

Safeguarding Suburban Mobility

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ABSTRACT

The suburban office boom of the past decade has flooded the outskirts of many metropolitan areas with unprecedented traffic, leading to major tie-ups that previously afflicted only downtown motorists. Some have forewarned that suburban congestion could become the dominant transportation issue in the late 1980s and 1990s. The congestion threat posed by rapid office growth on the metropolitan fringes is examined in this paper. The focus is on the roles of design, land use, and transportation management toward safeguarding suburban mobility. A national survey showed that extremely low densities and detached designs have rendered many new suburban office parks almost entirely dependent on the automobile. The absence of onsite consumer services, such as restaurants, as well as gross imbalances in the siting of jobs and housing along most suburban corridors have further reinforced workers' preferences for solo commuting. Some private-sector initiatives have been encouraging, notably ridesharing incentive programs, flextime work schedules, and cofinancing of needed infrastructure. Ordinances requiring developers to introduce such programs have also been enacted in several places around the country. Overcoming numerous institutional and logistical obstacles to traffic management in suburbia, however, remains a lofty, though not insurmountable, challenge.

Many American cities have witnessed an explosion of new office construction on their outskirts. Low-lying, campus-style projects are popping up in areas that only 10 years earlier were inhabited by cows and fruit groves. Combined with shopping malls, recreational theme parks, new subdivisions, and other mammoth land developments, outlying office centers are permanently reshaping the landscapes of suburban America.

The rapidity of suburban office development has been staggering. More than 80 percent of all office floor space in America's suburbs has been built since 1970 (1). By comparison, only 36 percent of all downtown office buildings have been built during the past 15 years. In some areas of the country, a tripling of current suburban office inventories has been projected by the century's end.

Although examples of the suburban office boom can be found almost anywhere, new construction has been particularly feverish on the fringes of rapidly growing sunbelt and western metropolises such as Atlanta, Dallas, Denver, Houston, and Orange County, California. Along Denver's southeast I-25 corridor, for example, a stretch dotted with office, high-technology, and business-executive parks, more office space has been produced than in all of downtown Denver (2). The suburban share of annual office construction in the Denver region has erupted from just 15 percent in 1970 to 73 percent in 1981 (1).

Even more mature eastern U.S. cities are undergoing visible suburban facelifts. In New York City, for example, the number of Fortune 500 firms headquartered in Manhattan dropped from 136 in the late 1960s to 65 in 1984 (3). Many have fled to neighboring Stamford, Connecticut, White Plains, New York, and Bergen County, New Jersey. By the late 1980s, more prime office space will exist in northeastern New Jersey than in midtown Manhattan (4).

The mobility implications of these recent trends are profound. As jobs continue to scatter along the urban fringes, regional commutersheds are taking on

amoeba-like forms, fanning out as much as 100 mi in places such as Houston, Los Angeles, and San Francisco. No longer does the dominant commute pattern resemble the radial spokes of a wheel focused on a downtown hub. Rather, trips are becoming increasingly dispersed and crosstown in direction. In 1980, for example, more than 40 percent of all metropolitan work trips in the United States were suburb-to-suburb, compared with 20 percent between a suburb and central city (5). All signs point to a continued dispersal of regional trip-making in the future (6). Remarks one observer: "If present trends continue, suburban mobility--or rather the growing lack thereof--may well become the central transportation issue of the late 1980s" (7, p.285).

The scope of mobility problems brewing along many of America's urban fringes is examined in this paper. It draws on interviews of office developers as well as a 1984 survey of property managers from 120 of the nation's largest suburban office complexes. The 120 responses represent nearly 40 percent of 310 questionnaires sent out to managers of complexes with one-half million or more square feet of office floor space. Around two-thirds of the office centers surveyed were already completed whereas the remaining one-third were at varying stages of completion. Among the projects surveyed, the average office park had a labor force of 9,985 employees (standard deviation = 17,460), and contained 2.43 million ft² of floor space (standard deviation = 5.25 million), on a land parcel of 230 acres (standard deviation = 335 acres). Although difficult to generalize because of considerable sample variation, mammoth developments on the fringes of some of the largest metropolitan areas in the United States were largely captured in the survey.

DESIGN AND LAND USE CONSIDERATIONS

Project Scale and Density

The physical layout and land use composition of outlying office developments directly defines the kinds

of traffic conditions that will exist, including the relative ease of site access, and even the modal preferences of employees commuting to and from work. Reasonably dense clusters of suburban employees are essential if public transit, private commuter buses, and carpools are to assemble trips without excessive route deviations and time delays. Although the service features of transit and vanpools, along with population densities at the residential ends of trips, are equally important, site design is the one area developers have direct control of.

