

An Opportunity to Reduce Minimum Parking Requirements

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Employer-paid parking subsidizes about a third of all automobile travel in the United States, and about two-thirds of all automobile travel during the morning peak hours. To reduce traffic congestion and air pollution, California has recently enacted legislation requiring employers who subsidize employee parking to offer employees the option to take the cash value of the parking subsidy, in lieu of the parking itself. The legislation also requires cities to reduce the parking requirements for developments that implement a parking cash-out program. This study estimates how the option to cash out employer-paid parking will reduce commuter parking demand, and recommends a corresponding reduction in minimum parking requirements. To deal with spillover parking problems that may occur if cities reduce parking requirements, the article concludes with a proposal to create "Parking Benefit Districts" where the revenues from market-priced curb parking are dedicated to paying for neighborhood public services. At market parking prices, curb parking revenue could easily exceed the current residential property tax revenue in neighborhoods subject to spillover parking.

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Almost all motorists in the United States park free. As evidence for this proposition, the 1990 Nationwide Personal Transportation Survey (NPTS) asked 48,400 respondents, "Did you pay for parking during any part of this trip?" for each automobile trip made on the previous day. Nationwide, motorists reported free parking for 99 percent of all automobile trips.¹

The survey also asked, "Do you pay for parking at work?" (not on the previous day, but in general). Nationwide, 95 percent of all automobile commuters said they parked free at work. The only commuters who appear to run more than a 10 percent risk of paying to park at work are the rich, the highly educated, and those living in Cincinnati (Table 1).²

In addition to the NPTS data, a variety of other sources show that almost all automobile commuters park free at work. A survey of 2,500 commuters in Southern California found that 93 percent of automobile commuters park free (Commuter Transportation Services 1993). Another survey of 4,000 commuters in 17 large metropolitan areas found that 89 percent of automobile commuters park free (Center for Urban Transportation Research 1989). Williams (1991) found that 82 percent of automobile commuters park free in the Washington, DC metropolitan area; in downtown Washington, only four percent of all commuters' cars parked at federal facilities paid the market rate for parking.

Why do almost all commuters park free? The most important explanation is employer-paid parking. In addition, some commuters park free on the street. The 1990 NPTS did not ascertain the share of commuters who park on the street, but the 1969 NPTS found that only 12 percent of commuters parked on the street (Shoup and Pickrell 1980). Since then, with the rapid spread of Residential Parking Permit Districts that reserve on-street parking for residents, the share of commuters who park on the street has probably decreased; if so, on-street parking can account for only a small share of free commuter parking.

Work trips account for 27 percent of all automobile trips, and 33 percent of all vehicle miles travelled in the United States. During the weekday morning peak (6 A.M. to 9 A.M.), work trips account for 64 percent of all automobile trips, and 71 percent of all vehicle miles travelled.³ Therefore, employer-paid parking subsidizes about one-third of all automobile travel, and about two-thirds of all automobile travel in the morning peak. Even in New York City, a survey of trans-Hudson commuters found that 54 percent of auto drivers bound for the Manhattan CBD during the morning peak received employer-paid parking (Port Authority of New York and New Jersey 1984).

TABLE 1. Share of automobile commuters who park free at work, by characteristics of commuter and location of commuter's residence

Characteristics of Commuter	Park Free	Location of Commuter's Residence	Park Free
<i>Sex</i>			
<i>Metropolitan Statistical Area</i>			
Male	96%	In MSA, in Central City	93%
Female	95%	In MSA, outside Central City	95%
All	95%	Not in MSA	98%
<i>Race</i>			
<i>MSA Size</i>			
White	95%	Less than 1,000,000	95%
Black	93%	1,000,000–3,000,000	94%
Other	95%	3,000,000 or more	94%
<i>Age</i>			
<i>Consolidated MSA</i>			
16–30	96%	Hartford	98%
30–50	94%	Detroit	96%
50–70	96%	Los Angeles	96%
Over 70	98%	Miami	96%
		Philadelphia	96%
		Boston	94%
<i>Income</i>			
		Chicago	94%
Under \$20,000	97%	Cleveland	94%
\$20,000–\$40,000	96%	New York	94%
\$40,000–\$60,000	95%	Seattle	94%
\$60,000–\$80,000	93%	Dallas	93%
\$80,000 or more	89%	Denver	93%
		Houston	93%
<i>Education</i>			
		Pittsburgh	93%
High School	97%	San Francisco	93%
College, 4 Years	93%	Cincinnati	88%
Graduate School, 2+ Years	88%		

Source: Calculated from data in the 1990 Nationwide Personal Transportation Survey.

Percentages refer to the 21,051 automobile commuters who responded to the question: "Do you pay for parking at work?"

The Effects Of Employer-Paid Parking

Employer-paid parking is an invitation to drive to work alone. To assess the effects of this invitation, Willson and Shoup (1990a) analyzed a 1986 survey of 5,060 commuters to downtown Los Angeles, where the average cost of commuter parking was \$3.87 a day. The average round trip distance driven to work was 36 miles. The average variable cost (for gasoline, oil, maintenance, and tires) of operating a passenger car was 6.52 cents per mile in 1986 (American Automobile Manufacturers Association 1993), so the vehicle operating cost for a 36-mile trip was \$2.35. Therefore, the commuter's average variable cost of driving to work (vehicle operating cost plus parking cost) was \$6.22 (= \$2.35 + \$3.87) a day if the driver paid for parking, and only \$2.35 a day if the employer paid for parking. Employer-paid parking thus reduced the average variable cost of driving to work from \$6.22 to \$2.35 a day, or by 62 percent. Everyone would call it an environmental outrage if an employer offered all employees free gasoline as a subsidy for driving to work, but employer-paid parking provided these commuters an even bigger subsidy for driving to work.

Table 2 summarizes the results from seven well documented case studies of how driver-paid parking reduces solo driving to work. These case studies have compared either: (1) the commuting behavior of matched samples of employees *with* and *without* employer-paid parking; or (2) the commuting behavior of the same employees *before* and *after* employer-paid parking was eliminated. On average, in these seven case studies, driver-paid parking reduced the number of cars driven to work by 19 cars per 100 employees.⁴

California's Parking Cash-Out Legislation

In 1992, the State of California enacted legislation that directly addresses the traffic congestion and air pollution problems caused by employer-paid parking. As part of its Climate Change Action Plan to reduce greenhouse gas emissions, the Clinton Administration announced that it will introduce similar legislation at the federal level (U.S. Environmental Protection Administration 1993).

Briefly, California now requires that employers who provide a parking subsidy to employees must also offer a parking cash-out program.⁵ As defined in the law,

"Parking cash-out program" means an employer-funded program under which an employer offers to provide a cash allowance to an employee equivalent to the

TABLE 2. Driver-paid parking reduces solo driving to work.

