Park-and-Ride/Fringe Parking

Park-and-Ride/Fringe Parking

■ Introduction

Park-and-ride facilities are an important element of all high-occupancy vehicle (HOV) programs. They serve as a collection point for individuals transferring to another vehicle containing at least one other person. Park-and-ride lots generally are designed to serve bus or rail transit, but also can be developed to facilitate carpooling, vanpooling, use of various types of shuttle services, and combinations of these high-occupancy vehicles.

Park-and-ride facilities may be dedicated lots on public property or joint-use lots on privately owned property where the normal parking function is not oriented toward modal transfer, such as at shopping centers or churches. The size of park-and-ride facilities varies widely – from only a few spaces in sparsely populated or less heavily-travelled corridors to lots of many hundreds of spaces serving major rapid transit lines.

Conceptually, park-and-ride facilities are designed for varying functions, depending upon their location and the types of services which are provided. "Fringe parking" generally refers to any parking facility located outside of a central business district (CBD). For the purpose of clarity in the following discussion, fringe parking refers to facilities on the edge of the CBD which serve as a downtown-end park-and-ride lot, usually served by a public transportation shuttle service. This concept is also described as "peripheral parking" in some of the literature. Park-and-ride lots often are served by public transportation and generally are sited to collect travellers near the origin end of their trip to maximize the amount of travel occurring via HOVs. As a result, these two concepts serve somewhat different functions. Park-and-ride lots are more effective at reducing the total amount of single-occupant vehicle miles travelled (VMT). Fringe parking can effectively reduce parking demand and overall travel volumes within CBDs where demand for parking and roadway space is greatest by relocating vehicle travel to less densely developed areas.

A variety of support facilities and services can be provided in connection with either park-and-ride or fringe lots. Most basically, these are information, signing, and marketing aimed at promoting lot usage. Lots also can be designed to facilitate access by walking and bicycle; for example, sidewalks and access paths can be provided to a lot and secure bicycle storage devices can be placed at a lot that are of sufficient quality to deter thefts. A variety of personal services can be provided at major lot locations including day care, financial services, convenience stores, and dry cleaning establishments. Direct connector ramps can be constructed between the park-and-ride lot and the freeway, such as is being done in Houston and Minneapolis.

The benefits of park-and-ride facilities are numerous. In terms of user costs, use of park-and-ride facilities can:

- Reduce automobile insurance premiums for policies written by companies that base their rates on vehicle mileage and travel purpose.
- Reduce fuel expenditures by reducing use of personal vehicles for the work trip.
- Reduce vehicle depreciation by reducing vehicle miles of travel and exposure to potential vehicle damage.
- Reduce vehicle maintenance costs by reducing the annual cost of mileage-related maintenance requirements.
- Reduce travel related fees such as tolls and parking fees.

User convenience is also a benefit afforded by park-and-ride participation. These benefits include:

- Reduced travel time when used in conjunction with HOV facilities or express bus or rail facilities, assuming good transportation connections, location of facilities close to the home end of the trip, and congestion which would be experienced by a competing auto trip.
- Improved travel comfort resulting from a passenger not being responsible for driving the vehicle.

Societal benefits accrue to the community as a whole from park-and-ride programs and are the basis for government involvement in their implementation. These societal benefits include:

- Reduced energy consumption through diverting trips from single or low-occupancy vehicles to high-occupancy vehicles or other energy efficient modes.
- Reduced traffic congestion, depending upon the location of the lots and the amount of reduced travel resulting from the program.
- Reduced automobile air pollution in urban centers assuming a sufficient number of vehicles are removed from these areas, including reduced cold starts in CBDs. Reduced congestion allows for better vehicle operating speeds and more efficient vehicle operation.
- Reduced parking demand at work sites and in the CBD where parking development costs are highest.
- Increased transit patronage by facilitating cost-effective line-haul transit service to locations of higher trip density.

- Improved access to jobs through increased ride-sharing opportunities, particularly if oriented to suburban employment areas not otherwise served by transit.

- Reduced ad hoc parking problems on private property or public ways without designated commuter parking.

Despite these many benefits of park-and-ride programs, some disbenefits can be identified. These disbenefits can be minimized, though, if reasonable care is taken in the planning and design process. In terms of cost, park-and-ride facilities would normally not break even as a financial investment. In comparison to commercial CBD parking rates, either no user fee is charged or user fees at park-and-ride lots are kept low in order for park-and-ride to be competitive with alternative modes. As a result, capital, operating, and maintenance costs may not be recovered through parking fees. However, in terms of overall societal costs, by reducing the need to construct more expensive CBD facilities and by reducing highway congestion, these costs can be balanced.

