The High Cost of Free Parking

Donald C. Shoup

The air was still; the street was empty except for the line of huge cars parked along the curb, glittering and grinning with chrome and polish and enamel. Paul had noticed already that in Los Angeles automobiles were a race apart, almost alive. The city was full of their hotels and beauty shops, their restaurants and nursing homes—immense, expensive structures where they could be parked or polished, fed or cured of their injuries. They spoke, and had pets—stuffed dogs and monkeys looked out of their rear windows, toys and good-luck charms hung above their dashboards, and fur tails waved from their aerials. Their horns sang in varied voices. . . . few people were visible. The automobiles outnumbered them ten to one. Paul imagined a tale in which it would be gradually revealed that these automobiles were the real inhabitants of the city, a secret master race which only kept human beings for its own greater convenience, or as pets (Lurie 1986, 7, 232).

Abstract

Urban planners typically set minimum parking requirements to meet the peak demand for parking at each land use, without considering either the price motorists pay for parking or the cost of providing the required parking spaces. By reducing the market price of parking, minimum parking requirements provide subsidies that inflate parking demand, and this inflated demand is then used to set minimum parking requirements. When considered as an impact fee, minimum parking requirements can increase development costs by more than 10 times the impact fees for all other public purposes combined. Eliminating minimum parking requirements would reduce the cost of urban development, improve urban design, reduce automobile dependency, and restrain urban sprawl.

Urban planners often ask questions about parking requirements. The Planning Advisory Service of the American Planning Association (1991, 1) reports that it "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." Yet, to my knowledge, urban planning education offers students no instruction in how to set parking requirements.

Urban planning textbooks offer no help in learning to set parking requirements. Consider the four editions of *Urban Land Use Planning* by F. Stuart Chapin and his coauthors (Chapin 1957, 1965; Chapin and Kaiser 1979; Kaiser, Godschalk, and Chapin 1995). This distinguished text is considered the "bible" of urban land use planning, yet no edition mentions parking requirements. Neither do leading textbooks on urban transportation planning, such as Dickey (1983), Hanson (1995), Meyer and Miller (1984), and Papacostas and Prevedouros (1993). Planning education seems to ignore parking requirements.

I will argue that parking is the unstudied link between transportation and land use. Urban planners have made serious mistakes in dealing with parking, and I will show that these mistakes have distorted the markets for both transportation and land. I will conclude with a proposal to improve planning for parking, transportation, and land use.

Planners have diagnosed the parking problem in a way that makes it expensive to solve. Understanding the problem as too few parking spaces, planners require developers to provide more parking. But if the problem is too many cars rather than too few parking spaces, minimum parking requirements make the original problem even worse. The problem, however, is neither a shortage of parking nor an excess of

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cars. I will argue that the fundamental problem is free parking.

■ The Meager Empirical Base of Minimum Parking Requirements

Practicing planners use simple empirical methods to set minimum parking requirements. In one of the few attempts to explain how parking requirements are set, Robert Weant and Herbert Levinson (1990, 35, 37) say:

> Most local governments, through their zoning ordinances, have a parking supply policy that requires land uses to provide sufficient off-street parking space to allow easy, convenient access to activities while maintaining free traffic flow. The objective is to provide enough parking space to accommodate recurrent peak-parking demands. . . . For the purpose of zoning ordinance applications, parking demand is defined as the accumulation of vehicles parked at a given time as the result of activity at a given site.

In effect, planners count the cars parked at existing land uses, identify the highest number counted as peak demand (without consideration of price), and then require developers to supply at least that many parking spaces (without consideration of cost). Planning for parking is planning without prices.

The only source of data that systematically relates parking demand to land use is *Parking Generation,* published by the Institute of Transportation Engineers (ITE).[1] The ITE (1987) reports the "parking generation rate" for 64 different land uses, from airports to warehouses. The parking generation rate for each land use is defined as the average peak parking demand observed in case studies:

> a 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. . . . *The objective of the survey is to count the number of vehicles parked at the time of peak parking demand* (ITE 1987, vii, xv; emphasis added).

Half the reported parking generation rates are based on four or fewer case studies, and 22 are based on a single case study. The case studies do not refer to parking prices, but most parking must be free because the 1990 Nationwide Personal Transportation Survey found that parking is free for 99 percent of all automobile trips in the United States (Shoup 1995).[2] The ITE parking generation rates therefore measure the peak demand for free parking observed in a few case studies conducted in suburban locations with little or no public transit.

Planners often set minimum parking requirements higher than the ITE parking generation rates. For example, a survey of 33 cities in nine southeastern states found that parking requirements averaged 3.7 spaces per 1,000 square feet of office space, or 32 percent higher than the ITE parking generation rate of 2.79 spaces per 1,000 square feet (Polanis and Price 1991, 32). Similarly, a survey of 117 cities in California found that parking requirements averaged 3.8 spaces per 1,000 square feet of office space, or 36 percent higher than the ITE parking generation rate (Shoup 1995, 18).

The generous parking capacity required by planners often goes unused. Studying office buildings in ten California cities, Richard Willson (1995) found that the peak parking demand averaged only 56 percent of capacity. Gruen Associates (1986) found that peak parking demand at nine suburban office parks near Philadelphia and San Francisco averaged only 47 percent of capacity, and that no office park had a peak parking demand greater than 60 percent of capacity.[3] The Urban Land Institute (1982, 12) found that the recommended parking requirements for shopping centers provide a surplus of parking spaces for all but nineteen hours a year, and leave at least half of all spaces vacant for more than 40 percent of the time a shopping center is open for business.

Given the way planners predict parking demand, unused parking spaces are unsurprising. For example, an office building may first serve as a corporate headquarters with 300-square-foot offices for executives, and then be used by a telemarketing firm with 30-square-foot cubicles for telephone sales personnel. Fitting more employees into a building by reducing the office space per person can greatly increase parking demand. Surveying 57 suburban employment centers in the United States, Robert Cervero (1988, 26) found that building occupancies ranged from 0.5 to 6.0 persons per 1,000 square feet, with a standard deviation almost as large as the mean. Given this 12-fold range of possible building occupancy, how can urban planners predict the number of parking spaces any office building will need throughout its economic life?

Figure 1 shows a typical page from *Parking Generation* (ITE 1987, 44). It reports all the case studies of peak parking demand observed at non-convention hotels.[4] Given the variation in observed peak parking demand (ranging from 0.29 to 0.68 parking spaces per room), what is an urban planner to say when asked to set the minimum parking requirement for a hotel? The average peak parking demand is 0.52 spaces per room. To be safe, why not require 0.68 spaces per room, the highest demand observed? Maybe 0.75 spaces per room will appear less arbitrary. One space per room also looks plausible. In a recent survey, the

Planning Advisory Service (1991, 16) reports eight cities' parking requirements for hotels: two cities require 0.75 spaces per room, two require 0.9 spaces per room, and four require one space per room. In setting minimum parking requirements, planners seem to play it safe.

To help planners set parking requirements, the Planning Advisory Service (1964, 1971, 1991) has published three national surveys of parking requirements in zoning ordinances. These surveys tell planners only what other cities have required, not what they ought to require. According to the second survey (PAS 1971, 1):

> 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."

An Allegory: Collect Telephone Calls

To illustrate the problems caused by ubiquitous free parking, consider the problems that would arise if the charges were automatically reversed for all telephone calls. In this case the called parties, not the callers, pay for telephone calls. Also, telephone bills do not itemize individual collect calls, and the entire telephone bill is usually bundled into a property's mortgage or rent payment, without separate charge. No one seems to pay for telephone calls.[5]

The demand for telephone use skyrockets. To guarantee

Peak Parking Spaces occupied vs. **rooms**
On a **weekday**

PARKING GENERATION RATES

Average Rate	*Range of Rates*	*Standard Deviation*	*Number of Studies*	*Average Number of Rooms*
0.52	0.29-0.68	*	4	188

DATA PLOT AND EQUATION

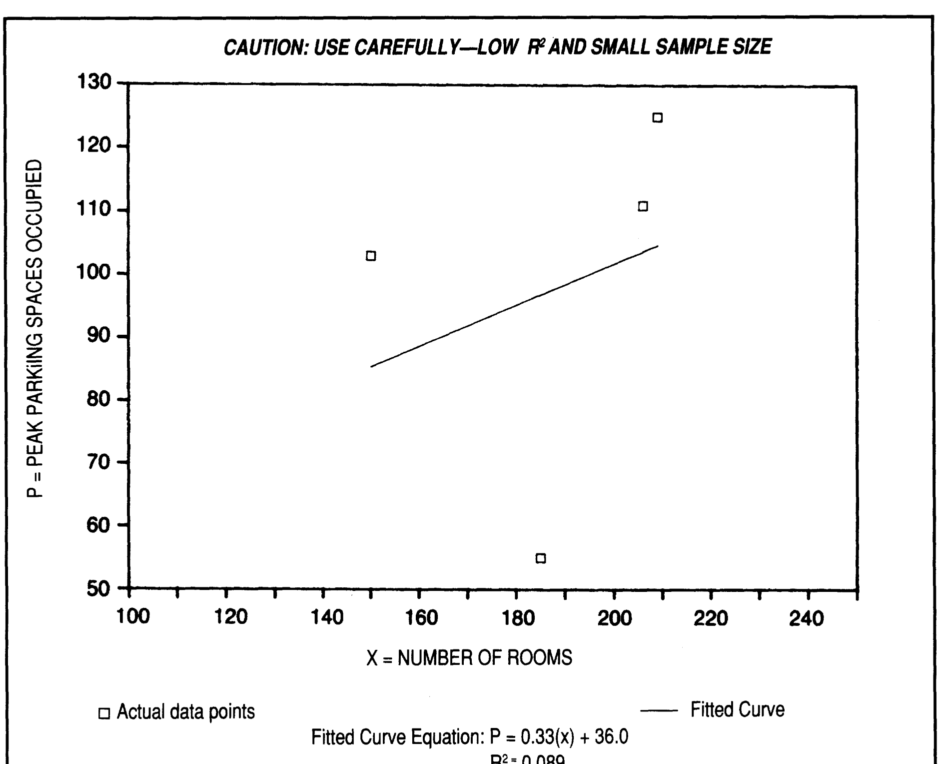

Figure 1. Parking generation by non-convention hotels. Source: Institute of Transportation Engineers (1987, 44).

urban development's capacity to accept all telephone calls without creating chronic busy signals, planners require each new building to provide a minimum number of telephone lines to handle the expected peak number of calls.