Location and Date	Solo-Driver Mode Share (%)			Cars Driven to Work per 100 Employees			
	Employer Pays for Parking	Driver Pays for Parking	Difference	Employer Pays for Parking	Driver Pays for Parking	Difference	Price Elasticity of Demand
Civic Center, Los Angeles, 1969 ^a	72%	40%	-32%	78	50	-28	-0.22
Downtown Ottawa, Canada, 1978 ^b	35%	28%	-7%	39	32	-7	-0.10
Century City, Los Angeles, 1980 ^a	92%	75%	-17%	94	80	-14	-0.08
Mid-Wilshire, Los Angeles, 1984 ^b	42%	8%	-34%	48	30	-18	-0.23
Warner Center, Los Angeles, 1989 ^b	90%	46%	-44%	92	64	-28	-0.18
Washington, DC, 1991 ^a	72%	50%	-22%	76	58	-18	-0.13
Downtown Los Angeles, 1991 ^a	69%	48%	-21%	75	56	-19	-0.15
Average of Case Studies	67%	42%	-25%	72	53	-19	-0.15

Sources: Groninga and Francis (1969), Transport Canada (1978), Shoup and Pickrell (1980), Surber, Shoup, and Wachs (1984), Soper (1989), Miller (1991), Willson (1991).

a Case study compared the commuting behavior of employees with and without employer-paid parking.

b Case study compared the commuting behavior of employees before and after employer-paid parking was eliminated.

parking subsidy that the employer would otherwise pay to provide the employee with a parking space. . . . "Parking subsidy" means the difference between the out-of-pocket amount paid by an employer on a regular basis in order to secure the availability of an employee parking space not owned by the employer and the price, if any, charged to an employee for the use of that space. (California Health and Safety Code Section 43845)

Offering employees the option to choose cash in lieu of a parking space has several important advantages:

First, asking commuters to choose either a free parking space or its cash value makes clear that even "free" parking has an opportunity cost—the cash not taken. The foregone cash is a new "price" for taking the "free" parking. Because parking usually costs more in the most congested areas, the option to take cash instead of a parking subsidy will offer a strong incentive to rideshare exactly where this incentive is most needed. An employee can use cash to pay for nontransportation expenses, so the offer of cash in lieu of parking also rewards walking and cycling, which are the most environmentally benign forms of commuting.

Second, cashing out gives employees a new choice. Many employers now offer their employees a parking subsidy or nothing. Offering employees the choice between parking or its cash value clearly benefits those who choose the cash, and does not harm those who continue to take the parking.

Third, cashing out costs employers little or nothing. The employer must offer cash in lieu of parking

only if the employer pays out-of-pocket cash to subsidize the employee's parking in a space not owned by the employer. Therefore, the employer clearly saves the parking subsidy if the employee takes the cash. If an employer has a pre-existing (as of January 1, 1993) parking lease that does not allow a reduction in the number of spaces leased, the cash-out requirement does not apply until the end of the lease. The law is thus carefully written to avoid increasing the employer's cost of subsidizing employees' commuting.

Cashing out does pose a cost to employers if some employees are now offered a parking subsidy, yet, despite the offer, do not drive to work. Employers would have to offer these employees cash in lieu of the parking subsidies they have already declined, without saving anything on parking subsidies with which to finance the new cash payment. But the 1990 NPTS found that only nine percent of American commuters do not travel to work by car; some of these nine percent are already offered a ridesharing subsidy or are not offered employer-paid parking. Therefore, the employer's cost of offering in-lieu cash to currently unsubsidized ridesharers who have declined a parking subsidy would have to be relatively small.

Although California's cash-out requirement applies only to leased (rather than to employer-owned) parking, it covers a surprisingly large number of spaces. A survey of 137 large companies in high-density office centers in Southern California found that 58 percent of employers lease parking spaces to provide employee parking; in downtown Los Angeles the share was 71 percent (Ho 1993). For employers who can reduce the number of spaces they lease, the

average parking subsidy per employee was \$79 a month; one employer, however, spent \$64,500 a month to subsidize employee parking in leased spaces. Clearly, many employers in the most congested areas of Southern California will have to offer their employees the option to take substantial cash payments in lieu of parking subsidies.

Cashing Out Parking Subsidies Will Reduce Parking Demand.

If cashing out employer-paid parking reduces parking demand, logically it should also reduce minimum parking requirements in zoning ordinances. The legislation addresses this issue in the following way: *The city or county in which a commercial development will implement a parking cash-out program . . . shall grant to that development an appropriate reduction in the parking requirements otherwise in effect for new commercial development* (California Health and Safety Code Section 65089). The legislation mandates an "appropriate" reduction in parking requirements if a developer offers to cash out parking subsidies, but how is a planner to calculate what is appropriate?

The case studies summarized in Table 2 can be used to suggest how cashing out parking subsidies will reduce parking demand. For office buildings, parking requirements are usually expressed in terms of parking spaces per 1,000 square feet of office space. Thus, the previously estimated figure for cars per 100 employees must be translated into cars per 1,000 square feet. To do this, it is necessary to estimate the office occupancy density of employees, their absentee rate (for sickness, vacations, and travel), and a peak parking occupancy factor (the percentage of drivers who are parked at the time of peak parking demand).

Most of the case studies in Table 2 were conducted in Los Angeles, so it seems appropriate to draw these additional data from the same place. A downtown Los Angeles employee survey (Barton Aschman Associates 1986) found an office occupancy density of 4.2 employees per 1,000 square feet. A downtown Los Angeles parking study (Wilbur Smith and Associates 1981) found an employee absentee rate of 14 percent and a peak parking occupancy factor of 94 percent.

If there are 4.2 employees per 1,000 square feet, and if 14 percent are absent on any day, there will be 3.6 employees present per 1,000 square feet. Table 2 shows an average of 0.72 cars per employee driven to work when the employer pays for parking, so there would be 2.6 cars driven to work per 1,000 square feet. If only 94 percent of drivers park during the peak parking accumulation period, the peak parking demand is 2.4 spaces per 1,000 square feet of office space when the employer pays for parking.

The method just described was used to develop Table 3, which shows the number of commuter parking spaces demanded per 1,000 square feet of office space, depending on whether the employer or the driver pays for parking. These data suggest that, on average, *employer*-paid parking creates a commuter demand for 2.4 spaces per 1,000 square feet, while *driver*-paid parking creates a commuter demand for 1.8 spaces per 1,000 square feet.⁶

Visitor parking must also be estimated. Using a survey of office employees carried out in San Diego in 1991, Higgins (1993) estimated a daily average of 0.5 visitors per employee, a visitor parking turnover rate of four per day, and a visitor drive-alone share of 85 percent. The resulting visitor parking demand is 0.1 spaces per employee. With 4.2 employees per 1,000 square feet, visitor parking demand is 0.4 spaces per 1,000 square feet.