A further possible disbenefit of park-and-ride programs is their potential for transferring traffic and pollution problems from one location to another. Traffic and air pollution problems may increase in the areas where park-and-ride lots are located. Examples of these problems include congestion on access routes and interchange ramps serving overused facilities, increased illegal traffic maneuvers, increased ad hoc parking, and increased ambient air pollution levels in the vicinity of the lots. These issues are discussed further in the following sections. However, it should be noted that these impacts can be minimized through efficient planning and design of site access and lot location.

■ Examples of Park-and-Ride/Fringe Parking Programs

Numerous successful examples of park-and-ride programs can be identified throughout the United States. Nearly all major metropolitan areas and many rural areas have implemented some form of park-and-ride program to provide support facilities for transit, congestion relief, or as staging areas for ridesharing. Often, these facilities are developed according to a plan based on predetermined implementation criteria which provides for a systematic program of investment and implementation, also addressing demand for service. On the other hand, some park-and-ride facilities are developed simply as a means of reducing ad hoc parking at particular locations where property may be available. Examples of programs in the San Francisco Bay and Chicago Metropolitan areas and the State of Connecticut are described.

San Francisco Bay Area

Park-and-ride lots have been provided in every county of the Bay Area. RIDES for Bay Area Commuters lists over 100 lots currently in operation including those owned by Caltrans (California Department of Transportation) and those with joint use agreements. Caltrans owns 34 lots with a total of 3,179 parking spaces. In addition, Caltrans has established joint use agreements to permit park-and-ride activities at 25 lots that include 1,290 spaces. An additional 19 state-owned lots are proposed for construction by 1992. These proposed lots would provide an additional 3,215 spaces. However, they are not included in the current State Transportation Improvement Program (STIP). Santa Clara County has maintained an aggressive policy in developing park-and-ride facilities. The County currently operates 14 park-and-ride lots and has made preliminary recommendations for an additional 9 lots as part of their Commute Service Element which focuses on express bus service and related support facilities. Santa Clara County has strategically located park-and-ride lots along their express bus and light rail lines.

Park-and-ride lots are an important element in Traffic Mitigation Plans (TMP) developed by Caltrans for major highway construction projects. By including new and temporary joint use park-and-ride lots in the traffic mitigation plans, it is hoped that the number of vehicles that must be handled during construction can be reduced.

Caltrans recently evaluated the effectiveness of their park-and-ride program in the Bay Area in terms of the productivity of each lot and presented the following findings:

- **Probably the main factor which contributes to the popularity of the park-and-ride lot is adequate bus service to San Francisco from the lot.** Four of the top 6 productive park-and-ride lots had express bus service. In addition, 73 percent of all lots with express service to San Francisco were within the top 36 percent of all lots based on productivity. The only lot in the top 12 without bus service to San Francisco was the Dumbarton Bridge Lot which serves Santa Clara County commuters rather than those destined for San Francisco.

- **Lots that do not provide shuttle service to BART, Caltrans, or ferry service when it is feasible are not as productive as those that do.** Of the 11 lots that could provide shuttle service but did not, only one ranked in the top twenty most productive lots. This one lot, however, provides express service to San Francisco.

- **Three of the four lots near existing HOV lanes are ranked in the top sixteen most productive lots.** The one lot not in the top sixteen is the Bay Bridge Toll Plaza lot. The Caltrans report concluded that "this is probably because this lot is not as convenient a meeting place for van and carpoolers." It also appears, that because the lot is located near the end of the commute trip, its use would result in limited time savings.

- **The longer a lot is opened, the higher its productivity.** Six of the top eleven lots and eight of the top twenty lots were built prior to 1980. Only 14 lots had been built

by that time. Only fourteen lots built prior to 1981 was found among the ten least productive lots.

- **Lots that were state-owned generally were more productive.** This was attributed to their proximity to and visibility from major highways. The state-owned lots were generally easy to see and access and well marked by signs, while some of the joint-use lots were more removed and less obvious from the major travel corridors.

Chicago Metropolitan Area

The Northeast Illinois Railroad Corporation, known as "Metra," oversees all commuter rail operations in the six counties of Northeastern Illinois, with responsibility for day-to-day operations, fare, service levels, planning, and capital improvements. In 1985, Metra conducted a Systemwide Commuter Rail Parking Inventory/Assessment to examine the regional parking situation. This study measured lot capacity and utilization, evaluated the condition of each lot, and recommended a program of improvements to achieve a higher level of service at commuter rail stations and parking sites. Among the findings of the study were the following statistics:

- 55 percent of commuters accessed rail by park-and-ride;
- There were 45,600 parked cars in the 54,000 available spaces at Metra parking facilities; and
- Metra had a systemwide 84 percent space utilization rate of commuter parking capacity.

