Implementation and Operation of Park-and-Ride Lots

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The implementation and operation of park-and-ride facilities must be carefully executed to optimize use of resources and to maximize the anticipated benefits. Implementation involves providing the necessary resources and the legal, administrative, and cooperative mechanisms for facilitating the construction and operation of park-and-ride facilities. There is a void of information in published literature on successful strategies for implementing and operating park-and-ride facilities. Although the *Guide for the Design of High Occupancy Vehicle and Transfer Facilities*, published by the American Association of State Highway and Transportation Officials, has been well recognized as a basic reference, the implementation and operation of parking elements need to be complemented. This paper discusses some of the frequently neglected aspects of implementation and operation and provides several ideas drawn from the author's experience and from the analysis of practices in several states. Liability, lease agreements, community involvement, funding and cost considerations, marketing, scheduling, fee structures, transit coordination, security, and enforcement are among the topics discussed.

The implementation and operation of park-and-ride facilities must be carefully executed to optimize use of resources and to maximize the anticipated benefits. Implementation involves providing the necessary resources and the legal, administrative, and cooperative mechanisms for facilitating the construction and operation of park-and-ride facilities. In the conduct of a national study (*1*) on the planning, design, operation, and implementation of park-and-ride lots, it was detected that formal planning of implementation and operation is still a capricious process, although a few states have good experiences that should be disseminated. Although the AASHTO Guide (*2*) has been well recognized as a basic reference for guidelines on planning and design of high-occupancy vehicle (HOV) facilities, implementation and operation of parking elements are given scant attention. This paper discusses some of the frequently neglected aspects of implementation and operation and provides several ideas drawn from the author's experience and from the analysis of practices in several states. The ideas presented in this paper can be viewed as supplementary to the national reference (*2*) on HOV facilities. Liability, lease agreements, community involvement, funding and cost considerations, marketing, and scheduling are some of the topics discussed under implementation. Items discussed under operation are fee structures, transit coordination, security and enforcement, maintenance, operations monitoring and evaluation, and overutilization.

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IMPLEMENTATION

General Liability of Lot Program

A basic premise of American law is that government is immune from suits by citizens (*3*). According to Wright (*4*), a growing number of jurisdictions have, through court decisions, abolished municipal tort immunity. Wright notes that the idea that the sovereign can do no wrong is not in the spirit of current times. California, Michigan, Wisconsin, Alaska, Minnesota, and Washington are typical jurisdictions in which major progress toward partial or total waiving of tort immunity has been achieved at state or local governmental levels. California purchases liability insurance to protect landowners with whom lease agreements for carpool lots are made. Such insurance policies cover installation, maintenance, and use of the lot (*3*). Special insurance for park-and-ride facilities is another option. Michigan, a self-insured state, requires that landowners purchase insurance for joint-use lots. Landowners are subsequently reimbursed. Connecticut insures park-and-ride lots through its State Insurance Purchasing Board. As a lot is added to the system, it is also added to the insurance schedule (*3*). As a rule, a park-and-ride facilities program should be advised by the state's general counsel on legal and liability issues regarding the use of public/private property for park-and-ride facilities and on necessary arrangements for implementing their use.

Lease Agreement

A lease is a contract that conveys a facility or real estate with specific rent and conditions regarding its use. This type of agreement may be a formal document signed by the parties who agree to the terms. It is not unusual, however, to find parties engaged in informal lease agreements where no documents are signed. Whereas some jurisdictions prefer the specificity of a written formal lease, others prefer the casual nature of informal, unwritten leases. The formal lease assures parking privileges for a specific period, provided the terms are not violated. The informal lease provides no such assurance and spares all parties of obligations normally written into formal leases. Whether formal or informal, leases have become a popular way for making land available for park-and-ride facilities. Leases are applicable to undeveloped lands as well as existing parking facilities for park-and-ride operations. This type of formal leasing is practiced by many state and local governments as well as transit agencies. California, Maryland, Connecticut, and Minnesota are examples of jurisdictions where

formal leasing is a standard practice. Figure 1 presents a typical lease agreement involving a transit agency and a church in Minnesota.