To set minimum telephone requirements, planners consult a "call generation rate" manual. Planners set specific telephone requirements for hundreds of individual land uses without considering the cumulative effects of the whole system of requirements.[6] Minimum telephone requirements differ wildly among cities, with no explanations asked or given.

The federal government inadvertently spurs peak-hour calling by excluding employer-paid telecommuting subsidies from employees' taxable income. Then, attempting to reduce solo telecommuting at peak hours, the federal government heavily subsidizes local mail service, spending more and more to carry a shrinking share of all communication. A telephone demand management (TDM) industry springs up.

Attempting to reduce congestion during peak hours, planners exempt the downtown from telephone requirements. Downtown developers provide free calling anyway, because ample free calling is available everywhere else. In desperation, planners impose downtown telephone caps.

The complications and expense are enormous. Now imagine that minimum telephone requirements also inflate housing prices, burden enterprise, and encourage urban sprawl. Excessive telephone use pollutes the air, depletes natural resources, and risks global warming. The problems are insoluble.

In reality, no one advocates ubiquitous collect telephone calls, but motorists *do* park free for 99 percent of all automobile trips. Minimum parking requirements have short-circuited the price system in the markets for both transportation and land, and they have created many unintended, but not unforeseeable, consequences. American transportation and land use would look very different today if parking had always been priced to cover its cost.

■ How Much Does a Parking Space Cost?

To introduce cost considerations into planning for parking, we can start by asking, "How much does a parking space cost?" This question has no simple answer, in part because the cost of land for a parking space depends on its location. There is one case, however, in which it is possible to make cost comparisons. When deciding whether to build a parking structure on a site previously used for surface parking, we can ask how much the structure will cost to build, and how many parking spaces it will add. In this context, the relevant question is, "*How much will each added parking space cost?*"

Because the land devoted to the structure's footprint could otherwise be used for surface parking, a parking structure adds fewer spaces than it contains. To illustrate the calculation of cost per space added, consider a 750-space parking structure built on the UCLA campus in 1980. The structure was built on a site that had provided 200 surface spaces. Although the structure contains 750 spaces, it added only 550 spaces to the parking supply. The construction cost was $10.5 million (in 1994 dollars). Therefore, each space added to the parking supply cost $19,000 ($10,500,000 divided by 550 spaces).

Calculating the cost per space added by a parking structure implicitly accounts for the opportunity cost of land by assuming the structure's site could otherwise be used for surface parking. In this calculation, the cost of land for a parking structure is the *number,* not the *value,* of surface parking spaces removed by the structure. Therefore, the market value of land does not determine the *cost per parking space added* by the structure, and we can meaningfully compare the cost per parking space added by parking structures built at different locations and times.[7]

■ The Cost per Parking Space Added

Little is known about the cost per parking space added by parking structures, perhaps because comparative data have not been available. Fortunately, such data are available for 12 parking structures built on the UCLA campus between 1961 and 1991. The construction contracts for all the structures were competitively bid, so the cost records are accurate and detailed, including the "soft" costs of planning and design. Using the method described above, I have estimated the cost of parking spaces added by these twelve parking structures. The UCLA Parking Service is one of the largest single-site parking systems in the nation, with 16,083 parking spaces in structures and 2,591 surface parking spaces.

Table 1 shows the estimated cost per parking space added by each parking structure.[8] The first two columns show the parking structure's name and year built. Column 3 shows the number of spaces in the structure. In total, 16,083 structured parking spaces were built. Column 4 shows the number of surface spaces lost as a result of building the structure.[9] In total, 2,992 surface spaces were lost. Column 5 shows the number of parking spaces added by each structure, obtained by subtracting the number of surface spaces lost from the number of spaces in the structure. Column 6 shows the original cost of each structure. In total, UCLA spent $111 million to build these twelve parking structures. Column 7 converts each structure's original cost into dollars of 1994 purchasing power by adjusting for construction cost inflation since the structure was built.[10] In 1994 dollars, UCLA spent $217 million to build these parking structures. Column 8 shows the original cost per space added by each parking structure. Column 9 converts this cost into 1994 dollars and answers the question, "How much does each added parking space cost?" For the 13,091 spaces added between 1961 and 1991, the average cost was $16,600 per parking space ($217,091,452 divided by 13,091).

Figure 2 shows the cost per space added by each parking structure, and it reveals a striking pattern. The average cost of structures built in the 1960s was $12,400 per space added, while the average cost of structures built since 1977

Year built (1)	Parking structure (2)	Spaces in structure (3)	Surface spaces lost (4)	Spaces added by structure (5)=(3)-(4)	Structure cost original $ (6)	Structure cost 1994 $ (7)	Cost per space added original $ (8)=(6)/(5)	Cost per space added 1994 $ (9)=(7)/(5)
1961	5	765	219	546	$ 1,091,122	$ 6,966,550	$ 2,000	$12,770
1963	14	1,428	355	1,073	$ 1,745,488	$10,476,589	$ 1,626	$ 9,760
1964	3	1,168	213	955	$ 1,859,001	$10,740,676	$ 1,946	$11,246
1966	9	1,800	298	1,502	$ 3,489,706	$18,520,065	$ 2,323	$12,327
1967	8	2,839	666	2,173	$ 6,060,753	$30,517,584	$ 2,789	$14,045
1969	2	2,253	323	1,930	$ 5,610,206	$23,908,098	$ 2,907	$12,389
1977	CHS	921	319	602	$ 7,083,893	$14,871,473	$11,762	$24,693
1980	6	750	200	550	$ 6,326,135	$10,568,750	$11,499	$19,210
1983	4	448	0	448	$ 8,849,000	$11,769,409	$19,752	$26,271
1990	1	2,851	346	2,505	$52,243,000	$59,705,071	$20,859	$23,839
1990	RC	144	53	91	$ 2,040,000	$ 2,331,381	$22,350	$25,542
1991	SV	716	0	716	$14,945,000	$16,715,805	$20,873	$23,346
Total		16,083	2,992	13,091	$111,343,304	$217,091,452		
Average 1961-1991		1,340	249	1,091	$ 9,279,000	$ 18,091,000	$ 8,500	$16,600
Average 1961-1969		1,709	346	1,363	$ 3,309,000	$ 16,855,000	$ 2,400	$12,400
Average 1977-1991		972	153	819	$15,248,000	$ 19,327,000	$ 18,600	$23,600

Table 1. *The cost of parking spaces added by 12 parking structures built at the University of California, Los Angeles, 1961-1991.*