Results of the 1985 study indicated that the lack of parking availability at outlying stations constituted the greatest single criticism of commuter rail service. The study determined that the system was experiencing a total immediate shortfall of 7,000 spaces, 60 stations were at 95 percent capacity utilization or greater, another 30 stations were at about 90 percent, and 25 more were above 85 percent.

In order to address this situation, Metra established an interdepartmental Parking Implementation Committee to 1) review the parking needs of communities; 2) identify achievable responses to those needs; and 3) monitor the programming and implementation of parking projects. Beginning with over 350 specific recommendations, an intensive review process was used to eliminate projects considered to have implementation problems, be cost prohibitive, or were unacceptable to the respective local community. Discussions with Metra departments and local communities, meanwhile, led to identification of additional projects. This process resulted in a list of 52 projects.

Due to resource limitations, a screening process was established to prioritize projects. Four criteria were used, including:

- **Project Readiness** – This was considered the most important factor, based on a desire to provide the maximum amount of additional parking in the shortest time period. Proposed projects not requiring acquisition of land were given highest ratings.

- **Local Support** – The willingness of a municipality to support a project could include agreeing to assume management of the facility upon completion, taking responsibility for engineering and design, or contributing financially to a project.

- **Opportunity Factor** – Several projects included development of parking on privately-owned land. Since use of this land for parking could be in competition with other potential uses, an opportunity rating was given each project. Lots on rail rights-of-way were given low scores, since the property was not likely to be developed for uses other than parking. Therefore, the need to dedicate these parcels for parking uses may not be as urgent.

- **Cost Effectiveness** – The final selection criteria involved the measure of estimated cost per space, with a low project unit cost resulting in a high score. Cost reflected only Metra's financial involvement, therefore a jointly-funded project (using local or Illinois DOT funding) would rate higher than a project where Metra incurs all capital expense.

Between December, 1988, and Summer, 1990, this streamlined implementation process has resulted in the development of 2,700 new parking spaces at 24 commuter rail stations. Metra notes that the committee process is able to procure plans for approximately 4,000 new spaces every year. However, given current ridership projections, only a fraction of these spaces can be considered as a net gain in capacity since new spaces are rapidly consumed.

State of Connecticut

The State of Connecticut has one of the longest operating and most extensive park-and-ride programs in the United States. In 1969, the Connecticut Department of Transportation (ConnDOT) initiated an Expressway Interchange Parking Study. During the initial phase of the study, expressway interchange areas (those interchanges where demand was demonstrated by parked vehicles) were surveyed. Based on the survey results, 4 initial commuter parking facilities were constructed, and a continuous program for the development of commuter parking facilities was begun.

Energy concerns and escalating fuel prices provided further impetus for the program and, by 1973, there were 11 commuter parking lots in service. Apart from these paved, permanent facilities, 66 low-cost gravel parking facilities were constructed in 1974. Because of the need to provide ridesharing capability, commuter parking facilities were no longer restricted to expressway interchange areas but were also constructed along State Highways at selected locations.

The first express commuter bus operation sponsored by ConnDOT began in 1972 with peak period service between West Hartford and the Hartford CBD. This was soon followed by commuter bus service between Enfield and Hartford. Both the number and usage of commuter parking lot and express bus facilities have continued to increase. As of 1988, the State of Connecticut was operating 212 park-and-ride lots, providing a total of nearly 21,000 parking spaces. A survey of 157 lots conducted in 1987 determined that average occupancy per lot was 61 percent, utilizing 56 percent of the total available capacity Statewide.

■ Transportation and Air Quality Impacts

Because park-and-ride programs are frequently incorporated into comprehensive programs involving a variety of strategies (i.e. areawide ridesharing, HOV priority lanes, parking management programs, etc.) to reduce single-occupant vehicle travel, it is difficult to isolate the contribution which individual or collective park-and-ride facilities make toward improved transportation and air quality. However, several studies have assessed the impacts of park-and-ride facilities on commuter travel.

A key factor used in evaluating changes in VMT resulting from park-and-ride programs is the previous mode of park-and-ride users. Data in Table 1 for several urban areas shows that between 11 and 85 percent of park-and-ride patrons had driven alone to their destinations before they began using park-and-ride facilities. The average prior drive alone share for all studies was 49 percent. Between 5 and 28 percent of lot users, or an average of 23 percent, had been part of a carpool or vanpool, and between 5 and 49 percent, or an average of 10 percent, had previously used transit. 15 percent of park-and-ride users had not previously made the trip at all.

It should be noted that for these prior rideshare and transit users that the availability of park-and-ride facilities does not necessarily divert them from their previous mode of travel but may facilitate their continued use of these modes. However, this also points out the need to consider the possibility of diverting prior rideshare and transit users into private automobiles for a larger proportion of their overall trip when siting park-and-ride facilities.