Transportation departments in states that have not sanctioned their involvement in park-and-ride facilities via legislation may not have the legal authority to enter formal lease agreements and, as a result, may use informal leasing as an interim procedure. Georgia feels bound by law not to enter formal agreements. It is the belief of some merchants in Atlanta, Georgia, that park-and-ride lots can boost profits of those businesses located near the facilities, thus putting remotely located merchants at an economic disadvantage. In Atlanta, some merchants had become jealous over the park-and-ride agreement of the Georgia Department of Transportation (DOT) with competing shopping malls. As a result of this situation the Georgia DOT adopted a hands-off stance on formal agreements with owners of private property.

Concerns about potential parking problems may make shopping center owners reluctant to allow joint-use parking. Studies of joint-use facilities in Houston (*5*) and Connecticut (*6,7*), as well as the *Park-and-Ride Planning Manual* (*8*), support the theory that merchants in shopping centers generally benefit from increased patronage resulting from the park-and-ride activity, except at peak shopping seasons when park-and-ride may deprive potential shoppers of parking spaces. The manual (*8*) recommends that the potential for increased business be advanced as an incentive to encourage owners of shopping centers to involve their facilities in park-and-ride.

The short-term nature—2 to 10 yr—of formal leases and the threat of parking disruption at informally leased lots would be a concern of transit agencies (*9*), particularly in planning park-and-ride facilities for rapid transit and commuter rail lines. Unlike bus routes, rail routes remain fixed for decades; thus, absolute ownership of associated parking lots should be the preferred option. The frailty of informal leases makes them unreliable elements in park-and-ride planning and, consequently, detrimental to a successful program.

The structure and contents of leases will vary among jurisdictions and transit agencies. There is no single model that is applicable to all lease situations. However, the following are the primary elements to be covered in leases for park-and-ride facilities.

1. *Purpose.* What the lot is to be used for.
2. *Premises.* A separate attachment detailing the lot or area of the lot to be used for park-and-ride.
3. *Access.* If only a certain area is to be used for park-and-ride, access must be guaranteed for those spaces.
4. *Term.* How long is the agreement for? What are the cancellation procedures? What is the status of any improvements made to the lot in case of cancellation?
5. *Improvement.* What type of improvements will be made to the lot? What is the notification procedure if the agency needs to go beyond the initial agreement? This could be a separate document detailing the improvements that will be effected. It could be a part of the maintenance agreement.
6. *Maintenance.* Who will perform specific duties? Such sections generally ask the owner of the lot to notify the agency of any maintenance that needs to be performed. For added flexibility, specific detailed maintenance responsibilities should be listed in a separate agreement.
7. *Liability insurance.* What types of insurance will be provided, if any? If none is to be furnished, it should first be ascertained that the agency is legally not responsible for liability claims, and this should be made clear in the agreement.
8. *Use of premises (nondiscrimination).* Some agreements stipulate that the lot shall be open for use by anyone without discrimination by the lot owner. In some cases this appears to be required by law when a government agency is involved.
9. *Examination of property.* Agreement attesting to the fact that the agency has examined the property and found it in good condition or that it accepts the property in its existing condition.
10. *Licensing.* In cases where only a license is granted by the lot owner, it must be made clear that no legal title or leasehold interest is created in the property.
11. *Governmental charges.* Finally, a clause stating that the agreement imposes no obligation on the sponsoring agency to pay the lot owner's taxes and the like.

These 11 elements may be addressed in all park-and-ride agreements. At the very least, the elements covering premises, term, improvements, maintenance, and liability insurance should be included.

Community Involvement

The involvement of the local community in the facilities and service elements of park-and-ride starts at the conceptual planning stage and continues through implementation. The local community—merchants, employers, and residents—must feel assured that special efforts are being made to minimize the adverse effects of potential problems identified in the planning phase, that the solutions to those problems are being implemented, that reasonable and special features desired by the community are being installed, and that the implementing agency is complying with resolutions resulting from initial citizen participation. This continuity in community involvement establishes a cooperative mood, so that the implementing agency or the agency charged with future operation can expect a more positive response from the community on current and future matters pertaining to facility operations. It is not enough to build park-and-ride facilities; there must be a real perception among citizens that the facilities contribute to the common welfare of the communities they serve.