Finally, a parking system operates most efficiently at an occupancy rate of between 85 and 95 percent of capacity, so that entering cars do not have to search the entire system to find a vacant space. The Parking Consultants Council (1992) recommends that the number of spaces should be between five and ten percent greater than the estimated parking demand. Adding ten percent to the estimated commuter and visitor demand brings the resulting requirement to 3.1 spaces

TABLE 3. Driver-paid parking reduces commuter parking demand.

Case Study	Parking Spaces Demanded per 1,000 Square Feet		
	Employer Pays for Parking	Driver Pays for Parking	Decrease
Civic Center, Los Angeles	2.6	1.7	-36%
Downtown Ottawa	1.3	1.1	-18
Century City, Los Angeles	3.2	2.7	-15
Mid Wilshire, Los Angeles	1.6	1.0	-38
Warner Center, Los Angeles	3.1	2.2	-30
Washington, DC	2.6	2.0	-24
Downtown Los Angeles	2.5	1.9	-25
Case Study Average	2.4	1.8	-26
Visitor Parking	0.4	0.4	
10% Vacancy Factor	0.3	0.2	
Total	3.1	2.4	-23%

Sources: See text and Table 2.

per 1,000 square feet for employer-paid parking, and 2.4 spaces per 1,000 square feet for driver-paid parking. The case studies in Table 3 thus suggest that, on average, driver-paid parking reduces parking demand by 23 percent.

Unfortunately, this rough estimation procedure is far more sophisticated than any method actually used to set parking requirements in zoning ordinances, where the effect of price on demand is never explicitly considered. The rough estimates made here are not meant to demonstrate that driver-paid parking would typically reduce the "need" for parking either by 23 percent or to 2.4 spaces per 1,000 square feet. The result clearly depends on the market price of parking at the work site, and the wide variation among cases confirms that there is no "right" number of spaces to require.⁷

How do these estimates of parking demand compare to existing minimum parking requirements? Two surveys of parking requirements for office buildings in 117 cities in Southern California suggest that most cities require more than the estimated demand for parking. The first survey was conducted in 1975; to estimate trends in parking requirements since then, I repeated the survey for the same cities in 1993.⁸ Between 1975 and 1993, the average requirement increased from 3.6 to 3.8 parking spaces per 1,000 square feet of office space. In 1993, 98 percent of the cities required more than the estimated demand of 2.4 spaces per 1,000 square feet for *driver*-paid parking, and 91 percent required more than the estimated demand of 3.1 spaces per 1,000 square feet for *employer*-paid parking.

This observation that 91 percent of the surveyed cities required more parking than the demand estimated at a zero price is consistent with other research on parking demand. A study of nine suburban office parks near Philadelphia and San Francisco found that the average peak parking demand was only 47 percent of capacity, and that no office park had more than 60 percent of its spaces occupied at the time of peak parking occupancy (Gruen Associates 1986). Robert Cervero surveyed 57 of the largest suburban employment centers in the country, and found an average of 3.85 parking spaces per 1,000 square feet of floorspace, which yielded slightly more than one parking space per worker (Cervero 1988). In a series of case studies, Richard Willson found that the average minimum parking requirement for suburban office buildings in Southern California was 4.1 spaces per 1,000 square feet, and that, even though all parking was free, the average peak parking demand was only 56 percent of capacity (Willson 1992).⁹

These findings raise the suspicion that the mini-

mum parking requirements in many zoning ordinances exceed even the demand for free parking. This result is not surprising, given the atheoretical, *ad hoc* methods used to set parking requirements. No city planning textbook explains the theory of minimum parking requirements, because there is none. Setting parking requirements is a talent learned only on the job, never in planning school. The academic inattention to parking requirements is puzzling, given the great amount of urban space and development expense devoted to providing the parking that planners require.

The California legislation's grant of an "appropriate" reduction in municipal parking requirements for developers who implement a parking cash-out program is not merely an additional, but rather an *essential* feature. Without it, many employers would not be able to offer any significant cash allowance in lieu of a parking space. Most zoning ordinances have in the past required so much parking that there is now enough to satisfy demand even at a zero price. These zoning-required parking spaces are already a sunk cost, and they cannot legally be used for anything other than parking, so the sensible solution is to offer free parking.

In the legislative hearings on California's parking cash-out bill, opponents argued that local zoning ordinances require developers to provide parking at great expense, and that it would be inconsistent for the state government to require employers to pay their employees not to use the expensive parking spaces that local governments require. This persuasive argument led the legislature to mandate the cash-out option only in cases where the employer makes an out-of-pocket payment to subsidize parking in a space not owned by the employer, so the employer clearly saves the parking subsidy if the commuter takes the cash.

The Problem Of Spillover Parking

A potentially serious problem with cashing out parking subsidies and reducing parking requirements is that employees may take the employer's cash and park on nearby streets, thus congesting surrounding areas with spillover parking. California's cash-out legislation addresses the spillover parking problem in the following way: "*A parking cash-out program may include a requirement that employee participants certify that they will comply with guidelines established by the employer designed to avoid neighborhood parking problems, with a provision that employees not complying will no longer be eligible for the parking cash-out program*" (California Health and Safety Code Section 43845).

This provision will be difficult to enforce, and employers will have little or no incentive even to try. It seems unlikely to prevent the spillover parking problems that minimum parking requirements are de-

signed to prevent. For example, consider the following typical ordinance language expressing the purpose of minimum parking requirements: "In connection with the use of each lot, sufficient off-street parking space shall be provided to meet the demand created by all activities on the lot" (Buena Park City Code Section 19.536.040).

Some zoning ordinances even explicitly prohibit any charge for off-street parking. For example, the specific plan for a section of Wilshire Boulevard (which has the best public transit service in Los Angeles) requires: "In order to mitigate traffic congestion on public right-of-way, for office and other commercial uses, there shall be at least three parking spaces provided for each 1,000 square feet of gross floor area *available at no charge to all patrons and employees of those uses*" (City of Los Angeles 1989, 616, italics added).

Parking requirements are based on observing the number of cars parked at existing developments. Because motorists report paying nothing to park for 99 percent of all trips, *parking requirements are implicitly based on the observed demand for free parking, without regard to either the cost of providing parking spaces or what motorists are willing to pay for them.* When all development is required to provide enough parking to satisfy demand at a zero price, the resulting market price will be zero. The consequence is a vicious circle of parking subsidy, required oversupply of parking, and ubiquitous free parking, which then leads to an observed "demand" that is used to set future minimum parking requirements.

