Parking-Requirement Reduction Process for Ridesharing: Current Practices, Evolving Issues, and Future Directions

STUART J. TENHOOR AND STEVEN A. SMITH

Current U.S. practices in instituting the process of reducing parking supply requirements when ridesharing at the development site reduces parking demand are reviewed. Key issues regarding developer support for such reductions, how programs are legally guaranteed and monitored, and who pays for such reductions are discussed. Finally recommendations on factors to consider when such a process is carried out are presented.

Because of rising land costs and local government's desire to reduce the economic, environmental, and energy problems associated with single-occupant vehicle commuting, both the public and the private sectors have sought methods of mitigating these problems. Concern about these high costs has resulted in the emergence of transportation system management (TSM) actions. TSM advocates short-term, low-capital-cost efforts to improve transportation system capacity. Parking management and ridesharing are two key, mutually complementary TSM techniques.

The control of parking supply is an important local tool for dealing with rising parking construction costs and congestion. The supply of parking in urban areas is controlled most frequently through off-street parking requirements for developments contained in the local zoning ordinance. In most jurisdictions a minimum number of parking spaces is required to be constructed in conjunction with a proposed development, although some cities are also imposing maximum limits on parking.

Parking requirements have been traditionally established to ensure that sufficient parking will be provided off public streets. Thus, the primary objectives were to enhance access, improve traffic circulation, and prevent neighborhood parking problems and other potential nuisances. It is now apparent that the parking code can also be effectively used as an instrument for managing traffic through provisions favoring ridesharing and public transit.

Ridesharing is the generic term used to describe a range of alternatives to single-occupant vehicle commuting, such as carpooling or vanpooling. Ridesharing not only helps to ease congestion problems but also decreases the number of parking spaces required at a building site through a reduction in the number of vehicles required to transport a given number of people. Ridesharing strategies have most often been focused on the work trip and thus primarily on office and industrial land uses.

One way to measure the effectiveness of a ridesharing program is to determine how it affects vehicle occupancy rates or the average number of persons per vehicle. Higher vehicle occupancy rates mean less parking demand at the employment site. To make vehicle occupancy figures meaningful, some background on national statistics is helpful.

The national work-trip automobile occupancy rate in 1977 was about 1.3. This is less than the 1.4 reported in 1969, probably reflecting continuing increases in automobile ownership. These figures provide a base from which to evaluate current parking demand figures at office or industrial land uses and then to evaluate anticipated parking demand reductions caused by ridesharing programs.

Assuming a typical vehicle occupancy rate for a major employer of 1.2 with a minimal ridesharing program, an increase to a vehicle occupancy rate of 1.6 would produce a 25 percent demand reduction. For example, subscription bus service was used by one major employer in this investigation, which reduced parking demand by more than 40 percent. Many other examples exist of employers with highly successful ridesharing programs.

The success of ridesharing is highly dependent on private-sector action. The off-street parking requirements afford a natural opportunity to encourage more private-sector participation in ridesharing to the mutual benefit of the public and private sectors. This opportunity exists in the offering of reductions in the minimum parking requirements for those developers or landowners who agree to institute certain ridesharing measures at the proposed site. These reductions can offer a significant economic benefit to developers and at the same time promote ridesharing, which increases the person capacity of the transportation system.

A list of some of the techniques that may be appropriate for inclusion in a parking-requirement reduction process is given in the following. The advances made in the use of these techniques by a number of jurisdictions are evaluated, some key issues in confronting this process are discussed, and some insight on future use of these techniques is provided.

1. Measures related to ridesharing
   a. Employee transportation coordinator,
   b. Locally sponsored ride-matching service,
   c. In-house rideshare matching,
   d. Preferential parking for high-occupancy vehicles (HOVs),
   e. Subsidized parking cost for HOVs,
   f. Flextime or other work-schedule program conducive to ridesharing,
   g. Vanpool or buspool service, and
   h. Monitored employee travel modes.
2. Measures related to public transit
   a. Employer-subsidized transit passes,
   b. Parking reductions based on proximity to transit,
   c. Elimination of parking cost subsidies,
   d. Daytime shuttle services, and
   e. Transit amenities.
3. Other parking management techniques
   a. Maximum parking requirements:
      A. Absolute maximum and
      B. Maximum with floor area ratio or financial penalties if exceeded;
   b. Fringe parking (allow a percentage of parking to be supplied at off-site location with transportation provided to the site); and
   c. Shared parking (share parking spaces with another use that has nonoverlapping peak parking demand).
4. Other TSM actions
   a. Pedestrian and bicycle facilities and
   b. Priority treatments through traffic operations.

