Appendix D

Survey of Effectiveness of Possible Actions To Improve Transit Ridership

This Appendix consists of a compendium of references, tables, and text based on recently published sources which describe and summarize existing experience relevant to each of the transit improvement/auto restraint actions outlined in chapter Viii.

NO FARE AND REDUCED FARE

Only one city in the United States has a systemwide, free fare public transit program, the small industrial town of Commerce, Calif. Approximately 15 other cities are experimenting with variations of the systemwide concept offering no fares during peak periods, within defined zones, and for special user groups, primarily students and the elderly. Most of these programs are small and few have produced comparable ridership and diversion data, [l]* At least 10 major cities are experimenting with systemwide reduced fares, including special programs for off peak hours and weekends. .The most notable example is Atlanta where a reduction of fare from 40cents to 15cents resulted in a 28 percent increase in ridership, of which about half were previous auto users. [2] A sample of no fare and reduced fare programs for which ridership and diversion data available is presented in Table 52.

Most of these no fare and reduced fare experiments have reported promising increases in ridership, especially when accompanied by corridor or systemwide service improvements. “In general, increased ridership has not offset lower fares in terms of revenue generation, resulting in a net revenue loss. Thus, fare reductions as well as service improvements generally require some type of public subsidy. Some studies indicate that if the cost needed for a fare-reduction program were applied to service improvements, a greater diversion from auto use would occur. The combination of a fare reduction with service improvements, however, seems to be a promising tool.[3]

Unlike most innovations, transit unions have fully supported subsidized transit and are actively lobbying for it within Congress and the Executive Branch. Therefore, little transit in-house resistance is expected. [4] Some opposition might be anticipated from those public agencies which are charged with the responsibility for finding the funds to support transit subsidies in lieu of direct Federal operating monies. If local tax levies are proposed, political support for public transit from the so-called non-user groups may be jeopardized, especially in the case of free-fare subsidies.

Additional reduced fare programs for special groups (elderly, and handicapped) have been initiated in Chicago, Milwaukee, Pittsburgh, and other cities with reported ridership increases ranging from 15 percent to 62 percent. Weekend reduced fare and no fare programs in Los Angeles, Chicago. Pittsburgh, and New York have also resulted in ridership increases from 25 percent to 200 percent.

TAX INCENTIVES

The effect of tax incentives such as transit fare deductions from Federal, State, and local income taxes, and transit fare rebates, would be to reduce the cost of using transit, and thus stimulate ridership. It is argued that since tax refunds would lag considerably behind the payment of transit fares and only apply to those who file income tax returns or itemize deductions, it is likely that their effect would be considerably less than a direct fare reduction. [s] On the other hand, public support for tax deductions and rebates might be stronger among non-user groups, than for fare reductions which require local tax increases. The net impact of either fare reductions or tax incentives on transit ridership may ultimately depend on the extent to which these actions are accompanied by service improvements and auto restraint measures.

*See References at end of chapter, on p. 147.

Table 52

SUMMARY OF NO-FARE AND REDUCED FARE IMPACTS ON TRANSIT RIDERSHIP AND DIVERSION

City	Type of Program	Results
Rome	Systemwide no fare during rush hour. 43- day experiment in May-July 1972; financed from general City revenues.	5 percent increase in total transit ridership. Ridership increase exceeded available excess capacity during peak hour resulting in chaos.
Seattle	CBD no fare zone. 105 square blocks, subsidized by City: September 1973.	Ridership increased on some lines in the area by 56 percent.
Dayton	CBD no fare zone. 66 block area; 1973.	14 percent increase in total transit ridership. 28 percent of this increase diverted from autos. Reported shift to long-term parking in peripheral areas.
Rockford	Senior citizens no fare program during off-peak hours. Subsidized 50 percent by State DOT and 50 percent by local revenue sharing funds; 1974.	100 percent increase in monthly senior citizen transit ridership.
Atlanta	Systemwide reduced fare from 40cents to 15cents. Funded by 1 percent sales tax. April 1973.	30 percent increase in total transit ridership, 50 percent of this increase diverted from autos.
San Diego	Systemwide reduced fare from 35cents to 25cents. Funded from State gasoline tax; 1973.	22 percent in total transit ridership.
Los Angeles	Systemwide reduced fare from zone system fares as high as $1.45 to a flat 25cents rate.	22 percent increase reported in weekday transit ridership.

PRIMARY SOURCE: "No Fare and Low Fare Transit", prepared for the California Legislature by the Metropolitan Transportation Commission, June 1973.