Almost without exception, employment and land use densities of suburban business complexes fall far below those of their central business district (CBD) counterparts. The data in Table 1 reveal that, on average, floor area ratios (FARs), which is the gross floor space divided by total land area, for suburban office developments are roughly 1/25 of downtown FARs. This obviously reflects the difference in massing of CBD versus suburban office structures--downtown buildings usually reach towering heights on relatively small plots of land, whereas buildings in suburban office parks are typically low-rise on generous size land parcels. Within buildings themselves, suburban office employees generally enjoy twice as much elbow room as downtown workers: on average, around 380 ft² of gross floor space per worker in the suburbs versus 175 to 200 ft² in downtown settings. Thus, not only are downtown buildings much taller, but floor-by-floor use is more intense. The mammoth scale of most suburban office spreads is reflected in the final density measure given in Table 1. Generally, there is more than 30 times as much land area per worker in suburban versus downtown office settings, indicating that the advantages of space available to the worker at suburban workplaces are even greater once outside the building. In short, suburban office structures are much closer to the ground, as well as more spacious and remote, which results in extremely low employment densities.

Clearly, most contemporary office developments are predestined for automobile use. Particularly in the case of sprawling office parks where liberally spaced, horizontally scaled buildings dominate the landscape, the private automobile faces no serious competition to speak of. Where inwardly focused buildings stand adrift in a sea of surface parking, the pedestrian invariably faces long, laborious distances.

The overarching theme of recent suburban office park designs has been shaped less by utilitarian principles than by plain and simple aesthetics. Most developers hope that the emphasis on landscaping, spaciousness, and visual amenities will tip the scales in their favor in luring widely sought tenants, such as high-technology firms. Strict zoning codes and covenants only serve to reinforce the low-rise, wide setback profiles of most suburban office projects.

Building high-density, more village-like workplaces could go a long way toward attenuating the automobile's dominance in suburban work settings. Similarly, grouping buildings into community clusters, each well connected by walkways, trails, and plazas, could allow developers to maintain moderate densities while also encouraging nonvehicular circulation.

Current low-profile, physically fragmented office parks are by no means locked into this form in perpetuity. In several instances, sprawling complexes have been converted to denser, community designs over incremental phases. One notable example is the Denver Technological Center. This expansive 850-acre compound, first built in the early 1960s, has been transformed into a village-like development by architecturally integrating buildings using extensive walkways and traditional urban squares. Over time, the Technological Center's developers have proceeded to raise early suburban densities of FAR 0.25 to more urban densities of 1.0 to 2.0 (10). All future buildings will range from 4 to 24 stories, configured around campus clusters. Through a new design template, the Technological Center's metamorphosis from a suburban office spread to a fully integrated urban village has allowed it, in the words of the developer, to "survive and regenerate" (10).

Transportation Design Features

In addition to project scale and layout considerations, certain design treatments, such as the provision of convenient transit shelters and preferential parking, can influence the travel choices of suburban commuters. Although by themselves, such design details might appear to be trivial, their collective influences on mode choice can be equally important as more macrolevel design decisions.

One prominent feature of suburban office complexes is the abundance of free on-street parking. Currently, the average suburban office development provides 3.9 spaces per 1,000 ft², roughly one space per employee. A common practice is to overbuild parking beyond code requirements as a marketing strategy (11,12).

Providing bountiful, free parking can nevertheless be a costly proposition. A single parking space consumes roughly 350 ft² of real estate, and can cost from \$1,500 to \$3,000, including land (11). With today's liberal standard of nearly one space per worker, suburban parking lots can actually consume as much area as the buildings they serve. Sprawling lots also create long walking distances to building entrances, not to mention the isolating, patulous effects they have on building placements and access to street-side pathways and transit stops. The general rule of thumb for the maximum

TABLE 1 Comparison of Suburban and CBD Office Density Characteristics

	Suburban Office Complexes ^a			CBD Range ^b	Approximate Difference Ratio of Suburbs to CBD
	Average	Low	High		
Floor area ratio ^c	0.29	0.06	1.48	5.0-10.0 (varies widely)	0.04:1
Floor space per employee (gross ft ²)	380	140	970	175-200	2:1
Total land per employee (ft ²)	1,410	230	3,360	35-50	33:1

^aBased on a national survey of 120 suburban office developments.

^bSee References 8 and 9 for sources.

^cFloor area ratio represents gross floor space of all buildings divided by the total land area of the office development.

acceptable walking distance from a parking spot to an office's front door is about 300 ft. The national survey of 120 office parks revealed that in most cases walking distances tend to be far below this maximum: for more than two-thirds of the parks, average walking distances from parking lots to building entrances were under 100 ft, and for 95 percent of them, distances were shorter than 200 ft.

As an inducement to ridesharing, some suburban office developers set aside the most convenient parking spaces for carpools and vanpools. From the national survey, approximately 40 percent of all large-scale business parks currently offer preferential parking. On average, approximately 7 percent of all stalls are reserved for carpools and vanpools at these complexes, and the mean walking distance to building entrances for preferred parkers is slightly more than 50 ft.

