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Potential Change Strategies In Urban Transportation: An Overview And Tentative Appraisal

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FINAL REPORT

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16. Abstract The aim of this report is to discern innovations in the urban transportation system which appear to combine in high degree political feasibility and cost-effectiveness with reference to the most salient problems of urban transportation. Such measures tend in practice to be of the "technical fix" variety that entail little or no behavioral change for urban travelers (for example, requirements that the auto manufacturers produce safer cars) and are available only with reference to a subset of urban transportation problems. In other periods, when resources have seemed more ample and there has been greater resistance to government regulation of business, the political system has been disposed primarily toward addressing problems by the expansion of subsidies. These appear cost-ineffective with respect to most of the significant current problems of urban transportation, however (with the important exception of equity problems involving the mobility-deprivation of those without ready access to automobiles), and in any event the predominant public mood of the late 1970s is one of fiscal austerity. There remain various strategies involving direct constraints upon consumer behavior, whether by direct regulation or by the manipulation of price disincentives, but these generally provoke intense political resistance even when, in the judgment of most technical analysts, their cost-effectiveness has been demonstrated in relatively clear-cut fashion. By way of background, this report summarizes previous analysis by the authors of the following: (1) the key factors bearing on political feasibility in the current period, (2) the main "problems" of urban transportation, and (3) other criteria than transportation problem amelioration frequently called upon as justifications for public activity in this field.					
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METRIC CONVERSION FACTORS

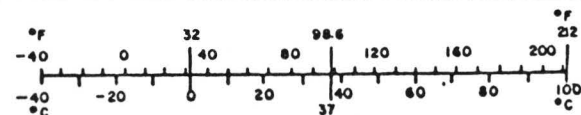
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.25, SD Catalog No. C13.10.286.

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EXECUTIVE SUMMARY

The aim of this study is to identify innovations in the urban transportation system which combine in high degree political feasibility and cost-effectiveness with respect to the most significant problems of urban transportation in the United States.

The initial portion of the report is devoted to a review of the nature of the American system of politics and governmental decision-making in the transportation area as well as the evolution of this system in the post World War II period.

The second portion of the report attempts to discern those aspects of the current transportation system which constitute "problems" deserving remedial action by government. These are found to be, most notably, excessive energy consumption, air pollution, **excessive** safety risks, inequitable transportation opportunities for those unable to afford or operate automobiles, and noise pollution. Two other concerns, highway congestion and land use patterns, are also discussed because of their importance to some of the participants in public debates on transportation even though there seems to be no societal consensus that they are serious problems.

The final portion of the study tests a range of potential innovations as to their efficacy in solving major transportation problems and for their fit with the American political system. The innovations tested (where an "innovation" is defined as any significant change in the system even if not a new concept intellectually) are: (1) highway capacity expansion, (2) fixed-route transit service

expansion, (3) traffic management techniques giving preference to high occupancy vehicles, (4) demand responsive transit, (5) private ride sharing, (6) regulation of business to alter product performance characteristics (e.g., auto fuel economy, emissions, noise, and crash survivability), (7) regulation of consumer behavior (e.g., seat belt use laws), and (8) price disincentives (e.g., gas taxes and congestion pricing of highway access).

The principal finding of the study is that at present those innovations which are both cost-effective and politically feasible tend to be of the "technical fix" variety that entail little or no behavioral change for urban travelers (for example, requirements that the auto manufacturers produce safer cars) and are available only with reference to a subset of urban transportation problems. In other periods, when resources have seemed more ample and there has been greater resistance to government regulation of business, the political system has been disposed primarily toward addressing problems by the expansion of spending and subsidies. These appear cost-ineffective with respect to most of the significant current problems of urban transportation, however (with the important exception of equity problems involving the mobility-deprivation of those without ready access to automobiles), and in any event the predominant public mood of the late 1970s is one of fiscal austerity.

There remain various strategies involving direct constraints upon consumer behavior, whether by direct regulation or by the manipulation of price disincentives, but these generally provoke intense political resistance even when, in the judgement of most technical analysts, their cost-effectiveness has been demonstrated in relatively clear-cut fashion.

PREFACE

What follows is the concluding chapter of a book by Alan Altshuler, with James Womack and John Pucher, entitled The Urban Transportation System: Politics and Policy Innovation (Cambridge: M.I.T. Press, 1979). The study reported therein was financed in predominant part by the University Research Program, Research and Special Programs Administration, U. S. Department of Transportation, (Contract DOT-OS-50240). Readers desiring additional detail and/or wishing to examine the documentation for statements appearing below are referred to the full report.

The central aim of this study is to provide a broad framework for evaluating proposed change strategies, here labeled "policy innovations," during the years immediately ahead. It is organized in three parts. Part I (3 chapters) reviews the political history of urban transportation policy evolution since World War II, and concludes with an effort to delineate the attributes of potential innovations (apart from their likely cost-effectiveness if implemented) that tend to bear most significantly on their political acceptability. Part II (7 chapters) examines the main substantive problems, actual and alleged, associated with the American system of urban transportation, and seeks to appraise (insofar as available evidence permits) the cost-effectiveness of eight broad types of policy innovation as instruments for their amelioration. These eight include: highway capacity expansion, fixed route transit service expansion, demand responsive transit, private ride-sharing, traffic management techniques giving preference to high occupancy vehicles, business regulatory measures concerned with product performance characteristics (such as automobile fuel economy), regulatory measures aimed directly at consumers (e.g., seat belt use laws), and price disincentives intended to bring about reductions in motor vehicle travel and/or gasoline consumption. Part III (one chapter), which follows, ventures summary appraisals of these policy innovative options with reference to the full range of considerations explored in the preceding chapters.