The results from Texas shown in Table 1 indicate that the highest percentage of park-and-ride users previously drove alone to their destinations. This figure ranged from 49 to 63 percent, or an average of 56 percent, for the five cities examined. Assuming that half of these commuters take a carpool from the park-and-ride lot to their destination and that half take public transportation, an 82 percent reduction in vehicle trips would be achieved among commuters using these park-and-ride facilities. This figure does not include the home to park-and-ride lot portion of the trip nor does it reflect the total number of work trips in the corridor or regionwide. However, if 10 percent of the commuters in a particular corridor used park-and-ride facilities and the distance between the lot and destination is, on average, the same as the distance between the trip

Table 1. Prior Travel Modes of Park-and-Ride Users

Geographic Area	Number of Lots Surveyed	Drove Alone	Carpool or Vanpool	Bus or Other Transit	Did Not Make Trip	Other
Canada						
Vancouver	1	38	8	21	–	–
California						
San Pedro	–	63%	23%	0%	14%	0%
San Francisco BART	–	37	18	43	27	2
San Francisco/ Los Angeles	15	22	9	38	29	2
San Francisco	1	45	–	–	–	–
Connecticut						
Hartford	–	56	16	23	4	1
Hartford	1	57	15	23	5	0
Hartford/New Haven	14	40	22	7	27	4
Connecticut Vanpoolers						
From all locations	–	27%	59%	12%	0%	2%
Southern California						
Normal Carpooler	NA	72%	16%	10%	0	2%
Long-Term Pooler	NA	83	11	3	0	3
Short-Term Pooler	NA	85	0	8	0	7
Four States						
Carpoolers	150	50%	28%	5%	16%	1%
Texas						
El Paso	5	61%	28%	8%	3%	0%
San Antonio	6	57	20	20	3	0
Dallas/Garland	1	50	11	11	25	3
Houston	11	49	17	8	24	2
Houston	8	45	20	6	26	3
Houston West Belt	1	31	5	47	15	2
Houston Mason	1	25	11	49	15	0
Houston Addicks	1	25	11	49	15	0
Fort Worth	8	63	15	8	9	5
Urban Fringe Lots	25	58	24	11	4	3
Urban Lots	32	57	25	7	8	3
Florida						
Miami	1	54	10	22	14	0
Miami	–	46%	14%	16%	24%	0%
Dade County	–	65	12	17	0	6

Table 1. Prior Travel Modes of Park-and-Ride Users (continued)

Geographic Area	Number of Lots Surveyed	Drove Alone	Carpool or Vanpool	Bus or Other Transit	Did Not Make Trip	Other
Wisconsin						
Milwaukee	–	25%	18%	38%	0%	19%
Milwaukee-Mayfair	1	33	7	40	20	0
Milwaukee-Bayshore	1	38	12	35	15	0
Milwaukee County	13	47	15	32	6	0
Washington, D.C.						
Metro	–	25%	18%	23%	0%	34%
Fringe Lots	3	25	9	29	0	37
Prior Trip Makers	–	40	14	46	0	0
Shopping Center	1	38	0	30	32	0
Virginia						
Shirley Busway	–	19%	13%	8%	57%	5%
Shirley Highway	1	38	12	42	9	0
New Jersey						
New Brunswick	1	11%	–	13%	–	76%
Washington						
Seattle	1	65%	12%	23%	0	0
Seattle	1	59	11	29	1	0
Seattle-Feb 1971	–	67	7	16	10	0
Seattle-June 1971	–	43	9	28	20	0

Source: Reference (3).

origin and the lot (i.e. lot is located midway on trip between origin and final destination), corridor work trip VMT would be reduced by 4.1 percent.

Table 1 also shows results of a study conducted by the Connecticut Department of Transportation of park-and-ride facilities serving the Hartford and New Haven areas, based on surveys conducted between 1977 and 1980 to determine if these lots were effective in decreasing commuter trips and reducing air pollution. Table 2 summarizes VMT and emission reductions resulting from use of these facilities. The average work trip length for both regions, 13.3 miles for New Haven and 13.2 miles for Hartford, falls into the national average of 5 to 20 miles. The combined reduction in VMT for both regions was 46 percent of the statewide park-and-ride lot program VMT reductions. Overall, the reduction in 1980 daily statewide VMT resulting from all park-and-ride facilities was 0.45 percent, or 1.04 percent of work trip VMT. This resulted in a reduction of 0.23 percent in statewide work trip emissions.

