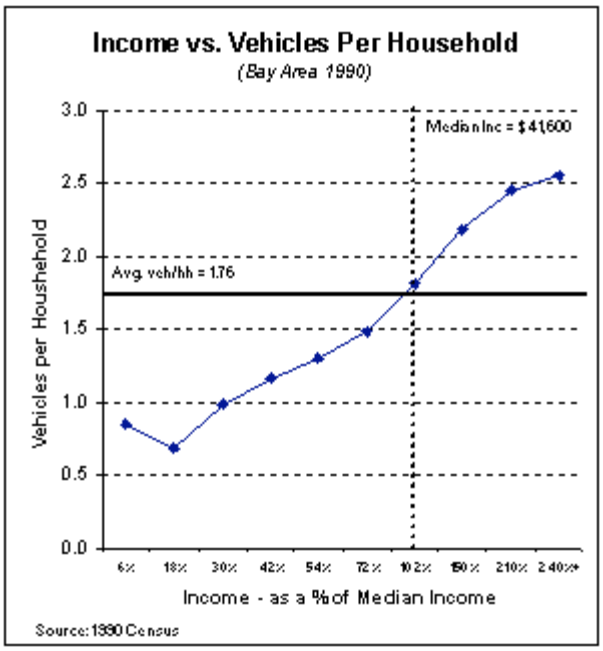
indicate the number of vehicles they own for the U.S. Census, there is a Nationwide Personal Transportation Survey (NPTS) that asks about vehicle ownership, and regional bodies, such as the Metropolitan Transportation Commission (MTC) periodically conduct extensive surveys of travel behavior, including the number of vehicles owned.[19] This data is linked to potentially useful information such as census tracts, household income, household size, neighborhood density, etc. This data is readily available.[20] Not only is there voluminous data on vehicle ownership with tremendous opportunities for exploration and use for local purposes, but also the factors surrounding vehicle ownership have been well studied. The research is typically conducted by regional planning bodies such as the MTC or by transportation researchers at universities and institutes. Research has become more sophisticated as interest increases in the impacts of land use conditions (such as parking availability) on transportation behavior (including vehicle ownership).

Local land-use planners have not leveraged this data and research on vehicle ownership in the transportation field. This is not so surprising when you consider the primary motive of MPRs: to prevent congestion of on-street parking. It is simply safer to set MPRs at a level higher than may be needed, and reduce local costs (like frustrated citizens who cannot park on their street).

3.3 Demographic Factors, Vehicle Ownership Patterns, and Minimum Parking Requirements

We looked at the available data and research available on associations with vehicle ownership. Most of the data presented here is specific to the Bay Area. The associations are similar to what has been found in vehicle ownership research around the country. After looking at the patterns, we look at minimum parking requirements in the region to see if they take these strong associations into account. We reviewed many jurisdictions' minimum parking requirements, talked to local planners, and consulted a 1997 survey of minimum parking requirements in 43 cities in the Bay Area.

Figure IV



3.3.1 Income and Vehicle Ownership

Research in travel behavior reveals that certain demographic factors have strong associations with car ownership rates and as argued here, the need for residential parking. Reid Ewing reviewed 17 studies since 1966 on vehicle ownership in 1998. Household income was the most common variable (in 15 of 17 studies) found to have a significant association with vehicle ownership. This pattern holds in the Bay

[19] The U.S. Census uses the term "vehicle availability" in order to consider leasing of vehicles which is not technically ownership. For this report the term "vehicle ownership" is used in its colloquial meaning which includes leased vehicles.

[20] For example, a 15 minute search on the U.S. Census Bureau's website (www.census.gov), can reveal the average rate of vehicle ownership per rental household in a specified census tract. This simple piece of information is arguably more useful than a citywide minimum parking requirement set in a years old zoning ordinance.

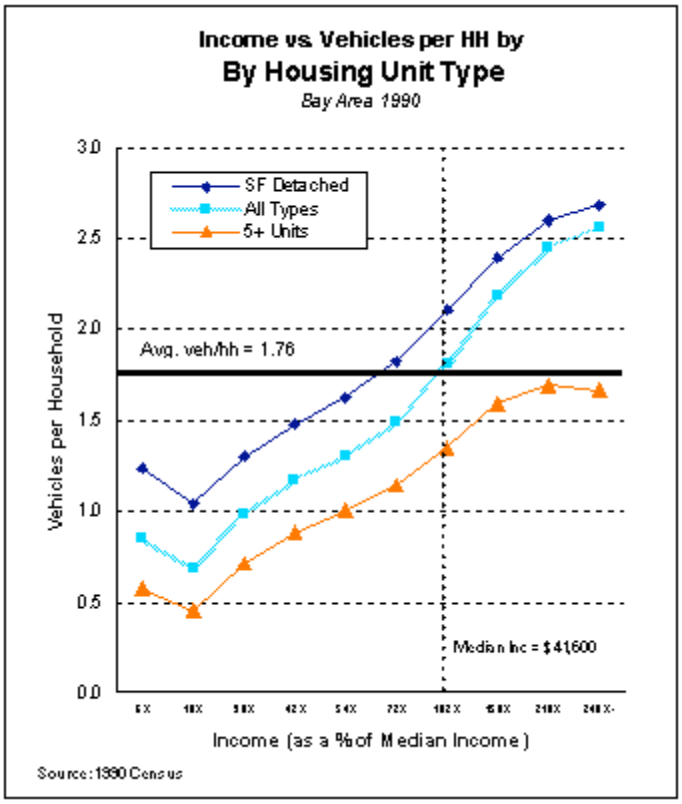
Area as well. In 1990, the average number of vehicles per household was 1.76 in the region. However, households earning between 48 and 60 percent of the median income owned on average only 1.30 vehicles, 26% below the region wide mean. And households earning between 24% and 36% of the regional median income averaged 0.98 vehicles, 44% below the mean. Relationships between income and vehicle ownership rates can be seen in Figures IV through VII.

While variances will be occasionally obtained (at a high cost of time and effort by the developer), no examples in the Bay Area were found in which minimum parking requirements are statutorily reduced for low-income housing. Anecdotal evidence from affordable housing developers shows that local jurisdictions are usually not receptive to arguments about the correlation between income and vehicle ownership. Outside the Bay Area, the City of Los Angeles has reduced parking requirements for deed restricted affordable housing, especially those served by transit. Santa Monica and San Diego reduce requirements for affordable housing as well.

3.3.2 *Housing Type and Vehicle Ownership*

Housing type, controlled for income, has associations with vehicle ownership. In 1990, households living in multi-family housing with 2 to 4 units on average owned only 1.28 vehicles (27% below the mean vehicle ownership rate). For developments of 5 or more units, the reduction was even lower, as households averaged 1.07 vehicles (39% below the mean) (See Figure V). At most income categories, vehicle ownership among residents of single-family detached homes own over 0.6 vehicles more than households in larger multi-family developments. Additionally, compared to all unit-types, households in larger multi-family developments, own from 25% to 35% fewer vehicles depending on the income category. In total, 24% of households in larger multi-family housing did not own a single vehicle in 1990 compared with 10% region wide.

Figure V



While renters and those living in multi-family housing tend to own fewer vehicles, some Bay Area zoning codes require less parking for single-family housing.