Equally convenient terminuses for buses should also be designed into suburban work centers. Based on the national survey, around one-quarter of all suburban office parks currently have some type of onsite transit amenity, ranging from specially designated transit drop-off zones to the provision of plexiglas-covered bus shelters. The siting of convenient bus stops is particularly important if transit users are to receive a fair shake in relation to motorists. To date, they have not fared particularly well. From the survey, average walking distances between main building entrances and onsite bus stops are approximately 480 ft, more than 4 times as far as the average motorists has to walk. For office parks without any onsite transit services, the average walking distances from the nearest off-premises bus stop to the main building entrance is nearly two-thirds of a mile, roughly 30 times farther than most motorists have to walk. In a number of office park settings, access to offsite bus stops has been confounded by the presence of residential soundwalls, freeway interchanges, and other physical barriers. Overall, it is apparent that transit has been relegated by design to second-class status in many suburban work settings.

Land Use and Tenant Mix Considerations

Commuting practices of suburban office employees are influenced by more than just the immediate built

environment. What takes place both inside and outside the physical confines of suburban office complexes, in terms of both land use and tenant mixes, usually affects worker commuting habits even more.

Over the past several decades, city planners have embraced the principle of land use mixing as a way of both enriching working and living environments and cutting down on vehicular trip-making. Opportunities for walking or cycling to work are greatly enhanced for employees who choose homes built either within or near an office or mixed-use compound. Jobs-housing balancing, then, is a potentially powerful means of safeguarding suburban mobility.

Currently, few suburban work centers in the United States have onsite housing. From the national survey, slightly less than 15 percent of suburban complexes with predominantly office functions have residential units for sale or lease on their premises. However, more than two-thirds of the survey respondents indicated that new housing construction was expected nearby, and approximately 62 percent believed that "a large amount" of housing already existed within 2 mi of their office site. Thus, many suburban office park settings could be characterized as having onsite provisions for housing, yet ample supplies close by. According to interviews, the overwhelming majority of suburban office developers believe that they have no responsibility for either building housing onsite or nearsite; rather, the general attitude appears to be that the marketplace will respond to the housing needs of office workers.

Nonetheless, there are a few outstanding examples of suburban office-housing intermixing. Table 2 gives 11 of North America's largest suburban office complexes that plan to have at least 1,000 or more residential units on their premises at buildout. Some of these projects, such as the City Post Oaks and South Coast Metro, represent large-scale, mixed-use complexes (7). These megacenters typically contain mid- to high-rise buildings along with massive concentrations of office workers and large resident populations

Some outlying communities have taken the integration of jobs and housing quite seriously. Costa Mesa, California, for example, requires developments such as the South Coast Metro (Table 2) to build residential units, either onsite or within the city limits, to house at least 20 percent of its workers. So far, 1,200 garden-style townhouse units have been

TABLE 2 Characteristics of Major North American Mixed-Use Office Developments at Buildout

Project and Metropolitan Area	Total Project Housing Units		Total Project Floor Space (%)				Total Project Floor Space in Millions of Square Feet	Total Acreage	Mileage to Regional CBD
	Undetached Multifamily	Detached Single Family	Office ^a	Retail	Housing	Other ^b			
Los Colinas Urban Center, Dallas	4,000	1,000	55	10	10	25	11.7	960	15
Denver Technical Center, Denver	4,750	250	85	5	5	5	40.0	850	10
City Post Oak, Houston	6,000	0	70	14	8	8	30.0	1,200	6
The Woodlands, Houston	2,500	4,500	58	5	16	21	4.1	2,000	27
Playa Vista, Los Angeles	8,000	0	25	40	12	23	8.2	926	20
South Coast Metro, Los Angeles/Orange County	1,200	0	72	17	4	7	21.0	2,240	36
Warner Center, Los Angeles	4,000	0	61	23	8	8	7.6	1,100	25
Opus 2, Minneapolis	1,000	0	80	3	10	7	6.0	560	20
Harmon Meadows, New York/Newark	2,600	0	72	5	18	5	7.5	550	10
Chesterbrook, Philadelphia	3,400	370	20	3	56	21	5.5	995	17
Scarborough Town Centre, Toronto	4,000	500	54	20	17	9	5.5	330	15

Source: 1984 survey of office developments

^aOffice category includes traditional office, light industrial, and research and development (R&D) uses.

^bOther category includes hotel, recreational, and institutional uses.

built within South Coast Metro. In other areas, however, there has actually been a public backlash against commingling housing and jobs in suburbia. In the Bay Area, for instance, developers of several large business parks were prohibited from constructing any housing onsite after areawide residents vehemently protested, fearing their neighborhood's image as a strictly zoned, upscale community would be tarnished.

Perhaps even more important than integrating homes and offices within a compound is the strategic balancing of jobs and housing at the subregional level, that is, providing enough homes within a 5-mi or more radius of all major employment centers. In many suburban areas, jobs and housing are in an alarming state of disequilibrium. Imbalances are particularly glaring around some of the nation's fastest growing suburban work centers. The ratio of employees to dwelling units stands at roughly 3:1 in Irvine and Santa Clare-Cupertino, California, 7:1 for City Post Oak, Texas, and 10:1 for the Westchester-El Segundo corridor of west Los Angeles, all of which have experienced phenomenal office growth over the past decade.