TRANSIT AND TRAFFIC MANAGEMENT

Priority Lanes and Control Devices

It has been estimated that in most cities buses carry a high proportion (85 percent) of peak-hour travelers on city streets and arterials. [6] Thus the most prevalent bus priority treatments to date have been designed to separate buses from mixed traffic on CBD arterial access routes by reserving one lane of street capacity for high occupancy vehicles. This is usually accomplished by eliminating curb side parking and utilizing this lane for buses and taxis (Table 53). Contra-flow or reversed-flow bus lanes on arterials are less common because of the obvious safety and traffic control measures required. In general, most priority bus lanes on arterials are implemented to improve traffic flow, reduce congestion, and increase the efficiency of transit. Almost all demonstrations to date have reported modest savings in transit travel times and some reduction in congestion. Impacts on ridership are difficult to assess because arterial treatments usually cannot be isolated from other service improvements and often constitute only one portion of a priority lane system extending between the CBD and peripheral areas.

Bus priority lanes on freeways are less common than arterial treatments and represent a fairly recent policy emphasis aimed at increasing the carrying capacity of existing highways and providing an attractive, efficient alternative to auto travel. Two approaches are commonly advanced. [4]

1. Reservation of a lane in the most heavily traveled side of the freeway. In this approach all or part of a lane of traffic is reserved for high occupancy vehicles, usually at the critical "bottleneck" portion of the freeway during the peak period. It may be sufficient to reserve lanes through very short bottleneck areas such as tollbooths or sections of the freeway where demand exceeds design capacity.

Table 53

SUMMARY OF PRIORITY LANE TREATMENT IMPACTS ON TRANSIT RIDERSHIP AND DIVERSION

Type of Treatment	Example	Description	Results
ARTERIAL RELATED			
Bus Streets	Nicollet Mall, Minneapolis	8-block "transit mall" for pedestrians and buses.	Traffic congest ion reduced and bus ridership in mall area increased by 18,000 per day.
CBD Curb Bus Lanes, Normal Flow	Baltimore	11 bus only curb lanes covering 5 miles.	No reported changes in ridership; transit speeds increased by 2104 in a.m. peak and 17% in p.m. peak.
Arterial Curb Bus Lanes, Normal Flow	New York City	15 miles of curb bus lanes on 11 streets mostly in midtown Manhattan.	No significant changes in ridership; time savings for buses increased from 22% to 42%.
	Vancouver	6-block p.m. peak hour curb bus lane on George Street.	Bus travel time reduced by 30%; 12% ridership increase reported.
CBD Median Bus Lanes, Contra-Flow	Chicago	.6 mile median busway on Washington Street.	
CBD Curb Bus Lanes, Contra-Flow	San Antonio		
Arterial Curb Bus Lanes, Contra-Flow	Louisville	Two contra-flow lanes on parallel streets during peak hours.	25 % time savings reported.
FREEWAY RELATED			
Bus Lanes on Freeways, Normal Flow	Washington, D.C.	9th Street Expressway.	
	Seattle	Reversible freeway lanes with exclusive bus ramps, service improvements and park-and-ride lots.	Ridership increased by 1/3; new riders were equally divided between those diverted from autos and those who did not previously make the trip.
	1-495, New Jersey	21 /2-mile contra-flow bus lane which operates in morning peak connecting the New Jersey Turnpike and the Lincoln Tunnel.	6% increase in morning peak period ridership and time savings of over 10 minutes per trip.
	Long Island Expressway, New York	2.2-mile contra-flow bus lane operated during morning peak.	Time savings of 12 minutes per trip for transit riders, 16 to 23 minutes for auto users.
	Boston	8.4-mile contra-flow bus lane operated during morning peak.	Bus riders save 14 minutes per trip; auto users save from 17 to 22 minutes per trip.

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Table 53-Continued

SUMMARY OF PRIORITY LANE TREATMENT IMPACTS ON TRANSIT RIDERSHIP AND DIVERSION Cent'd.

Type of Treatment	Example	Description	Results
Bus Lane Bypass of Toll Plaza	San Francisco	System of priority lanes for buses and carpools at the Bay Bridge toll plaza.	Bus and car travel times reduced by 5 minutes; 8 to 10% increase in ridership.