3.3.3 *Household Size and Vehicle Ownership*

Household size was considered significant in 10 of Ewing's surveyed studies. This pattern is evident in the Bay Area as households with 2 people averaged 1.79 vehicles in 1990 versus households of 4 or more persons averaging 2.33 vehicles. One-person households averaged only 0.69 vehicles in 1990. Many local jurisdictions increase their required parking spaces

per unit as the number of bedrooms increases following this relationship. However, at below median incomes, vehicle ownership rates are similar for two, three, and four or more person households (see Figure VI). For example, two-person households earning between 48% and 60% of the regional median income owned on average 1.48 vehicles, only 9.8% less than the 1.64 vehicles owned by households with four or more people in the same income category.

Using unit type as a proxy for household size, many Bay Area jurisdictions increase parking as the number of bedrooms increase. However, 13 of 41 jurisdictions penalize smaller units by requiring the same number of parking spaces per unit for studios through 3 bedrooms. Two additional jurisdictions have equivalent parking for studios and two bedroom units. Eleven jurisdictions require two or more spaces for each studio unit while the average one and two person households in the Bay Area owned only 0.9 and 1.8 vehicles, respectively. (See Table I for list of minimum parking requirements.)

3.3.4 Tenure and Vehicle Ownership

The tenure of households is associated with differences in vehicle ownership. That is, renters, at equivalent incomes own fewer vehicles than owners (see Figure 7). At each income level, renting households own on average 0.4 fewer vehicles.

Few Bay Area minimum parking requirements delineate between ownership and rental housing despite this significant difference in vehicle ownership rates.

3.3.5 Age and Vehicle Ownership

The more recent models of vehicle ownership have recognized the link between age and rates of vehicle ownership. MTC's 1990 survey of over 9,000 Bay Area households showed that households with all members aged 65 or older own an average of 1.24

Figure VI

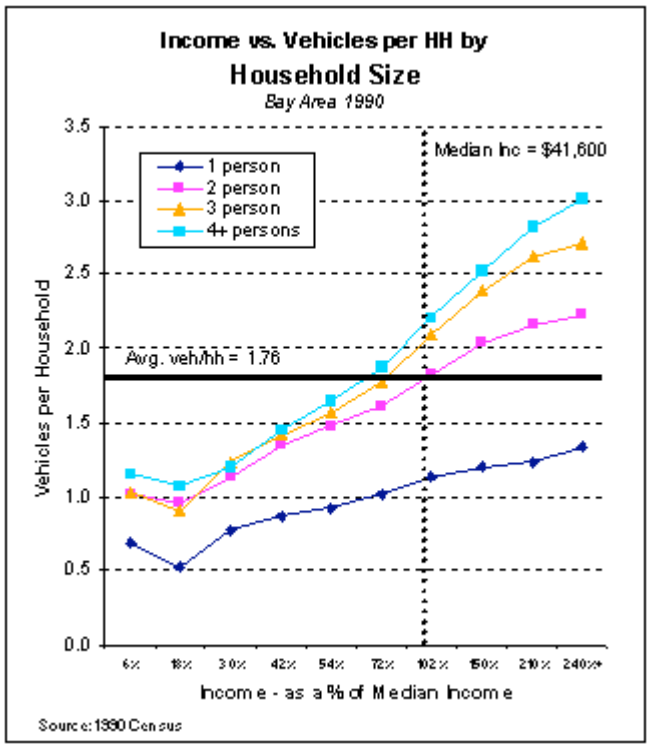
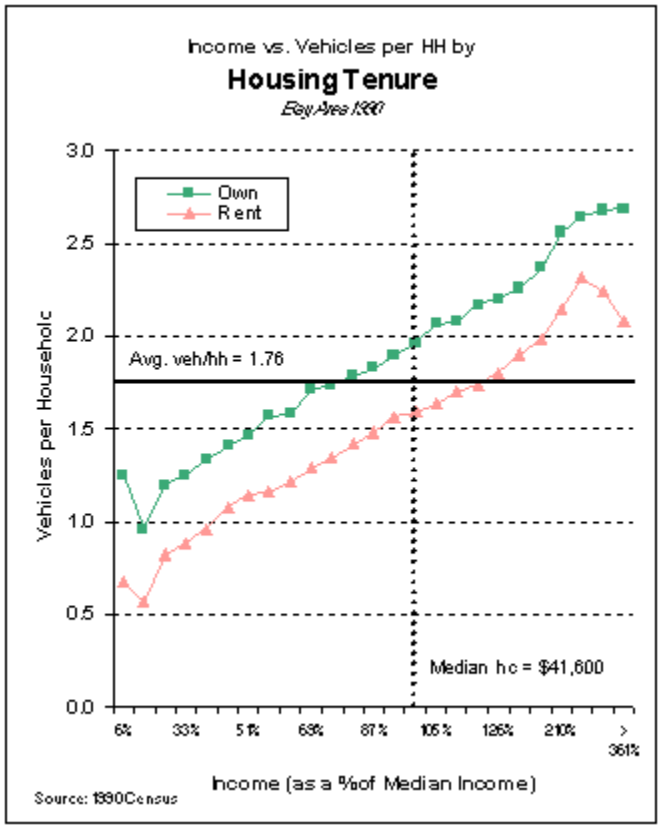


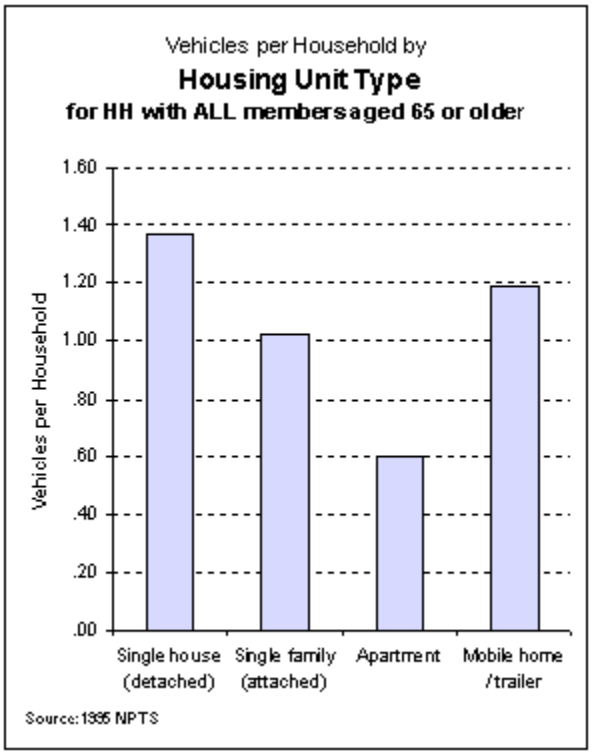
Figure VII



vehicles, 34% fewer than the 1.89 owned by households with no seniors. Vehicle ownership falls further to 0.89 per household when all members are aged 75 and over. Like all households, lower income senior households own fewer vehicles than higher income senior households. Housing type has stronger associations with vehicle ownership in senior households than households generally as shown in Figure VIII. Elderly households living in single-family homes average 1.37 vehicles versus 0.60 (56% less) for households in multifamily housing.[21]

There are some examples of zoning codes sensitive to the vehicle ownership patterns of seniors. In San Francisco, the planning code requires senior housing developments to have only 1 space per 5 units versus one space per unit. However, many other jurisdictions have not reduced their parking for affordable senior housing developments.