CURRENT PRACTICES

In Figure 1 some of the developments to date are summarized in the creation of parking-requirement reduction processes for ridesharing in a number of jurisdictions across the country. Although it is not an all-inclusive list, for the most part it represents the state of the practice of these techniques. The experience of several of the jurisdictions is discussed below.

Because of the significant variation in local land use law and the methods of encouraging ridesharing, it is difficult to establish a consistent classification of local parking-requirement reduction processes for ridesharing. Generally, however, these approaches appear to fall into three general categories.

The first category is the ridesharing incentive option. This method requires the addition to a zoning ordinance of a provision by which an applicant may reduce the minimum parking requirement by a certain percentage (up to a maximum) proportionate to the strength of a ridesharing incentive program to be provided continuously for the life of the building. This method has been instituted in several jurisdictions such as Sacramento, California; Schaumburg, Illinois; and Bellevue, Washington.

The second technique establishes a performance standard in the zoning code for application generally or on a case-by-case basis. In this type a vehicle trip-generation standard that cannot be exceeded or an automobile occupancy standard that must be achieved is established for a given development. The standard can be calibrated according to geographic region and set low enough that an applicant has to rely on alternative modes of transportation to serve the building. Both Fairfax, Virginia, and Dallas, Texas, have experimented with this approach, granting approval to individual development sites contingent on their meeting maximum trip-generation or automobile occupancy criteria.

The final category is mitigating measures. This approach, used in high-growth regions, mandates actions that new developments must carry out to obtain development approval. Santa Cruz and Sunnyvale, California, and Seattle, Washington, have each used this approach. In-depth descriptions of how several local jurisdictions have undertaken their selected approaches are given in the following.

Bellevue, Washington

A suburb of Seattle, Bellevue has a rapidly expanding central business district (CBD). In February 1981 Bellevue enacted a comprehensive zoning amendment called Modification of Parking Space Requirements. That section empowers the planning director to grant adjustments to the minimum parking requirements in any CBD zone for landowner actions to encourage ridesharing provided any adverse impacts on adjacent property will be adequately mitigated. The director is also instructed to require such covenants or agreements as are needed to ensure compliance.

Eleven ridesharing techniques that constitute effective alternatives to automobile access are enumerated as illustrative of programs that landowners may institute to qualify for a maximum of 50 percent reduction in the requirements. Those techniques were listed previously in Figure 1.

Schaumburg, Illinois

Another developing suburban area similar to Bellevue recently instituted the ridesharing incentive option. Schaumburg sought to meet its goals of increasing work-trip vehicle occupancies approximately 10 percent by permitting a maximum 40 percent reduction from the 4.0 spaces per 1,000 ft^2 required for offices. The applicability of such provisions is limited to buildings having at least 50,000 ft^2 of floor space, and developers must submit evidence to the Zoning Board of Appeals of participation in an approved carpooling program, other activities like flextime or preferential parking to further encourage HOV use, or transit access within 0.5 mile of the site.

Sacramento, California

In July 1981 the city of Sacramento revised its parking requirements to institute both parking maximums and minimums for office uses in its downtown district and also created a code section labeled In-Lieu Vehicle Parking Substitution Measures sanctioning several ridesharing techniques. Under this change, three specific techniques and a fourth omnibus category, limited only by a developer's inventiveness and reasonableness, were created only for office uses in the C-3 zone of the CBD. Landowners under this section may receive a 60 percent reduction for new or expanded offices and a 100 percent reduction for office conversions provided a use permit is obtained.

Under the provisions of the first technique, each preferential carpool space so designated may be used to eliminate 2.5 unmarked parking spaces. Included within this technique is a requirement that the owner accept responsibility for enforcement and permit the state ridesharing office to circulate ridesharing information and user surveys. The maximum reduction attainable under this technique is 15 percent.

The second method permitted is landowner purchase of a year's worth of monthly transit passes at the current pass rate for each required space reduced for a 25-year term. This agreement is entered into at the time the building permit is approved for placement in a joint transit fund account for annual payment to the local transit agency. A third technique permits provision of additional bicycle parking facilities at a rate of one additional parking space for each required space omitted. A maximum reduction of 2 percent of the required parking spaces is permitted. A final catch-all measure permits a parking reduction for other measures that would adequately and effectively meet employee and patron transportation needs generated by the office building.