To see the circular logic used to set parking requirements, consider the study of parking requirements for shopping centers conducted for the Urban Land Institute (ULI) in 1982. Although the demand for shopping trips differs from the demand for work trips, the ULI study represents by far the most elaborate research ever conducted on parking demand for a single land use. Its methodology clearly illustrates the fundamental problems encountered in setting any minimum parking standard.

Data were gathered on parking occupancy at 506 participating shopping centers in 41 states and six Canadian provinces. Detailed parking accumulation counts were obtained from 135 centers, and daily counts for an entire year were obtained from 22 shopping centers. The resulting recommendation was:

To provide adequate parking for a typical shopping center today, the number of spaces required is:

- 4.0 spaces per 1,000 square feet of gross leasable area (GLA) for centers having a GLA of 25,000 to 400,000 square feet;

- from 4.0 to 5.0 spaces in a linear progression, with an average of 4.5 spaces per 1,000 square feet of GLA, for centers having from 400,000 to 600,000 square feet; and
- 5.0 spaces per 1,000 square feet of GLA for centers having a GLA of over 600,000 square feet.

The provision of parking based on these standards will serve patrons and employee needs at the 20th busiest hour of the year, and allow a surplus during all but 19 hours of the remainder of the more than 3,000 hours during which a typical center is open annually. During 19 hours of each year, which are distributed over 10 peak shopping days, some patrons will not be able to find vacant spaces *when they first enter.* (Urban Land Institute 1982, 2, italics added)

Because the observations on parking occupancy were taken in shopping centers where all parking was free, the implicit assumption is that the "required" parking is also free to both shoppers and employees. Basing the standard on the 20th busiest hour of the year (the "design hour") leaves spaces vacant more than 99 percent of the time that a shopping center is open for business, and leaves at least half of the spaces vacant at least 40 percent of the time (Urban Land Institute 1982, 12). An earlier ULI study of parking requirements for shopping centers had adopted the 10th busiest hour as the design hour. Neither of these design-hour choices was justified by estimating the resulting costs and benefits either to the shopping center or to society.

The only authority cited for using the "design hour" criterion in the 1982 study was a then-fifteen-year-old textbook that severely criticized the concept on the grounds that (1) one should not assume that the size of a facility provided will not influence the demand for the facility, and (2) one should not assume that the facility provided for the design-hour is the optimum economic solution without examining the costs and benefits of the specific facility. The textbook's authors concluded: "While [it] may seem frustrating, and while use of simpler and more straightforward concepts, such as ... the thirtieth highest hour, may seem more practical to the 'real world' engineer, the fact remains that proper engineering design techniques require more detailed and more comprehensive analysis" (Wohl and Martin 1967, 176)

The 1982 ULI study has provided the basis for almost all cities' parking requirements for shopping centers, despite the fact that it implicitly assumes "required" parking to be the *demand at a zero price at the busiest time of year.* Unless the price of parking is explic-

itly considered as a *variable* in estimating the number of parking spaces “required” for new development, off-street parking requirements are perfectly circular and wholly unscientific. Estimating demand without prices is planning without science, or at least without economics.

Some developers may *choose* to provide ample free parking to attract customers, but this is no reason for planners to *require* developers to provide ample free parking. Comprehensive planning is supposed to coordinate individual actions toward a desired overall outcome, but what worthwhile planning goal is achieved by zoning ordinances that effectively remove the cost of parking as any disincentive to automobile ownership or use? Minimum parking requirements in zoning ordinances are like fertility drugs for cars, and they help to explain why the United States now has 1.1 motor vehicles per licensed driver (Lave 1992).

To be sure, requiring “enough” off-street parking will prevent new development from creating local parking spillover, but at the same time minimum parking requirements slowly increase the city-wide density of off-street parking spaces, and of cars. With the same street pattern, a higher density of cars creates more traffic congestion, and leads to calls for street widening, intersection flaring, computerized traffic signals, and the like. When the whole city is considered the patient, minimum parking requirements will never cure traffic congestion or improve urban design. Rather, minimum parking requirements are an addiction masquerading as a cure. When three spaces per 1,000 square feet no longer accommodate the demand for free parking, a stronger dose of four spaces per 1,000 square feet can temporarily quiet the neighbors’ complaints, but every jab of the parking needle relieves only the local symptoms, and ultimately worsens the real disease.

The Theoretical Vacuum In Setting Parking Requirements

In the absence of academic research on minimum parking requirements, surveys conducted by the Planning Advisory Service of the American Planning Association (PAS) have been the practicing planner’s chief source of information on how many parking spaces to require for each land use. A review of these PAS surveys reveals several serious problems, and suggests that minimum parking requirements are based on the scantiest evidence, or none at all.

The first PAS report on parking requirements, a 1964 survey of ordinances in 20 cities, frankly admitted the theoretical vacuum in which requirements are set: “The underlying assumptions used in drafting lo-

cal regulations are unknown” (Planning Advisory Service 1964, 1).

The second PAS report on parking requirements, a 1971 survey of ordinances in 66 cities, honestly explained how the requirements are set:

Since the establishment of the principle that zoning ordinances may legally require the provision of off-street parking, ordinance drafters have been asking questions like: “How many spaces should be provided for a drive-in restaurant?”—or any other land use for that matter. The question is typically answered by relying upon what ordinances for other jurisdictions require. Two options are then open: first, to go through the ordinances in the agency’s files, and, second, to consult nationally published surveys. The implicit assumption is that other areas must know what they are doing (the ordinances were adopted, after all) and so it is a relatively safe bet to adopt a parking standard “close to the average.” This may simply result in a repetition of someone else’s mistakes. Nevertheless, the planner who needs to present a numerical standard by the next planning commission meeting can’t answer the original question by saying, “I don’t really know.” He must unavoidably use comparative statistics, coupled with his judgment and knowledge about the characteristics of the use at issue. . . . The fact that parking requirements differ markedly from city to city suggests that there is no firm base upon which the requirements are founded. Experience also suggests that parking requirements tend to be arbitrary, at times insufficient, at other times excessive. . . . A 1965 survey of shopping center parking lots in the busiest shopping day of the year (before Christmas) showed requirements were substantially higher than actual demand. (Planning Advisory Service 1971, 1–3)

The two surveys of parking requirements for office buildings in Southern California in 1975 and 1993, discussed earlier, confirm the PAS’s observation that cities tend to adopt parking standards “close to the average.” In 1975 the most frequent minimum parking requirement (the mode) was 4 spaces per 1,000 square feet. Sixty-five percent of the cities that required less than the mode in 1975 had increased the requirement by 1993, and none had reduced it. Eighty percent of the cities that required more than the mode in 1975 had reduced the requirement by 1993, and none had increased it. Only two of the 31 cities with the mode requirement in 1975 had changed their requirement by 1993 (one up, one down). These changes

doubled the percentage of cities requiring four spaces per 1,000 square feet, from 27 percent in 1975 to 54 percent in 1993, and halved the standard deviation. As these 117 cities' parking requirements grew more alike, their average requirement also increased from 3.6 to 3.8 spaces per 1,000 square feet.