Figure VIII



3.4 LAND USE, TRANSIT SERVICE, VEHICLE OWNERSHIP, AND MINIMUM PARKING REQUIREMENTS

In twelve of the seventeen vehicle ownership studies surveyed by Ewing, density was considered a significant variable in predicting vehicle ownership. Also, a measure of transit availability was considered significant in ten of the studies. Density is often considered a proxy for increased access to transit, more walkable and mixed-use environments, and proximity to jobs. Thus, higher density and transit accessibility would reduce the need for vehicle ownership. The correlation between density and vehicle ownership is consistently observed and not disputed (see Figure XI). However, it is debated in the planning community as to whether density and transit influence travel behavior after controlling for income and demographic characteristics.

Three studies have explicitly incorporated vehicle ownership rates while testing the impacts of density, transit, and other *local* land use factors while controlling for demographic factors. The studies and their findings are summarized in Table IV. These studies generally indicate that denser areas with mixes of land uses and quality transit service have lower rates of vehicle ownership, keeping other household characteristics equal.

The assertion that vehicle ownership rates decline with an increase in the quality of transit is supported by the MTC, which uses a measure of transit accessibility versus auto accessibility in its vehicle ownership model. And research by John Holtzclaw to develop the Location Efficient Mortgage (LEM) found transit density (number and frequency of stops) to be

[21] NPTS, 1995

significant in its impact on vehicle ownership. Fannie Mae and many mortgage lenders support the LEM, which rewards households for decreased transportation costs based on the comparatively higher accessibility of a location.

Compared city to city in the region, minimum parking requirements for multi-family housing reflect land use conditions and the availability of quality transit service. In cities like San Francisco and Oakland, where densities are higher and transit service a true transportation alternative, minimum parking requirements are low at 1 or 1.5 spaces per unit. In lower density suburban cities, minimum parking requirements are generally around 2 or more spaces per unit.

Table IV – Summary of Studies Considering Neighborhood Conditions, Controlling for Demographics

Places Studied (Source)	Study Description	Findings
27 California Neighborhoods (from San Francisco, Los Angeles, San Diego, and Sacramento Regions) (Holtzclaw, 1994)	Compared density, transit service, neighborhood shopping, and pedestrian accessibility with auto ownership and vehicle miles traveled. Demographic characteristics were somewhat controlled for by selecting communities with similar incomes.	Auto ownership declined in each region as density of each neighborhood increased. Doubling density resulted in a 16% reduction in vehicle ownership per household. There was not enough data to detect whether transit service, neighborhood shopping, and pedestrian accessibility had an impact on vehicle ownership independent from density.
Nationally by Zipcode (Schimek, 1996)	Modeled vehicle ownership, vehicle trips, and vehicle miles traveled with zip code densities, incomes, transit service and demographic factors using NPTS data.	For each 1 percent increase in density (about 2/3 of a unit per acre), vehicle ownership fell by 0.11 vehicles per household.
Bay Area (1,000 traffic analysis zones and 1,200 Census tracts) (Kockelman, 1997)	Combined land use data and Bay Area travel survey data to explore impacts of mixed use, land use balance, and density on travel behavior controlling for income and demographic factors.	▪ Auto ownership is lower in areas with mixed-use, near jobs, and higher density. ▪ Auto ownership is more significantly influenced by local attributes of the build environment (density and land use balance) than VMT and mode choice.

Neighborhood sensitive parking requirements, however, have been difficult to find. Housing built in much of San Francisco's downtown area, because it is a mixed used district, is required to build only .25 spaces per housing unit. Oakland's minimum parking requirements vary from 1 to 1.5 spaces per unit depending the zoning classification. In Los Angeles, affordable housing projects get an additional parking reduction if they are within 1,500 feet of a rail line or a major bus line. In the city of San Diego, parking requirements are reduced by .25 spaces per unit for "Transit Areas." As far as we can tell, there are no parking requirements with explicit density, transit or accessibility-linked adjustments in the Bay Area.

3.5 PARKING COSTS, VEHICLE OWNERSHIP, AND MINIMUM PARKING REQUIREMENTS

It is difficult to statistically determine the impact that paying for parking one's car has on the vehicle ownership decision because so few households live in markets where housing and parking are "unbundled." Also, because residential parking costs are rare they are generally not part of transportation behavior surveys. If the true cost of parking a vehicle were communicated to households, it is reasonable to expect a significant impact on auto

ownership rates. The actual cost of the parking space can equal or exceed the annual cost of the vehicle itself, thus doubling its cost. Some researchers feel that the significance of density explaining vehicle ownership rates is connected to the fact that it is costly (either in hassle or in needing to rent a garage space) to park a vehicle in older, denser urban areas.[22] Since minimum parking requirements are planning for free parking, they do not incorporate whether or not residents will pay for parking despite the potential for prices to impact vehicle ownership rates.

3.6 TRIP GENERATION AND LOCAL TRAFFIC IMPACTS

A frequent barrier to infill, affordable housing are the results of Traffic Impact Analyses. Traffic Impact Analyses assume that new land uses will generate a certain amount of local vehicle trips. Those trips are added to existing local traffic conditions in a simulation. If the simulation results in a projected degrading of the Level of Service of local streets, officials may require developers to scale down a development.

Unfortunately, the trip generation rates used in Traffic Impact Analyses are often simplistic, inaccurate, and statistically unreliable. Trip generation rates rarely take into account access to transit, neighborhood density and demographic factors like income and age.[23]

First, in terms of vehicle ownership, trip generation rates are lower for households with fewer cars. In fact, trip rates by vehicle are typically one-third higher for households with two or more vehicles than one-vehicle households. In turn, one vehicle household's trip rates are two-thirds higher than those of zero vehicle households.[24] Second, trip generation rates are lower for lower income households, and a higher percentage of those trips are via transit. See Table V for details of Bay Area households.

Traffic impact analyses could be improved if they considered these demo-graphic considerations as well as locational characteristics, such as proximity to transit and job centers. Non-profit affordable housing devel-opers frequently are discouraged from developing in accessible locations and are forced to locations on the fringe of the region due to traffic impact analyses. Due to lower trip rates and the higher share on transit, affordable housing can be more advantageous than other land uses at accessible locations.

Table V – Bay Area Weekday Trips Per Day by Income

	Total Trips	Percent Transit
Low Income (< $25,000)	5.5	12.5%
Low Medium Income ($25,000 - $45,000)	7.5	5.8%
High Medium Income ($45,000 - $75,000)	9.4	4.6%
High Income (> $75,000)	10.5	3.7%
All Households	7.6	6.6%

Source: Pervis, 1994

[22] Shimek, 1996
[23] For more, see Shoup, 2000
[24] Ewing, 1998

4. SETTING A NEW COURSE – PARKING STRATEGIES FOR INCREASING HOUSING AFFORDABILITY AND ACHIEVING SMART GROWTH

How can the process of development regulation be improved in a manner acceptable to local communities? This section explores strategies for dealing with residential parking issues as housing is developed in the Bay Area. Most of the recommendations are interrelated and are necessary for other initiatives to be effective. All jurisdictions probably have districts where most of the recommendations could apply, however, some tools are only appropriate in more urban areas.

The overarching strategy is for local governments, including planners, planning commissions and traffic engineers to creatively and cooperatively address issues of vehicle ownership and parking, working with developers and addressing their communities' concerns. This broad strategy of addressing the parking and housing linkage is useful for all Bay Area jurisdictions.