PRIMARY SOURCE: "Bus Use of Highways: State of the Art," National Cooperative Highway Research Program, Report 143, Washington, D.C., 1975

2. Use of an opposing lane. In this approach a lane on the least heavily traveled side of the urban freeway is reserved for high occupancy vehicles. For example, in the a.m. peak, a lane on the outbound portion of the freeway usually next to the median strip, is reserved for high occupancy vehicles to travel inbound against the traffic flow on the outbound lane. In this way, the exclusive use lane does not subtract from the total previously existing capacity on the congested portion of the freeway.

It should be noted that priority lanes need not run the entire length of a freeway, but might be appropriate for only close in, relatively short sections where congestion severely retards transit travel times. [4] Such treatments are generally inexpensive to implement requiring only signing, striping, lane delineators or cones, etc., but often are difficult to enforce and may have "adverse impacts on adjacent auto drivers. As indicated in Table 53, ridership, diversion, and time savings data thus far reported by a sample of existing freeway priority experiments is promising. The most successful demonstrations have been operated during peak periods and in combination with peripheral parking, exclusive access ramps and priority lane CBD distribution systems.

Bus priority signal systems such as metered bus ramps, signal preemption, special signalization, and special turn permission are being tested throughout the country. These systems vary in effectiveness based on their application in each situation,

The implementation and successful operation of priority bus lanes on arterial streets, highways, and access ramps is primarily dependent on well defined traffic management policies and a high level of intermodal cooperation. Designation of priority lanes usually does not require legislative action other than local approval, and few significant obstacles are apparent at the State and Federal levels. [3] Opposition can be expected where priority treatments exclude private carriers or present a competitive threat to para-transit modes such as taxi cabs, An example of this opposition was evidenced by a recent protest in New York City as reported in The New *York* Times, April **16, 1975:**

> "QUEENS BLVD. BUS LANE POSTPONED" The city's Traffic Department postponed plans to establish an experimental two-and-a-half-mile express bus lane along Queens Boulevard after 100 Medallion cab drivers blocked the lane Monday night to protest their exclusion from it, A departmental spokesman said the project had "been postponed until further notice" so that meetings could be held with the Community Planning Board, the Chamber of Commerce, the tax industry, and local organizations. Under the planned 2-week experiment, express buses would have been allowed to travel east along a normally west-bound lane, away from the Queens-bound rush-hour crush, beginning at 5 p.m. each weekday,

TRANSIT SERVICE IMPROVEMENTS

Fleet Expansion

In a recent EPA publication it was concluded that the improvement and expansion of mass transit facilities, especially bus fleet expansion, is one of the key elements necessary to attract auto drivers to transit and reduce VMT, [7] While no data on po~ tential transit ridership increases are available, EPA estimates that in order to achieve a 10 to 20 percent reduction in auto use by diversion of work trips to transit, existing bus fleets would have to be expanded by 50 percent, and in some cases over 500 percent. [7] Current EPA and DOT estimates of the amount of fleet expansion required to comply with transportation control plans are presenied in Table 54. EPA estimates are higher because:

1, In some cities EPA projects that transportation controls will achieve a greater reduction in automobile usage than DOT projects.

2. EPA has assumed that increased carpooling will achieve 25 percent of the needed reductions in auto use, whereas DOT assumes that carpools will carry 75 percent of the diverted auto travelers. [7]

EPA has specifically approved transit plans as part of transportation control plans in Washington, D. C., Baltimore, and Seattle, where firm commitments for fleet expansion have been made.

Express Bus Systems

Express bus systems in Seattle, Milwaukee, Washington, D. C., Portland, Oreg. and other United States cities have demonstrated that express bus service can attract significant transit ridership, especially in corridors not served by rail transit lines. The following is a summary of key ridership- and diversion-related experience thus far recorded by existing systems:

1. Express bus ridership, particularly those riders diverted from automobiles, appears to be very sensitive to cost and service variables such as parking costs and fares, time savings, and rider comfort.
2. Ridership increases may vary significantly among express bus routes, especially in areas where the service is aimed primarily at the suburban -to-CBD commuter market. As a result, successful express bus lines may not always increase total system ridership. For example, bus ridership on the Seattle Blue Streak route increased over 30 percent while total system ridership has decreased. [8]
3. In some cases, ridership increases may reflect a diversion from other transit lines, as well as the automobile. It has been estimated that over 38 percent of total ridership on the Shirley Highway route was diverted from other transit routes, while approximately 10 percent were former carpoolers. [8]
4. Most existing express bus systems provide free or inexpensive fringe parking either at regional shopping areas or on publicly owned land adjacent to major CBD access routes. The potential for feeder bus services instead of peripheral parking facilities has not yet been fully investigated.
5. The most successful express bus services have usually been implemented in conjunction with other transit service improvements or ridership inducements, Priority lane treatments, special fare, and accessible, inexpensive parking facilities are common examples.
6. Express bus service to particular employment concentrations, such as the Swan Island prepeak express in Portland, may have a high potential for attracting new transit riders.