Sunnyvale, California

The city of Sunnyvale has established both minimum and maximum parking requirements for industrial uses only. Although it does not expressly permit reductions in parking space requirements, the city does require ridesharing-related traffic mitigation measures at the stage when the building permit or new use and occupancy permit is obtained when the planning board determines that the site requires it.

The city considered several transportation mitigation measures in the spring of 1980, selecting preferential carpool parking and bicycle parking as acceptable mandatory mitigation measures for imposition on landowners. Alternative work schedules, company-sponsored carpools and vanpools, or bus passes are encouraged as voluntary measures.

Like other jurisdictions, Sunnyvale's changes are quite recent, and thus there have been no measurable long-term effects. Planning staff there confirm, however, that at least three facilities have actu-

Figure 1. TSM actions contained in selected U.S. zoning ordinances.

Jurisdiction	Type of Area	ETC*	Participating in Ride Matching Service	Provision of HOV* Parking Spaces	Flex-Time Work Hours	Parking Charges	Provision of HOV's	Transit Passes HOV Cost Subsidy	Provision of Transit or RS Amenities	Contribution to Transportation/RS Fund	Company RS* Program	Other 4/	Implementation	Enforcement	Reductions Permitted	Comments
Bellevue, WA.	CBD (12,000) 1/	X	X	X	X	X	X	X	X	X			When landowner accepts reduction, takes responsibility	"Such covenants and guarantees as necessary."	Up to 50 percent	Very comprehensive ordinance.
Dallas, TX.	2 Large mixed-use developments; 1 CBD, 1 Suburban	O	O	O		O			O				Developer agreement to mitigate high trip generation rates	Approval conditioned upon self-enforcement and effective program.	None requested	This is a site specific reduction but principles are same.
Los Angeles, CA.	City of 3 Million	Potentially all: Landowner must submit plan											Landowner submits plan outlining TSM tactics	Covenant and/or contractual obligation to develop needed off-street parking	Staff sets based on site transportation study; maximum 40%	Ordinance passed March 1983
Montgomery Co., MD.	Several CBD's with low density, developing mix		O	O		O				O	O		Optional developer or county responsibility	Land or parking space set-aside; payment to RS fund; revoke permit	10 percent county program; 10 percent employer program; 20 percent maximum	Further review due before passage; long-term enforcement key issue.
Orlando, FLA.	City Population 132,000	Potentially all 5											Landowner pays trust fund cost per space reduced	Authority in planning and development dept.; control permit issuance	Maximum of 20 percent	Only TSM trust fund ordinance in U.S.
Placer Co., CA.	20 Miles N.E. of Sacremento; Rural but developing	X	X	X		X		X	X			X	Required of all new development with sufficient employment	• Civil penalties • Criminal: misdemeanor	No maximum; commensurate with trip generation reductions proven.	Community supports as necessary to control growth.
Sacramento, CA. (City and County)	CBD (C-3)	O		X 3	O	O	O	X	O			X O	When landowner accepts reduction, takes responsibility	Landowner self-enforcement	-60 percent new or expanded office -100 percent office conversions	Instituted both maximum and minimum in CBD, C-3 zone: changes under study
Schaumburg, IL.	Village (30,000) 1	X	X	X	X	O	X	X	X	X	X	X	When landowner accepts reduction, takes responsibility	Landowner records a covenant which must be present in all leases. Land set aside required	Maximum to 40 percent for buildings over 50,000 sq. feet	Implemented summer 1982; very comprehensive in scope.
Seattle, WA	CBD	X	X	X			O	X 2		O			Requires landowner to implement through State environmental law	City agency funded by transportation fee.	Currently parking maximums, 1 per 1500 sq. feet.	Required of 14 developments through 1982. Primarily used for office or mixed use development.

1/ Total employment
2/ Development approval contingent upon provision of HOV parking spaces.
3/ 15 percent maximum reduction for this method.
4/ Other includes: bicycle lockers/showers (or) shuttle service or subscription bus
5/ TSM trust fund could be used to finance any technique listed above.

KEY: X = Implemented
O = Proposed
RS = Ridesharing
ETC = Employee Transportation Coordinator
HOV = High Occupancy Vehicle (i.e., car/vanpool, bus, etc.)

ally been required to remove excess parking and have complied by either landscaping the spaces or providing recreational amenities.

Dallas, Texas

Although Dallas has no specific section within its zoning code that permits reductions in the amount of off-street parking required in exchange for ridesharing techniques, it has granted a significant parking reduction to a huge mixed-use facility in exchange for the developer's guarantee to provide vanpooling access to the site, which was calculated to reduce the total number of peak-hour vehicle trips by 20 percent.