Community involvement is a proven strategy for blending local ideas into the planning, design, implementation, and operation of park-and-ride facilities. Radio, the press, and television; direct communication with citizen groups, employees, employers, and residents; and on-site notices are standard communication strategies. Very often, these strategies, used before the implementation phase, pave the way for a more positive marketing response that translates into higher utilization when the facilities are finally opened to the public.

Funding and Cost Considerations

The cost of implementing a park-and-ride program can be substantial, especially if a large number of parking spaces are to be built. Building the parking lots often requires coordination of several agencies that share different cost burdens

AGREEMENT

THIS AGREEMENT, made as of the _____ day of _____19, by and between the METROPOLITAN TRANSIT AREA, a public corporation and political subdivision of the State of Minnesota, acting by and through its governing body, the Metropolitan Transit Commission (hereinafter called "MTC") and the _____a body corporate of the State of Minnesota (hereinafter called "Church").

WITNESSETH, that:

WHEREAS, the CHURCH desires to contribute to the reduction of transportation problems in the St. Paul and Minneapolis metropolitan area;

WHEREAS, the MTC wishes to establish locations within the metropolitan area at which passengers may park their automobiles and ride an MTC bus to the downtown areas of Minneapolis and St. Paul;

WHEREAS, the CHURCH owns and maintains a parking lot presently used primarily for parking by members of the CHURCH attending Sunday services;

NOW, THEREFORE, IT IS MUTUALLY AGREED, by and between the parties hereto, as follows:

1. Use of Parking Lot. The MTC may use the parking lot owned by the CHURCH located at ....., Minnesota, as a park-and-ride lot for the parking of at least 25 automobiles of MTC passengers.

2. Time of Usage. The parking lot may be used by the MTC on Monday through Friday. Saturdays, Sundays, Good Friday, Thanksgiving Day, Christmas Day, and other church holidays specified by the CHURCH shall be days MTC use of the parking lot is prohibited.

3. Maintenance. The CHURCH shall arrange for regular and/or timely snow plowing in accordance with the provisions and diagrams set forth in Exhibit A attached hereto. All abnormal maintenance or repair required by the extra usage resulting from this Agreement shall be provided by the MTC.

4. Signs. The MTC may, with the agreement of the CHURCH, erect a sign on or adjacent to the parking lot designating the area as a park-and-ride and specifying the days on which it may be used as such by MTC passengers.

5. Insurance. The MTC represents that it is a qualified self-insurer under the Minnesota Safety Responsibility Act.

6. Indemnity. The MTC agrees to indemnify and save harmless the CHURCH from and against all claims or demands of every nature on account of injury to or death of persons or damage to or loss of property caused by or resulting in any manner from any acts or omission of the MTC, its agents or employees, in the direct operation of the parking lot as a park-and-ride lot under this Agreement. The MTC shall also indemnify and hold harmless the CHURCH against risk of loss of all kinds through injury to the MTC's employees while in the course and scope of their employment under this Agreement.

7. Term and Termination. This agreement shall be in force for an indeterminate period of time, but may be terminated by either party hereto upon thirty (30) days written notice.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by the persons thereunto duly authorized as of the day and year first written above.

METROPOLITAN TRANSIT COMMISSION	CHURCH
By	By
Chief Administrator	Church Representative

FIGURE 1 Sample lease agreement involving private property.

for implementation and operation. It is not uncommon to find local or state transportation departments providing the funds for constructing park-and-ride lots, with another private or public agency having the authority to operate them. This situation draws attention to the need for accurate cost accounting by the operating agency, so that the real capital costs can be identified. Of course, many agencies build and operate their own lots. Transit agencies have been doing this for decades.

Funds for implementing park-and-ride facilities are available from the federal government. Federal law (Title 23, U.S. Code) provides for categorical funding for park-and-ride

through the federal-aid highway program administered by the Federal Highway Administration (FHWA), depending on the purpose and location of the facilities.

The federal share of the costs of qualifying projects depends on the applicable federal-aid highway programs—Federal-Aid Primary, Federal-Aid Secondary, Federal-Aid Interstate, Interstate 4R, Federal-Aid Urban. The Surface Transportation Act of 1982 provides a local-federal matching formula for distributing federal-aid highway funds (contact the FHWA division Office). For highway construction, the federal share is normally 75 percent, although states may request up to 100 percent federal support for commuter carpool and vanpool facilities. Section 3, discretionary funds; Sections 9 and 18, formula grant; and Section 8, planning grant, programs administered by the Urban Mass Transportation Administration (UMTA) provide funding for park-and-ride facilities associated with transit and certain funds for rideshare activities. Department of Energy (DOE) funds are also available for park-and-ride activities when they are included in the State Energy Plan.