Clearly, the onus lies at the subregional level for balancing jobs and housing. Some progress has been made to date in coordinating both housing and job development. Both Costa Mesa and Santa Ana, California, for example, index incremental increases in allowable office and industrial floor space to housing availability. In both places, building permits for industrial and office construction are conditioned on adequate housing being provided for area workers.

Regardless of how many carrots or sticks are used to achieve equanimity in jobs and housing, there can be no guarantees that either average commuting distances will shrink or workers will begin abandoning their automobiles as a consequence. For one, although a numerical parity might be struck in a particular community, it will not necessarily be the case that those working in the municipality will occupy available in-town residences. At one suburban Los Angeles mixed-use megacenters, for instance, a recent survey conducted by project managers indicated that less than 10 percent of all residents living onsite or within several blocks of a complex actually worked there. It might very well be the case that some workers simply prefer a change of environment from where they spend their daylight hours to where they retire for the evening. Moreover, it is not clear that in cases in which housing has been provided onsite or nearby, that workers, many of whom earn clerical wages, can afford to purchase available units even if they wanted to. Finally, jobs-housing integration might also backfire by discouraging ridesharing and transit use. Building plentiful housing within a 3- to 5-mi zone of suburban office parks might result in commuting distances that are too far to walk or cycle, yet too close to efficiently organize carpools. Conceivably, the vehicle-miles traversed each day by 1,000 workers who live within a 5-mi radius of work and solo commute could exceed those of 1,000 coworkers who live 20 to 30 mi away and pool together in vans.

The need for fusing together suburban land use goes beyond job-housing integration. Unless restaurants, shops, and the like, are also sited close to employment centers, most suburban office workers will find it necessary to drive their own cars in order to access lunchtime destinations and run midday errands. From the national survey, the average distance from the geographic center of today's suburban office complexes to the nearest offsite retail establishment is 1.5 mi, clearly too far to walk during the normal 1-hr lunchbreak. Only a half dozen

or so of the nation's largest suburban office complexes presently circulate shuttle buses between their complexes and nearby retail areas. Thus, the overwhelming majority of suburban office workers have to drive their own cars if they want to go anywhere at midday.

In recognition of the need to provide onsite consumer services, many suburban developers have begun integrating retail uses and ancillary functions into their projects. The national survey revealed that 42 percent of the largest office complexes currently have some supplementary retail or service function. By far, the most frequent type of onsite consumer function is eateries (40 percent of all respondents), ranging from formal restaurants to small delis. Other common onsite commercial activities include: convenience retail stores (17 percent of respondents), financial services such as banks (13 percent of respondents), assorted customer services such as gas stations (12 percent of respondents), and consumer merchandise shops such as clothiers (11 percent of respondents). Some of the larger-scale, mixed-use suburban work centers are given in Table 2.

THE ROLE OF SUBURBAN TRAFFIC MANAGEMENT PROGRAMS

Today a mixed bag of public programs and private initiatives are being pursued in the battle to stave off suburban traffic congestion. In contrast to the design and land use planning strategies just discussed, these efforts aim to change commuting preferences of suburban commuters and to creatively finance needed infrastructure. Programs that seek to modify travel demand typically involve the initiation of transportation system management (TSM) strategies, such as ridesharing and flextime programs. Financing programs, on the other hand, are generally supply-side and encompass both cooperative public or private cofunding, as well as legislative mandates to pay for subregional roadway improvements. As noted in the next paragraph, numerous obstacles (some social and institutional, others contextual), limit the effectiveness of many traffic management and funding programs in suburbia.

Before discussing the types of traffic management programs underway, current transportation supply and demand characteristics of suburban office complexes should be mentioned. Among the U.S. office developments surveyed, either controlled-access freeways or major four-lane arterials provided the primary access linkage to two-thirds of office parks' main entrances. Almost one-half of the office developers indicated a major freeway nearby, regardless of whether or not it served as the main thoroughfare leading into their complex. Around two-thirds of the respondents described current rush hour conditions on nearby roadways as either moderately or heavily congested. Nearly one-quarter believed traffic was fairly light, whereas 9 percent believed no access or circulation problems existed. Overall, it appears that as of the mid-1980s, most suburban office park settings are operating at tolerable congestion levels during peak hours, somewhere between 85 and 95 percent of roadway capacity. Because nearly one-third of the surveyed complexes have yet to reach buildout, and the vast majority expect higher future employment levels both onsite and nearby, traffic conditions can only be expected to worsen over time in many of these settings.

Transportation Management Associations and Ridesharing

Transportation management associations (TMAs), are effective coalitions for dealing with the knotty

access problems found at many suburban work centers, especially ones that have poor transit services. Most associations, anywhere from 5- to 75-employer voluntary members strong, engage in a wide range of activities including: promoting ridesharing through computerized matching services, purchasing fleets of vans for employee pooling, underwriting internal shuttle services, financing areawide street improvements, and lobbying for suburban highway interests.