One off-street parking space (along with its share of ramps and aisles) occupies at least 300 square feet, and often over 350 square feet. The most common requirement, of four parking spaces per 1,000 square feet of office space, devotes at least 20 percent, and often over 40 percent, more space to parking than to the office building it serves. In effect, planners are requiring developers to provide more space for cars than for people.

The third PAS report on parking requirements, published in 1983, presented several of what were considered best-practice examples. Nevertheless, this report candidly admitted: "For every land use whose parking demand we know something about, there are at least a dozen that remain mysteries" (Planning Advisory Service 1983, 15).

Finally, the most recent PAS report on parking requirements, a 1991 survey of ordinances in 127 cities, commented: "The American Planning Association's Planning Advisory Service (PAS) receives hundreds of requests each year about off-street parking requirements for different land uses—in fact, we receive more requests year after year on this topic than on any other. Drafting off-street parking requirements is clearly one of the most important tasks of a planning agency. There is typically tremendous citizen concern about the availability of parking, its effect on the transportation network, and ultimately on the quality of life in a community. There are also, of course, significant effects on developers and their projects, often with serious cost implications" (Planning Advisory Service 1991, 1, *italics added*).

Twenty years had elapsed since the previous PAS survey to answer the practicing planner's most frequently asked question: how many parking spaces should be required for each land use? The most compelling reason for publishing the 1991 report was not to provide new analysis or new data, however, but simply to reorganize the presentation: "Perhaps the most compelling reason for the update of the 1971 report, however, was that it has been difficult to use for some because of the way it is organized. In this new report, standards are segregated by land use rather than by the amount of required parking, as in the case in the 1971 report. Within each land use category, we arranged the standards from those that require the least amount of parking to those that require the most. This criteria was adhered to as closely as possible de-

spite the fact that, in some cases, absurd twists of logic in the way the standards were drafted might make such hierarchies impossible" (Planning Advisory Service 1991, 1).

Table 4 presents a selection of the minimum parking requirements found in these surveys of zoning ordinances. It shows but a tiny fraction of all the land uses for which there are minimum parking requirements. (The 1991 PAS survey included 179 different land uses.) These examples suggest the impossibility, in both theory and practice, of setting sensible parking requirements for every land use. Perhaps the only common element among these requirements is the apparent assumption that there should be at least one parking space for every person for every land use (except religious uses).

One particular anomaly worth noting is that most American cities require parking, while a few American and many European cities cap the number of parking spaces allowed in new development. Planners have

TABLE 4. Selected parking requirements

Land Use	Minimum Parking Requirements
Adult entertainment	1 parking space per patron plus 1 space per employee on the largest working shift
Barber shop	2 parking spaces per barber
Beauty shop	3 parking spaces per beautician
Bicycle repair	3 parking spaces per 1,000 square feet
Bowling alley	1 parking space for each employee and employer, plus 5 spaces for each alley
Gunsmith	3 parking spaces per 1,000 square feet
Heliport	5 parking spaces per touchdown pad
Mausoleum	10 parking spaces per maximum number of interments in a one-hour period
Nunnery	1 parking space per 10 nuns
Rectory	3 parking spaces per 4 clergymen
Swimming pool	1 parking space per 2,500 gallons of water
Taxi stand	1 parking space for each employee on the largest shift, plus 1 space per taxi, plus sufficient spaces to accommodate the largest number of visitors that may be expected at any one time
Tennis court	1 parking space per player

Sources: Planning Advisory Service (1971, 1991); Witheford and Kanaan (1972)

abruptly amended parking requirements directly from a minimum to a cap, with the new cap lower than the previously required minimum. There is never an interim period of *laissez-faire* when planners admit that they simply do not know how many parking spaces should be required or allowed. As they lurch from high minimum parking requirements to low parking caps, planners appear to follow the former Soviet maxim, "What is not made compulsory must be prohibited."

Solving The Spillover Parking Problem

Practicing planners may argue that it is not helpful to criticize minimum parking requirements unless the critic can propose a better way to deal with the manifest problem these requirements are designed to prevent—spillover parking. In view of the clear concern over this issue when California's cash-out legislation was debated, the remainder of this article deals with ways to solve the spillover problems that may result from cashing out parking subsidies and reducing parking requirements.

Parking Prohibitions and Time Limits

Commuter parking spillover is not a concern in most central business districts, where curb parking is either prohibited or metered for short term rather than all-day use. Therefore, if employers offer employees the option to cash out their existing parking subsidies, employees cannot simply take the cash and park free on the street. This barrier to spillover permits cities such as Boston, Chicago, New York, Portland, San Diego, and San Francisco to cap the number of parking spaces in new development, without worrying about spillover parking.

Residential Parking Permits

Residential Parking Permit (RPP) districts that reserve curb spaces for residents and their guests can also prevent commuter parking spillover. RPP districts have spread rapidly throughout the country since 1977, when the United States Supreme Court upheld the ordinance that established the country's first RPP district, in Arlington, Virginia. RPP districts have also evolved by creative adaptations. For example, the City of West Hollywood, California, sells RPP permits allowing daytime parking by employees of nearby commercial areas. Most residents drive to work during the day and park on their own streets only in the evening, and fees that commuters pay for daytime parking subsidize the fees that residents pay. Vancouver, British Columbia has RPP districts that reserve some

but not all spaces exclusively for residents, with metered spaces mixed in to accommodate visitors to adjacent commercial uses.

Pricing Curb Parking

Where curb parking is free, commuters who are offered cash in lieu of their free off-street spaces can take the cash and park on the street, continuing to drive to work. Stated in this conventional way, employers must provide free off-street parking so their employees will not park on the street. Rather than provide free off-street parking, however, another way to deal with the problem of commuter spillover is to charge for curb parking. Indeed, charges for curb parking and limits on the length of stay are what allow some cities to impose parking caps in central business districts to reduce congestion on the routes to downtown without creating curb parking congestion in downtown. But is pricing curb parking to prevent spillover feasible in areas other than central business districts?

Consider what it means to set a price that clears the market for curb parking. Traffic engineers usually recommend that at least one in seven curb spaces should remain vacant at all times to ensure easy parking access and egress (Witheyford and Kanaan 1972; Briery 1972; May 1975). Thus, the appropriate price for curb parking would limit the demand for parking so that at least one in seven spaces remains vacant. This strategy is not new; all commercial parking operators set prices high enough to maintain vacancies for entering cars. The last thing a commercial operator ever wants to do is to put out the "full" sign, because it means that the price is too low.