The Dallas approach proposes a TSM strategy to attain a vehicle occupancy level of 1.4 for peak-hour work trips. This target is based on current levels of ridesharing in carpools, vanpools, and transit that have been attained elsewhere in the country or in the Dallas region coupled with guarantees of management strategies such as variable work hours. The combination of strategies here is designed to reduce evening peak-hour trips by 20 percent for the total development of 2 million ft^2 of office space and 1 million ft^2 of retail and hotel space. Retail use in the complex began in the fall of 1982; office and hotel space is still under construction.

Seattle, Washington

Although not as broad-based as the Bellevue plan, Seattle's efforts demonstrate its role as a ridesharing innovator. Seattle is one of several jurisdictions with maximum parking requirements for its downtown region made possible by excellent transit service and high densities in downtown land uses. Parking space demand in downtown Seattle, where most of the ridesharing promotion efforts have been targeted, is approximately 0.5 to 0.6 space per 1,000 ft^2 of office space. Outside the downtown region Seattle uses traditional minimum-parking requirements.

The process used in Seattle has been to condition the granting of building permits on developer agreements to set aside a significant number of dedicated carpool and vanpool spaces. At least six buildings under construction in 1982 or recently completed have received approval under this method.

Seattle has no zoning ordinance provision that permits landowners to institute ridesharing incentives in exchange for parking reductions. Through the state environmental authority, it deals with developers individually, letting them develop proposals to increase vehicle occupancy rates while seeking such actions as the institution of HOV parking spaces, which are relatively easily monitored and enforced.

EVOLVING ISSUES

Experience to date with a parking-requirement reduction process for ridesharing has demonstrated that many factors affect the success or failure of such provisions. Although there is still too little experience to say conclusively which combination of provisions will produce the most effective ridesharing incentives, we can say that the following criteria are necessary for a successful set of ridesharing provisions in a local zoning ordinance:

1. Validity: There must be a valid relationship between parking and the TSM measure (e.g., the number of parking spaces reduced for a landowner commitment to ridesharing must be related to the degree of increased ridesharing expected to result from the actions taken).
2. Attractiveness to the private sector: It should create the necessary financial or development incentives for the provisions to be used by the private sector.
3. Legality: It must be legal and enforceable.
4. Flexibility: The code must allow room for adjustments to a wide variety of circumstances.
5. Simplicity: The code must be easy to understand and administer.
6. Protection of public interest: It should protect the public interest by maintaining good planning practices (e.g., minimize residential parking problems).

Issues relating to the above criteria are discussed in the following sections.

Validity

A parking-requirement reduction process for ridesharing must have a sound technical relationship between parking demand and the ridesharing techniques employed. For example, one must have a reasonable estimate of the impact that TSM strategies such as preferential HOV spaces and flextime have on the number of parking spaces required.

From the public agency's perspective, the concern is that the ridesharing measures instituted produce a reduction in parking demand comparable to the reduction granted in the parking supply. Ideally both the public agency and the developer would like to know the percentage of reduction in parking that might be attributable to such measures. A number of ridesharing and TSM measures that have potential for inclusion in a parking-requirement reduction process have been listed.

Unfortunately the effectiveness of these strategies has not been adequately quantified, and although attempts to develop such relationships have been and are being made, it is unlikely that anything more than rule-of-thumb numbers will be available. An infinite variety of variables can govern measures such as a ridesharing coordinator (e.g., employer size, employer type, many employers versus a single employer), and the effect of such measures can vary widely in degree of emphasis (some employers will have more aggressive ridesharing coordinators than others).

The resolution to this dilemma will lie in developing adequate definitions and performance criteria for each ridesharing measure and assigning reasonable effectiveness estimates (e.g., automobile occupancy increases) to each. These definitions and performance criteria must be specific enough for the public agency to determine whether the intent of the incentives has been satisfied by the developer or landowner. The agency must not allow the actions promised by the developer to be so loosely defined that there is little hope of holding him to his commitment should he want to back out of his obligations for financial or other reasons. He may conform to the letter of his initial promise without complying with the intent.