Despite the wide attention TMAs have received in transportation literature in recent years (13,14), according to the survey, only an estimated 4 percent of all large suburban office complexes nationwide currently support such programs. These complexes are found mostly in large suburban megacenters and areas that have critical masses of workers rather than along corridors with multiple small-scale office projects where they are often needed the most. Indeed, the cumulative traffic impacts of numerous loosely organized office and retail centers can be every bit as troublesome as large-scale megacomplexes. Among those developers currently involved with TMAs, the overwhelming majority believe their projects are more marketable as a result.

The most common activity of suburban-based TMAs is ridesharing coordination, although there are many more cases of individual employer-sponsored ridesharing campaigns. According to the survey, approximately 16 percent of large-scale office developments currently have some form of formal carpooling or vanpooling program. The majority of these have designated an employee as program coordinator, though most coordinators spend fewer than 10 hr per week on ridesharing matters. Statistically, the presence of a coordinator appears to be making a difference. The estimated share of employees pooling to work among all surveyed office parks was slightly less than 5 percent. Among those with coordinators, admittedly a small subsample, the share was 11 percent.

As discussed previously, the detached layouts and sheer enormity of many suburban office parks have discouraged ridesharing in many instances. Where few onsite consumer services, such as restaurants and banks, are available, the chances of successful ridesharing are even slimmer. The fear of being stranded without a car during midday is indeed one of the biggest deterrents to ridesharing in suburban work settings. A recent survey of 2,500 employees at the mixed-use South Coast Metro in Costa Mesa, California, for example, found that 45 percent needed their cars for personal reasons and 83 percent needed them to conduct business at least once a week. One way around this vehicular dependency problem would be to make company cars and idle vans available to rideshare participants during midday. To date, no TMA has sponsored such a floating vehicle program.

Transit and Other Market Strategies

Conventional fixed-route bus services are even less competitive with the private automobile in suburban office settings than vanpools. Densities on both residential and employment ends of suburban transit routes are often too low to make even a slight difference in areawide traffic conditions. In 1980, for example, while 8.0 percent of all 1980 journeys to work in U.S. metropolitan areas were via public transit, for commute trips made within suburbs the figure was only 1.6 percent (15).

For transit to realistically compete in sprawling suburban environs, major service reforms are called for. In light of the trend towards cross-haul commuting, radial downtown-oriented routes should, where possible, be converted into grid networks that use office parks, shopping malls, and other activity

nodes as timed-transfer points. Perhaps even more important, flexible forms of mass transportation need to be fully exploited, such as shared-ride taxis and private buspools (16).

Allowing workers to arrive and depart at different times of the workday could help to spread out the rush hour crunch experienced along many suburban corridors. National survey results indicate that nearly 40 percent of all large suburban office developments have some form of modified work schedules: flextime, staggered work hours, or multiple work shifts. One of the more impressive programs is at the massive Warner Center mixed-use complex in the Los Angeles San Fernando Valley where over 3,000 employees of two large insurance companies presently enjoy flextime privileges. At both places, shifts begin and end every 15 min, from 6:00 to 9:00 a.m. and from 3:00 to 6:00 p.m. Surveys show that, given the chance, many workers have opted to arrive before the usual rush hours, take shorter lunch breaks, and leave work early, thereby accruing extra prime time daylight hours in the afternoon for themselves. However, several other suburban businesses around the country have scuttled their flextime programs because their office functions were considered highly time-interdependent.

Traffic Impact Ordinances

The threat of suburban gridlock has prompted an expanding roster of municipalities and county governments to introduce legislation aimed at either reducing vehicular trips or shifting funding responsibilities for roadway improvements to the private sector. Three major fronts of activity have been (a) trip reduction ordinances, (b) impact fee ordinances, and (c) parking reduction ordinances.

Trip Reduction Ordinances

These ordinances hold developers and employers to a stipulated phasedown in the percentage of solo automobile trips made to their establishments. They have been primarily passed in rapidly developing suburbs of California, including Placer County, Costa Mesa, and Pleasanton, although nearly two dozen other communities nationwide are seriously considering such legislation (4). To date, the most comprehensive, far-reaching trip reduction ordinance enacted is the one enacted in Pleasanton. Partly in response to concerns about the rapidly sprouting Hacienda Business Park, one of the largest office compounds nationwide, the city of Pleasanton passed the ordinance requiring all employers with 50 or more persons to institute various TSM programs, such as ridesharing, in order to trim peak trips by 45 percent, assuming that all workers would normally drive alone (17). Companies failing to comply with any parts of the ordinance would be subject to fines of \$250 per day.