Special Services

The national experience with special transit services consists of approximately 75 demand-responsive systems and a wide variety of small-scale, privately operated variations, usually consisting of only one or two vehicles. The most frequently cited demonstration projects have taken place in Haddonfield, N. J.; Ann Arbor, Mich.; Batavia, N. Y.; Bay Ridges, Ontario; and Regina. Saskatchewan. All of these demonstrations serve population concentrations of under 50,000 distributed over a limited area, operate on a subsidy and have attracted sufficient ridership to warrant fleet and service expansions after an initial operating period. In demonstrations where demand-actuated special services were coordinated with existing

Table 54

BUS FLEET EXPANSIONS NEEDED TO ACHIEVE PROJECTED REDUCTIONS IN AUTO USE

City	EPA Estimate		DOT Estimate	
	VMT Reduction Percent	Buses	VMT Reduction Percent	Buses
Los Angeles	17	12,913	7	2.533
San Francisco	14	3,310	7	787
Baltimore	4	377	tl 3	267
N.. New Jersey	18	8,684	8	1,840
Sacramento	9	501	7	186
San Diego	10	1,709	7	307
Phoenix/Tucson	8	802	8	386
Houston/Galveston	5	730	6	386
Denver	14	1,175	10	400
San Joaquin Valley	7	569	7	266
Boston	13	2,882	8	520
Washington, D.C. area	5	1,058	tl 2	467
Springfield, Mass.	● 9	58	● 22	40
New York City	● 5	502	● 40	213
Pittsburgh	6	663	1	26
Philadelphia	5	700	1	67
San Antonio	1	49	2	53
Salt Lake City	● 17	116	● 19	53
Seattle	● lo	174	● lo	80
Spokane	● 5	174	● 7	13
Portland, Oreg.	● lo	116	● lo	53
Minneapolis	2	267	● 2	27
TOTAL		37,529		8,970

● CBD only +Peak Period

SOURCE: **Transportation Controls To Reduce Auto Use and Improve Air Quality in Cities**, EPA, November 1974.

transit services, some increases in systemwide ridership have been recorded.

In most instances special services have acted as a catalyst for new transit operating and marketing techniques, They have also demonstrated that a variety of different transit markets exist, and the necessity to provide different services for each market. {10} The dimensions of the special service market, and the potential ridership which such services could attract in combination with other existing and proposed transit improvements was estimated in a recent study of the Cleveland Metropolitan Area. If implemented as part of a metropolitanwide program of transit improvements including fare reductions, modernization, service coordination, and new rapid transit lines, special services might increase total system ridership by as much as 15 percent. [20]

TRANSIT CAPITAL IMPROVEMENTS

Light Rail Systems [11]

The role of light rail technology in future United States transport systems appears to involve two types of situations. In one of them an inexpensive right-of-way would be available for which light rail would be the least expensive medium-capacity grade-separated system. This would of course require adequate distribution in the CBD. The other situation would reflect the European view that light rail has a higher amenity coefficient than buses and is worth installing even if the long run total costs are higher than bus systems which would move the same capacities, The maximum capacities of light rail systems are influenced by the same factors as rail rapid transit—number of cars per hour and standee ratios. The typical single car operation with a 2-minute headway (30 cars per hour) can move 6,000 to 9,000 one-way riders. The largest practical trains are three cars, due to movements in mixed traffic on some portions of the route. This provides an upper capacity range of 10,000 to 27,000 per hour. The capacities assume either 200 or 300 riders in either a 75-foot straight car or a 90–100 foot articulated car. The standee ratios would be 2.2 to 2.5. These capacities are all based on observation of actual operations.

Automated Guideway Transit (AGT) [21]

AGT may be divided into three categories:

1) Shuttle-Loop Transit SLT)
2) Group Rapid Transit (GRT)
3) Personal Rapid Transit (PRT)

All of these systems operate unmanned vehicles on exclusive guideways.

Several SLT systems are currently in operation at airports, recreational centers, and private commercial developments. These systems provide low to medium capacity service usually on closed circuits requiring no switching. In specialized urban environments where loop service (such as in a CBD) or shuttle service (such as between two large activity centers) is needed. SLT systems could improve transit service and ridership. However, the SLT systems are not suited for service to large metropolitan areas.