One method of specifying parking reductions that can relieve public agencies from some of the pressure of developing accurate definitions is a performance-standard approach rather than a ridesharing-incentives-option approach, defined earlier in this paper. In the performance-standard approach, the developer commits himself to achieving a specified level of ridesharing, expressed in terms of number of carpoolers and vanpoolers, the level of average automobile occupancy to be achieved, a trip-generation rate reduction, or some other quantifi-

able measure of program effectiveness. As long as the chosen measure can be monitored, the burden of estimating the effectiveness of the various ridesharing measures remains with the developer or landowner, and there will be fewer chances of a confrontation over the interpretation of a definition. To assist the developer or landowner in making the assessments of potential effectiveness, however, transportation professionals should actively seek ways to improve their knowledge of the relationship between ridesharing and parking demand.

One attempt to quantify the relationship among parking demand, automobile occupancy, ridesharing incentives, and other factors was made in a study by JHK and Associates (1). With a data set of 42 office buildings, regression equations were developed correlating several dependent variables, including parking demand and automobile occupancy, with various characteristics of the building, parking arrangements (including parking supply and cost), and transportation service factors. An independent variable consisting of a composite ridesharing-incentive index was constructed to attempt to link the level of ridesharing support to changes in the dependent variables, particularly automobile occupancy. This index consisted of a scale between 0 and 10 derived by assigning a set number of points for each aspect of a ridesharing program in effect at a site (e.g., one point for the provision of preferential carpool spaces and two to four points for a vanpool program, depending on the level of commitment by the employer). The 42 sites included a wide range of building and employer sizes and were located in either suburban or outlying CBD settings.

The results indicated that the ridesharing index was able to explain more of the variation in automobile occupancy than any of the other nine dependent variables, with an R^2 of 0.57. The resulting regression equation was

Automobile occupancy = 1.14 + 0.065 (ridesharing index).

No attempt was made to correlate individual components of the ridesharing index (such as the existence of preferential HOV spaces) with automobile occupancy. Several of the sites had very high automobile occupancies (up to 2.37), which had a substantial impact on the coefficient of the ridesharing index.

The equation would suggest that, on the average, one could expect to achieve an automobile occupancy of approximately 1.8 for the most extensive investment in ridesharing in a suburban setting as long as certain other conditions were also satisfied (e.g., there is a sufficiently large employment base).

Although the regression equation proved reasonable, it is of limited practical value in establishing ridesharing commitments for zoning ordinances. The contribution of the multitude of individual ridesharing actions to increased automobile occupancy has not been isolated, and the degree to which given actions are performed varies widely among employers. Additional quantitative analyses are needed to improve our ability to make effectiveness estimates.

Attractiveness to the Private Sector

Although on the one hand parking reductions for ridesharing must not permit abuses nor endanger the well-being of communities and neighborhoods from a traffic standpoint, they must entice developers from a financial standpoint to assume the risks that may be necessary. Some jurisdictions require ridesharing actions as necessary mitigation measures, making them mandatory for all developers of employment-intensive uses. In this case the attractiveness of the ridesharing provisions is not as much of an issue as the overall attractiveness of development. Certain locations may be so inherently attractive to developers that mandatory ridesharing mitigation measures will not dampen developer enthusiasm for the site. On the other hand, this approach applied to less attractive developments may be the deciding factor in discouraging new development or redevelopment. The economic, land, use, and development objectives of a given jurisdiction will be the determining factor as to the applicability of an optional versus a mandatory ridesharing provision.

If the optional approach is selected, the provisions must be attractive enough (in terms of reduced parking construction costs and so on) for developers to want to take advantage of them. This will mean that the public agency must incur some risk but with the expectation that ultimately there will be more efficient use of land and transportation resources. The public agency must gauge the attractiveness of ridesharing provisions to developers by computing the potential economic benefits and costs to all parties from the process. To be reasonably attractive, there should be at least a 2:1 ratio of benefits to costs over the long term. Economic analyses have indicated that the benefits of the program to the employees may actually outweigh the savings to the developer, particularly when land costs are low and structured parking is not involved.

Legality

Enforcement uncertainty has emerged as a significant stumbling block to more widespread use of ridesharing provisions in local zoning ordinances. Political decision makers have wanted assurances that the developer making the agreement to institute certain ridesharing actions will in fact follow through. So far there have been several primary issues relating to enforcement. These include

1. The proper legal mechanism to use as the basis for enforcement,
2. The types of penalties or disincentives to employ, and
3. The transferability of the commitment to subsequent landowners.

Because of the great variety in local zoning practices, it is safe to say that a variety of enforcement techniques will be necessary. In the last section of this paper some of the most commonly used and most promising alternatives are outlined. Until more experience has been gained with ridesharing provisions and their ensuing enforcement problems, it will be difficult to determine the enforcement strategies that will be most effective. For instance, there apparently has been only one court challenge to a legal guarantee executed for a parking-requirement reduction process. The issue that is currently being litigated in San Francisco is the constitutional authority of a local jurisdiction to assess development mitigation fees.