Table 3 gives both the advantages and disadvantages of the trip reduction approach. Compared to traffic impact programs, trip reduction ordinances grant employers a fair degree of latitude in dealing with their own specific mobility problems. These ordinances usually also apply to all large employers, and not just to the tenants of new developments. Because everyone is generally "in the same boat," they can promote intercompany coordination of ridesharing. Moreover, they respond to suburban mobility problems by attempting to modify travel behavior rather than increasing the vehicle-carrying capacity of thoroughfares. However, the true litmus test of a trip reduction ordinance is whether it can actually be enforced. In Costa Mesa, even though several large

TABLE 3 Advantages and Disadvantages of Transportation Ordinances in Suburban Settings

Type Of Ordinance	Ordinance Areas	Advantages	Potential Problems
Trip reduction	Placer County, Calif. Costa Mesa, Calif. Pleasanton, Calif. Fairfax County, Va.	Employer latitude Equitable Demand-oriented	Enforcement Survey errors Individual employer emphasis
Impact fee	Costa Mesa, Calif. Santa Ana, Calif. Irvine, Calif. Los Angeles, Calif. San Diego, Calif. Carlsbad, Calif. Fairfax County, Va. Montgomery County, Md.	Benefit assessment Pools fund for area improvements	Equity concerns Measuring per trip costs Tempo/timing problem Supply-side bias Possible jurisdictional gaps
Parking reduction	Los Angeles, Calif. Palo Alto, Calif. Orlando, Fla. St. Petersburg, Fla. Montgomery County, Md. Hartford, Conn. Bellevue, Wash.	Promotes ridesharing Cost savings to developer	Parking perceived as proven, risk-free and permanent Ridesharing considered risky Resistance from lenders Administrative problems

office projects have been approved over the past 5 years with specific TSM conditions attached, to date little progress has been made monitoring toward meeting conditions (18). Furthermore, because surveys of employee commuting are generally required only once every year or so, there is always a possibility of unrepresentative sampling. Some employers have expressed contempt about the peremptory tone of these ordinances, preferring instead programs based more on voluntarism. Finally, by focusing primarily on in-house efforts to cope with traffic, almost literally on a building-by-building basis, these ordinances could have the perverse effect of turning attention away from communitywide mobility problems.

Traffic Impact Fee Ordinances

A more common legislative approach to suburban traffic management has been the exaction of impact fees. Rather than assessing individual landowners based on their real property valuations, these ordinances collect monies according to how much traffic a future development will likely generate. By far, the largest number of traffic impact ordinances have been enacted in Southern California, though they can be found in Colorado, Florida, New Jersey, and around metropolitan Washington, D.C., as well (7).

The most ambitious impact fee programs today are found in Los Angeles County. In Los Angeles' Century City and Westwood Districts, both major centers of brisk office construction, developers pay a one-time fee of almost \$1,000 for each afternoon peak trip generated on an average weekday. Moreover, in the booming Westchester area near Los Angeles international airport, an ordinance that exacts a one-time fee of \$2,010 per peak hour automobile trip was recently passed. In all three districts, covenants affixed to land parcels bind all tenants to participate in TSM programs. Developers can receive credits against their fee obligation by introducing vanpooling, dedicating land for transit centers, and pursuing other mitigation programs.

The major advantage of impact fee ordinances is that they are based on proven principles of welfare economics (see Table 3); those who impose the cost of increased congestion should pay for whatever public improvements are necessary to correct them. Impact fees likewise appeal to many suburbanites' sense of equity; those benefitting most directly from the construction of freeway interchanges and arterial widenings should pick up the tab. Another major selling point is that impact fees generate a

pool of funds for financing areawide, rather than just nearsite, transportation improvements. Thus, by establishing a trust fund, fee ordinances ensure that developers are responsible for more than just their own immediate problems.

However a number of stumbling blocks still stand in the way of wide-scale adoption of traffic impact legislation. One issue concerns equity. In almost all cases, fees are only passed on to new future projects. Residential and retail projects are often exempt from fee requirements. Some developers charge that they are being forced to pick up the bill for costly infrastructural improvements while previously existing establishments whose businesses contribute equally to traffic snarls pay nothing. Developers are not only concerned about others getting a free ride, but also about possibly having to pay for past traffic planning mistakes and oversights. Compounding matters even more is the inability to accurately gauge the true marginal cost of each additional rush hour trip generated by a new suburban project. Standard trip generation rates are often used, although most have been empirically derived from urban-like settings and do not necessarily reflect current or future suburban travel behavior.

Another problem with these ordinances is the mismatch between when impact fees are collected and when actual improvements are made. Fees are usually assessed and collected before the issuance of building permits and occupancy certificates, and funds are accumulated in a reserve account for financing future projects. In several instances, this cash flow problem has been to the consternation of developers who have paid large sums of money to trust accounts only to see no actual roadway improvements implemented. Other potential problems with these ordinances are their distinct pavement and concrete, supply-side bias and the possibility that abstention of a single municipality from a subregional fee assessment program could leave crippling gaps in a major new thoroughfare system.