GRT systems are in partial operation at the Dallas/Ft. Worth Airport (AIRTRANS) and under construction at Morgan town, W.Va. Both have experienced technical difficulties; however, within the next few years systems of this type should be capable of serving light to medium density corridors in urban areas. A GRT system is planned for Denver which would greatly improve transit service and ridership in the area.

PRT systems are invisioned to consist of small vehicles which carry a passenger or a small group of passengers to their destination with few, if any intermediate stops. No PRT systems are in operation at this time, and it is not likely that such systems will have any impact on urban transportation in the short term.

Exclusive Busways

Exclusive busways involve the construction of a special facility of some type, usually permanent, exclusive lanes for buses similar in cost and design to freeway construction, or separate access ramp facilities. In some cases, part of an existing highway is converted to a busway utilizing one or more existing lanes or the median strip. Operationally, busways are similar to temporary reserved or priority lanes, but their capacity can be significantly higher depending on access restrictions and control devices. The busway capacities presented in table 55 assume conventional headways and traffic safety devices, and exclusive lanes on expressways or high class arterials with restricted access and few controlled intersections. [11] It now appears that "platooning" [13] could further increase these capacities to an upper range of 1,100 to 1,400 buses per hour.

Existing experience with busways is limited to the three demonstrations listed in table 56, These busways ranged in cost from $1.9 million (Seattle,

Table 55

HOURLY ONE WAY EXPRESS BUS CAPACITIES ON BUSWAYS

Busway Operation	Buses per Hour per Lane	Riders per Hour at Average Occupancies 45	Riders per Hour at Average Occupancies 60
Medium Speed Operation 30-35 mph	[b]750	33,750	[a]45,000
High Speed Operation 50-60 mph	500	22,500	([a])

[a]No standees on high speed services due to passenger safety. There are serious safety arguments against the practice for medium speed services with very short headways implied here—5 seconds. The above figure may surrogate for double-deck or articulated buses. It will not be used in any of the subsequent tables.

[b]To obtain 700 to 800 buses per hour all loading and unloading must be done *off* the roadway and traffic segregation and flow controls must be sophisticated. These volumes are actually attained by the Port of New York-New Jersey Authority using Lincoln Tunnel (6 lanes with 2 reversible, bus-only lanes in peak hours) and the Port Authority Bus Terminal which has a *four-lane* throughout capacity. During rail service strikes almost 900 buses per hour have used this system but the speed drops by 5-10 mph, i.e., to 20-25 mph.

SOURCE: Reference 11.

Table 56

SUMMARY OF BUSWAY IMPACTS ON TRANSIT RIDERSHIP AND DIVERSION

Example	Description	Results
Blue Streak, Seattle	9 miles of reversible bus lanes, exclusive *bus* ramp, fringe parking.	Ridership increases by 1/3; new riders were equally divided between those diverted from autos and those who did not previously make the trip. Bus speeds increased 5-7 mph and average transit travel time improvements were 11 minutes in the a.m. and 9 minutes in the p.m. peak periods. Total daily passenger volume of 10,000.
San Bernadino, Los Angeles	11 -mile busway downtown Los Angeles and El Monte located within the median and adjacent to the San Bernadino Freeway.	Average patronage increases of up to 200 percent have been reported. Total daily passenger volume is expected to reach 17,000 upon completion.
Shirley Highway, Washington, D.C.	9-mile busway between Northern Virginia and Washington, D. C., *special bus* access *ramps at interchanges,* fringe parking, and bus shelters.	Bus ridership increased from 27 percent in 1968 to approximately 37 percent in 1972. Some of this increase was diverted from other bus lines as well as autos. Total daily passenger volume has exceeded 16,000 utilizing 300 buses with time savings of 10 to 15 minutes over autos.

PRIMARY SOURCES: References 6,8, and 9

exclusive bus ramps) to $53 million (San Bernadine, 11-mile busway). All of these facilities reported ridership and diversion increases that are interrelated with express bus service improvements and other fare and fringe parking inducements.

AUTO RESTRAINT

Road User Charges

Despite an ever increasing number of potential road pricing mechanisms such as metering, automatic scanning, differential license plates, etc., the only road pricing practices currently in use are charges applied through gasoline taxes and tolls on bridges, tunnels, and other roadways. These practices have traditionally been implemented to raise revenues (not to control traffic) in order to pay for highway construction costs (fuel taxes) and the construction of high cost bridges, tunnels, and freeways (tolls).