A recent study of the relationship of parking programs to air quality in Portland, Oregon examined the effectiveness of 11 alternative measures which might potentially "offset" the air quality impacts of additional parking spaces in the downtown. Analysis was conducted using a computer model which accounted for travel behavior as would be affected by potential changes in parking and other transportation policies. As output, the model produced estimates of the downtown emission impacts of each measure. Results of this analysis are shown in Table 3. As shown, although fringe parking was found to have a somewhat greater emissions reduction potential than remote park-and-ride, neither program was found to be as effective as most of the other measures considered. The study concluded that successful management of the downtown parking supply and achievement of federal air quality standards will require a combination of measures. However, it also cautioned that,

> "The predicted impacts [of each measure]...often do not include long-term adjustments that may occur as commuter parkers are shifted out of downtown and spaces are made available, or as travel speeds improve on downtown streets. In some cases, a reaction to these improved conditions (people returning to downtown by car) will result in a lessening of the predicted emissions reduction impact....If new drivers emerge to replace those diverted to other modes or parking locations outside the downtown, the value of the measure as an offset can be lost. If the shift is also accompanied by an increase in the turnover rate for the space vacated, the effect may even be an increase in the level of emissions. "

Another issue with respect to park-and-ride lots is the effect of shifting the location of cold-starts from downtown to fringe or more remote parking locations. Although use of park-and-ride facilities would reduce total VMT by diverting low occupant vehicle users into HOV or transit modes for a portion of their commute, the total number of "cold starts," the phase of vehicle operation producing the highest emission output, would not necessarily be reduced. This means that although emissions in CBDs may decline, total areawide emissions may experience a smaller reduction. As a result, park-and-ride and fringe parking programs appear to have more relevance as localized CO reduction strategies but less relevance as strategies to reduce areawide pollutants such as ozone.

Table 2. VMT and Emissions Reductions for Connecticut Park-and-Ride Trips[1] (1977-1980)

	Average 2-Way Work Trip Length	Daily VMT Reduction	Daily CO Emissions Reduction[2]
New Haven	13.3	32,493	460,795
Hartford	13.2	57,134	929,413
Statewide	-	194,612[3]	2,727,320[4]

[1] The trip length assumed is 13 miles. Many users of park-and-ride/fringe parking facilities travel much further.

[2] Grams/day.

[3] Equivalent to 0.45% total VMT; 1.04% work VMT; percentages unavailable for New Haven and Hartford regions.

[4] Percentage only available for aggregate of all vehicular emissions – reduction of 0.08% total vehicular emissions; 0.23% work trip vehicular emissions.

Source: Reference (4).

Table 3. Summary of Potential Emissions Impacts of Offsets

	Measure	Potential Change	Potential CO Emissions Reduction
1.	Fringe Parking	600 Downtown Parkers Diverted	60 kg
2.	Alternative Work Schedules	1 MPH Increase in P.M. Speeds - 4,000 Employees	147 kg
3.	Subsidy of Ridesharing	$.50/day Subsidy - 35,000 Employees	255 kg
4.	Parking Management		
	Increase Long-Term Rates	$1 increase in All-Day Rate - 30,000 Parkers	129 kg
	Increase All Parking Rates	20% Increase for All Parkers - 56,000 Parkers	187 kg
	Reserve Off-Street Parking Before 10 A.M.	15% of Core Off-street Spaces Restricted - 2,000 Spaces	302 kg
	Reserve Parking for Carpools	1,000 Additional Spaces Used	17 kg
5.	Park-and-Ride Remote	335 Spaces Used	13 kg
6.	Alternative Fuels	1,000 Light Vehicles Converted	51 kg
7.	Reserved Parking	No Apparent Reduction	
8.	Enhanced Inspection and and Maintenance	Annual Inspection for All Vehicles	462 kg
9.	Increased Transit Capacity	6,000 Trips Diverted to Transit	364 kg
10.	Traffic Flow Improvement	.5 MPH Increase in P.M. Peak Periods	73 kg
11.	Bicycle Access	50 to 100 Commuters Shifting	5-10 kg

(1) The change in parking and in emissions represents only the reduction in parking produced by the measure. As spaces become available, some additional parkers may be attracted to the downtown and the magnitude of the change is therefore likely to be less. Because of the limitations in the data available to the project, the response to the change in space availability could not be predicted.

The Regional Air Quality Plan for Sacramento, focusing on these issues, states that "remote park-and-ride has little direct potential for air quality improvement because it affects a very small proportion of total daily trips." In Sacramento, approximately 20 percent of areawide weekday trips are between home and work. Only 20 percent of these trips have central city destinations, these being the trips for which park-and-ride is best suited. Also, as indicated above, diversion of trips to park-and-ride lots does not reduce the volume of automobile "cold starts." As a result, VMT reductions from a park-and-ride program result in correspondingly smaller emission reductions than measures which eliminate the entire trip. Similarly, the Sacramento Plan concluded that fringe parking facilities produce no regionwide air quality benefit because of the small number of daily automobile trips destined for the downtown and the fact that, of those trips, fringe parking lots eliminate only the last 2 to 3 miles of travel. Therefore, VMT reductions are minimal. However, the Plan also indicated that a reduction in the number of automobiles within the central city will result in some reduction of carbon monoxide emissions in the downtown. In general, the Plan concluded that remote and fringe park-and-ride lots provide little areawide air quality benefits but are important as a support measure to public transit and congestion relief, justifying their implementation along high volume corridors.