Parking Reduction Ordinances

In Los Angeles, Orlando and St. Petersburg, Florida, and several other communities around the country, ordinances allow developers to reduce expensive code-required parking as a quid pro quo for commitments to ridesharing. In both Florida communities, for example, builders have the option of contributing to a TSM fund in lieu of providing the usual four parking spaces per 1,000 ft² of office space (7).

To date, parking reduction ordinances have had little success in inducing developers to purchase employee vans instead of paved over parking lots. In Los Angeles the local ordinance allowing up to a 40 percent reduction in code-required parking has failed to attract a single taker during its inaugural 2 years (19). Many developers consider the trade-off of parking for vanpools simply too risky. Parking is widely perceived as a one-time, upfront investment with a proven track record. Moreover, it is a permanent fixture to the land. In contrast, suburban ridesharing programs are largely untested, require ongoing funding support, and are impermanent. A ridesharing program can fold at any time, either as a result of a sudden plunge in gasoline prices or changes in commuting preferences. Equally important, perhaps, is the fact that some banks and lenders have frowned on past attempts to introduce below-standard parking in suburbia, threatening to withdraw investment loans unless universally accepted parking levels are provided. Some developers have also avoided parking programs because of the lengthy delays in processing and approving requests as well as the absence of explicit criteria for evaluating success of ridesharing substitution.

Cooperative Agreements and Financing

Not all private developers have been coerced into financing offsite transportation improvements, and not all municipalities have chosen the ordinance route in battling suburban congestion. Increasingly, both parties are entering into ad hoc, cooperative agreements that spell out mutual funding responsibilities for offsite roadway improvements.

Based on the national survey, an estimated 68 percent of all suburban office developers have helped pay for offsite roadway improvements. More than one-half of these public-private coventures have involved cofinancing of areawide traffic control improvements, such as installing computer-controlled signal networks. Some of the largest private sector contributions for offsite suburban roadway improvements recorded to date are given in Table 4. Together, more than \$300 million has already been spent on or pledged toward major infrastructure in the vicinity of 13 rapidly expanding office corridors in nine major U.S. metropolises. The most generous contribu-

tion to date has come from the developers of the Hacienda Business Park in Pleasanton where more than \$80 million has been committed toward major freeway and arterial investments, as well as the construction of areawide pedestrian and cycling trails, residential sound barriers, and flood control canals (7).

The major advantage of cooperative financing to a developer is that, unlike trust fund programs, he has some direct control over how his contributions are spent. Through the process of negotiations, developers can usually secure guarantees that certain pet projects will be funded. The major drawback of the negotiated approach appears to be that in almost all instances to date, funding has gone to nearsite, rather than subregional, roadway improvements. The emphasis appears to be more on resolving front-entrance access problems than relieving the downstream effects of, for example, 50,000 new peak trips generated by a colossal employment center that just opened. Nearsite investments can contribute little to the vehicular capacity of an area if other regional improvements are not built in tandem. This lesson was brought to light in the case of a \$9 million developer financing of a four-lane highway expansion in McLean, Virginia, that abruptly changes into a narrow two-lane road at the owner's property line (20).

CONCLUSIONS

America's suburbs certainly are not lacking in technical know-how for dealing with traffic congestion. An assortment of strategies (some design- and land-use-oriented, others involving creative institutional arrangements and financing), are viable candidates for safeguarding suburban mobility. Still, the effects of any one or two efforts are apt to be marginal, at best, over the long run. In tandem, however, the right cluster of design, land use, and transportation management tools could mark the difference between choked and free-flow travel conditions. In many suburban corridors, all it takes is a 3 to 5 percent reduction in peak hour traffic to free up clogged arteries and restore circulation. However, more will be needed than just additional capacity. Quick fixes that ignore more systemic problems such as jobs-housing imbalances are ultimately doomed for failure. What is called for is a

TABLE 4 Major Private Sector Contributions to Roadway Improvements Outside of Metropolitan CBDs

Metropolitan Area	Contributor	Amount (\$000,000s)	Location and Types of Improvements
Denver	Joint Southeast Public Improvement Authority	23 ^a	Highway upgrading in Southeast Denver area
Houston	West Houston Association	8.5	New four-lane arterial in West Houston
Los Angeles	Several Private Developers	2.3	New interchanges and ramps on Katy Freeway
	Private Developer	4.0	Assorted roadway improvements in Universal City area
New York/Newark	Private Developer	30 ^a	Interchange ramps and signal upgrading in Westchester District
	Private Developer	11	Highway, bridge, and freeway off-ramp improvements in the Meadowlands
Orange County, Calif.	Private Developer	65 ^a	Freeway, parkway, ramps, and signal improvements for Irvine Spectrum
Philadelphia	Private Developer	1.3	Traffic control in Newport Beach area
	Private Developer	2.0	Freeway interchange near the Chesterbrook Corporate Center
San Diego	Private Developer	57.5	New arterials, freeway overpasses, and signal upgrades for north county area
San Francisco	Private Developer	14	Freeway interchange, signal upgrade, and road widening in San Ramon
	Private Developers	85	Freeway interchanges, computerized signaling, soundwalls, and landscaping in Pleasanton
Washington, D.C.	Private Developers	22	New highway and overpass in Fairfax County and Tysons Corner area

Source: Survey results.