The acquisition of federal funds for park-and-ride programs requires an understanding of the budgetary process of the state and local governments and metropolitan planning organizations, as well as of the federal criteria for selecting projects and administering the funds. Generally federal-aid highway funds administered by the states are cost reimbursable. Thus, agencies must first use their own funds and then ask for the federal government to contribute its share. Projects that receive federal-aid highway funds must also be in the budget of state governments. Thus, park-and-ride development must have projects registered in the local and state budgets if federal-aid highway funds are to be committed. This is particularly important because most jurisdictions normally exclude nonbudgetary items from their spending programs. The transition of a project idea to a budget item requires deliberate actions. Selective use of the political channels and strong factual justification based on evidence of potential savings in highway construction, improved highway capacity, and increased patronage of regional transit are essential for project recognition in the budget process.

It is not always possible for agencies to satisfy the criteria for federal funds for park-and-ride lots. In addition, federal funds for such facilities are anticipated to decline in future years, while the demand for park-and-ride will be increased. Thus agencies may have to rely on nonfederal funding sources and use innovative approaches to minimize the cost of new capital investments in park-and-ride lots. Many agencies are already funding 100 percent of the capital cost for park-and-ride lots through special taxes or general revenues. Giving developers the option of providing fewer on-site parking spaces while contributing the associated cost savings to a local fund for promoting park-and-ride is a feasible fund-raising strategy. Another parking management tactic (*10*) that reduces the cost to local government involves the use of zoning regulations that shift part of the cost of park-and-ride lots from government to developers and large employers. The Los Angeles Planning Commission allows developers the option of substituting off-site park-and-ride spaces for on-site spaces (*9*). Preferential parking rates for HOVs using standard facilities is another interim measure for reducing total space demand and for deferring capital investment on new facilities. Seattle, Washington; Montgomery County, Maryland; and San Francisco, California, are some of the jurisdictions that have had success in using preferential rates.

Staged development of park-and-ride lots is a viable strategy that could be combined with 100 percent local funding. Staging allows an agency to upgrade facilities when the demand warrants. In spite of potential administrative problems, joint-use lots are good interim measures for postponing the need for major capital investments. In urban areas where major restructuring of transit routes is anticipated because of the introduction of rapid rail systems or changes in land use, the delay in capital investment could accommodate the possibility of a shift in demand that must stabilize before permanent facilities can be effectively located. For example, the Soldiers Home lot and Carter Barron joint-use park-and-ride lots in Washington, D.C., are no longer effective urban-fringe facilities. Major shifts in demand as a result of improved service provided by the regional rail rapid transit system and parking facilities have been responsible for declining use of those once-busy parking facilities.

Jurisdictions faced with rapidly increasing land development and severe limitations on their ability to expand existing highway facilities require new methods for diverting a significant proportion of new trips to HOVs. Faced with this need, the Montgomery County (Maryland) Planning Board has been experimenting with the involvement of developers in ridesharing programs as a partial condition for approval of building permits for large office and residential subdivisions (*11*). Such development-related ridesharing programs must be reviewed and approved by the county, although they are to be planned and executed by developers at their own expense over a stipulated number of years. As a precaution against default, developers are required to post a substantial annual bond for the duration of the stipulated period. The county plans to assume control of the developer's ridesharing program after the expiration of the agreed term of operation. Although the cost of ridesharing programs may be high—$45,000 annually for 10 years in one case—developers of large projects seem willing to comply rather than face the possible rejection of subdivision development plans. Developers and government agencies are also becoming aware of the benefits of reduced congestion in making development sites more attractive to employers. This approach may become an accepted alternative strategy for funding ridesharing programs.

Marketing Program

Marketing involves the use of promotional techniques to inform motorists about park-and-ride services. The marketing effort for new park-and-ride programs must be deliberate, and it must be geared toward achieving the objective of increasing the use of HOVs. Effective marketing can both increase the level of park-and-ride facility usage and hasten the rate of user growth (*12*). Both outcomes are particularly beneficial to paid facilities that require immediate revenue to cover operating expenses. In the long run, park-and-ride facilities that are properly implemented could become the focus of promotional campaigns for increasing ridership on all associated high-occupancy modes.