In summary, in developing and implementing fringe park-and-ride facilities, an assessment of the air quality impacts should be undertaken which looks at the emission reductions expected due to VMT reduction balanced against cold start emissions which are not eliminated and options for reducing auto trips altogether.

■ Costs/Impacts/Affected Market Groups

The market group for which park-and-ride programs are most heavily oriented are the suburban and exurban commuters bound for the central city and other larger suburban employment centers who travel via single- or low-occupancy vehicles. Therefore, the primary objective of park-and-ride programs is to provide attractive alternatives to combine these motorists into HOV transportation services. A second market group which benefits from park-and-ride facilities are existing transit and HOV users who might benefit from facilities which have greater capacity or are more conveniently located than what otherwise might be available. However, in terms of energy consumption and pollutant emissions, attracting this market group to park-and-ride facilities provides lesser benefit given their pre-existing use of transit and HOVs.

The cost of building surface park-and-ride lots is estimated to be $2,500-$3,000 per parking space, based on recent experience. This includes paving, drainage, lighting, signage, and striping. It also assumes a four inch pavement section, relatively flat location, and lots that are adjacent to the freeway. Land costs will vary substantially depending upon the location of the lot. At a cost of $7.50 per square foot ($326,700 per acre), land costs would add $2,450 per parking space, based on an area of approximately 325 square feet (stall plus driveway area).

The financial commitment necessary to implement a comprehensive park-and-ride program, thus, can be substantial, particularly if a large number of spaces are to be constructed. Such an effort requires the coordination of several agencies that share different responsibilities for funding and implementation. Frequently, local or state transportation agencies will provide funding for lot construction, and another private or public agency then has responsibility for operation. On the other hand, transit agencies will often build and operate their own lots in coordination with transit services which they provide.

Funds for implementing park-and-ride facilities are available from the federal government. Title 23, U.S. Code, provides for funding of park-and-ride programs through the federal-aid highway program administered by the Federal Highway Administration (FHWA). Section 3, discretionary funds; Sections 9 and 18, formula grant; and Section 8, planning grant, programs administered by the Federal Transit Administration (FTA) provide funding for park-and-ride facilities associated with transit and certain rideshare activities. Department of Energy (DOE) funds are also available for park-and-ride activities included in the State Energy Plan.

Normally, federal-aid highway funds administered by states are cost reimbursable. Therefore, agencies must first use their own funds and then apply to the federal government for reimbursement. Such projects must be included in the budget of the state government, often involving political or legislative activity. In such cases, technical analysis of project benefits, developed through the transportation planning process, can be useful in justifying the projects.

In recent years, more agencies are relying on non-federal funding for transportation improvements and are using innovative approaches to minimize the extent of their capital investment. These strategies may involve special taxes or the use of general revenues. Allowing developers to provide fewer on-site parking spaces who would then contribute their associated cost savings to a fund for park-and-ride development is a possible approach. More and more communities are shifting a share of the cost of development from government to developers and large employers. Some areas have required developer involvement in ridesharing programs as a condition for approval of building permits and subdivision applications. Although costs may be high, developers of large projects are willing to comply rather than face the possible rejection of subdivision development plans. Developers and government agencies are becoming increasingly aware of the benefits of reduced congestion in making development sites more attractive to employers.

■ Implementation Considerations

While an assessment of the air quality impacts of park-and-ride/fringe parking program should be undertaken, it should be recognized that in isolation, these facilities may not

contribute significantly to emission reductions. However, they are an important element in supporting congestion relief efforts as well as public transit and ridesharing. Thus, when taken with the combined benefits of a variety of strategies, park-and-ride/fringe facilities can be an important component addressing air quality problems.

There are 3 phases of program implementation which must be addressed in the development of park-and-ride/fringe parking program development. These are:

- **Planning** – Includes development of program goals and objectives, establishment of service area and determination of targeted market groups

- **Design** – Involves definition of program operating characteristics, site selection, and facility design

- **Implementation** – Includes execution of leases for private property, identification of funding sources, parking enforcement procedures, marketing, maintenance, and facility construction and operation

There is extensive material available describing the implementation of park-and-ride/fringe parking programs, listed in the bibliography, which can be consulted for documentation of detailed procedures. Certain important considerations should be noted, however, and are discussed below.