The components of the overall strategy are:

1. ***LEVERAGING KNOWLEDGE OF VEHICLE OWNERSHIP PATTERNS IN PLANNING FOR PARKING***
2. ***ADDRESSING CONCERNS OF SPILLOVER PARKING***
3. ***PLANNING FOR RESIDENTS' TRANSPORTATION NEEDS RATHER THAN SIMPLY PARKING NEEDS***
4. ***INCREASING THE FLEXIBILITY OF HOW PARKING IS PROVIDED***
5. ***ENCOURAGING THE "UNBUNDLING" OF PARKING FROM HOUSING***

While parking in new developments is regulated locally, others including transit agencies, regional transportation planners, and state and federal governments have a role in implementing the above strategies. Their role will be highlighted as we move through the strategies.

STRATEGY 1: LEVERAGING KNOWLEDGE OF VEHICLE OWNERSHIP PATTERNS IN PLANNING FOR PARKING

City or county wide minimum parking standards for all multi-family developments do not reflect the unique circumstances of neighborhoods and developments. Available data, research, and planning tools can be harnessed to help developers and local governments tailor their minimum parking requirements to truly reflect local conditions. Varied vehicle ownership rates among different populations and in different locations should be recognized in zoning codes.

S 1.1 Adjust Parking Requirements to Reflect Demographic Factors: Income, Age, Disability, & Tenure
S 1.2 Adjust Parking Requirements to Reflect Land Use and Transit Factors
S 1.3 Adjust Traffic Impact Analyses to Reflect Vehicle Ownership Rates & Transportation Behavior

S 1.4 Use Parking Maximums to Advance Goals of Affordable Housing and Transportation Choice
S 1.5 Use New Tools & Strategies to Assess Parking Demand
S 1.6 Help Local Governments Develop & Implement New Tools
S 1.7 Provide Clearinghouse of Best Practices & Evaluate Current Practice

S 1.1 Adjust Parking Requirements to Reflect Demographic Factors: Income, Age, Disability, & Tenure
(Local Governments)

Income, Age, Tenure, and Disability should be reflected in minimum parking requirements. Lower income households own fewer vehicles on average, especially in areas with quality transportation alternatives. For affordable housing that is deed-restricted (and thus permanently affordable), minimum parking requirements can be adjusted to reflect these lower ownership rates. This is also true for senior housing and housing for the disabled. Housing dedicated for students can have lower parking ratios as well. Rental housing should have a lower standard than ownership housing (i.e. condominiums)

S 1.2 Adjust Parking Requirements to Reflect Land Use and Transit Factors
(Local Governments)

Especially in combination with income, neighborhood density and access to quality transit serves to reduce the rates of vehicle ownership. These patterns should be reflected in minimum parking requirements. (See Case Study I for an example.) An added benefit of reductions near transit and in dense neighborhoods, would be to reduce development cost in those areas, placing accessible locations at an advantage over inaccessible areas in terms of likelihood of development.

S 1.3 Adjust Traffic Impact Analyses to Reflect Vehicle Ownership Rates & Transportation Behavior
(Local Governments/Traffic Engineers)

The process of projecting a development's impact on local traffic conditions often inhibits project approval or forces a downscaling of the project. Unfortunately, the process treats all housing the same. If a location has less parking, unbundled parking, affordable units, and is near transit, etc., lower vehicle ownership rates will translate to lower numbers of trips generated by that development. Traffic impact analysis should reflect these factors to improve the accuracy of their predictions.

S 1.4 Use Parking Maximums to Advance Goals of Affordable Housing and Transportation Choice
(Local Governments)

Since there is an inverse relationship between parking supply on one hand and density, transportation, and new housing affordability on the other, local governments can make their zoning policies match goals of affordable housing production and viable transportation choices. With parking maximums, developers are less likely to build luxury housing which would be less affordable, and a constrained supply will encourage unbundling of parking and get the most out of investments in transit. A parking maximum was used for this purpose in the planned mixed-use redevelopment of the formerly industrial Mission Bay, the policy is profiled in Case Study II.

S 1.5 Use New Tools & Strategies to Assess Parking Demand
(Local Governments and Developers)

With the rich availability of data and research on vehicle ownership, tools to assess a projects parking demand can be easily developed. For this study, we developed a development parking prediction model. It is available at www.nonprofithousing.org. It applies a multiple regression vehicle ownership model used for the Location Efficient Mortgage program and is based on Census and MTC travel survey data. The factors in the model are household income, household size, neighborhood density, and quality of transit access. For an affordable housing development generally, all of these factors are known, and the development specifics can be translated to the model inputs. This model is just the beginning of potential tools available for local planners and developers.

S 1.6 Help Local Governments Develop & Implement New Tools
(Regional Entities)

MTC and ABAG store and analyze volumes of valuable regional data. This data can be used to improve local planning. Recognizing the importance of helping to improve local land use planning, these agencies should foster the development and provide resources for the implementation of new tools and improved policies.

S 1.7 Provide Clearinghouse of Best Practices & Evaluate Current Practice
(Regional Entities)

Along the same lines, these entities can promote best practices and provide model zoning ordinances and model planning tools for local governments. It is also difficult to assess where zoning policies including minimum parking requirements are counter productive to regional goals. The MTC, ABAG and BART are in a position to evaluate local policies so that communities understand a given locality's position on the spectrum of planning for transit and housing versus free parking. Evaluations of local policies can inform decisions regarding where regional transit investments and other funding are directed.

STRATEGY 2: ADDRESSING CONCERNS OVER SPILLOVER PARKING

Every developer consulted for this study cited community concern over congestion in the on street parking as the key barrier to housing with moderate parking supplies. Local planners concurred that a community's desire for free and available parking on street was the political driver behind firmly enforced or increased parking requirements. Addressing spillover will clear a major roadblock to increasing housing supply and affordability.

S 2.1 Allow Landscape Reserves to Allay Community Concerns
S 2.2 Require Developers To Maintain Standard of On-Street Parking Availability
S 2.3 Restrict Parking Permits For Residents New Housing
S 2.4 Utilize Parking Benefit Districts To Give Neighborhoods Benefits of Pricing On-Street Parking
S 2.5 Involve Communities in Design Process, Include Education Around Parking Impacts on Design and Traffic
S 2.6 Commit to Work With Communities After Projects Are Built
S 2.7 Provide Resources For Improved Local Planning
S 2.8 Channel Transit Investments to Communities Who Choose Transportation Choice and Affordable Housing over Free Parking

S 2.1 Allow Landscape Reserves to Allay Community Concerns

(Local Governments)

A landscape reserve addresses the issue of uncertainty around parking demand in a development. If a municipality is unsure whether factors such as income and access to transit will result in reduced parking demand, it can approve a lower parking ratio, but require that a certain amount of open space be available to be converted to parking if there is significant spillover. This technique has been used successfully in Palo Alto and is profiled in Case Study III.

S 2.2 Require Developers To Maintain Standard of On-Street Parking Availability

(Local Governments)

If the goal of a minimum parking requirement is to minimize congestion in parking on street, why not skip the middle step of the parking requirement, and require the developer / manager to commit to a minimal on-street impact. If spillover congestion exceeded a certain threshold, the developer / manager would be required to come up with a remedy such as providing transit passes or subsidies to residents. This would give developers an incentive to seriously consider the impacts of its building on the neighborhood and more importantly encourage them to keep a working relationship with the neighborhood and the new residents after a project was built.