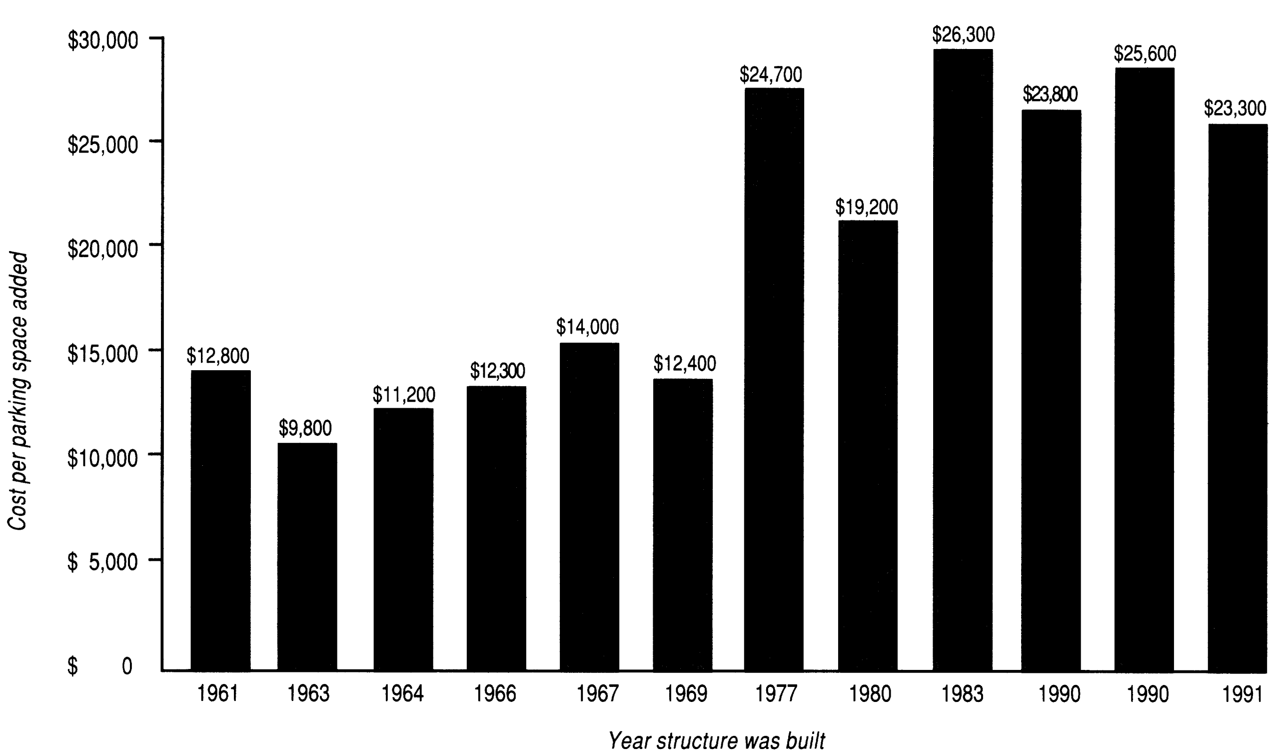

Figure 2. *The cost per parking space added by parking stuctures at the University of California, Los Angeles (1994$).*

was $23,600 per space added. After adjusting for construction-cost inflation, the spaces added since 1977 have cost almost twice as much as the spaces added in the 1960s.

The newer spaces are more expensive for two reasons. First, one structure (4) is entirely underground, and four structures (CHS, 6, 1, SV) are partially underground. Underground parking requires expensive excavation, fireproofing, ventilation, and dewatering. No underground spaces were built in the 1960s, but five of the six structures built since 1977 have some or all spaces underground.

Second, the newer structures are smaller. Smaller structures are more expensive because the fixed costs of ramps, elevators, and stairwells create economies of scale. The structures built since 1977 average 43 percent fewer spaces than the structures built in the 1960s. The one entirely aboveground structure (RC) built since 1977 is small (only 144 spaces) and expensive ($25,500 per space added).

The high cost of land does not *directly* explain the high cost of parking spaces added since 1977. In calculating the cost per space added, land for a parking structure is valued as the number of surface spaces lost, not the market value of these spaces. The high cost of land *indirectly* explains the high cost of recent parking spaces, however, because in recent years the scarcity of vacant land has led to more expensive methods of construction—underground or on small sites—that conserve land.[11]

The parking structures built at UCLA in the 1960s appear typical of the structures now built in suburban areas where vacant land is available, while the parking structures built since 1977 appear typical of those built in denser areas where vacant land is scarce.[12] The rise in the cost of building recent parking structures at UCLA thus reflects the higher cost of building parking structures in denser areas.

Table 2 puts the cost of a new parking space in perspective by comparing it with the price of a new car. Column 2 shows the original cost per space added by each structure (not indexed for subsequent inflation), taken from Column 8 of Table 1. Column 3 shows the average price of a new car purchased in the year the structure was built. Finally, Column 4 shows the ratio between the average cost of a new parking space and the average price of a new car.[13] Since 1977, the cost of a new parking space has averaged 155 percent of the price of a new car. Although few motorists may realize it, many parking spaces cost more than the cars parked in them.[14]

Year built (1)	Cost per parking space (2)	Average price of new car (3)	Space cost as % of car price (4)=(2)/(3)
1961	$ 2,000	$ 2,841	70%
1963	$ 1,626	$ 2,968	55%
1964	$ 1,946	$ 2,954	66%
1966	$ 2.323	$ 3,070	76%
1967	$ 2,789	$ 3,212	87%
1969	$ 2,907	$ 3,557	82%
1977	$11,762	$ 5,814	202%
1980	$11,499	$ 7,523	153%
1983	$19,752	$10,640	186%
1990	$20,859	$16,162	129%
1990	$22,350	$16,778	138%
1991	$20,873	$16,778	124%
Average 1961-1969			73%
Average 1977-1991			155%

Table 2. The cost of a new parking space compared with the price of a new car, 1961-1991.

■ The Monthly Cost of a Parking Space

The preceding calculations focused on the capital cost of new parking spaces. We can convert this capital cost into a monthly cost by assuming an amortization period and an interest rate.

UCLA's first parking structure, built in 1961, required extensive reconstruction in 1991. Most of the other structures built in the 1960s do not meet current design or earthquake safety standards. The structure built in 1963 may be demolished to redevelop the site, and the structure built in 1977 needs extensive repairs. A 50-year amortization period for a parking structure is therefore optimistic.

The original capital cost of each parking structure has already been converted into 1994 dollars. If future costs and revenues are also measured in 1994 dollars, it is appropriate to convert the capital cost into a monthly cost using the "real" interest rate (the interest rate after accounting for inflation), which is commonly assumed to be around 4 percent per year.

Payments of $91 per space per month (in 1994 dollars) for 50 years at 4 percent interest will amortize a capital cost of $23,600 per space (the average cost per space added by parking structures built since 1977).[15] The monthly equivalent of the $23,600 capital cost of a new parking space is thus $91 per space per month.

Parking structures also have operation and maintenance costs. The UCLA Parking Service spent an average of $33 per space per month for these functions in 1993-1994. This cost includes such items as cleaning, lighting, revenue collection, liability insurance, security, and maintenance.[16] The capital cost plus operation and maintenance cost of parking spaces added by the six parking structures built since 1977 is therefore $124 per space per month (see Table 3).

This cost may appear high, but is well below the market price of much parking in densely developed areas. A 1993

Assumptions	
Capital cost per space	$23,600
Amortization period	50 years
Interest rate	4 percent
Cost per parking space per month	
Capital cost	$ 91
Operating & maintenance	$ 33
Cost per space per month	**$124**

Table 3. *The monthly cost of a parking space (in 1994$).*

survey of 83 office buildings in downtown Los Angeles found that 78 percent charged more than $124 per space per month for commuter parking (Francis 1993). The average price per space was $174 a month, and the highest price was $302 a month.[17]

The estimate that recent parking spaces cost $124 per space per month is conservative, for the following reasons:

- Land is valued at its opportunity cost for surface parking, but a parking structure is built only when land is too valuable to use for surface parking.
- Land cost is calculated only for the structure's footprint, but a parking structure requires additional land for access roads and landscaped setback.
- No land cost is charged for underground parking structures, although they occupy valuable subterranean space that could be used for other purposes, such as storage and mechanical equipment.
- The operation and maintenance cost per space for parking structures is assumed to be the same as for the entire parking system (including surface lots) although parking structures have higher costs for elevators, lighting, ventilation, security, and maintenance than do surface lots.
- Property taxes are excluded because UCLA is a tax-exempt institution.
- Structures are optimistically assumed to have a 50-year life.
- The interest rate is only 4 percent per year.[18]

Given the compound conservatism of these assumptions, the six parking structures built since 1977 cost *at least* $23,600 per parking space added, or *at least* $124 per space per month.

■ Minimum Parking Requirements Compared to Impact Fees

Suppose the parking required for a new office building costs $23,600 per space. How would this affect the cost of real estate development, and should it affect the planning decision about how many parking spaces to require?

If one parking space costs $23,600, four parking spaces per 1,000 square feet of office space will add $94.40 per square foot to the cost of constructing an office building (4 x $23,600 divided by 1,000). The average cost of constructing an office building, excluding the cost of parking, is about $150 per square foot in Los Angeles.[19] Therefore, providing four parking spaces per 1,000 square feet of office space accounts for about 39 percent of the total cost of constructing an office building, including the parking.

The minimum parking requirement causes only part of this expense because most developers will provide some parking even if zoning does not require it. Nevertheless, each *additional* parking space per 1,000 square feet of office space adds $23.60 per square foot to the cost of constructing the office space. If a developer wants to provide three parking spaces per 1,000 square feet of office space, and the city requires four spaces per 1,000 square feet, the parking *requirement* adds $23.60 per square foot to the cost of constructing the office building.

The cost of required parking can be compared with municipal impact fees. For example, San Francisco levies a transit impact fee of $5 per square foot of new office space—the highest transit impact fee in the country—to subsidize the San Francisco Municipal Railway. If one parking space per 1,000 square feet of office building adds $23.60 per square foot to the cost of construction, providing one parking space per 1,000 square feet costs 4.7 times more than a transit impact fee of $5 per square foot.

Minimum parking requirements clearly resemble impact fees when cities allow developers to pay a fee in lieu of providing the required parking. Cities use the in-lieu fees to build municipal parking facilities, but do not dedicate the new parking spaces to the sites that pay the fees. Therefore, these fees in lieu of private parking are impact fees to pay for public parking.