The toll collection approach is in wide use at present and may be an effective means of increasing transit ridership. Applied by public authorities (and occasionally local governments) operating river crossings or high capacity highways, tolls are levied to recover the costs of these particular facilities from the motorists actually using them. In contrast to fuel taxation, whereby motorists pay "averaged" prices for road use, toll collection imposes differing charges which can be varied according to the cost of the specific facility and how many times it is used. [14] Furthermore, tolls are widely levied in high density urban locations where maximum auto restraint and diversion to transit could be expected, assuming alternative transit service is available. Among the large cities with toll facilities on major entry points for high capacity highway links in the city are Boston, New York City, Philadelphia, Baltimore, Chicago, Kansas City, Jacksonville, and Miami.

Comparisons of the impact of toll increases on traffic volume on existing bridges has revealed that increases of up to 87 percent may reduce traffic by only 6 percent, However, where reasonably good bus service exists as an alternative mode during the peak hour, it has been estimated that a 25-cent toll wouId result in an 11 percent reduction in CBD work trips. [15]

In summary, relatively light congestion toll increases may be effective in diverting auto drivers to transit in situations where an alternative transit mode is available which can provide a competitive level of service for large numbers of travelers with negligible congestion effects. @51 Examples are the Lindenwald corridor in Philadelphia, where high speed rail service is available as an alternative to auto travel, and the Shirley Highway in Washington, D. C., where high quality express bus service is operating.

Parking Taxes

Parking taxes resulting in parking rate increases have been implemented in London, New York, Pittsburgh, San Francisco, and other major cities, but efforts to isolate the impacts of these increases on transit ridership and auto diversion have yielded few definitive conclusions. In general, parking taxes can be applied for the entire day (flat rate per hour) or for peak periods only, depending on what portion of the parking market the tax is aimed at; long term parking (commuters) or short term parking (primarily shopping, business, and deliveries),

Assuming that parking taxes would be implemented to discourage commuters from driving their private cars into the CBD and use alternative transit services, what are the potential effects on transit ridership? Using a mode split model fitted to Washington CBD-bound work trips, one researcher [16] estimated changes in travel behavior as shown in Table 57. Using an average current parking charge of $2, the data in Table 57 lead to a price elasticity estimate of –.41 for auto driver trips and a "cross-elasticity" of ,38 for bus passenger trips. [17] This data is consistent with experiences reported in other cities indicating that the price elasticity of parking demand is fairly low (–.3 to –.4).

Since parking taxes could possibly affect only 40 percent of all CBD trips in most areas (assuming 60 percent pass through without stopping), parking taxes alone may not be a very effective means of reducing total CBD-oriented traffic volumes. However, at a demand elasticity of –.3 and a tax increase of $2, peak hour transit usage might be expected to rise from 20 to 30 percent, making the parking tax one of the most effective auto restraint/transit improvement actions in terms of transit ridership and energy conservation. This increase would depend on the scale at which the tax is applied, how much of the market it includes, and the availability of quality transit alternatives, Seven United States cities have included parking surcharges as part of AQIP Plans; Washington, D. C., Boston, and five metropolitan areas in California. [7]

Table 57

PROJECTED CHANGES IN TRAVEL BEHAVIOR RESULTING FROM A PARKING TAX IN WASHINGTON, D.C.

Increase in Average Parking Cost	Auto Driver Trips	Transit Trips
$ .25	–4	+3
.50	–8	+6
.75	–12	+1 o
1.00	–15	+13
1.50	–20	+20
2.00	–23	+26
2.50	-26	+33
3.00	-29	+38
3.50	–31	+42
4.00	–34	+47
4.50	–36	+51
5.00	–37	+55

SOURCE: Ted Erlich, "Transportation Pricing and Parking Charges," paper presented at the 'meeting of the Highway Research Board's Committee on Taxation, Finance, and Pricing, Washington, D. C., January 1973.