Although the conventional image of charging for curb parking is a meter at every space, several alternative technologies now widely used in European cities have eliminated unsightly and inconvenient curbside parking meters. One particularly promising new system employs personal in-vehicle parking meters that are similar in size and appearance to a small pocket calculator, and operate like a debit card. Cities in California, New York, and Virginia have already begun to use the in-vehicle parking meter, which in Europe is called an "electronic purse."¹⁰ Several other unobtrusive payment systems can also resolve any aesthetic or practical objection to charging for curb parking.

Although cashing out employer-paid parking can cause a spillover problem, the root of the problem is not the market's failure to provide enough free off-street parking. Rather, the root of the problem is the government's failure to charge for scarce curb parking.

Parking Benefit Districts

Minimum parking requirements emerge from a political, not an analytical process, and better analysis alone will scarcely affect the outcome. In the politics of zoning for parking, planners must weigh the interests of residents against the interests of developers. Residents want no on-street parking but their own; developers must pay for off-street parking to prevent spillover. The minimum parking requirements born of compromise and political expediency cannot be characterized as a coherent system that takes into account the effects of parking on traffic, land use, air quality, and urban form. Minimum parking requirements have never been used as a long-run strategic instrument, but are instead reactive, tactical responses to solve immediate and intensely local problems.

What can be done to change the fundamental political calculus that produces minimum parking requirements? And if solving the spillover problem by charging for curbside parking, rather than by imposing minimum parking requirements, is as simple as I have proposed, why was it not done long ago? The answer to both questions lies, I believe, with what happens to parking meter revenue. Money put into a parking meter seems literally to disappear into thin air.

According to the only survey I have been able to locate, 60 percent of all cities deposited their parking meter revenues into their General Funds, and 40 percent deposited them into special Parking Funds that typically were used to provide public off-street parking (Robertson 1972). If parking meter revenue goes into the General Fund, the neighborhood sees no direct benefit; if the money goes to pay for more off-street parking, many residents will not see that as worth the cost of paying for their own curbside parking. Neither of these fund uses is politically so popular that residents of any neighborhood would argue in favor of market prices for their own curbside parking. An easier way to prevent parking spillover has been to require developers to provide "enough" off-street parking.

Installing parking meters on a city street is analogous to enclosing a commons in a rural village. It is a political act that creates benefits and costs, and unless citizens can see obvious benefits from the resulting revenue, why would they support paying market prices for their own curbside parking? But, to change the political calculus, suppose market prices for curbside parking are introduced by creating "Parking Benefit Districts" that differ from existing Residential Parking Permit Districts in two ways. First, residents continue to receive permits to park in their District, but nonresidents will be charged the market price for parking. Second, the resulting revenue will be spent for addi-

tional public services in the neighborhood where the revenue is collected, such as sidewalk and street repair, street tree planting and trimming, street cleaning, street lighting, graffiti removal, historic preservation, or putting overhead utility wires underground.

A Parking Benefit District is a compromise between the one extreme of free curbside parking that is overused by nonresidents, and the opposite extreme of Residential Parking Permit Districts that flatly prohibit nonresident parking. When cities establish conventional RPP districts that prohibit nonresident parking, they are overreacting to the problem of spillover parking, and are overlooking important benefits that a more market-like solution can offer to both residents and nonresidents. Nonresidents should prefer a Parking Benefit District to an RPP district, because it offers them the option of parking at a fair market price (rather than simply prohibiting them from parking). Residents should also prefer a Parking Benefit District, because it offers them neighborhood public revenue derived from nonresidents.

Seen from the resident's side of the transaction, charging nonresidents for curbside parking and spending the money to benefit the adjacent property resembles Monty Python's scheme to "tax foreigners living abroad." The purpose of a Parking Benefit District would be to collect and spend curbside parking revenue to make the neighborhood a place where people want to be, rather than merely a place where anyone can park free.

Can market-priced curbside parking really yield sufficient revenue to make it worth collecting? One way to suggest the revenue potential of curbside parking is to compare it to the residential property tax. In 1991, the median property tax on single-family houses was \$922 (U.S. Bureau of the Census 1993). At a modest price of fifty cents an hour for only eight hours each weekday, and an 85 percent occupancy rate, one curbside parking space would yield \$884 a year. Many single-family neighborhoods have two curbside spaces in front of every house, so, even at a modest price, curbside parking revenue could easily exceed current property tax revenue in neighborhoods subject to spillover parking.¹¹

The revenue potential of curbside parking can also be related to the value of the privately owned land that it fronts. A standard curbside parking lane is eight feet wide. Where private property lines extend 100 feet back from the street (an unusually shallow lot), curbside parking occupies about eight percent as much space as the privately owned land it fronts. Where private property lines extend 160 feet back from the street (an unusually deep lot), curbside parking occupies about five percent

as much space as the privately owned land it fronts. Curb spaces yielding the same rent per square foot as the privately owned land they front would thus yield between five and eight percent of total urban land rent.¹²

Citizens may doubt a city's ability to charge a price for curb parking that ensures vacancies, but experience alone can guide curb parking prices to their market-clearing level, just as it now does for commercial off-street parking. Short-term demand shifts would cause the vacancy rate to vary about its average, but the cure for systematic overoccupancy or underoccupancy would be evident and simple: adjust the price.¹³ Commercial parking operators always charge prices that ensure vacancies, so if public agencies find it difficult to do so, why not contract out the task to private enterprise?

Using a neighborhood-generated land rent to finance neighborhood public services should appeal especially to advocates of greater neighborhood self-government. By encouraging grass-roots action and fostering local choice, the proposed Parking Benefit Districts closely resemble existing Special Assessment Districts, which are often used to finance the same sorts of neighborhood public services that Parking Benefit Districts could finance. A Special Assessment District is usually organized by a neighborhood's residents to tax themselves for neighborhood services such as street lighting and sidewalk repair, and property owners commonly pay special assessments in proportion to their street frontage, just as curb parking would provide revenue in proportion to street frontage. Indeed, the chief difference between a Special Assessment District and a Parking Benefit District seems to lie in who pays: the resident property owners pay a special assessment; the nonresident motorists would pay for curb parking. Since most cities already use special assessments (local governments' special assessment revenue totalled \$2.3 billion in 1990), they must already have the accounting systems necessary to allocate district-specific revenue to pay for neighborhood public services.¹⁴

A Parking Benefit District could be tried in any neighborhood, without requiring any changes outside the neighborhood that tries it. Residents could petition for a Parking Benefit District, just as they now petition for a conventional RPP district, so a Parking Benefit District would be formed only if the residents wanted it. Citizen demand rather than government initiative explains the rapid spread of RPP districts throughout the United States, and if Parking Benefit Districts were successful once tried, they could spread in exactly the same way, by petition from residents.