Two important aspects of a marketing program are identifying the target audience and determining the most effective mechanism for communicating the desired information. Com-

munication techniques for familiarizing potential travelers with rideshare and park-and-ride services include informational signs strategically placed along roadways and in parking facilities, news releases, brochures distributed directly to residents of the service area, public service announcements on radio and television, newspaper advertisements, posters, bumper stickers, billboards, brochures distributed to large employers, employer-coordinated activities, and maps showing the location of lots, transit routes, and schedules.

In some cases, rideshare and park-and-ride marketing can be coordinated with other public service messages to provide more efficient use of public facilities, as in the case of the Southeast Expressway reconstruction in the Boston area. The target audience usually consists of motorists who travel alone and have either an origin or a destination in the service area. Carpoolers and vanpoolers for whom a diversion to rapid transit is feasible can also be a target audience. In San Francisco, California, parking is more conveniently located for vanpoolers and carpoolers who use the rapid transit system.

As a general rule, the strategy for reaching target audiences depends on their travel characteristics. Work-related travel characteristics are the principal information category for park-and-ride studies. State and local departments of transportation, transit agencies, metropolitan planning organizations, and rideshare agencies can play a leading role in coordinating the marketing effort. The services of professional advertising firms may also be used in designing and/or implementing promotional advertisements for share-a-ride and park-and-ride, especially when a large market is anticipated and information on the characteristics of potential users is unavailable. It is also important to note that promotional efforts must cover both the facilities and the transportation connection; they go together as hand and glove. Many jurisdictions have active campaigns for disseminating information on the location of park-and-ride facilities: it should not be assumed that motorists know where they are.

The marketing program must be of the same scale as the park-and-ride service. For isolated carpool and vanpool lots located on a major commuter route, it may be sufficient to use public service announcements to advertise the initiation of such facilities and to use roadside information signs as a continuing long-term advertising strategy. Regional park-and-ride programs involving multiple facilities could require a combination of marketing techniques coordinated by a ridesharing agency, the state DOT, or a regional government group.

Implementation Plan

A detailed implementation plan should be developed to define implementation details and agreements. The magnitude of the plan must be equivalent in scope to the park-and-ride program. Programs involving the expenditure of tens of thousands of dollars for many facilities, the coordination of several jurisdictions or agencies, and staged development over several years should receive a more detailed implementation plan than isolated lots where a less sophisticated system is appropriate. The implementation plan may also serve as a future reference on park-and-ride actions. The implementation plan should include the size and location of facilities, engineering design information, construction cost, advertisement strategy, facility usage options, traffic control features, vehicle acquisitions for HOV service, coordination with planned or existing transit service, funding sources, operating framework, and major tasks and milestones. The implementation plan may also be adopted, in whole or in part, into larger regional or sector development plans and may serve as the basis for budgetary discussion within the implementing agency.

OPERATION

The operation of an HOV program is a dynamic process aimed at sustaining a desired level of service through use of its various elements. Typical program elements include marketing, amenities, security, connecting HOV user service, traffic control, and parking lot pavement and drainage. These elements cannot sustain themselves and require continuous attention. Each operating agency must develop an operating program with procedures for providing operating resources, monitoring systems status, and providing the resources needed to maintain or improve service. It must be understood that the quality of service provided by any one element can affect utilization. For example, neglect in the area of security can lead to low utilization of park-and-ride lots, and unpredictable transit schedules will surely cause motorists to stay in their automobiles for the work trip. In spite of good planning, there is no guarantee that these elements will function as planned. Hence, the operating process must be able to respond to conditions that adversely affect the park-and-ride program. Some of the basic considerations to be addressed in lot operations are fee structure policies, security and enforcement, transit service coordination, maintenance, marketing, and monitoring of facility operations.

Fee Structure Policies

The fee structure established for a park-and-ride facility is the subject of an important policy decision. Parking fees are a potential means of facility financial support and can be used to control demand in heavily used lots.