Public agencies must not discourage developers interested in taking advantage of the provisions by setting unreasonable enforcement goals. Many developers and major employers are as yet unaware that there are economic and other benefits of ridesharing and that ridesharing programs can and do work. To overplay the potential for failure because of disregard of commitments will defeat one of the purposes of introducing ridesharing provisions, that is, to more widely expose ridesharing and its poten-

tial to the private sector. Certainly enforcement problems must be anticipated, but abuse has been minor to date.

Flexibility and Simplicity

In drafting a parking-requirement reduction process for ridesharing, flexibility and simplicity are key criteria by which to judge the final product. Simplicity, or making the provisions easy to understand, will increase the likelihood of their being used. Unduly complex provisions may create uncertainty and discourage developers from taking the time to carefully evaluate and consider the process. Lack of simplicity may also foster citizen distrust, causing the provisions to be perceived as a further complication of development-related transportation problems.

Likewise, there must be enough flexibility in the provisions to allow them to be tailored to a variety of circumstances. For example, certain employer types are more capable of instituting certain ridesharing provisions, and local land conditions or other factors may favor one approach over another. The provisions should not preclude the options that may be best suited to a given situation.

Protection of the Public Interest

Protection of the public interest is related to the enforcement issue but is somewhat broader. It reflects the need for balance in parking policy between the economic development interests and the protection of the street environment, particularly the residential street environment. Near residential areas one must be more cautious in the magnitude of parking reductions granted and should contemplate what can be done to relieve any adverse impacts if the developer does not achieve the reductions in parking demand expected. Residential parking permit programs can be instituted to relieve some of the impacts, but their existence is no excuse for poor planning practices.

Other Issues

There are several other issues that need examination but that do not fall neatly into any of the categories discussed previously. One such issue has to do with how the ridesharing provisions combine with the other provisions in the zoning ordinance. The ridesharing provisions have greatest potential when applied to office and industrial uses, because most successful ridesharing programs have been employer-sponsored and focused on the work trip. An important prerequisite to instituting a parking-requirement reduction process for ridesharing is to have an acceptable base from which to make those reductions. If the base office requirement, for example, is already low, there will be little incentive for further parking reductions. If the reductions are taken in this setting, an inadequate parking supply and the accompanying traffic and aesthetic problems will likely result. Reductions from an already low requirement are illogical. The best way to avoid these problems is to have a reasonable base from which to reduce requirements.

Also frequently mentioned is how those who finance developments resist having less parking, because in the development community, sufficient parking has always been a prerequisite for development success. Lenders are therefore an important group to educate in the potential benefits of ridesharing and associated parking reductions. This educational process will gain momentum as more localities introduce ridesharing provisions, but transportation professionals must be ready to demonstrate the benefits and likelihood of success of these projects.

Another issue with which many jurisdictions grapple is the degree to which zoning ordinance provisions should be negotiable on a case-by-case basis. Although a highly negotiable approach affords a high degree of flexibility, it places a substantial burden on both the public agency and the developer to prove their case and frequently results in an adversary relationship. It does little to foster mutual trust, may result in unnecessary delays or cancellations of projects, and consumes additional staff time in both private and public sector. In addition, the final resolution of negotiated parking reductions often must be based on the same data or same precedents each time. This argues for establishing a ridesharing provision that has more rigid guidelines based on the best available data with enough flexibility to enable a response to the more unusual circumstances. Localities may want to retain the right to negotiate on large developments but let the smaller routine developments be addressed directly by provisions in the ordinance.

FUTURE DIRECTIONS

Essential Ingredients of Ridesharing Provisions

Experience to date has indicated that there are certain components that must be present in a set of ridesharing provisions for it to satisfy the criteria discussed in the previous section. These are

1. Specification of the ridesharing options to be employed,
2. Method of negotiation or agreement,
3. Monitoring procedures, and
4. Enforcement techniques.

Specification of Ridesharing Options

Potential TSM options were listed previously. There must be a mechanism for relating these to the probable impact on parking demand, either identified explicitly in the ordinance itself or in some other document that can be used as the technical basis for the parking reductions granted. As experience with these techniques increases, it will be desirable to develop more rigid guidelines on the reductions allowed for given developer actions. Specific ridesharing reduction formulas, as crude as they may be and have been, will help streamline the process and eliminate some of the uncertainty that developers may otherwise feel when entering into a development proposal.