Consider two examples of these parking impact fees. First, Palo Alto, California, requires four parking spaces per 1,000 square feet of office space, and charges an in-lieu fee of $17,848 per parking space not provided. The parking requirement and the in-lieu fee together are equivalent to a parking impact fee of $71 per square foot of office space (4 x $17,848 divided by 1,000). Developers who provide no parking must pay an impact fee of $71 per square foot of office space.

Second, Beverly Hills, California, requires one parking space per 350 square feet of retail space, and its in-lieu fees range from $15,135 to $25,225 per parking space not provided, depending on a project's location. The parking requirement and the in-lieu fees together are equivalent to an impact fee ranging from $43 to $72 per square foot of retail space.

How do these parking impact fees compare with other impact fees? A 1991 survey of impact fees in 100 American cities found that the average impact fee for all public services

combined (roads, schools, parks, sewers, flood control, and the like) was $6.05 per square foot of office space and $7.06 per square foot of retail space (Altshuler and Gómez-Ibáñez 1993, 40). Palo Alto's parking impact fee of $71 per square foot of office space is thus twelve times the average office-space impact fee for all other public services combined. Beverly Hills's parking impact fees of $43 to $72 per square foot of retail space range from six to ten times the average retail-space impact fee for all other public services combined.

Measured variable	Before Requirement	After Requirement	Change #	Change %
Construction cost per dwelling unit ($/dwelling unit)	$6,613	$7,805	+$1,192	+18%
Construction cost per square foot of dwelling ($/sq. ft.)	$10.63	$10.23	-$0.40	-4%
Housing investment per acre ($/acre)	$513,000	$412,000	-$92,000	-18%
Housing density (dwelling units/acre)	77	54	-23	-30%
Land value ($/acre)	$217,000	$145,000	-$72,000	-33%

Table 4. *The effects of requiring one parking space per dwelling unit in Oakland, Calif.*

Cities often base their in-lieu fees on the cost of providing parking spaces. Palo Alto bases its in-lieu fee of $17,848 per space on the city's construction cost per parking space added by parking structures. Lake Forest, Illinois, bases its in-lieu fee on the city's land-and-construction cost of $18,000 per parking space in surface lots. Walnut Creek, California, bases its in-lieu fee on the construction cost of a municipal parking structure built in 1994; this cost was $32,400 per parking space added. Until 1992, Beverly Hills based each development project's in-lieu fee on the land-and-construction cost per parking space in parking structures near the project site; between 1978 and 1992, this cost averaged $37,000 per space, and the highest cost was $53,000 per space (Shoup 1997).[20] These cities' cost of providing a public parking space suggests that the estimated cost of $23,600 per parking space added at UCLA is not unrealistic.

■ Minimum Parking Requirements Raise Housing Costs and Reduce Urban Density

The only research on how parking requirements affect housing shows that they raise housing costs, reduce urban density, and reduce land values. In 1961, Oakland, California, began to require one parking space per dwelling unit for apartment buildings. Brian Bertha (1964) collected data for 45 apartment projects developed in the four years before Oakland introduced the parking requirement, and for 19 projects developed in the two years after. Table 4 summarizes the changes caused by the parking requirement. After parking was required, the construction cost per dwelling unit rose by 18 percent, housing density fell by 30 percent, and land values fell by 33 percent.

Why did the minimum parking requirement cause developers to build fewer but more expensive apartments? According to Bertha (1964, 108-120):

> The zoning change made prior densities impossible without underground garages. . . . This increased the cost of development if the same density were to be achieved before and after the zoning change. . . . The developers interviewed stated that the increased pre-development land costs encouraged development of an apartment with a higher rent structure, and in order to be able to receive higher rents in the market, the developer tried offering the tenants larger units.

Oakland's requirement provided more parking, but it also increased the cost of housing and reduced density. The cost of parking a car was incorporated into the cost of renting an apartment, making cars more affordable and housing less affordable. Housing investment per acre fell by 18 percent after the parking requirement was imposed.

Richard Willson (1995, 37) estimated that increasing the parking requirement for an office building in Southern California from 2.5 to 3.8 spaces per 1,000 square feet would reduce density by 30 percent and land values by 32 percent. What Willson estimated *would* happen to density and land values in Southern California after increasing a parking requirement is almost exactly what *did* happen to density and land values after Oakland introduced a parking requirement (see Table 4).

Where land is cheap, the cost of surface parking will be low. If minimum parking requirements depress land values, however, the resulting value of the land is a poor guide to the cost of a surface parking space. That is, if the market value of land would be higher without minimum parking requirements, calculating the cost of a parking requirement by

referring to the market value of land subject to the parking requirement will understate the cost of required parking. Calculating the cost per space added by a parking structure, as in Table 1, avoids this understatement of cost (see Appendix).

To my knowledge, Bertha's and Willson's studies are the only attempts to estimate how parking requirements affect urban density and development cost. Planners everywhere are concerned with the questions of density and cost, especially housing cost. Nevertheless, planners have adopted minimum parking requirements with almost no attempt to assess the effects on density and cost. Had planners attempted such assessments, it is difficult to believe they would have found that minimum parking requirements do *not* reduce density and increase costs.

Minimum parking requirements create especially severe problems in older commercial areas. For example, parking requirements have hindered rebuilding of the retail corridors destroyed in the 1992 Los Angeles riots. These retail corridors have narrow parcels on which building a store *and* providing the required parking is difficult. As a result, much commercial land remains vacant, and adjacent neighborhoods lack retail services, even food stores (ConsumerQuest 1995).[21] In effect, planners consider no shopping better than shopping without ample free parking.

In many cases, form no longer follows function, fashion, or even finance. Instead, form follows parking requirements. Minimum parking requirements determine what can be built, what it looks like, and how much it costs. Minimum parking requirements have transformed many residential streets into garagescapes where the only obvious way to enter a building is with an electronic garage-door opener. Courtyard housing—the traditional California bungalow court—is now a historic style that cannot be replicated with today's parking requirements. Planners initially designed parking requirements to serve buildings. Architects now design buildings to serve the parking requirements.

Cities rarely reduce the parking requirements for low-income housing, although lower-income households own fewer cars. On average, households with incomes below $10,000 a year own only one car, while households with incomes above $40,000 a year own 2.3 cars. In total, 10.6 million households do not own a car (Pisarski 1995, 3-24). Among ethnic groups, 8 percent of non-Hispanic white households, 19 percent of Hispanic households, and 30 percent of African-American households do not own a car (Pisarski 1996, 36).[22] Nevertheless, everyone pays for minimum parking requirements.

Minimum parking requirements increase housing costs only when they require more spaces than the market would otherwise provide. But minimum parking requirements would be pointless if they did not require more spaces than the market would otherwise provide. Ubiquitous anecdotal evidence from architects and developers suggests that, if permitted, the market would often provide far fewer parking spaces than zoning requires. Further, minimum parking requirements have inflated expectations about how many parking spaces a building ought to have. If the market had always provided parking only when it was profitable (just as the market provides cars and gasoline only when it is profitable), everyone would now expect fewer parking spaces.

By increasing the supply and reducing the price of parking, minimum parking requirements reduce the cost of automobile ownership. We have adapted our patterns of automobile ownership to ubiquitous free parking, so parking demand is now much higher than if minimum parking requirements had never existed. Ubiquitous free parking helps to explain why the United States now has more motor vehicles than licensed drivers (Pisarski 1996, 32-33).[23]

Zoning further increases the parking supply if it requires "replacement parking" when new development removes existing parking spaces. With a replacement parking requirement, developers must not only provide the parking spaces normally required for a new land use, but must also replace any existing parking spaces removed even if zoning never required this parking.[24] Replacement parking requirements further increase the cost of new buildings, beyond the cost of meeting the normal parking requirement.

Minimum parking requirements also reduce the value of existing buildings. Suppose a building meets the requirement of one parking space per 1,000 square feet for a furniture store. The furniture store goes out of business, and a bicycle repair shop wants to use the vacant building. Because the parking requirement for a bicycle repair shop is three spaces per 1,000 square feet, and the building has only one space per 1,000 square feet, the bicycle shop cannot obtain an occupancy permit.[25] Minimum parking requirements thus reduce the flexibility of existing buildings, stymie adaptive reuse, and stifle enterprise.

Minimum parking requirements may be urban planners' most costly intervention in the land market, with the most serious consequences. Nevertheless, planning education has ignored minimum parking requirements. When considered as impact fees, minimum parking requirements impose staggering costs on urban development and provide large subsidies for cars. How large is this subsidy for cars?