Parking is most commonly free in park-and-ride lots. The provision of free parking is a policy that is used to encourage park-and-ride by providing a free transfer point. Most lots are publicly developed or located on private property where the landowner (e.g., a shopping center) provides the space as a public service. The primary rationale for providing free parking is to encourage ridesharing, but in many locations competing free spaces are readily available. Fees may be charged for only the most heavily used lots, and these are most commonly associated with heavy demand at rail rapid transit stations.

Parking at reduced fees in some public garages not exclusively constructed for HOVs can be provided for carpools and vanpools as an incentive for their use. These reduced fees are also usually associated with reserved spaces as an added incentive. How to collect fees should also be taken into consideration when a fee is charged. It would obviously be cost-ineffective to attempt to charge fees at small remote lots. In large lots where fees will be levied, the use of meters or exit payment must be compared for their operational convenience and cost-effectiveness. The alternatives analysis must compare the capital and operating costs, including costs and manpower requirements, and the effectiveness of the fee collection method (e.g., without effective meter-limit enforcement,

much revenue will be lost). Fee collection provisions are also a factor in design requirements. Exit payment booths, for example, require environmental provisions for staff and gates, with their added construction and maintenance costs.

The decision to charge fees is based on whether the lot must be financially self-supporting or whether it must remain free to attract HOV users. If a fee is charged, it should be related to the overall trip cost with and without the park-and-ride opportunity. The cost of parking and a high-occupancy mode trip should not exceed the cost of driving and parking at the destination end. The fee is set at or below that rate level if it is to provide an incentive for park-and-ride lot use.

Security Provisions

Security issues are normally treated in the location and design stages of park-and-ride facility development. It is only during the operation stage, however, that the effectiveness of planned security measures can be determined. Arrangements must be made to ensure that supplementary security measures—closed circuit television, police patrols, guards, and the like—are in place and working. There is a need to coordinate the security at publicly owned facilities with the activities of the police department having statutory or designated jurisdiction. Park-and-ride lots for promoting transit usage are usually under the security jurisdiction of transit authorities. It should be noted that police departments will not automatically assume the responsibility for security surveillance of such facilities. There must be a clear understanding at the time of facility development of who will be responsible for security measures and the degree of surveillance required. The Connecticut DOT conducted a study (*13*) of theft and vandalism problems at lots throughout the state. Among the recommendations for providing better security at park-and-ride lots are

1. Establishment of law enforcement responsibilities,
2. Frequent police patrol of lots,
3. Lot location and design for high visibility,
4. Lighting and fencing of facilities,
5. Encouragement of all-day lot traffic by providing amenities such as phones and newspaper vending machines, and
6. Better crime recording and monitoring procedures to permit problem recognition and analysis.

Maintenance Operations

Maintenance of the physical elements of park-and-ride facilities must be a planned, deliberate activity that includes an appropriate budget, designated responsibility for maintenance requirements, and an established program of maintenance that provides for normal and special needs (e.g., snow removal). Priorities should be established for normal and special requirements so that conflicts between park-and-ride maintenance and other maintenance responsibilities are easily resolved. Negligence in maintaining a park-and-ride facility has an adverse impact on perceived and real personal security, as well as the physical condition of the facility.

Transit Service Operations

Transit service is often the main reason for using a park-and-ride facility. It is important to provide sufficient information on service availability, both at the lot and throughout the lot market area. It is equally important to monitor transit use to maintain adequate levels of service and to determine the need for different services. Where possible, new services should be routed to serve park-and-ride lots.

Monitoring Park-and-Ride Lots

Monitoring the operation of park-and-ride lots is a necessary part of the planning process. Monitoring involves the development and execution of a strategy for collecting and analyzing specific information that can be used in the operation and improvement of park-and-ride lots and the planning of future facilities. Monitoring could involve a detailed study to determine whether the target goals are being met. Such a detailed study would involve the collection and analysis of data to determine if planned objectives were accomplished on the basis of a set of predetermined measures of effectiveness. Monitoring may also focus on the collection and analysis of information that can be used to identify potentially adverse situations that affect park-and-ride. Traffic congestion and overutilization of lots are examples of adverse situations that may be identified through monitoring.