^aProposed private contribution.

more strategic planning approach whereby both public and private interests work together in crafting the right balance of design, land use, and traffic management programs tailored to specific suburban needs.

Any viable and lasting effort must also go beyond simply implementing a checklist of TSM and design improvements. Major institutional, political, and behavioral impediments have to be dealt with as well. Indeed, overcoming resistance to limits on suburban parking or the distrust some suburbanites have of mixed land uses pose far greater challenges than adding new freeway interchanges or generating computerized carpool matchlists.

One common denominator of nearly all successful suburban transportation programs to date has been the expanding role of the private sector. Whether through designing in-transit amenities or financing offsite roadway improvements, businesses and developers are emerging as leaders in the war against suburban traffic congestion. Most are more than willing to pay their fair share simply because they realize the long-term profitability of their investments hinges crucially on good access and liveable suburbs.

Overall, recent progress toward safeguarding suburban mobility has been encouraging, although much remains to be done. Clearly, heading off suburban gridlock in the years to come depends on both public and private interests working closely together, each leveraging its own resources and unique abilities toward this pursuit.

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REFERENCES

1. Institute of Real Estate Management. Office Buildings: Income/Expense Analysis, Downtown and Suburban. Institute of Real Estate Management, Chicago, Ill., 1984.
2. R. Cervero. Managing the Traffic Impacts of Suburban Office Growth. *Transportation Quarterly*, Vol. 38, No. 4, 1984, pp. 533-550.
3. L.D. Maloney. America's Suburbs Still Alive and Doing Fine. *U.S. News & World Report*, March 12, 1984, pp. 59-62.
4. J.S. Lublin. The Suburban Life: Trees, Grass Plus Noise, Traffic and Pollution. *Wall Street Journal*, June 20, 1985, p. 29.
5. U.S. Department of Commerce, Bureau of the Census. The Journey to Work Summary. U.S. Government Printing Office, 1982.
6. F. Spielberg and S. Andrie. The Implications of Demographic Changes on Transportation Policy. *Journal of the American Planning Association*, Vol. 48, No. 3, 1982, pp. 301-308.
7. C.K. Orski. Suburban Mobility: The Coming Transportation Crisis? *Transportation Quarterly*, Vol. 39, No. 2, 1985, pp. 283-296.
8. F. SO, ed. The Practice of Local Government Planning. International City Management Association, Chicago, Ill., 1979.
9. B. Cohen. A Look at Suburban Office Space. *Sky-scraper Management*, Feb. 1971, pp. 6-10.
10. R.F. Galehouse. Mixed-Use Centers in Suburban Office Parks. *Urban Land*, Vol. 43, No. 8, 1984, pp. 10-13.
11. W.P. O'Mara and J.A. Casaza. Office Development Handbook. The Urban Land Institute, Washington, D.C., 1982.
12. A. Lenny. Canyon Corporate Center--From RVs to R&D: Transition to a Higher Use. *Urban Land*, Vol. 43, No. 4, 1984, pp. 20-24.
13. E. Schreffler and M.D. Meyer. Evolving Institutional Arrangements for Employer Involvement in Transportation: The Case of Employer Associations. *In Transportation Research Record 914*, TRB, National Research Council, Washington, D.C., 1983, pp. 42-49.
14. D. Torluecke. An Employer's Perspective: Transportation. *WestPlan*, Fall 1983, pp. 14-15.
15. P.M. Fulton. Changing Journey-to-Work Patterns: The Increasing Prevalence of Commuting within the Suburbs in Metropolitan Areas. Presented at 65th Annual Meeting of the Transportation Research Board, Washington, D.C., 1986.
16. G. Guiliano and R.F. Teal. Privately Provided Commuter Bus Services: Experiences, Problems, and Prospects. *Urban Transit: Private Challenges to Public Transportation*, (C. Lave, ed.), Pacific Institute for Public Policy Research, San Francisco, Calif., 1985.
17. D. Curry and K. Fraser-Middleton. Pleasanton TSM Ordinance: A New Approach to Traffic Mitigation. *In Transportation Research Record 1018*, TRB, National Research Council, Washington, D.C., 1985, pp. 41-46.
18. South Coast Metro Area Pilot Transportation System Management Program. Consulting report prepared for the Orange County Transportation Commission. Ruth and Going, Inc., San Jose, Calif., 1983.
19. D. Curry and A. Martin. City of Los Angeles Parking Management Ordinance. *In Transportation Research Record 1018*, TRB, National Research Council, Washington, D.C., 1985, pp. 61-67.
20. D.W. Schoppert and W.S. Herald. Private Funds for Highway Improvements. *In Transportation Research Record 900*, TRB, National Research Council, Washington, D.C., 1983, pp. 42-47.