Method of Agreement

When a developer exercises the option (or is required) to institute ridesharing actions, there must be a legal, binding agreement stating the responsibilities of both the public agency and the developer or landowner. The agreement should set forth not only all the terms and conditions but also any penalties to be imposed in the event of noncompliance. Some of the possible approaches to this agreement are

1. Contract,
2. Land covenant,
3. Performance bond,
4. Building permit conditions,

5. State environmental enabling authority to control landowner actions that degrade the environment, and
6. TSM development fee or trust fund.

All of these have been instituted in some form or another, but space does not permit a description of each here. The applicability of each method will vary depending on each jurisdiction's governmental and legal structure. There is too little experience to demonstrate the superiority of any one of these techniques, and the workability of the techniques will often be determined by local laws and practices. Special mechanisms may exist in some local jurisdictions that offer a unique opportunity better suited to local development practices than one of those just listed.

Monitoring Procedures

The monitoring element of a parking-requirement reduction process comprises the means by which compliance or noncompliance is determined. If certain standards are to be met, it must be determined whether in fact the standard has been satisfied. Monitoring determines whether enforcement is necessary. Monitoring could range from a simple checking to see whether the landowner is generally following through on his commitments to ridesharing or other techniques to a more elaborate quantitative assessment through automobile occupancy surveys and other data analyses. This is certainly a procedure in which public agencies will be concerned with simplicity, because they generally cannot afford to spend a great deal of time and effort in most monitoring processes. In some cases fees could be assessed to developers who benefit from significant parking reductions to help offset the cost of program monitoring.

Enforcement

The enforcement procedure has been one of the most controversial parts of the parking-requirement reduction process for ridesharing to date. Although it is hoped that the need to exercise enforcement procedures would be rare, mechanisms must be available to protect the public interest when ridesharing actions are agreed on. It must be determined not only what enforcement stages will apply to the original landowner should his commitment fail, but also how enforcement procedures will be made applicable to subsequent owners of that property. Again several options are available as follows:

1. Land set aside or the addition of more structured parking,
2. Fines (this is a criminal action, not a civil action),
3. Forfeiture of performance bond,
4. Revocation of use and occupancy permit,
5. Development moratorium,
6. Contempt-of-court citations, and
7. Liquidated-damage contractual penalties.

Each jurisdiction may have different agencies that would enforce the options just listed. The prescribed enforcement measures should be specified in the agreement, but the timing and actual enforcement of a violation must be predetermined. As mentioned, the city of Seattle has been using environmental legislation as the basis for enforcement. Agencies should select those elements that are most compatible with the zoning approach or parking mitigation methods in their jurisdiction.

Research and Information Needs

A review of the experience to date and of the issues that have evolved indicates several important needs for the future development of ridesharing and TSM provisions for local zoning ordinances. Some of these needs are as follows:

1. Improved technical information on the relationship between ridesharing measures and parking demand (both developers and policy makers may continue to have reservations about moving forward with such provisions unless clear evidence is presented of the potential benefits and the likelihood of success of the program),
2. Better knowledge of how lenders perceive such provisions and creation of an educational process to familiarize key groups with the purpose and benefits of ridesharing provisions,
3. Better methods of providing assurances that commitments will be fulfilled without unduly discouraging developers from participating in the program of parking reductions in exchange for ridesharing commitments, and
4. Continual updating of parking-requirement reduction processes for ridesharing nationwide and dissemination of information on the subject as it becomes available.

In addition, several general rules are offered to guide the future development of ridesharing and TSM provisions. First, it is important to think comprehensively. There are many competing objectives that come into play in the development process. Certain transportation objectives (such as promoting more efficient modes of travel) cannot be isolated from others. The desires and impacts on the many groups with an interest in land development, parking, and transportation must be considered. Further, all such parties should be involved in the process to avoid creating provisions that are not used by private development. Participants should include developers, citizens, employers, attorneys, lenders, and public agency staff of various disciplines. There must particularly be a keen awareness of how the development community views such actions.

Second, the political process must be considered. The zoning ordinance is a legal tool controlled by politicians who must deal with many other issues besides transportation and are generally unfamiliar with what can be accomplished with ridesharing. The case must be presented concisely, clearly, and forcefully, indicating how these concepts will benefit the public at large. This educational process must reach developers, demonstrating how ridesharing actions can present substantial economic benefits that outweigh the risks perceived.