San Francisco's Metropolitan Transportation Commission has established implementation guidelines for development of park-and-ride lots, as follow:

1. **Located conveniently near interchanges of HOV lane or major highway**

   The preferable location is within one quarter mile or adjacent to the roadway entrance ramp. In Fairfax County, Virginia, several lots located in outlying areas and more than 5 miles from a major highway were poorly used, typically operating at 5 to 25 percent of capacity. Lots located adjacent or near highways in metropolitan Washington D.C. reach capacity early during the morning peak period. Also, lot locations convenient to transit (rail or bus) are likely to experience greater use.

2. **Effective market capture area or distance that major park-and-ride facilities attract users is about 5 miles**

   According to several surveys, most lot users drove 5 to 7 miles, with a trip time of 12 to 20 minutes maximum. A survey performed in Fairfax County for 12 park-and-ride facilities found that 80 percent of total lot users came from a distance of 5 miles or less.

3. **Location upstream of congestion**

   A site should be upstream of congestion, and located on the side of the morning commute direction.

4. **Safety**

   A lot should be visible, well lighted, and preferably, have a telephone nearby. It should also be regularly patrolled by state police if it is a state-owned lot, or by a security guard if it is a shared facility.

5. **Good ingress and egress**

   Safe and efficient traffic movement is a major concern. Access to the lot should be convenient to both transit and auto.

6. **Projected demand**

   Demand for park-and-ride spaces is based on analysis of individual travel corridors. Estimation of demand provides a guideline as to the most effective size for the lot.

7. **Visibility from roadways**

   The lot should be visible from freeways and major roadways. Visibility of facilities contributes to the recognition by passing motorists of their availability. Visibility of a lot is also a deterrent to vandalism.

8. **Signing/marketing**

   Motorists should be informed of the lots location with directional roadway signs. Marketing is as important as planning and development of facilities. New lots should be promoted, as well as the overall park-and-ride program.

9. **Accessibility to HOV lanes**

   Sites located adjacent to HOV lanes, HOV priority ramps, or other priority facilities provide benefits to park-and-ride users. Coordination of the location of park-and-ride sites with HOV facility development can increase the usefulness and efficiency of both facilities.

10. **Fewer and larger (300 spaces or more) lots are preferable**

    Larger facilities are more visible and attract correspondingly more riders than small lots. They provide a "critical mass" of visibility and transit service viability. In Fairfax County and in the Greater Boston area, lots in excess of 300 spaces experience much higher rates of casual carpooling and private transit service than do smaller lots. In Boston where many private bus carriers provide commuter services, the larger lots are major staging areas, allowing fewer stops to fill buses, a major

consideration for determining service profitability. A lot of 300 spaces or more provides sufficient capacity to provide an exclusive express bus service that services only the one lot and provides a peak period headway of 10 to 15 minutes.

11. **Express bus transit service**

    Express bus service is also an important support service for a successful park-and-ride program if effectively operated. Consideration must be given to when bus service should be initiated. Either service can be offered upon opening of a facility, or a critical mass of cars could be required before new service is initiated. Recent national experience indicates that express buses become a viable service to park-and-ride facilities when the following three conditions are met: 1) the park-and-ride facility is operating at 75 percent capacity or greater, 2) the park-and-ride facility is located near HOV facilities or highway corridors that feed into HOV lanes, and 3) park-and-ride lots are consolidated into a minimum number of large non-competing lots that assure a "critical mass" of potential users, allowing for fewer stops and faster in-vehicle travel times. Destination stops should also be minimized, with stops only at major employment or transit distribution centers. Also, adequate shelters, telephones, and allowance for security are desirable amenities at major lots.

The City of Boston recently developed its own criteria for evaluating potential park-and-ride sites for expansion of existing facilities. These criteria include the following:

- The site has convenient access to adjacent high volume arterials or expressways, or offers potential for good access with reasonable cost improvements.

- Traffic generated by additional parking at an existing facility or by a new facility will not negatively impact adjacent neighborhoods or exacerbate an existing traffic problem.

- The site provides for convenient connections to high-quality transit service or offers the potential for a convenient connection.

- To maximize reduction in vehicle miles travelled, sites should be located in close proximity to the home origins of commuters.

In addition, various area-specific considerations must be addressed as part of the implementation process. A few of the most crucial are described below:

- **General Liability of Lot Program** – As a rule, a park-and-ride program should obtain the advice of the state's general counsel on the legal and liability issues regarding the use of public/private property for park-and-ride facilities and on necessary arrangements for implementing their use. Some states purchase special liability insurance to protect landowners with whom lease agreements are made for carpool lots.