S 2.3 Restrict Parking Permits For Residents of New Housing

(Local Governments)

This strategy is somewhat draconian, and accepts the questionable premise that current residents have a greater right to the on-street parking than new residents. However, if a development is receiving a parking reduction on the basis that some or all residents will not own vehicles, restricting those residents from accessing the on street parking can be a fair concession. This strategy was used for a senior housing project in downtown Berkeley and is profiled in Case Study IV.

S 2.4 Utilize Parking Benefit Districts To Give Neighborhoods Benefits of Pricing On-Street Parking

(Local Governments)

Donald Shoup, a UCLA professor who has written on parking issues, has proposed Parking Benefit Districts to make a market for parking amenable to residents who feel ownership of the free, or minimally charged, on street parking requirement in their neighborhood. Parking Benefit Districts in essence give the revenues of charging market prices for curb parking to a neighborhood for improvements such as street trees, sidewalks, speed humps, etc. In this way, a new development which increases demand for on street parking, would allow existing residents to raise the price of on-street parking, increasing benefits to the neighborhood.[25]

S 2.5 Involve Communities in Design Process, Include Education Around Parking Impacts on Design and Traffic

(Housing Developers)

Like all development issues with neighborhoods, initiating thorough communication early in the development process is essential. If communities understand the design and cost impacts of parking, they may choose a better design with less parking. In addition,

[25] Shoup, 1995

communities could better assess developments with a more refined understanding of how parking supply impacts vehicle trip generation. A positive example of community participation is presented in Case Study V.

S 2.6 Commit to Work With Communities After Projects Are Built
(Housing Developers)

Committing to address communities long term concerns around a new develop will help build trust, will make sure communities do not regret permitting new development, and will set precedents for other communities to accept denser development with less parking than a community would originally desire.

S 2.7 Provide Resources For Improved Local Planning
(Regional Bodies, Transit Providers, and State Governments)

Local governments generally want to address regional housing concerns in a way acceptable to its residents. However, planning for infill development is a complex process that requires local governments to work closely and extensively with developers and community members. To do quality planning that takes advantage of new tools and strategies, local governments need more resources and incentives.

S 2.8 Channel Transit Investments to Communities Who Choose Transportation Choice and Affordable Housing over Free Parking
(Regional Bodies, Transit Providers, and State Governments)

While local governments have a challenge to figure out how to plan for new housing, some communities are and may continue to choose abundant free parking over new, affordable housing and transportation options. This choice is essentially made through the level and flexibility of a locality's minimum parking requirements. Since abundant, unpriced parking is a significant subsidy to travel by private vehicle and inhibits the attainment of transit supporting densities, communities which make this choice should not receive large public investments in transit and other discretionary transportation funds. Alternative transportation will be hard pressed to compete for a significant share of trips and will require large subsidies to maintain the service in areas with high off-street parking requirements.

Strategies 2.7 and 2.8 are ways of rewarding communities who choose density and reduced parking with amenities like planning dollars and transit. MTC's Livable Communities grant program is a model of rewarding local governments who make regionally beneficially land use choices. The program and others like it should consider local flexibility around minimum parking requirements in their grant criteria.

STRATEGY 3: PLANNING FOR RESIDENTS' TRANSPORTATION NEEDS RATHER THAN SIMPLY PARKING NEEDS

Current planning practice assumes vehicle ownership will continue an inexorable rise that must be accommodated. However, policies like high minimum parking requirements contribute to that rise. Strategizing to meet transportation needs while minimizing the marginal need for a car can free developers to create more new housing rather than new parking. Whether it is a household's second or third car in the suburbs, or the first or second car in a more urban context, new tools are evolving which developers and local governments can partner together on to improve the service they give their residents / citizens. These initiatives need to be supported by local governments and implemented by developer/ managers. If local governments cannot be flexible and reduce parking in response to the plans, there is no incentive for developers to provide these services.

S 3.1 Encourage & Implement Development Transportation Management Plans
S 3.2 Expand Opportunities for Development Wide Transit Passes (i.e. Eco-Pass)

S 3.1 Encourage & Implement Development Transportation Management Plans

(Local Governments & Developers)

Local governments could require a developer to submit a Transportation Management Plan. The plans would include the portfolio of strategies the developer plans to implement in order to minimize the parking and traffic impact on the neighborhood. These plans would provide services to residents and reduce the demand for vehicles; as such a local government would certify the plan and allow a reduction in the parking required. Plans can be tailored to a particular development's residents and location. Some potential services that developers can implement:

- **Transportation Counseling For New Residents**
  Similar to services provided under the Location Efficient Mortgage program, new residents would be counseled as to the availability of alternative transportation, local services, development parking policies, and the cost of vehicle ownership. Thus a household moving to a new neighborhood can make an informed decision on the number of vehicles to own. Local governments could work with developers to implement an appropriate orientation in each community.
- **Promotion of Car Sharing and Car Sharing at Housing Developments**
  This is beginning to occur both in San Francisco and Berkeley. Car sharing can provide multiple households access to a vehicle. Currently more applicable to urban settings, car sharing can significantly reduce the parking demand at a particular development. In lower density settings, facilitating informal car sharing can reduce average household vehicle ownership.
- **Provide Cab and Dial-A-Ride Vouchers for Emergencies**
  In some locations, transit may work for the journey to work but the quick point-to-point service of a car is essential in some situations. Providing residents with an allocation of cab or dial-a-ride vouchers can keep them from making a significant investment in a vehicle for only occasional use.

S 3.2 Expand Opportunities for Development Wide Transit Passes (i.e. Residential Eco-Pass)

(Transit Agencies & Developers)

This is probably the most powerful demand management tool that can truly improve services to residences. In Santa Clara County, the Residential Eco-Pass allows developers/managers to purchase annual transit passes for all of their residents for between $20 and $80 per resident depending on community size and the location of the development. Nearly a $700 value, this pass makes transit essentially free for all residents. At a price of $60, a manager would spend $6,000 to provide 100 residents a transit pass for a year. Comparing that to the cost of a parking space could make Eco-Passes a worthwhile perk to provide residents if it reduced the need to construct parking. Other transit agencies should follow the VTA's lead and allow developers to buy fixed cost annual passes for their residents. Also, developers could offer transit passes to residents who forego their parking space as a way of unbundling parking and communicating its value/cost to residents.

STRATEGY 4: INCREASING THE FLEXIBILITY OF HOW DEVELOPERS MEET PARKING REQUIREMENTS

A strict requirement to build a certain amount of parking off-street and on-site ties the hands of developers and inhibits the potential for creativity by developers and local planners.

S 4.1 Provide Parking on an Area Basis; Use In-Lieu Fees for Financing
S 4.2 Permit Shared Parking in Mixed-Use Districts
S 4.3 Permit Creative Design Solutions (i.e. Tandem Parking; Elevator Parking)
S 4.4 Consider How Development Parking is Managed
S 4.5 Seek Inexpensive Ways to Meet Parking Demand / Requirement (i.e. Off-Site)
S 4.6 Analyze and Communicate Costs of Parking Under Different Scenarios

S 4.1 Provide Parking on an Area Basis; Use In-Lieu Fees for Financing

(Local Governments)

In downtowns and more dense urban areas, parking can be most efficiently provided in a neighborhood garage that could serve multiple properties. An in-lieu fee to a parking district is a feasible way to finance neighborhood parking. Like minimum parking requirements, in-lieu fees should be sensitive to the factors which contribute to a developments impact on parking demand (income, location, etc.). Also, giving developers the option of leasing spaces from the existing supply can allow them to make the most efficient choice and reduce the cost of development.