Parking Regulations

Parking regulations are ways to control the location, amount, and use of parking without resorting to a pricing mechanism. In most metropolitan areas administrative action has been taken to prohibit on-street parking whenever and wherever it obstructs traffic movement, typically along major arterials during commuting hours. This has been particularly effective in New York City where strict enforcement prevails and iIlegally parked motorists are towed away, resulting in a $75 fine. However, such measures usually improve traffic flow characteristics to the benefit of the auto commuter, rather than encourage transit ridership. Other cities have moved to limit existing on-street parking **at certain** hours to residents only, in an attempt to discourage parking on city streets by residents of outlying districts. Boston, for example, now limits all nighttime street parking to city residents who display a special sticker on their windshield. [14]

Since most commuters use long term off-street parking, regulations which attempt to influence their mode of travel to the CBD must focus on these spaces. Studies show that in most metropolitan areas with a population over 100,000, commercial, off-street parking may account for as much as 80 percent of all parking in the city. [17] This preponderance of commercial facilities and the lack of any precise data on the effects of reducing off-street parking supply, greatly complicates the use of parking regulations to achieve change-of-mode objectives. For example, simple reductions in the total quantity of available parking in an area may not affect commuters at all, Since CBD parking space is frequently allocated on a first-come-first-served basis or through monthly contracts, commuters are likely to consume whatever space remains after a parking supply cutback, eliminating all non-work travelers from the parking market. [7]

While many cities such as London and Washington, D. C., have already reduced the total number of available on-street parking spaces, regulations to limit the supply of off-street parking have only recently been initiated, primarily because of their controversial effects on private and commercial operations and unknown impacts on peak-hour commuters. Moratoriums on new parking facilities both public and private, restrictions governing the location of new off-street spaces, and limitations on the number of spaces permitted in new office and residential structures are some of the regulations currently being tested. Several areas such as San Diego, Los Angeles, Portland, and Seattle have developed parking regulatory programs as part of AQIP transportation control plans. These programs regulate the location, operation and increase in parking related facilities, consistent with air quality needs, [7] Another approach has been to provide free or reduced-cost municipal parking as an inducement for commuters to switch modes. Boston, Chicago, and Cleveland all have peripheral parking programs which have dramatically increased peak hour ridership on specific transit lines.

Auto-Free Zones

"Vehicle-free zones generally refer to closing off a limited area in a heavily trafficked commercial district to autos and trucks. There are over 100 cities in the world which have banned traffic from portions of their central cities, Most of these cities are in Europe where population densities are higher and people are more accustomed to using bicycle, pedestrian, and transit modes. The impetus behind most of these zones is to eliminate an ever-increasing level of traffic congestion which leads to high air pollution, noise, accident rates, and unpleasantness levels. There were questions as to whether the pedestrian malls would result in less sales and therefore offset the economic viability of the area. Experience indicates that the economic viability has not been threatened and has in fact improved in many locations. [3]

"Gothenburg, Sweden, is an example of an area where an attempt was made to restrict unnecessary traffic. In this case, autos were not banned, but the city was divided into sectors, and vehicles were not allowed to cross sector lines. Through traffic was rerouted. This resulted in: elimination of traffic congestion, less travel in the area, more distance traveled by through traffic at higher, speeds, and better performance by transit vehicles in the CBD. However, it is significant that Gothenburg is a relatively small city which is well served by transit." [3]

In the United States the major examples of such zones have been shopping malls and street closings. The 8-block Nicollet Avenue transit mall in Minneapolis is one of the few cases where transit considerations were included as a major component. In this treatment a pedestrian street also functions as a local transit distribution system and a terminal for buses entering the CBD. Bus ridership in the mall area increased by 17,500 per day.

LAND USE CONTROLS

See Chapter XI for long-range land use considerations.

MARKETING

Many transit systems across the country have initiated extensive advertising and promotional campaigns in order to counteract declining ridership. Others have used marketing techniques to dispel transit's poor image during the conversion from private to public ownership, and to promote new services and disseminate information concerning system operations. The impact of these marketing programs varies widely, from no effect to slight reductions in the rate of ridership decline, to I0-15 percent ridership increases on particular transit lines. No conclusive evidence exists to support the position that marketing techniques alone will influence transit ridership in the short run. [18] However, some transit systems such as those in Seattle, Pittsburgh, and Cleveland have credited marketing techniques as partially responsible for meeting limited ridership objectives. The most successful marketing programs have placed heavy emphasis on customer information services, methods to increase transit visibility, and close coordination with new service improvements.

STAGGERED WORK HOURS

Staggered work hours may be achieved by varying starting and release times in major employment centers or by allowing "flexible" work periods for individual employees on a companywide basis. The general effect of such measures would be to reduce peak-hour pressure on existing transportation facilities (highways, bridges, tunnels, transit systems), reduce congestion and consequently, reduce the need for new facilities and services. Staggered work hours might be beneficial to transit in at least two ways:

1! By reducing the peak-period demand and spreading it to times when transit vehicles are operating at lower capacity, transit service can be improved, thus attracting increased ridership. A recent variable work hours program in Ottawa reported that ridership, expressed as a percentage of seating capacity, had a "flatter distribution" during peak periods and that transit ridership increased slightly. [19]

2. Because an effective staggered work hours program is likely to reduce congestion and create some excess capacity in the highway network during peak hours, it could make travel by automobile more attractive. However, if this excess highway capacity is utilized for new transit services such as priority or exclusive bus lanes, transit ridership and auto/transit mode shifts might be increased.