Factors to Be Monitored

Comprehensive monitoring of lot operations is a costly and labor-intensive process. It is primarily because of cost that many operators of park-and-ride lots monitor only selected data. Utilization is the most commonly observed factor. Although utilization is a good indicator of space usage, it does not reflect the success of design elements, traffic operation and control, environmental precautions, needed personal safety measures, and aesthetics. A good monitoring process must also determine whether each lot continues to be conducive to park-and-ride activities. Elements that should be monitored include utilization, access traffic operation, economics of operation, traffic-generated air and noise pollution, energy conservation, transit service, user satisfaction, access modes, effectiveness of park-and-ride information, user characteristics, physical condition of lot, and degree of achievement of specific goals.

Utilization

This involves a periodic parking inventory based on standard traffic engineering practice. Utilization surveys for determining average usage should be conducted between 9:00 a.m. and 3:00 p.m. on Tuesdays, Wednesdays, and Thursdays to avoid the effects of weekend variations on lot usage. The primary product of this inventory is the percentage of spaces in use at the time of the inventory. Over time, this result can be evaluated to develop future trends. This statistic does not address use of spaces. However, it is a good general measure involving data that can be collected by technicians. Evaluation of the observed trend in utilization may suggest needed actions. For example, high utilization—greater than 85 percent—suggests the need for facility expansion or for parking management strategies to distribute users among a set of lots. Low utilization—less than 30 percent—may be a result of one or more factors that require reevaluation and correction. Thus,

utilization is a minimum factor to be monitored. When it takes on values at the extreme ends of the percentage scale, there is a need to evaluate other factors in making decisions. Utilization data should be correlated with other pertinent information about a park-and-ride lot.

Access Traffic Operation

Standard traffic engineering techniques must be used in planning the access to park-and-ride lots. Once implemented, however, the traffic operations design must be periodically monitored, because changing land use, user characteristics, and demand for parking and roadway capacity will generate the need for access improvement. Monitoring access traffic operations may involve one or more typical traffic engineering studies—volume studies, capacity analysis, traffic control evaluations, accident studies, and so on—that must be executed by experienced traffic or transportation engineers.

Economics

In planning a system of park-and-ride lots, it is often necessary to use estimates to determine the potential costs of capital investment, operation, maintenance, and the monetary value of benefits and disbenefits. A more accurate picture of the relationship between benefits and costs can be determined only after implementation. The benefit/cost analysis is a suitable technique for monitoring cost-effectiveness. Typical benefits include direct user-cost savings, fuel savings, reduction in hydrocarbon and carbon monoxide pollution, and reduced formation of nitrogen oxide pollutants. A benefit/cost analysis should be performed at least once after the implementation of a park-and-ride program. Although it is possible to conduct such analyses for individual lots, the aggregate cost-effectiveness of a system of park-and-ride lots should be the target of a benefit/cost analysis. Monitoring provides the opportunity to acquire more realistic data for computing the monetary value associated with user and community benefits. Several available publications (*14–19*) present good information on the theory and practice of benefit/cost analysis and may be reviewed for further information.

Traffic-Generated Noise and Air Pollutants

The monitoring of traffic-generated noise and air pollutants should be done on a regional basis, preferably by agencies such as metropolitan planning organizations and states whose domain transcends local jurisdictional boundaries. At least once a year, air pollutants should be sampled. However, seasonal variations in atmospheric conditions and travel can be more appropriately monitored by a continuous sampling process. All pollution monitoring must be executed by individuals with training in that technical area.

Energy Conservation

Monitoring this factor normally involves obtaining factual data on reductions in vehicle miles of travel, as opposed to crude estimates developed in the planning stage. Where energy conservation is an important goal, it can be assessed only with the collection of travel data.

Transit Service

The availability, quality, and scheduled frequency of transit service must be evaluated periodically. This is particularly important in routing transit to existing park-and-ride lots and in identifying those lots that have been adversely affected by the elimination of connecting bus service or the introduction of regional rapid rail systems. Some jurisdictions tend to ignore those park-and-ride lots whose usefulness is significantly reduced or eliminated. Such lots could be rededicated to other uses. Deterioration in the quality of transit service is a concern for users who are motivated by the convenience of such services.