S 4.2 Permit Shared Parking in Mixed-Use Districts

(Local Governments)

In downtowns and denser, mixed-used areas, zoning codes should recognize the potential for shared parking. Housing related parking demand peaks at night and on weekends while office related parking demand has opposite peaks. These inverse peaks can be leveraged to reduce the total urban land devoted to parking and reduce housing development costs.

S 4.3 Permit Creative Design Solutions (i.e. Tandem Parking; Elevator Parking)

(Local Governments)

Many zoning codes are strict in their application. Tandem parking spaces, which can save space by allowing two cars to park in line with each other, are often restricted from meeting off-street parking requirements. Also, zoning codes typically do not allow newer technologies like resident operated lift or elevator parking which can cut the space consumption of parking on a site in half. This technology, common in Europe, has been used in a number of projects by a developer in Berkeley.

S 4.4 Consider How Development Parking is Managed

(Local Governments)

A number of city zoning codes in the region already consider how parking is managed in their minimum parking requirements. If the spaces in a development are unassigned and accessible to all eligible residents and visitors, as opposed to being assigned to individual residents and visitors, fewer overall spaces may be needed. An Orange County study indicated that 1 unassigned space was equivalent to 1.17 assigned parking spaces.[26] This means that zoning codes could allow around a 15% reduction in parking required if parking were to be managed on an unassigned basis.

S 4.5 Seek Inexpensive Ways to Meet Parking Demand / Requirement (i.e. Off-Site)

(Local Governments and Developers)

As mentioned above, leasing spaces off-site like in a neighborhood garage could be a less expensive way to met parking requirements and improve a development's design. Developers need the option to find spaces off-site in local zoning codes in order to pursue this potential cost saving strategy.

S 4.6 Analyze and Communicate Costs of Parking Under Different Scenarios

(Developers)

This is essential for all interactions with local governments and for improved project planning. Understanding and communicating the costs, be it in dollars, in open space, or in lost opportunities to provide site or neighborhood amenities such as a community center, will help policy makers and developers themselves make informed decisions.

STRATEGY 5: ENCOURAGING THE "UNBUNDLING" OF PARKING FROM HOUSING

Giving households choice whether to pay for parking as opposed to forcing them to pay for it in their rent is fair, makes housing more affordable, and makes transportation decisions more efficient. Unbundling can reduce local demand for parking by reducing vehicle ownership rates. This is the most important, most powerful, and unfortunately, the most difficult reform to be undertaken to address the issues addressed in this report

S 5.1 Reduce Parking Requirements When Parking is Unbundled
S 5.2 Use 'Rent-Rebates' to Sensitively Charge for Parking
S 5.3 Remove Restrictions Which Prohibit Rent-Rebates or Charging for Parking
S 5.4 Unbundle Parking at new TOD to Achieve Expected Ridership Gains

[26] Smith, 1983

S 5.1 Reduce Parking Requirements When Parking is Unbundled

(Local Governments)

In settings in which there are the beginnings of a market for parking (bigger cities, denser neighborhoods, neighborhoods with permit parking, suburban downtowns, areas around major transit centers), parking requirements should be reduced for developments which agree to unbundle payment for parking spaces from rent payments. The demand for the usually free parking on street will increase, thus addressing spillover is essential to this strategy (see Strategy 2). This measure makes sense because residents will own fewer vehicles if the costs of parking are more effectively communicated. The reduced parking requirements give developers an incentive to unbundle parking costs from housing costs.

S 5.2 Use "Rent-Rebates" to Sensitively Charge for Parking

(Non-Profit and For-Profit Developers)

Scarcely any of the developments we surveyed unbundle parking from housing. The primary reasons for this are regulatory barriers and the generous supply they have had to build. The high supply removes any incentive to allocate spaces with pricing. Often they are explicitly not allowed to charge for parking. However, some developers appear reluctant to do so out of sensitivity to the means of their tenants and unwillingness to "penalize" households who depend on cars. However, developers are not reluctant to charge higher rent for households who consume more space via larger units (usually via more bedrooms), in essence "penalizing" larger households for being large. Consuming additional parking spaces is hardly different than consuming additional bedrooms. To force households who choose to own fewer vehicles and use transit or walk to pay for parking through their rent (which can exceed the cost of the vehicle) is unfair.

In order to remain sensitive, the "charge" for parking can be structured as a "reduction" or "rebate" for households with fewer vehicles. For example, three-bedroom units at a particular affordability level could rent for $1,000 a month including two parking spaces, $900 a month with one, and $800 a month if no parking spaces are used.

S 5.3 Remove Restrictions Which Prohibit Rent-Rebates or Charging for Parking

(State and Federal Housing Programs)

An additional barrier to externalizing the cost of parking and improving fairness in a residential setting is the regulations of various affordable housing subsidy programs (i.e. Tax Credits). Charging for parking at existing developments is considered the removal of an amenity and thus not allowed under many housing funding programs. Housing programs at the local, state and federal level should be reexamined to remove barriers to incorporating parking costs into development pricing structures.

S 5.4 Unbundle Parking to Achieve Expected Ridership Gains

(Transit Agencies and TOD Housing Developers)

Transit agencies are eager to boost ridership with "transit-oriented development" (TOD). The principle of TOD is that by clustering residents around transit services, TOD projects will raise transit ridership by clustering residents around stations, thus lessening congestion and making more efficient use of transit investments. However, unbundled parking is rarely part of a TOD plan. If residents are forced to pay the costs of parking, a major incentive is being

given to driving over transit usage, contrary to TOD's goals.[27] Therefore it is essential that TOD both moderate the supply of parking and make sure its costs are communicated. Otherwise TOD will not deliver the benefits that backers assert. Unbundled parking can especially work at TOD because if demand falls below supply for residential parking, it can be used to meet demand from commuters.

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[27] While transportation by automobile is the most expensive mode of transportation, most of its cost are fixed costs which are "sunk" once the vehicle is purchased. On an individual trip basis, travel by car will often have lower marginal / variable costs, even if quality transit, like a BART station is directly across the street. Thus bundling, which is in effect subsidizing, the fixed cost portion of vehicle ownership is antithetical to the goals of transit-oriented-development.

CASE STUDIES

I. LOS ANGELES - ZONING FOR TRANSIT AND AFFORDABLE HOUSING

Policies and Practices Exhibited:

- *Reduction in parking requirements for affordable housing in zoning code.*
- *Reduction in parking requirements for proximity to transit in zoning code.*

Using Parking Policy to Encourage Affordable Housing Near Transit

Most Bay Area residents associate Los Angeles with high car ownership. However, in the City of Los Angeles, 22% of rental households do not own cars, and a high proportion of zero or single car households have low incomes. The City of Los Angeles recognized the interrelations between income, transit service and vehicle ownership when it set its minimum parking requirements. Parking requirements are reduced as an incentive to produce permanently affordable housing (i.e. deed restricted).