■ Minimum Parking Requirements Subsidize Cars

To suggest how much free parking subsidizes cars, we can compare the cost of providing free parking at work with the price that commuters pay for driving to work. If a parking space costs $124 a month (as estimated in Table 3), and a commuter works twenty-two days each month, a parking space at work costs $5.64 a day. A commuter who parks free in this space therefore receives a parking subsidy of $5.64 a day (see Table 5).[26]

The national average round-trip commute distance by car

is 20.8 miles (Hu and Young 1992, 24). Given this distance, a parking subsidy of $5.64 a day is worth 27 cents per mile driven. In 1994, the average new car's variable operating cost (for gasoline, oil, maintenance, and tires) was 9.2 cents per mile driven (AAMA 1994, 56).[27] In this case, the subsidy for free parking *at* work is triple the vehicle operating cost for driving *to* work.[28]

For the average commute of 20.8 miles, the vehicle operating cost for driving to work is $1.91 a day (20.8 x 9.2 cents). The driver's variable cost of automobile commuting is $1.91 a day if the driver parks free, or $7.55 a day if the driver pays for parking ($1.91 + $5.64). The cost of parking is therefore 75 percent of the variable cost of automobile commuting. In this case, the driver's variable cost of automobile commuting *without* free parking is quadruple this cost *with* free parking.

Nationwide, 91 percent of all workers in the United States commute by automobile; 95 percent of all automobile commuters park free at work; and 92 percent of all automobiles driven to work have only one occupant.[29] Therefore, when planners base minimum parking requirements on the peak number of parked cars observed at worksites, they are in effect basing these requirements on the peak demand for free parking. Minimum parking requirements thus provide large subsidies for parking, which in turn inflate both parking generation rates and trip generation rates. Nevertheless, when setting parking requirements, planners rarely consider how the resulting parking subsidies will influence the demand for parking and the demand for vehicle trips.

■ The Demand for Minimum Parking Requirements

Minimum parking requirements act like a fertility drug for cars. Why do urban planners prescribe this drug? One explanation is that planners are not exercising professional judgment, but are simply responding to political pressure. People want cars, and they need to park them somewhere. Minimum parking requirements would not have flourished if citizens, developers, and politicians had rejected them. Urban planners are not so influential that they could impose an expensive, irrational system of parking requirements on an unwilling public.

In opening the Pandora's Box of minimum parking requirements, planners found a popular land use regulation. In 1946, a survey of 76 cities found that only 17 percent had off-street parking requirements in their zoning ordinances. Five years later, 70 percent of these same cities had off-street parking requirements or were in the process of adopting them.[30] Has any other land use regulation ever spread so quickly?

In 1944, the Los Angeles County Planning Commission concluded, "While the parking requirements of a particular store or office building will vary, there seems to be an irreducible minimum requirement of parking space equal in area to the retail floor or business area."[31] That is, more than 50 years ago, planners in Los Angeles had decided that cities should provide at least as much space for parked cars as for stores and offices.

Parking subsidy per month (1994)	$124/month	*(Table 3)*
Working days per month	22 days	
Parking subsidy per day	$5.64/day	*($124/22)*
Round trip to work	20.8 miles	*(1990 NPTS)*
Parking subsidy per mile driven	27¢/mile	*($5.64/20.8)*
Automobile operating cost per mile driven (gas, oil, maintenance, tires)	9.2¢/mile	*(1994 AAMA)*
Parking subsidy/automobile operating cost	2.9	*(27¢/9.2¢)*

Table 5. The subsidy for parking at work compared with the cost of driving to work.

In their influential book, *Zoning and Traffic,* Edward Mogren and Wilbur Smith (1952, 37) asserted the "need to base zoning requirements for off-street parking on *maximum possible* building usage and increased automobile travel rather than on normal building usage and present automobile travel factors" (italics in the original). Mogren and Smith (1952, 27) quote one delighted mayor as saying, "We consider zoning for parking our greatest advance . . . It is working out exceptionally well, far better than we had expected. In brief, it calls for all new buildings to make ample provision for parking space required for its own uses."

Minimum parking requirements were a great advance because they solved a classic "commons" problem. Everyone realizes that if curb parking is free (a commons), and if buildings do not provide enough off-street parking to serve their own uses, curb parking will quickly become congested. Garrett Hardin used curb parking to illustrate the commons problem in his famous essay on "The Tragedy of the Commons." Hardin (1968, 1245) says that in Leominster, Massachusetts:

> During the Christmas shopping season the parking meters downtown were covered with plastic bags that bore tags reading: "Do not open until after Christmas. Free parking courtesy of the mayor and city council." In other words, facing the prospect of an increased demand for already scarce space, the city fathers re-instituted the system of the commons.

Thomas Schelling (1978, 111) explains, "The commons has come to serve as a paradigm for situations in which

people so impinge on each other in pursuing their own interests that collectively they might be better off if they could be restrained, but no one gains individually by self-restraint." Planners use zoning to solve the curb-parking commons problem by requiring developers to increase the parking supply by as much as they increase parking demand. The problem is how to estimate parking demand.

Economists using precise data have difficulty estimating demand because they estimate it as a function of price (a demand curve). Yet planners using crude data estimate the parking demand for hundreds of different land uses. How do they do it? Planners pull the sword from the stone by making the (unstated) assumption that all parking is free.

Estimating demand presents problems even when parking *is* free. For example, in a survey of 66 cities, the PAS (1971) found 609 different parking requirements for 83 land uses. Table 6 shows the parking requirements for funeral parlors,

Parking spaces required	# of cities requiring
1 per 100 sq. ft	3
1 per 200 sq. ft	1
1 per 250 sq. ft	1
1 per 100 sq. ft + 1 per dwelling unit	1
1 per 100 sq. ft or 1 per 6 seats	1
1 per 5 seats or 1 per 35 sq. ft. seating area + 1 per 400 sq. ft other areas	1
1 per 3 seats	1
1 per 4 seats	1
5 + 1 per 5 seats in largest chapel	1
1 per 6 seats in chapel	1
1 per 3 seats + 1 per funeral vehicle	1
1 per 4 seats + 1 per funeral vehicle + 1 per employee	1
1 per 5 seats + 1 per funeral vehicle + 1 per dw. unit	1
1 per 25 sq. ft. of parlor area	1
1 per 50 sq. ft. of parlor area	4
3 per parlor	2
4 per parlor	1
5 per parlor	3
15 + 5 per parlor over 3 parlors	1
5 per parlor or 1 per 4 seats	1
5 per parlor + 1 per funeral vehicle	2
8 per parlor + 1 per funeral vehicle	9
10 per parlor + 1 per funeral vehicle	4
5 per parlor + 1 per funeral vehicle + 1 per family	1
5 minimum	1
30 minimum	1
1 per 4 persons of design capacity	1
No specific requirements	19
TOTAL	66

Table 6. Minimum parking requirements for the afterlife (funeral parlors). Source: Planning Advisory Service (1971, 36).

a land use that raises the question of how many parking spaces to require per—per what? With no theory to guide them, and no training to prepare them, planners required parking spaces for funeral parlors in proportion to chapels, dwelling units, employees, families on premises, funeral vehicles, parlor area, parlors, persons of design capacity, seats, seats in chapel, seats in largest chapel, square feet, square feet of seating area, and square feet of other areas. The 66 cities had 27 different requirements, and 20 cities had a unique requirement. Each requirement, taken alone, might appear plausible. The many different requirements for the same land use, however, raise grave doubts about minimum parking requirements.

Minimum parking requirements for other land uses also vary widely. Studying minimum parking requirements in 49 cities in the San Francisco Bay Area, Cook et al. (1997) found that parking for hospitals was required in proportion to beds, doctors, employees, gross floor area, and patients. The parking required for a specific hospital (336,430 gross square feet, 228 beds, 106 doctors, and 455 other employees) in the 49 cities ranged from 29 to 1,682 spaces (a ratio of 58/1). The variation in population density among the cities explained only 1.3 percent of the variation in the required parking.

While most cities require a minimum number of parking spaces, a few cities restrict the maximum number of parking spaces allowed. For an office building in the central business district, for example, Los Angeles requires five times more parking spaces than San Francisco allows. For an auditorium in the CBD, Los Angeles requires 50 times more parking spaces than San Francisco allows.[32] It is as if, for the same disease, one physician prescribed bloodletting, while another prescribed blood transfusion. What is the patient to think?

Minimum parking requirements arose from the vision of a world with ample free parking. Parking requirements have legislated this vision into reality because every new building must correspond to the vision, no matter how much it costs. Parking requirements hide the cost of parking by bundling it into higher housing prices, higher consumer prices, lower urban density, and lower land values. Everyone but the motorist pays for parking.

Because planners base minimum parking requirements on the peak demand for free parking, the result is usually a surplus of parking spaces, which explains why motorists can park free for 99 percent of all automobile trips in the United States. Minimum parking requirements provide subsidies that inflate parking demand, and this inflated demand is then used to set the minimum parking requirements.[33] Because of this circular reasoning, free parking dictates the design of urban development. Minimum parking requirements that meet the peak demand for free parking are, in reality, free parking requirements.

Parking requirements in zoning ordinances implicitly assume that cars and people come in fixed proportions. The

requirements are often stated in parking spaces per person—for example, per barber, beautician, clergyman, client, dentist, doctor, employee, inmate, mechanic, nun, patron, resident, salesperson, student, teacher, or tennis player (PAS 1971, 1991). Zoning ordinances thus specify the ratio of cars to people with the (unstated) assumption that all parking is free.