User Satisfaction

In spite of efforts to incorporate user needs in planning park-and-ride lots, there is no assurance that all concerns will be satisfied and that new concerns will be identified automatically. To be effective, park-and-ride lots must meet minimum user standards. It is the duty of park-and-ride lot operators to strive to seek continuous feedback on users' experience and perceptions about park-and-ride lots. Information from monitoring user satisfaction should be collected via brief surveys that provide users with the opportunity to comment. These surveys may be part of a larger information-gathering exercise or may be dedicated to assessing user satisfaction. All such surveys must be formal, properly prepared, and executed with the explicit authorization of the agency in charge.

Access Modes

The modes used to access park-and-ride lots are not fixed. Users make decisions on modal choice that could affect lot usage and traffic operations. Increased use of small cars, motorcycles, bicycles, and recreational vehicles could affect the distribution of parking spaces. Operators must be aware of changing modes so that they can plan to accommodate and/or control the parking of vehicles that were not specifically considered in the planning process. The need for motorcycle parking is often detected by monitoring lot usage.

Effectiveness of Park-and-Ride Information

A park-and-ride program often involves several strategies for disseminating information. These strategies may include signing and special marketing efforts to reach users at home and at work. Lot usage correlates with the effectiveness of the information and its dissemination method. It is important for operators to know which techniques yield the best results. Here, too, information for assessing the effectiveness of promotional activities may be part of a larger survey.

User Characteristics

User information is particularly useful in estimating demand for park-and-ride program expansion. Information on user

characteristics must be gathered for the specific region where the facilities will be located. Planners must be aware that user characteristics vary across the nation and that there is no substitute for collecting information on actual and potential users in a region. User characteristic surveys are usually very broad in coverage and may involve sensitive data on age, sex, income, education, and so on. Therefore, they should be conducted infrequently or less than once in 2 yr.

Physical Condition

Deterioration of park-and-ride lots reduces use and must be prevented. Periodic surveys should be done of the pavement conditions, drainage structures, trash facilities, illumination, amenities, traffic control, and informational signs and markings. Neglect in the upkeep of some physical elements could contribute to unsafe conditions. Utilization and physical condition surveys may be executed using the same techniques when the lots are visited.

Management of Overutilization

Overutilization of park-and-ride lots is characterized by unsatisfied demand, with many potential users being turned away as a result of unavailable spaces, illegal parking on the overutilized lot and on adjacent private facilities and nearby roadways, and illegal vehicle maneuvers by frustrated motorists. Premature overutilization could reflect a weakness in the planning process. Underestimation of demand is clearly a defect in the planning process. There are also situations, however, where the facility must be scaled down at the implementation phase as a result of funding limitations. Unforeseen circumstances, such as energy shortages, user preference for certain lots, and accelerated land development, could cause a premature surge in demand for some parking facilities. Whatever the cause of overutilization, it is clearly a condition that requires immediate attention to eliminate those characteristics that discourage park-and-ride usage and contribute to unsafe traffic flow.

Treatments for overutilization may involve facility expansion to increase the space supply by reducing the size of some of the parking spaces to small-car dimensions, provision of alternative overflow facilities, pricing tactics that make other lots more attractive from a cost standpoint, use of periodic lotteries to distribute the parking opportunity, preferential parking spaces for HOVs, a facility served by transit, flexible working hours, selective use of compressed workweeks, pricing tactics favoring carpoolers and vanpoolers, and shuttle bus service from satellite parking facilities. Pricing has been used experimentally to manage overutilization of some of the park-and-ride lots on the regional rapid rail system serving the Washington, D.C., metropolitan area. New Jersey has used a lottery for distributing the opportunity to use one of its largest park-and-ride lots. The Bay Area Rapid Transit used preferential parking for carpoolers and vanpoolers. Flexible work hours, although not aimed specifically at park-and-ride facilities, are used by the federal government in Washington, D.C.; this has significantly moderated commuter traffic surges and partially transferred the use of parking facilities to nontraditional working hours. Prince George's County, Maryland, operated a public shuttle bus from a park-and-ride lot to the central business district of its county seat, Upper Marlboro. A number of additional transportation system management tools and parking management tactics (*6,9,10*) may also ensure compliance with traffic control measures. Each case of overutilization must receive careful study to determine the appropriate management strategy. As a general rule, the chosen strategy must be simple, fair, supported with resources for implementation and maintenance, and perceived to be just by facility users.

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Publication of this paper sponsored by Committee on Parking and Terminals.