The minimum parking policies (shown in the chart below) are sensible for a number of reasons. They are focused on the possibility of households owning a second car. Since it is likely that households will own one car in Los Angeles due to its general auto orientation, the minimum 1 space per unit requirement is unchanged for affordable housing. However, the requirements recognize that lower income households are less likely to own a second vehicle. Thus requirements are reduced for units with 4 or more habitable rooms from 2.0 spaces to 1.5 spaces per unit. This corresponds with statistical evidence. While vehicle ownership increases on average as household size grows, this trend is not as evident in low-income households.

The potential for access to quality transit service to reduce the need for owning a second car is also acknowledged with the reduction of required spaces to 1 per unit from 1.5 for affordable units within 1,500 feet of significant transit service. By coupling the transit-based reduction and income-based reduction, the City of Los Angeles' minimum parking requirements reflect what transportation researchers have generally concluded, that higher income households will continue to own vehicles despite access to transit (except in extremely well served areas like some neighborhoods in San Francisco and Manhattan). However, lower income residents, when given quality transit options are likely to forego ownership of first or second cars.

City of Los Angeles Minimum Parking Requirements (Spaces per Unit)

	Number of Habitable Rooms		
	1-2	3	4+
Market Rate Housing	1 / unit	1.5 / unit	2 / unit
Restricted Affordable Units	1 / unit	1.5 / unit	1.5 / unit
Restricted Affordable Units within 1,500 ft of mass transit or major bus line.	1 / unit	1 / unit	1 / unit

II. SAN FRANCISCO – MISSION BAY – PARKING MAXIMUMS

Policies and Practices Exhibited:

- *Area wide maximum parking requirement, makes for efficient use of transit investment, encourages developers to unbundle parking from housing.*
- *Reduced parking requirements allow for community amenities, activated streets, with ground floor uses.*
- *Car-sharing to meet resident transportation needs, reduce parking demand.*

Coordinating Redevelopment, New Housing, and Transportation Investments with Smart Parking Policy to Create an Urban Neighborhood

The self-fulfilling prophecy of providing parking supply leading to car use could work in the reverse direction by reducing parking supply, planning for a pedestrian friendly neighborhood, and quality transit service. This is what is underway in the Mission Bay redevelopment area.

The Mission Bay redevelopment area in San Francisco covers a 303 acre formerly industrial area. The plan for the site includes housing (6,000 units), office space, university space, a hotel, community facilities, and retail. While the area in question is currently a foreboding, industrial landscape that is hardly pedestrian nor transit friendly, planners recognized that the redevelopment projects themselves would change that.

The area will be a mixed-use district with jobs and services nearby and will be served by the extension of San Francisco's Third Street Light Rail line. In order to maximize the amount of housing that could be built in the area and to maximize transit investments and minimize traffic impacts, residential parking is set at a *maximum* of one parking space per unit. Typically, parking mandates are *minimums*.

The fruits of the maximum will be more housing, more transit ridership, and greater neighborhood amenities. The affordable housing component of the redevelopment, being developed by Mission Housing Development Corporation, is benefiting from the maximum parking requirement. One development currently being planned includes 83 spaces for 100 units. This is 17 less spaces than would be required under San Francisco's general minimum parking requirement of 1 space per unit. With fewer spaces, a ground floor childcare center and retail uses are possible. The space saved is expected to generate $132,000 annually for the project (300 sq feet per space at $25.80 per square foot in rent), reducing the cost of housing and increasing its affordability. Ground floor retail uses also serve to "activate" the street, making it a more pleasant environment for pedestrians. Mission Housing is also planning to devote two of the parking spaces for City CarShare vehicles that will be available to residents. This will provide the convenience of a car to all residents without the full financial burden of vehicle ownership.

The maximum parking requirement in the Mission Bay area is part of a larger plan that coordinates investments in new transit service with more intense housing development, which means more efficient use of public resources.

III. PALO ALTO – CALIFORNIA PARK APARTMENTS – LANDSCAPE RESERVES

Policies and Practices Exhibited:

- *Reduction in parking for affordable housing near commuter rail.*
- *Landscape reserve used as contingency for spillover parking.*
- *Discretion of planning director versus strict requirement.*

A Landscape Reserve and Local Discretion Allays Community Concerns & Provides More Open Space in Suburban, Affordable, Transit-Oriented Housing

Many suburban communities think they have little option but to accommodate the car. In Palo Alto, the local government recognizes that parking needs differ when you are dealing with affordable housing at a location near real transit service. California Park Apartments, developed in 1989, is situated adjacent to the California Avenue Caltrain station. The development provides 45 units of affordable family housing (2, 3, and 4 bedroom flats and town homes) on 1.7 acres.

If built according to Palo Alto's standard parking requirements, the 45 units would have been accompanied by 95 parking spaces. The nearby train station, bus stops and numerous nearby shops and restaurants led the developer and local planners to believe that all of those parking spaces may not have been necessary. Palo Alto's zoning code anticipated these situations and gives the planning director and the architectural review board discretion in "deferring" the standard minimum parking requirements. This allows the developer to hold open space in "landscape reserve" for additional parking if it is determined that the reduced parking is insufficient. If parking demand were too high, the open space would be converted to parking spaces.

At California Park, Palo Alto Housing Corporation was permitted to build 73, instead of 95 parking spaces. In the deferred space, a family play area was installed that includes a sandlot, some play equipment, two picnic tables and a barbeque.

Since the project opened, the reduced parking has been sufficient and there are no plans to convert the "landscape reserve" family play area to parking. The landscape reserve policy is useful in two ways, first it addressees community concerns that reduced parking will cause congestion in on-street parking and it communicates the trade-off between parking and amenities like open-space. Also, by giving the local planning department discretion in the zoning code, Palo Alto has recognized that a one-size fits all minimum parking requirement is not appropriate for the whole city.

IV. BERKELEY – SHATTUCK SENIOR HOMES – CAR FREE HOUSING & PERMIT RESTRICTIONS

Policies and Practices Exhibited:

- *Car-free housing for a small lot, downtown, with nearby amenities and services.*
- *Provision of alternative forms of transportation for residents.*
- *Restricting use of on-street parking for residents of car-free housing in order to address concerns of spillover.*

Car Free Housing for Seniors in Downtown Berkeley has a Market

Senior households, especially those with low incomes, own fewer than average vehicles and rely more heavily on transit or paratransit. In the Bay Area, persons aged 65 and above on average use walking, cycling or transit for 19% of their trips.[28] The city of Berkeley and Affordable Housing Associates (AHA), a non-profit developer recognized this when they planned a senior housing development in Berkeley's downtown area. While all senior housing should not necessarily be car-free, it made sense for 2425 Shattuck. The 27 unit development is located on a half-acre in Berkeley's pedestrian friendly downtown, which has nearby shops, restaurants, and services (including health care) and excellent transit service in the form of the downtown Berkeley BART station and a number of AC Transit bus lines. By developing car free, AHA was able to get four more units on the site and Berkeley was able to retain the pedestrian feel of its downtown.

Because the city feared that residents would simply park on the street, AHA agreed to restrict residents from obtaining residential parking permits. During the leasing phase, potential residents were told of the lack of off-street parking and the permit restrictions. That did not prevent 2425 Shattuck from leasing up quickly due to the important need that the housing served. If residents needed to keep their cars, they could apply at another AHA development or use parking garages downtown. Only five out of 300 applicants withdrew their applications due to the parking restrictions.