Minimum parking requirements have severed the link between the cost of providing parking and the price that motorists pay for it. The cost of providing parking has ceased to influence most decisions about whether to own or use a car. Because motorists pay nothing for parking, they own and use cars as if parking costs nothing, and traffic congestion results. When citizens object to congestion, planners restrict new development to reduce traffic. That is, minimum parking requirements force development to subsidize cars, and planners must then limit the density of development (and of people) to limit the density of cars. Free parking has become the arbiter of urban form, and cars have replaced people and buildings as zoning's real density concern.

Where minimum parking requirements produce more parking than motorists would demand if parking were priced to cover its cost, the city becomes less compact and more automobile friendly. Some will say that the resulting automobile dominance arises from market choices revealing consumers' preferences. Nevertheless, minimum parking requirements prescribed by urban planners have also helped to automobilize America. Planners supposedly base parking requirements on parking demand, but they act as if this demand were immaculately conceived.

Urban planners have no analytic basis for requiring parking in proportion to land use. The hapless urban planner who must foretell the parking need for every land use resembles the Wizard of Oz. At the end of L. Frank Baum's (1903, 148, 160-161) story, Dorothy's little dog, Toto, knocks over the screen hiding the Wizard, who confesses, "I have fooled everyone so long that I thought I should never be found out. . . . [but] how can I help being a humbug when all these people make me do things that everybody knows can't be done?"[34]

An Alternative to Minimum Parking Requirements

Urban planners require developers to supply enough off-street spaces to satisfy the peak demand for parking, so that new buildings will not cause a spillover problem. Elsewhere I have argued that the failure to supply ample off-street parking does not cause the spillover problem (Shoup 1992, 1994, 1995). Instead, the failure to charge market prices for scarce curb parking causes the spillover problem.

If curb parking were priced to create vacancies (the way commercial operators price off-street parking), any increase in demand for the fixed supply of curb spaces would increase their price, and shortages would not occur. Cities could eliminate minimum parking requirements, and they would receive the market value of spillover parking as curb parking revenue.

To make this pricing solution politically viable, I have previously proposed creating "parking benefit districts," which are like existing residential permit parking (RPP) districts except that *nonresidents* can pay to park at the curb, and the curb parking revenue is used to finance public services for residents in the neighborhood where it is collected (Shoup 1995, 23-26). For example, nonresidents' payments for curb parking can be used to repair sidewalks, plant street trees, or put overhead utility wires underground. Even at modest prices for nonresidents' parking, curb parking revenue can easily exceed the existing property tax revenue in many neighborhoods.

At the simplest level, cities might create parking benefit districts by selling to nonresidents a few "daytime" permits to park in existing RPP districts. Neighborhoods near commercial developments often establish RPP districts so that commuters' cars will not congest their curb parking. An RPP district is a minor but real inconvenience for the residents, who must buy permits for their own cars and deal with the restrictions for their guests' cars. RPP districts can create a high vacancy rate for curb parking in residential neighborhoods, while nearby commercial developers must build expensive parking structures for commuters. In this situation, a city might sell two or three daytime RPP permits per residential block to commuters and use the resulting revenue to eliminate charges for the residents' own permits.

If, as calculated earlier, a parking space costs $124 a month to provide, selling RPP permits to nonresidents can generate substantial revenue. For example, Los Angeles charges residents $15 a year per car for permits in RPP districts. One nonresident permit at a price of $100 a month ($1,200 a year) can replace the residents' payments for 80 cars. One nonresident permit can more than replace the median property tax on a single-family house ($922 a year) in the United States.[35]

Parking benefit districts can create a symbiotic relationship between parking generators and their nearby neighborhoods, because any spillover parkers will be paying guests. Market prices allocate cars and gasoline, and market prices can allocate parking spaces just as easily. Because curb parking prices can be set to yield any desired vacancy rate, pricing can solve any spillover parking problem.

Parking benefit districts would grant to neighborhoods a valuable, income-earning property—curb parking spaces. As a result, residents would begin to see curb parking through the eyes of a parking lot owner. Charging nonresidents for curb parking would be politically acceptable not because everyone has been convinced that paying for parking is good

public policy, but because residents want the revenue to improve their own neighborhoods. The reciprocal nature of the payments—you pay to park in my neighborhood, but I pay to park in your neighborhood—should help to make paying for parking seem fair.

If curb parking revenue disappears into the city's general fund, parking meters will have few friends. Curb parking revenue needs the appropriate territorial claimant—its neighborhood—before the neighborhood's residents will want to charge market prices for curb parking spaces.

The real justification for off-street parking requirements is the constraint that curb parking is free. Aaron Wildavsky (1979, 59) described this situation perfectly: "Constraints are not mere obstacles, but are opportunities asking (daring, pleading) to be shown how they can be overcome." Planners invented minimum parking requirements when charging for parking was difficult, and curb parking was a commons.[36] Requiring new development to provide ample off-street parking made sense. But charging for parking is easy now, and public concern has shifted to problems that minimum parking requirements make worse, such as traffic congestion and air pollution.

Charging for curb parking does not require a meter at every parking space. Besides selling daytime permits, many European and a few American cities use several inconspicuous ways to collect curb parking revenue, such as multispace and in-vehicle parking meters.[37] These revenue collection technologies can resolve any aesthetic or practical objections to charging for curb parking.

Emancipated from minimum parking requirements, land and capital will shift from parking to uses that employ more workers and pay more taxes. The option to build without providing parking will encourage adaptive reuse of older buildings, and infill development on sites where providing parking is difficult. It will also encourage land uses that rely on pedestrian and transit access, and that offer shopping opportunities for nearby neighborhoods. Land uses with fewer parking spaces will generate fewer automobile trips, another desirable feature for nearby neighborhoods.

Eliminating parking requirements will not produce benefits overnight. The long-term benefits will occur only after the supply and demand for parking have adjusted to user-paid prices that cover the full cost of providing parking spaces. Nevertheless, residents who (collectively) own and profit from curb parking should quickly come to welcome nearby development that has little off-street parking, because it will increase the demand for what they sell to nonresidents—curb parking.

Curb parking revenue could also fund business improvement districts (BIDs) formed to revitalize commercial areas. The increases in parking meter revenues occurring after formation of a BID could be dedicated to finance the BID, just as tax increment finance dedicates to redevelopment projects the subsequent increases in property tax revenues. Because curb parking revenue would finance the BIDs' activities, "parking increment finance" would not only encourage formation of BIDs, it would encourage a more businesslike attitude toward managing curb parking. To increase revenues, a BID could install additional parking meters, extend meter hours, or increase meter rates. These actions would encourage parking turnover, so that more curb spaces would be available to short-term parkers. Because the city would continue to receive the "base" meter revenues, parking increment finance would not cost the city anything.

Pricing curb parking to create vacant spaces, and using the revenue to pay for public services, can put into practice the precepts of Henry George (1879), who advocated taxing land rent to pay for public services. Parking benefit districts would use land rent to pay for public services, but the rent would come from publicly owned land, not from taxes.

To illustrate the differences between minimum parking requirements and parking benefit districts, suppose you were advising a developing country on how to solve the parking problems caused by rapidly increasing automobile ownership. You might recommend either minimum parking requirements or parking benefit districts.

Minimum parking requirements will increase the supply and reduce the price of parking. Cheaper parking will increase the demand for automobiles and gasoline, thus increasing oil imports, traffic congestion, and air pollution. The cost of parking will be hidden in higher housing costs and lower urban density. Cheaper parking will discourage travel by foot, bicycle, and mass transit.

Parking benefit districts will let the market determine the supply and price of parking. Market-priced parking will restrain the demand for automobiles and gasoline, thus reducing oil imports, traffic congestion, and air pollution. The cost of parking will be conspicuous rather than hidden. Market-priced parking will encourage travel by foot, bicycle, and mass transit. The revenue from curb parking will finance neighborhood public improvements, such as sewers and sidewalks.

Which would you recommend?

■ Conclusion: First, Do No Harm

Recent parking structures built at UCLA have cost *at least* \$23,600 per parking space added, or *at least* \$124 per space per month. These estimates were made with a host of conservative assumptions, including a low interest rate, a long amortization period, and no taxes. If the assumptions were less conservative, the cost would be higher. But the cost of parking at UCLA is not the important point here. The important point is that parking spaces can be expensive, and that planners ignore this cost in setting minimum parking requirements.

Because cities have a parking requirement for every land use, one would expect to find many other studies of how

much parking spaces cost, and therefore of how much parking requirements cost. If such studies have been done, I have been unable to find them.

Even if parking spaces elsewhere cost only half as much as calculated here, minimum parking requirements still raise the cost of development and reduce the cost of owning cars. This sounds unwise, and it is. Minimum parking requirements are a hidden tax on development to subsidize cars. If urban planners want to encourage housing and reduce traffic, why tax housing to subsidize cars?

My aim in calculating the cost of parking may seem more critical than constructive. Information on cost does not help planners in setting parking requirements because planners rarely consider cost in setting parking requirements. Nevertheless, the high cost of free parking should provoke analysts to examine the two strange assumptions—that parking is free to motorists and that the cost of providing required parking is irrelevant—lying behind the question practicing planners ask, year after year, more often than any other: *How many parking spaces should we require?*

Minimum parking requirements have imposed planners' judgments over an important link between transportation and land use. I have tried to show that the planners' judgments are profoundly mistaken. Historian Daniel Boorstin (1962, 259) says, "To know our disease, to discover what we suffer from, may itself be the only possible cure." Misunderstanding the disease, planners have disastrously misdiagnosed the parking problem as not enough parking spaces, and have prescribed minimum parking requirements as the cure. I have argued that the disease is ubiquitous free parking.