Finally, it is important to think in the long term; ridesharing acceptance will not occur overnight. Deliberate efforts will be necessary to bring about a change in attitudes about ridesharing and its role in local zoning controls. The inclusion of a parking-requirement reduction process for ridesharing affords an excellent catalyst for educating the private sector about ridesharing. It can now be viewed as a realistic and useful tool sanctioned by local legislation. Thus, in effect, this process institutionalizes a concept that may play a key role in America's transportation future.

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REFERENCE

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Prediction of Land Use Traffic Impact

C.E. HALLAM AND G. PINDAR

The current procedures for prediction of the traffic impact of proposed land use developments and their parking requirements are based on historical and nonquantitative assessment procedures, which has in many cases led to the preparation by local governments of inappropriate parking codes. Research recently undertaken in New South Wales, Australia, aimed at provision of a more quantitative basis for impact prediction. Surveys were conducted at sites in each of the following land use categories: motels, service stations, car dealerships, dealers of car accessories and tires, hotels, road transport terminals, warehouses, recreation, fast food sites, factories, licensed clubs, office blocks, shopping centers, home units (apartments), homes for the aged (retirement villages), and restaurants. Survey results were analyzed by using linear regression techniques. Descriptive models, where able to be developed, are presented in the form of regression equations. Use of these models should take into consideration their accuracy and the range of independent variables for which they are applicable. In situations where it was not possible to develop models, proposed land use developments may be compared with developments surveyed in the study that possess similar characteristics, and a subjective assessment may be made. The use of the survey data as a standard data base should be of considerable value in maintaining a common standard of impact assessment. The models should improve the accuracy of impact prediction and assist in the development of more reliable parking codes and design guidelines. The degree of transferability of these results to countries other than Australia requires further research.

A major research project has recently been completed by the Traffic Authority of New South Wales, Australia, the aim of which was to develop reliable methods for predicting the impact of particular land uses on traffic conditions. To date, such predictions have been based primarily on subjective historical bases. This research has aimed at putting predictions and assessments on a more quantified basis. The resulting models should be used with caution, and due consideration should be taken for their stated accuracy and ranges of applicability. It was not possible to develop models for every aspect of land use studied. In these situations if a proposed development has similar characteristics to those of one of the survey sites, a direct comparison of the developments could give an indicative estimation of traffic impact.

Information was collected and analyzed on (a) person and vehicle flows generated by the development, the time at which such flows are at a peak, and person and vehicle flows generated during the on-street peak vehicle hour and (b) the parking provision necessary if the parking demand is to be met on site without constraint. The land uses studied in this research were motels, service stations, car dealerships, dealers of car accessories and tires, hotels, fast food sites, road transport terminals, warehouses, recreation, factories, licensed clubs, office blocks, shopping centers, restaurants, homes for the aged, and home units. These land uses, many of which occur in strip development, were selected because they occurred most frequently in development applications submitted for comment to the Traffic Authority. The results can also be used to develop more comprehensive strip development control policies. With changing emphasis from construction to transport system management techniques, the most effective use of the existing road system is becoming increasingly important. Thus planners should ensure that adequate protection is afforded to preserve the integrity of current and future arterial routes.

SURVEYS

For each land use, with the exception of shopping centers and home units, 10 examples were chosen for survey that exhibited a range of types and size of development. Further, the sites chosen were geographically diverse in order to reflect socioeconomic factors (particularly vehicle ownership) and public transport availability. Sites of fairly recent construction with on-site parking provision were preferred. For shopping centers, 33 sites were surveyed. For home units, surveys were conducted by means of postal questionnaire surveys. Of the 2,000 questionnaires distributed, 544 valid replies were received.

With the exception of home units, information was collected by conducting interviews with users and site management personnel together with measurements of person and vehicular flows and parking accumulation. Site and floor areas were measured on site.

Surveys of office blocks, factories, licensed clubs, and some shopping centers were conducted in 1978. The remaining surveys were conducted in 1979 with the exception of restaurants, home units, and homes for the aged, which were conducted in 1981. Surveys were conducted for a period of one day per site except for three of the shopping centers, at which 6-day counts were conducted. In the case of home units, information was requested for one specific day.

ANALYSIS

In consideration of the relatively small number of sample points, the use of complex statistical methods was not considered appropriate, particularly in view of the intended general use of the results. The emphasis was thus on simpler manipulations based on multiple linear regressions.

The resultant models should be used with due consideration for their accuracy. The accuracy is expressed in terms of the correlation coefficient (R^2).

Checks made in the analysis were that multicol-