Shattuck Senior Homes houses seniors earning between 40 and 50 percent of area median income. Along with the quality public transit in the area, the residents at Shattuck Senior Homes have regularly scheduled van trips for errands like grocery shopping.

Shattuck Senior Homes is an important example of sensible planning and win-win policies that facilitate increasing housing for a needy population.

[28] Purvis, 1994

V. SAN LEANDRO – COMMUNITY PARTICIPATION IN HOUSING DESIGN

Policies and Practices Exhibited:

- *Involvement of Neighbors in Design to Educate on Parking & Design Impacts.*
- *Reduction in Parking Requirements for Senior Housing*

Community Visioning Process Turns Neighbors from NIMBY's to Advocates for Reduced Parking

Requirements for off-street parking at affordable housing developments are often driven by community concerns over the potential of spillover parking. Planning departments and commissions as well as zoning boards are particularly sensitive to neighborhood concerns. Thus, a well-informed community is an essential part of implementing smart parking policies.

An affordable senior housing project being developed by American Baptist Homes of the West and designed by Pyatok Associates is a role model for community participation and education. Following a community outreach process, residents supported and defended the developer's request for reduced parking in front of local officials.

As is typical, the community began with concerns over both parking congestions and generally the prospect of an affordable housing development. Designers approached the community with a blank slate, using Styrofoam blocks to allow them to come up with their own layout for the 1.5 acre site. Community members were instructed to come up with designs with varying degrees of parking. This communicated to residents the design implications of additional parking on this particular lot. Providing parking at the minimums mandated by the city (1.5 per unit) would force the parking lot onto the street frontage.

In the meantime, the developers shared their experience with parking at similar affordable senior housing developments. After four community meetings, most community members were behind a parking ratio of 1 space per unit. Feeling ownership of a project they had a hand in designing, many residents then supported the project as it went in front of the San Leandro's Planning Commission and Board of Zoning Adjustments. Community support was essential in approving the project with a reduced parking ratio. As a result, the 60 units of affordable (50 percent or less of Area Median Income) 1 bedroom apartments will be constructed with 43 resident and staff stalls, and 17 visitor stalls. The reduced requirement saved the space and cost of 30 parking spaces. With less parking, the project will provide more gardening space for residents, more landscaped areas instead of asphalt, and more total units.

WORKS CITED & SOURCES

Bernal Heights Neighborhood Center. 1997. Parking *Survey of Affordable Family Apartment Complexes in San Francisco*. (Unpublished.)

Bertha, Brian. 1964. Appendix A. In *The Low-Rise Speculative Apartment* by W. Smith. Research Report 25. Berkeley, Calif.: Center for Real Estate and Urban Economics, Institute of Urban and Regional Development, University of California.

Childs, Mark C. 1999. *Parking Spaces: A Design, Implementation, and Use Manual for Architects, Planners, and Engineers*. New York: McGraw-Hill.

Cook, J., et. al. 1997. *Parking Policies in Bay Area Jurisdictions: A Survey of Parking Requirements, Their Methodological Origins, and an Exploration of Their Land Use Impacts*. Paper in City Planning 217. Berkeley, Calif.: University of California.

Dorsett, John W. 1998. The Price Tag of Parking. *Urban Land*, Vol. 57, No. 5:66-70.

Dunphy, Robert T. and Kimberly Fisher. 1996. Transportation, Congestion, and Density: New Insights. *Transportation Research Record*, No. 1552: 89-96.

Ehrlich, Susan. 1993. *The Case for Reduced Parking Requirements for Affordable Housing in the City of Los Angeles*. Professional Report for Masters of City Planning. Los Angeles, Calif.: University of California.

Ewing, Reid and Shi-Chiang Li. 1998. *A Vehicle Ownership Model for FSUTMS*. Washington, D.C.: National Research Council, Transportation Research Board.

Frank, Lawrence and Gary Pivo. 1994. *Relationships Between Land Use and Travel Behavior in the Puget Sound Region*. Washington State Department of Transportation, Vol. 42:A-11.

Holtzclaw, John. 1994. *Using Residential Patterns and Transit to Decrease Auto Dependence and Costs*. San Francisco: Natural Resources Defense Council.

Institute of Transportation Engineers. 1987. *Parking Generation*. 2nd Edition. Washington, D.C.

Jia, Wenyu and Martin Wachs. 1997. Parking and Affordable Housing. *Access*, Vol. 13, No 2:22-25. Available at: http://socrates.berkeley.edu/~uctc/Access13.pdf (Visited March 1, 2001).

Kockelman, Kara M. 1997. *Travel Behavior as a Function of Accessibility, Land Use Mixing and Land Use Balance: Evidence From the San Francisco Bay Area.* Washington, D.C.: National Research Council, Transportation Research Board.

Litman, Todd. 1999. *Parking Requirements Impacts on Housing Affordability*. Victoria Transport Policy Institute. Available at: http://www.vtpi.org/0_land.htm (Visited March 1, 2001).

Metropolitan Transportation Commission. 1995. *San Francisco Bay Area Detailed Household Characteristics*. Available at http://www.mtc.ca.gov/datamart/census.htm (Visited March 2001).

Purvis, Charles L. 1994. *San Francisco Bay Area 1990 Regional Travel Characteristics: Working Paper #4*. Metropolitan Transportation Commission: Oakland, Calif. Available at: http://ntl.bts.gov/DOCS/SF.html (Visited April 1, 2001).

RS Means. 1999. *Building Construction Cost Data 2000: 58th Edition*. Robert S. Means Co.

San Francisco Planning and Urban Research Association (SPUR). 1998. *Reducing Housing Costs by Rethinking Parking Requirements*. Report 369. Available at: http://www.spur.org/spurhsgpkg.html (Visited March 1, 2001)

Schimek, Paul. 1996. *Household Motor Vehicle Ownership and Use: How Much Does Residential Density Matter?* Washington DC: National Research Council, Transportation Research Board.

Shoup, Donald C. 1995. An Opportunity to Reduce Minimum Parking Requirements. *Journal of the American Planning Association*, Vol. 61, No. 1:14-28.

Shoup, Donald C. 1997. The High Cost of Free Parking. *Journal of Planning Education and Research*, Vol. 17, No. 1:3-20.

Shoup, Donald C. 1999a. The Trouble with Minimum Parking Requirements. *Transportation Research Record*, Part A, Vol. 33:549-574.

Shoup, Donald C. 1999b. Instead of Free Parking. *Access*, Vol. 15, No 2:6-9. Available at: http://www.uctc.net/access/access15.pdf (Visited March 15, 2001).

Shoup, Donald C. 2000. *Truth in Transportation Planning*. Washington, D.C.: National Research Council, Transportation Research Board.

Smith, Thomas P. 1983. *Flexible Parking Requirements*. Planning Advisory Service Report Number 377. Chicago, IL: American Planning Association.

U.S. Department of Transportation, Federal Highway Administration. 1997. *1995 Nationwide Personal Transportation Survey*. Washington, D.C.

Weant, Robert and Herbert Levinson. 1990. *Parking*. Westport, Conn.: Eno Foundation.

Willson, Richard. *Suburban Parking Requirements. 1995.* Journal of the American Planning Association*, Vol. 61, No. 1:29-42.*