Free curb parking is the tail that wags the dog of minimum parking requirements. In turn, minimum parking requirements based on free parking have dangerously distorted the markets for both transportation and land. The distortions created by minimum parking requirements thus stem from the initial public mismanagement of curb parking. Planning for parking needs a paradigm shift, from off-street parking requirements (which misallocate scarce resources and produce urban sprawl) to pricing curb parking (which can allocate resources efficiently and produce public revenue).

Minimum parking requirements work against almost every goal of urban planners—except the goal of preventing parking spillover. They increase the cost of urban development, degrade urban design, burden enterprise, promote automobile dependency, and encourage urban sprawl. If curb parking were properly priced, the market could easily regulate the number of parking spaces. Eliminating minimum parking requirements would reduce the cost of urban development, improve urban design, unburden enterprise, reduce automobile dependency, and restrain urban sprawl.

I do not advocate ceasing to plan for parking. Instead of regulating the number of parking spaces, planners can focus on the many other dimensions of parking that affect the public: curb cuts, landscaping, layout, location, parking guidance, pedestrian access, provisions for the handicapped, setback, signage, stormwater runoff, and visual impact. In other words, planners can focus on the quality of parking, not the quantity. Properly pricing curb parking and eliminating minimum parking requirements will greatly improve urban transportation, land use, and life.

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Appendix

Land Value Implied by Construction Cost per Parking Space Added

The construction cost per space added by a parking structure reveals the break-even land value at which building a parking structure becomes cost-effective. Table 1 shows the construction cost per space added by each of the 12 parking structures built at UCLA between 1961 and 1991. Table 7 uses these estimated costs per space added to calculate the break-even land value (in 1994 dollars) implied by the decisions to build the structures.

In Table 7, the implied land value per surface space lost for each structure (Column 3) is the same as the structure's cost per parking space added (Column 2). These two figures are equal because the break-even land value equates the cost of adding spaces by building a structure to the cost of adding spaces by using more land for surface parking.

Dividing the break-even land value per surface parking space by the number of square feet per parking space gives the more common measure of land value per square foot.[38] Column 4 shows these break-even land values (expressed in 1994$).

In the 1960s, the break-even land value implied by the decision to build the structures ranged from $30 to $43 per square foot. Since 1977, the break-even land value implied by the decision to build the structures ranged from $58 to $80 per square foot.

How do land prices near UCLA compare with the break-

Year built (1)	Cost per parking space added (2)	Land value per Surface space (3)=(2)	Land value per Square foot (4)=(3)/329
1961	$12,770	$12,770	$39
1963	$ 9,760	$ 9,760	$30
1964	$11,246	$11,246	$34
1966	$12,347	$12,347	$37
1967	$14,045	$14,045	$43
1969	$12,389	$12,389	$38
1977	$24,693	$24,693	$75
1980	$19,210	$19,210	$58
1983	$26,271	$26,271	$80
1990	$23,839	$23,839	$72
1990	$25,542	$25,542	$78
1991	$23,346	$23,346	$71

Table 7. *Land value implied by the cost per parking space added (in 1994 dollars).*

even land values for these structures? Accurate land prices are difficult to obtain, but a comparable price exists for the two structures completed in 1990. The break-even land values for these two structures were $72 and $78 per square foot. These values imply that a parking structure was cheaper than surface parking if land was worth more than $78 per square foot.

In 1988, a four-acre site near the UCLA campus was sold at a price of $241 per square foot.[39] If land costs $241 per square foot, building the two parking structures was cheaper than buying more land for surface parking (which is not to say that the two parking structures were good investments).

This market price of $241 per square foot of land implies that the construction cost per space added *by* these two parking structures underestimates the total cost per parking space *in* the structures. In calculating the cost per space added, land is implicitly valued at only $72 or $78 per square foot, but the market price of land was at least three times higher. If the land devoted to these two structures is valued at $241 per square foot, the average land plus construction cost becomes $30,600 per space in the larger structure, and $45,400 per space in the smaller structure.

Price of Parking Compared with Cost of New Parking Spaces

How does the price charged for a parking permit compare with the capital cost of a new parking space? Table 8 shows this comparison. Column 3 shows the cost per space added by each structure, expressed in current dollars of the year of construction (from Column 8 in Table 1). Column 4 shows the price the UCLA Parking Service charged for an annual campus parking permit in the year the structure was built. Finally, Column 5 shows the ratio between the price of a parking permit and the capital cost of a new parking space.

In the 1960s, the price of a parking permit averaged 3 percent of the capital cost of a new parking space. Since 1977, the price of a parking permit has averaged only 1 percent of the capital cost of a new parking space.

Parking fees must also pay for operation and maintenance costs, as well as the capital cost, so the net operating revenue derived from a new parking space would be even less than 1 percent of its capital cost. Obviously, the net operating revenue from new parking spaces did not finance their capital cost. Where did the subsidy necessary to finance each new parking structure come from? It came from raising the price of parking in all the previous structures and in the remaining surface lots. The deficit created by each new parking structure was financed by raising the systemwide price, which always remained far below the marginal cost of new parking spaces. This form of cross-subsidy is common in public enterprises that charge a price to cover average cost, not marginal cost.

During the past 20 years, the share of all UCLA students on the "waiting list" for a parking permit ranged between 1 percent (in 1991) and 17 percent (in 1981), with an average of 11 percent of all students waiting for a parking permit. The unsatisfied student demand for parking permits created intense pressure to build new parking structures. The Parking Service repeatedly responded to the excess demand created by its low average-cost price for parking by (1)

Year built (1)	Cost per space added (3)	Price of annual permit (4)	Permit price as % of space cost (5)
1961	$ 2,000	$ 50	2%
1963	$ 1,626	$ 50	3%
1964	$ 1,946	$ 72	4%
1966	$ 2,323	$ 72	3%
1967	$ 2,789	$ 72	3%
1969	$ 2,907	$ 84	3%
1977	$11,762	$108	1%
1980	$11,499	$108	1%
1983	$19,752	$180	1%
1990	$20,859	$384	2%
1990	$22,350	$384	2%
1991	$20,873	$468	2%
Average 1961-1969			3%
Average 1977-1991			1%

Table 8. *Parking prices compared with parking space costs.*

adding more spaces at a high marginal cost and (2) then raising all prices to cover the resulting deficit. The price charged for parking was always far below what was necessary to finance new capacity. Because every new parking structure was subsidized, every new parking structure led to an increase in all parking prices.[40]