Experience also indicates that staggered work hours can have negative impacts on carpooling programs and may present transit scheduling problems which could jeopardize transit patronage. [4]

NEW TECHNOLOGY

"Current manual bus scheduling procedures are extremely slow and inefficient. As a result of this archaic technology, it is almost impossible to make major route and schedule changes in the medium-sized and larger bus systems. Assignment of men and vehicles is accomplished in an inefficient manner and route patterns are not easily changed in response to changes in the patterns or origins and destination. It is thought that automation of this procedure, chiefly through computerization, would improve the frequency and thoroughness of schedule revision." [4]

Selective computerization of key portions of the transit industry could be implemented in the short term resulting in near term service improvements and cost saving benefits. Gradual automation of the entire industry promises many long-term benefits which are essential to the reorganization of existing services and the creation of new services competitive with the automobile. Implementation of these measures is dependent on careful application to each transit system and could face resistance from unions.

REFERENCES

1. No Fare and Low Fare Transit, The Metropolitan Transportation Commission, Prepared for the California Legislature, June 1973.
2. Technical Report No. **2,** Analysis of Transit Passenger Data, Metropolitan Atlanta Rapid Transit Authority, February 1974.
3. Guidelines To Reduce Energy Consumption Through Transportation Actions, Alan M. Voorhees and Associates, Inc., Prepared for UMTA, May **1974.**
4. Low Cost Urban Transportation Alternatives, Volume **1,** R. H. Pratt Associates, Inc., January **1973.**
5. "A Report On Actions and Recommendations for Energy Conservation Through Public Mass

Transportation Improvements," U.S. Department of Transportation, Washington, D. C., October 1974.

6. Report 143, Bus Use of Highways: State of the Art, National Cooperative Highway Research Program, Washington, D. C., 1973.

7, Transportation Controls To Reduce Automobile Use and Improve Air Quality in Cities, U.S. Environmental Protection Agency, Office of Air and Waste Management, November 1974.

8. Blue Streak Bus Rapid Transit Demonstration Project, Final Report, Alan M. Voorhees and Associates, Inc., June 1973.

9. The Shirley Highway Express Bus on the Freeway Demonstration Project, A Summary of Findings, February 1973.

10. Demand-Responsive Transportation, Special Report 147, Transportation Research Board, Washington, D. C., 1974.

11, Hourly Passenger Capacity Standards for Judging Potential Application of Various Modes in Urban Transportation Planning, Unpublished paper by Ralph Rechel, November 1974.

12. Lea Transit Compendium, Parts 3 and 4, Lea Transport at ion Research Corporation, Huntsville, Ala., 1974.

13. "Comparison of Experimental Results With Estimated Single Lane Bus Flow Through a Series of Stations Along a Private Busway", General Motors, Jerold W. Scheel and James E. Foote, Warren, Mich., Transportation Research Department Publication GMR-888, May 1969.

14. Evaluating Transportation Controls To Reduce Motor Vehicle Emissions in Major Metropolitan Areas, A Draft Interim Report, Prepared by IPA, Teknekran, Inc. and TRW, Inc., December 1971.

15. Road User Charges-Some Practical Considerations, Ronald Kirby, The Urban Institute, March 1974.

16, "Transportation Pricing and Parking Charges," Ted Erlich, Paper presented at the meeting of the Highway Research Board's Committee on Taxation, Finance, and Pricing, Washington, D. C., January 1973.

17, Parking Taxes for Congestion Relief: A Survey of Related Experience, Damian Kulash, The Urban Institute, March 1974,

18. Marketing Techniques and the Mass Transit System, The National Urban League and Mark Battle Association, Inc., Washington, D. C., July 1973.

19. "Variable Work Hours: Who Benefits ?," by Reza Safavian and Keith G. McLean, Traffic Engineering, March 1975.

20. Ten Year Transit Development Program Summary Report, Cleveland Five-County Transit Study, Alan M. Voorhees & Associates, Inc., March 1974.

21. U.S. Congress, Office of Technology Assessment, Automated Guideway Transit, June 1975.