- **Lease Agreement** – A lease is a contract that conveys a facility or real estate with conditions regarding its use and specification of rent. Whether formal or informal, leases are a popular way of making land available for park-and-ride facilities. However, informal lease arrangements can be an unreliable basis for use of a site and, consequently, be detrimental to a successful program. The content of formal leases will vary among jurisdictions and transit agencies. A sample lease is shown in Figure 1.

- **Community Involvement** – The involvement of the local community in park-and-ride development begins at the conceptual planning stage and continues through implementation. The local community must feel confident that efforts are being made to minimize the potential adverse impacts which might result from a new parking facility within their community and that the implementing agency is aware of their concerns. Community involvement is an important part of the planning process that must carry over into the implementation process. Communication strategies which involve contact with community groups, employers and residences, use of the media, and on-site notices before the implementation phase can contribute toward higher utilization of a facility once it is opened to the public.

- **Marketing Program** – Marketing activities to inform motorists about the availability and advantages of park-and-ride must be deliberate and aimed at an objective of increased HOV use. A marketing program must identify the target audience and determine the most effective mechanism for conveying the intended message. Numerous communication techniques such as informational signs, news releases, public service announcements, bumper stickers, employer activities, and maps showing the location of the lots and connecting transit services can be utilized. Generally, the strategy used to reach target audiences depends upon their travel characteristics; most often the focus must be on the work-related commuter trip.

■ Bibliography

1. Aronson, Michael N., and Wolfgang S. Homburger, "The Location and Design of Safe and Convenient Park and Ride Lots," prepared for the State of California, Department of Transportation, Sacramento, CA, January 1983.

2. Barton-Aschman Associates, Inc., "Traveler Response to Transportation System Changes," Federal Highway Administration, Washington, D.C., July 1981.

3. Bowler, Charles E., et al. "Park-and-Ride Facilities – Guidelines for Planning, Design, and Operation," Federal Highway Administration, Washington, D.C., January 1986.

Figure 1. Sample Lease Agreement Involving Private Property

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
By
Chief Administrator

CHURCH
By
Church Representative

4. Burke, James W., Stuart D. Leland, and Paul Buckley, "Parklot – A Computerized Analysis Tool for Developing Ridesharing Facilities and Services," prepared for the Connecticut Department of Transportation.

5. Cambridge Systematics, Inc. "Fairfax County Commuter Park-and-Ride Study Final Report," prepared for the County of Fairfax, Office of Transportation, Fairfax, VA, February 1988.

6. Cambridge Systematics, Inc. "Improved Air Quality in Maricopa and Pima Counties – The Applicability of Transportation Measures" prepared for the U.S. Environmental Protection Agency, Region IX, San Francisco, CA, November 1986.

7. Cambridge Systematics, Inc. "Implementation Guidelines for HOV Support Facilities and Programs: 2005 HOV Program Prioritization, Deliverable #2" prepared for the Metropolitan Transportation Commission, San Francisco, CA, January 1990.

8. Cambridge Systematics, Inc. "Implementation Guidelines for HOV Support Facilities and Programs: 2005 HOV Program Prioritization, Deliverable #5.1" prepared for the Metropolitan Transportation Commission, San Francisco, CA, May 1990.

9. Cambridge Systematics, Inc. "National Review of Fringe Parking Lot Issues," prepared for the Tri-County Metropolitan Transportation District of Oregon, Portland, OR, June 1989.

10. Creager, G.S., C.P. Zelachowski, and E.N. Burns. "Park-and-Ride Design Guidelines," prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration, January 1979.

11. DiRenzo, John F., et al. "Parking Management Tactics, Volume 3: Reference Guide," prepared for the Federal Highway Administration, Washington, D.C., June 1981.

12. Higgins, Thomas J., "Parking Management and Traffic Mitigation in Six Cities: Implications for Local Policy," Transportation Research Record 1232. Urban Traffic Systems and Operations, 1989.

13. Loudon, William R., Elsa Coleman, and John Suhrbier, "Air Quality Offsets for Parking," Transportation Research Record 1232. Urban Traffic Systems and Operations, 1989.

14. McAtee, J. Patrick, Unpublished paper describing Metra's Parking Improvement Programs, prepared for Northeast Illinois Railroad Corporation, Chicago, IL, 1990.

15. Metra Parking Implementation Committee, "Proposed FY90 Parking Improvement Program," Northeast Illinois Railroad Corporation, Chicago, IL, February 1990.

16. Noel, Errol C., "Implementation and Operation of Park-and-Ride Lots," Transportation Research Record 1232. Urban Traffic Systems and Operations, 1989.

17. TAMS Consultants, Inc. and Cambridge Systematics, Inc. "Strategic Parking Plan: Analysis and Recommendations" prepared for the City of Boston, Department of Transportation and the Real Property Board, Boston, MA, March 1990.