■ Notes

1. In a survey of planning directors in 144 Southern California cities, Richard Willson (1996) asked how they established minimum parking requirements. The most frequent response was "survey nearby cities," and the second most frequent response was "ITE Handbooks."
2. For all automobile trips made on the previous day, the 1990 Nationwide Personal Transportation Survey (NPTS) asked 48,000 respondents, "Did you pay for parking during any part of this trip?" Ninety-nine percent of the 56,733 responses to this question were "No." This question was asked only for automobile trips that did not end at home, so free parking at home did not bias this response upward.
3. "Parking capacity" is not a wholly unambiguous concept. Valet parking and stack parking can increase capacity by parking cars in tandem and in access aisles, thus substituting labor for land and capital in providing parking spaces. Requirements for a minimum number of *parking spaces* eliminate the option to substitute labor for land and capital in providing what is ultimately consumed, which is *parked-car-hours*.
4. Four observations may seem too few to estimate a parking generation rate, but half of the ITE parking generation rates are based on four or fewer observations.
5. With free parking, the locations that motorists visit must finance the cost of providing the parking. With collect telephone calls, the locations called must finance the cost of telephone calls. Because parking is free for 99 percent of all automobile trips in the United States, it is as if 99 percent of all telephone calls were to 800 numbers.
6. PAS (1991) gives the parking requirements that have been specified for bait shops, diet clinics, houseboats, junkyards, landfills, locksmiths, pawn shops, sawmills, stockyards, taxi stands, and 168 other land uses. For example, one city's parking requirement for a taxi stand is "one space for each employee on the largest working shift, plus one space per taxi, plus sufficient spaces to accommodate the largest number of visitors that may be expected at any one time" (PAS 1991, 25).
7. Because a parking space is a well-defined unit of real estate, and because the cost per space added by a parking structure does not include the market value of land for the structure's footprint, the cost per space added by a parking structure should vary less among different locations than do most other real estate costs.
8. One atypical structure is excluded from the list. This "demountable" structure was prefabricated and intended for removal (and reassembly elsewhere) at a later date. It was placed on a portion of Lot 32, remote from the main campus, and its appearance would not be acceptable on the main campus. In regard to its location, Bob Hope said, "It takes four years to get through UCLA, or five if you park in Lot 32."
9. Surface parking lots at UCLA occupy a total of 851,725 square feet of land and contain 2,591 parking spaces, for an average of 329 square feet per surface space (including access lanes). Therefore, each structure's footprint was divided by 329 square feet to estimate the number of surface spaces lost. No surface spaces are assumed to be lost for underground parking structures.
10. To estimate the increase in the cost of construction since each parking structure was built, the 20-city average of the *ENR* Construction Cost Index for June 20, 1994, was divided by the average *ENR* Construction Cost Index for the year in which the parking structure was built. This ratio was then multiplied by the original construction cost to yield the construction cost expressed in dollars of 1994 purchasing power.
11. The high cost of construction in Los Angeles can explain only a small part of the high cost of adding recent parking spaces at UCLA. The *ENR* Construction Cost Index for Los Angeles in 1994 was only 15 percent above the median Construction Cost Index for the 20 cities.
12. In case studies of suburban office developments in Southern California, Willson (1995, 39) found "the average combined land and construction cost for structure parking in the case study sites was $12,300 per space." This cost is almost identical to the average cost of $12,400 per parking space added by the suburban-style parking structures built at UCLA in the 1960s. Building a new suburban-style parking structure at UCLA might still cost only $12,400 per parking space added.
13. Data for the average price of a new car are taken from the *AAMA Motor Vehicle Facts and Figures '93* and from earlier editions of the same publication.
14. In the 1960s, the cost of a new parking space averaged 73 percent of the price of a new car. Parking spaces have remained the same (or become smaller) since the 1960s, while the quality of new cars has improved significantly, but a new parking space more than doubled in cost when compared with the price of a new car.
15. Varying the assumptions about a parking structure's lifespan and the interest rate will affect the equivalent monthly capital cost per parking space. For example, with a 4 percent interest rate, a 30-year life raises the monthly cost per space to $113, while a 100-year life reduces it to $80. With a 50-year life, a 3 percent interest rate reduces the monthly cost per space to $76, while a 5 percent interest rate increases it to $107.
16. This figure excludes the cost of $3 per space per month for enforcement, which is allocated to a separate budget. It also excludes the overhead administrative cost of the Parking Service.
17. Validated and employer-paid parking reduce the price of parking to zero for many drivers. Therefore, the high posted prices for parking in downtown areas are evidence more of the cost of providing parking than of the price that drivers pay for it.
18. Revenue bonds that finance parking structures at UCLA bear interest rates of 6.1 percent, 8.25 percent, and 7.74 percent, and a variable rate that can float between 4 percent and 9 percent. These are all tax-exempt interest rates; taxable bonds issued to finance commercial parking structures will bear higher interest rates. Revenue bonds are secured by the revenues of the entire parking system (including surface spaces), not by the revenues of the particular parking structure financed by a bond. Thus, the revenue bonds can be a safe investment for the lender even if the investment in a new parking structure is risky for the Parking Service. The appropriate risk premium for investment in a single structure is therefore higher than implied by the interest rates on existing Parking Service bonds.
19. The average cost of $150 per square foot refers to Class A, steel-framed office buildings. This figure includes construction cost, tenant improvement costs, and "soft" costs such as financing, insurance, and real estate taxes during construction, but excludes the cost of parking. This figure was supplied by the Los Angeles County Assessor. The total cost per square foot, including the cost of four parking spaces per 1,000 square feet, is $244.40 ($150 + $94.40). The cost of parking is 39 percent of the total construction cost ($94.40 divided by $244.40).
20. In 1992 Beverly Hills shifted its in-lieu fees to a uniform schedule of fees that depend only on the project's location.
21. In a survey of more than 1,000 residents who live near properties damaged by the riots, the overwhelming request was for grocery stores (ConsumerQuest 1995).
22. The 1990 NPTS reports the distribution of vehicle ownership by household income (Pisarski 1995). The 1990 Census reports the distribution of households that do not own a car (Pisarski 1996).
23. Pisarski (1996, 32-33) reports that in the 1980s the number of vehicles in the United States increased by 23 million while the number of households increased by 11 million, and that there are now more vehicles than licensed drivers. Estimating how minimum parking requirements now increase the parking supply above what individual developers voluntarily provide will seriously underestimate how the whole system of minimum parking requirements has increased the total parking supply above what an unregulated market would provide.
24. In Los Angeles, for example, the Westwood Village Specific Plan states, "If a project results in the removal of any parking spaces which existed at the time this Ordinance became effective and which do not serve an existing building or buildings, 50% of such parking spaces shall be replaced and shall be in addition to the number of spaces otherwise

required for the project or for any existing building or buildings on any other lot or lots. Replacement parking shall be made available for public use" (Los Angeles City Ordinance 164.305, effective January 30, 1989).

25. These are the minimum parking requirements for furniture stores and bicycle repair shops in Hillsborough County, Florida (PAS 1991). Why a bicycle repair shop needs three times more parking spaces than a furniture store is anyone's guess.
26. Some commuters will be absent from work, so more commuters can be offered parking than there are spaces. On the other hand, a parking system operates most efficiently with a vacancy rate of between 5 and 15 percent. The absentee rate found in parking studies is typically between 5 and 15 percent, so these two factors are assumed to cancel each other.
27. If the operating cost is 9.2 cents per mile, driving a car 25 miles an hour consumes fuel at a rate of $2.30 an hour. Where parking costs more than $2.30 an hour, driving a car is cheaper than parking it.
28. We can also compare the subsidy for parking at work with the gasoline tax for driving to work. In 1994, the average new car's fuel efficiency was 28.1 miles per gallon (AAMA 1994, 83). The average round-trip commute distance by car is 20.8 miles, so the average commute in a new car consumes 0.74 gallons of gasoline a day. If the parking subsidy is $5.64 a day, and the commute consumes 0.74 gallons of gasoline, the parking subsidy at work equals $7.61 per gallon of gasoline consumed by the commute to work ($5.64 divided by 0.74 gallons). In this case, free parking at work reduces the cost of driving to work by as much as a gasoline tax of $7.61 per gallon would increase it.
29. The 1990 NPTS found that 91 percent of commuters travel to work by automobile (Hu and Young 1992, 22), and that 95 percent of all automobile commuters park free at work (Shoup 1995, 14). The 1990 Census found that 92 percent of automobiles driven to work have only one occupant (Pisarski 1996, 49). In contrast, a 1996 survey found that fewer than 1 percent of employers offer commuters any transit benefits (Association for Commuter Transportation, 1996, 26). Shoup and Breinholt (1997) found that employers in the United States provide 85 million free parking spaces for commuters.
30. When non-respondents are eliminated from the 1951 survey, 81 percent of cities had or were adopting parking requirements; there were no non-respondents in the 1946 survey (Mogren and Smith 1952, 29).
31. "Business Districts," Los Angeles Regional Planning Commission, Los Angeles, California, 1944; quoted in Mogren and Smith (1952, 33). This "irreducible minimum" parking requirement is approximately three parking spaces per 1,000 square feet of retail and office space.
32. For office buildings in the CBD, Los Angeles requires a minimum of one parking space per 1,000 square feet, with no maximum. San Francisco allows parking spaces equal to a maximum of 7 percent of building area (0.2 spaces per 1,000 square feet if a parking space occupies 350 square feet), with no minimum. For auditoriums in the CBD, Los Angeles requires a minimum of ten parking spaces per 1000 square feet, with no maximum. San Francisco allows parking spaces equal to a maximum of 7 percent of building area, with no minimum.
33. In a survey of planning officials of 144 Southern California cities, Richard Willson (1996) asked "Why does your city have minimum parking requirements?" The most frequent response was the circular explanation "to have an adequate number of spaces."
34. In the 1939 film version, Toto pulls aside a curtain to reveal the Wizard, who roars "Do you presume to criticize the Great Oz?" and looks suspiciously like a planner setting parking requirements. Even the phrase "setting parking requirements" misleadingly implies the possession of special skills, expertise, or technical ability, such as for calibrating a finely tuned instrument. Given the haphazard nature of the process, perhaps planners merely "establish" or "impose" parking requirements.
35. See *Statistical Brief*, SB/93-5. Washington, D.C.: U.S. Bureau of the Census, May 1993.
36. Columbus, Ohio, introduced the country's first minimum parking requirement in 1923, and Oklahoma City introduced the first parking meters in 1935 (Witheford and Kanaan 1972). The Reverend C.H. North was the first motorist cited for overstaying a parking meter's time limit; his novel excuse that he "had gone to get change" persuaded the judge to dismiss the citation (*Allright Parking News* 1985, 5).
37. Shoup (1992, 1994, 1995) describes new technologies to collect curb parking revenues without using conventional parking meters.
38. Because the average surface parking space on campus occupies 329 square feet of land, the implied value of land for surface parking is thus the land value per surface space lost divided by 329 (see endnote 9).
39. A large R-5 residential site near campus was sold for $504 per square foot of land in 1989. Several small commercial sites in Westwood Village adjacent to the campus have also been sold at prices above $241 per square foot of land in recent years. Therefore, a price of $241 per square foot of land seems conservative. This information was supplied by the Los Angeles County Assessor.
40. The parking system was also subsidized because it was not charged anything for its use of land. The market solution, typically advocated by economists, is to charge a price for parking that covers the marginal cost of adding parking spaces, and then build new spaces only when there is excess demand at the price that covers this marginal cost. If price equals marginal cost, and marginal cost is above average cost, the difference between price and average cost will yield a rental return to land.

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