Parking Benefit Districts might even make neigh-

borhood streets safer, because the link between parking revenue and public services should encourage residents to take a proprietary interest in ensuring the safety of visitors and their cars. Anyone parking illegally would be stealing from neighborhood public revenues, so residents would have an incentive to cooperate with the police and parking enforcement officers in supporting parking regulations. And if market-clearing prices created vacant legal spaces, no one would ever "need" to park illegally by a fire hydrant, at a bus stop, or in a handicap space. Although collecting market prices for curb parking may sound complicated, it should be far simpler than enforcing the existing nonprice time limits on curb parking. Surveys often show that more than half of all cars parking in time-limited zones either violate the time limit or are in an illegal space.

In summary, the proposal is: charge market prices to allocate curb parking efficiently, and spend the revenue to make the parking charges politically acceptable. The real obstacles to market prices for curb parking are political, not technical, and the political acceptability of pricing curb parking depends on a politically acceptable distribution of the revenue. Dedicating each neighborhood's parking revenue to that neighborhood's highest public spending priority could be the key to creating a political constituency for pricing curb parking and reducing or eliminating off-street parking requirements.

Is It Fair to Charge for Parking?

To some, parking meters are ethically akin to pay toilets. If people "need" parking, won't pricing it necessarily harm the poor? But the fairness of charging for parking has to be considered in comparison to the alternative, which is "free" parking made possible by minimum parking requirements for all land uses. Minimum parking requirements can make parking *appear* free, but the cost does not disappear; rather, it reappears as higher costs for all other goods and services, especially housing.

A case study from Oakland, California shows how minimum parking requirements raise the cost of housing. Wallace Smith (1964) studied a sample of 64 rental housing projects developed within four years before and two years after Oakland introduced its first off-street parking requirement for rental housing. Before 1961, Oakland's zoning ordinance did not even mention off-street parking in residential districts. In 1961 the zoning was changed to require one off-street parking space per dwelling unit for all apartments developed after that date.

As a result of the parking requirement, the number of dwelling units per acre in new developments fell

by 30 percent, and the construction cost per dwelling unit rose by 18 percent. Even including the cost of the newly required parking spaces, housing investment per acre declined by 18 percent. Land values fell even more (by 33 percent), because the land was suddenly burdened with a new requirement to provide parking that residents did not pay for. Property tax revenues also declined, because both land values and construction investment declined.

Why did developers reduce housing density by 30 percent in response to a minimum parking requirement of one parking space per dwelling unit? First, developers said the requirement made previous densities impossible without expensive underground garages, so the cost of development at the previous density greatly increased; therefore, they reduced density and devoted more land to surface parking. Second, developers said that *adding* a dwelling unit required another parking space, but *enlarging* a dwelling unit did not; therefore, they built fewer but larger units. All architects and developers know of similar situations where minimum parking requirements dictate what can be built, what it looks like, and what it costs. Form no longer follows function, fashion, or even finance; instead, form follows parking requirements.¹⁵

It is doubtful that “free” parking benefits the poor when the hidden costs of the consequent minimum parking requirements are considered. Because the cost of providing the required “free” parking is incorporated into the cost of all other goods and services, parking requirements force the poor to pay for parking regardless of whether or not they own a car. A recent transportation survey in Southern California found that the richest 20 percent of the population owned one car for each person, while the poorest 20 percent owned only one car for every three persons (Cameron 1994). In this environment, it would be misleading to argue that reducing off-street parking requirements and charging nonresidents for curb parking will harm poor people.

Some may argue that automobiles already pay for public roads through gasoline taxes, so charging for curb parking is unfair “double taxation.” But automobiles use gasoline only while they are moving, not while they are parked (unless evaporative emissions, which pollute the air, are considered). The more a car is parked, the less it pays in gasoline taxes, so gasoline taxes clearly do not pay for parking spaces, and charging for curb parking is not unfair double taxation.¹⁶

Pricing Curb Parking: the Implications for Business

A separate equity issue is whether it is fair to charge market prices for curb parking in older com-

mercial areas where small businesses rely on curb parking for their customers. Recall that the goal is to price parking to yield about an 85 percent occupancy rate so motorists can quickly find a place to park near their destination. A lower price is called for if there are too many vacancies, and a higher price if there are so few vacancies that motorists must drive around to find a place to park. The total number of curb spaces will not be reduced. Instead, market-clearing prices will reduce the number of parked cars by only enough to create a few curb vacancies, so a parking space will never be hard to find.

Those who arrive in higher occupancy vehicles can split any parking charge, so their cost per person will be low, and those who stay a short time will pay little even if the price per hour is high. Thus, market prices for curb parking will ensure that everyone can park quickly, will favor higher occupancy vehicles, and will encourage parking turnover. The adjacent shops should end up with more customers per curb space than when curb parking is free but taken by solo drivers who are willing to spend the time (and gasoline) necessary to hunt for a space, and who will park longer once they find it.

Finally, by allocating the available curb spaces to those who are most willing to pay for them (without having to search for them), rather than to those who will come only if parking is free (but difficult to find because there are no vacancies), market-clearing parking prices should attract customers who will spend more, per hour they are parked, in the adjacent shops. By attracting more, and higher-spending, customers per curb parking space, market-clearing parking prices should help rather than harm small businesses whose customers rely on curb parking. The resulting revenue will also be available to spend on public improvements in the business districts where it is collected.

Conclusion

Employer-paid parking subsidizes about a third of all automobile travel in the United States, and about two-thirds of all automobile travel during the morning peak hours. To reduce traffic congestion and air pollution, California has recently enacted legislation that requires employers who subsidize employee parking to allow employees to take the cash value of the parking subsidy, in lieu of the parking itself. By shifting subsidies from parking to people, cashing out employer-paid parking will encourage commuters to do what planners have long exhorted them to do: car-pool, ride mass transit, bicycle, or walk to work.

California's new legislation also requires cities to reduce their minimum parking requirements for developments that implement a parking cash-out pro-

gram. But a potentially serious problem with cashing out parking subsidies and reducing parking requirements is that employees may take the cash and park free on nearby streets, thus congesting surrounding areas with spillover parking. If curb parking is free, cashing out employer-paid parking can cause spillover, but I have argued that the root of the spillover problem is the government's failure to charge for scarce curb parking, not the market's failure to provide free off-street parking.

The fear of spillover parking is a legitimate but not unanswerable objection to cashing out employer-paid parking and reducing parking requirements. To deal with spillover parking problems that may occur if cities reduce parking requirements, I have proposed creating Parking Benefit Districts where the revenues from market-priced curb parking are dedicated to paying for neighborhood public services. At relatively modest parking prices, curb parking revenue can easily exceed the current residential property tax in neighborhoods subject to spillover parking from nearby commercial development.

With market prices for curb parking, and a commitment to spend the resulting revenue to benefit the neighborhood where it is collected, spillover parking can become an important source of public revenue, rather than a source of annoyance. That is, spillover parking can be converted into an additional advantage from cashing out employer-paid parking and reducing or eliminating minimum parking requirements.

AUTHOR'S NOTE

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NOTES

1. This result was calculated from the 56,733 responses to the parking question in the 1990 Nationwide Personal Transportation Survey's "Travel Day File." The parking question was not asked for automobile trips that ended at home.
2. Ninety-seven percent of the lowest-income employees park free at work, while only 89 percent of the highest-

income employees park free at work. This finding does not necessarily imply that lower-income employees are more likely to be offered free parking at work. Another explanation is that lower-income employees are less likely to drive to work if they have to pay for parking. Sample sizes for the 16 individual CMSAs ranged from 146 commuters in Pittsburgh to 1,954 commuters in New York.

3. These percentages are calculated from data in the 1990 NPTS "travel day file," and refer to automobile travel to and from work as a share of total personal automobile travel for all trip purposes.
4. The number of cars driven to work includes the cars driven by carpoolers as well as those driven by solo drivers. The case studies included information on the share of employees who carpooled, but not on the average carpool size. In the table, an average of one vehicle per 2.62 carpoolers is used to estimate the number of cars driven to work by carpoolers. This figure was calculated from the 1988 *Commuter Survey* (Commuter Transportation Services 1988). Moderate changes in the assumed average carpool size have little effect on the estimated number of cars driven to work per 100 employees.
5. The cash-out requirement applies to employers of 50 or more persons in areas that do not meet the state's clean air standards. California's cash-out legislation was based on the research reported in Shoup (1992), which contains the full text of the legislation.
6. Because cash in lieu of a parking space is taxable for the employee, cashing out employer-paid parking will reduce parking demand by less than would occur if employer-paid parking were eliminated altogether. See Shoup (1992, 58-63) for an estimate that cashing out employer-paid parking will reduce parking demand by about two-thirds of the reduction caused by eliminating employer-paid parking.
7. In particular, parking demand depends crucially on office occupancy density. In a survey of 57 of the largest suburban employment centers in the United States, Robert Cervero (1988, 26) found that average office occupancy density ranged from 0.5 to 6 employees per 1,000 square feet; the standard deviation was almost as large as the mean. Given this broad range of office occupancy densities, it is impossible to imagine that any planner can know how many parking spaces per 1,000 square feet an office building "needs."
8. The parking requirement was calculated for an assumed 10,000-square-foot, three-story office building. Rex Link carried out the 1975 survey. A few cities included in Link's 1975 survey were not included in the comparison to 1993 because the city's 1993 requirement was difficult to interpret. For example, in 1993, for a corporate office building, the City of Banning required "one parking space for each employee on the largest shift plus one space per 350 square feet of floor area." Therefore, building size alone is insufficient information to calculate the required parking. The results of both surveys are available from the author.
9. When the office space in a building was less than fully

leased, Willson adjusted the observed parking occupancy upward to estimate peak parking demand for a fully leased building, so the empty parking spaces were not explained by empty offices in the buildings themselves.

10. See *Public Technology* (November/December 1990, 4). Motorists prepay a municipal authority for a total value of parking that is programmed into the motorist's personal in-vehicle meter. After parking, the motorist keys in a secret "PIN" number and the code of the parking zone, switches on the meter, and leaves it inside the car with its LCD display visible from outside the car. The meter deducts the appropriate parking charge per minute from the meter's prepaid balance, until the motorist returns and switches the meter off. Motorists do not need to carry coins, and do not suffer the "meter anxiety" associated with conventional parking meters that require prepayment for a fixed amount of time despite uncertainty about how long the motorist will want to remain parked. Enforcement personnel can easily see whether a parked car's meter is running; with adequate fines for violation, motorists who have prepaid for parking will always find it cheaper to use their in-vehicle meters than to risk a ticket. Arlington, Virginia was the first local government in the United States to introduce the in-vehicle parking meter. Users report an overwhelmingly positive response. See Shoup (1992, 95-97) for a description of the technology available for collecting curb parking revenue.
11. Moreover, the operating cost plus amortized capital cost of structured parking now almost always exceeds \$922 per space per year, so at market prices each curb parking space should earn more than \$922 per year before it is economical to build an adjacent off-street parking structure.
12. This calculation is approximate, because not all curb space is available for parking, and additional curb spaces are available along the sides as well as the fronts of blocks. To obtain a more accurate estimate for one sample location, I measured the area of privately owned land (excluding sidewalks and alleys) on 12 blocks near UCLA, and compared it to the area devoted to curb parking spaces surrounding each block. The average ratio of curb parking space to privately owned land was 5.1 percent.
13. Perhaps the simplest way to guarantee residents that there will not be too many cars parked on the streets in a Parking Benefit District would be to sell a limited number of nonresident permits, perhaps only two or three permits on each block, for commuters who want to park in an existing RPP district, with the price set high enough to limit demand to the fixed quantity of commuter permits. Later, when the revenue potential of these nonresident permits has been established, residents could make the tradeoff between the inconvenience of more paying guests and the benefits of more public revenue. Also, higher-tech methods of charging for nonresident parking could be introduced, such as the in-vehicle parking meters described earlier. In

densely populated neighborhoods, even residents would presumably have to pay for parking to clear the market for the relatively few curb spaces, but the resulting revenue spent on better public services for the neighborhood could make these payments politically acceptable, especially if residents without cars outnumbered those with cars. Wherever curb parking is scarce, there will be a necessary trade-off between how many permits to allocate to residents, and at what price, versus how much income can be generated by charging nonresidents for parking in the curb spaces not used by residents.

14. See Shoup (1990) for an explanation of how special assessments based on front-foot charges are used to finance neighborhood public investments. In regard to what neighborhood public purposes should be eligible for finance by a Parking Benefit District, one simple answer is to specify that a Parking Benefit District could finance any public purpose that can already be financed by a special assessment.
15. If Oakland's modest requirement of one parking space per dwelling unit had such a dramatic effect on land use, try to imagine how today's much higher minimum parking requirements must further reduce housing density and housing investment, and raise housing costs, all for the purpose of providing more "free" parking. For example, the Park Mile Specific Plan in Los Angeles requires, "For dwelling units, there shall be at least two and one-half parking spaces for each dwelling regardless of the number of habitable rooms contained therein" (City of Los Angeles 1989, 616-617).
16. MacKenzie, Dower, and Chen (1992) estimate that gasoline taxes and automobile user fees cover only about 60 percent of public spending on roads.

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