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INTRODUCTION

Our aim in this concluding chapter will be to discern which of the main candidate innovations appear to combine in high degree both political feasibility and cost-effectiveness with reference to the most salient problems of urban transportation.

Such measures, we shall argue, tend in practice to be of the "technical fix" variety that entail little or no behavioral change for urban travelers (for example, requirements that the auto manufacturers produce safer cars) and are available only with reference to a subset of urban transportation problems. In other periods, when resources have seemed more ample and there has been greater resistance to government regulation of business, the political system has been disposed primarily toward addressing problems by the expansion of subsidies. These appear cost-ineffective with respect to most of the significant current problems of urban transportation, however (with the important exception of equity problems involving the mobility-deprivation of those without ready access to automobiles), and in any event the predominant public mood of the late 1970's is one of fiscal austerity. There remain various strategies involving direct constraints upon consumer behavior, whether by direct regulation or by the manipulation of price disincentives, but these generally provoke intense political resistance even when, in the judgment of most technical analysts, their cost-effectiveness has been demonstrated in relatively clear-cut fashion.

By way of background, we shall in this section summarize our analysis in previous chapters of the following: (1) the key factors bearing on political feasibility in the current period, (2) the main "problems" of urban transportation, and (3) other criteria than transportation problem amelioration frequently called upon as justifications for public activity in this field.

Determinants of Political Feasibility

Political feasibility, we have argued, tends to vary inversely with the degree of private inconvenience that any given proposal would entail and with the visibility of the connection between the public action and private discomfort. It matters a great deal to elected officials whether the linkage is clear and immediate or blurred and deferred. At the same time it bears emphasis that public attitudes, and thus governmental priorities, are fluid. Many people were genuinely concerned in the 1950s about whether it was proper for the federal government to become involved in such apparently local matters as the financing of mass transit and the control of air pollution, but these inhibitions evaporated during the 1960s. There was a great reluctance to consider regulating the automobile companies until the mid-1960s, matched by an easy-going acceptance of the disruption of neighborhoods and public open spaces to make way for expressways, but these priorities were completely reversed during the subsequent decade. The issue of congestion commanded more attention than all others combined in the field of urban transportation during the 1950s and 1960s but it has been relegated to the back-burner during the 1970s. And whereas the predominant atmosphere was one of fiscal abundance from the 1950s through the early 1970s with the result that policy focused overwhelmingly on capacity expansion, the predominant tone since about 1973 has been one of scarcity--fiscal, energy, and ecological--with the result that attention has focused increasingly on means of improving the utilization of existing capacity.

The great constant, though, has been an extreme reluctance to interfere directly with widespread patterns of voter (consumer) behavior. Until the mid-1960s, there was no disposition even to try to influence urban travel behavior. The emphasis, rather, was entirely on accommodating market trends--most notably, the trend of ever-increasing motor vehicle traffic. More recently a variety of government policies have sought to lure motorists into high-occupancy vehicles and to ensure their use of safer, less polluting, more energy-efficient automobiles. The methods have been promotion, service provision, and regulation of

the auto manufacturers, however, rather than direct constraints upon individual travel behavior.

With these features of the political system in mind, we have suggested that innovative options can usefully be categorized and ranked in order of acceptability as follows:

1. The most feasible innovations are those that consumers will buy in the private marketplace, at prices high enough to cover their production costs. Where such innovations require public implementation, it greatly helps to be able to contend that decisions on use are voluntary and that public expenditures are financed by user charges.
2. Among measures that do entail some compulsion, the most attractive are those that alleviate widely perceived problems at little or no cost (fiscal, social, or environmental) and that either (a) operate in the first instance upon corporate enterprises rather than individual travelers or (b) entail the exercise of traditional governmental powers in relatively unobtrusive ways. An example in subcategory (a) would be new-car fuel economy standards that involved direct regulation only of the auto manufacturers, and that resulted in unchanged or even lower lifetime costs for automobile owners. An example in subcategory (b) would be traffic signal systems giving priority to buses.
3. Among measures that entail significant public or private cost for the benefits they confer, the most feasible are those that do so in ways that permit substantial diffusion or deferment of the blame. Spending decisions are frequently in this category, particularly when revenues are growing rapidly at constant tax rates, when there is widespread acceptance (as in the 1960s and 1970s) of growing deficits, or when expenditures can be bonded. (From the standpoint of state and local officials, spending decisions are also in this category whenever large portions of the cost are to be borne by higher levels of government.) Decisions to tax are generally separated quite widely in the governmental process, moreover, from decisions to spend. Some regulatory decisions are in this category as well. The most obvious examples are

new-car performance standards that lead, years after enactment (or executive rulemaking), to automobile price increases. Few motorists tend to associate them with specific legislative votes. At the time of adoption, moreover, it is frequently plausible to hope that the costs will prove trivial. Even if they do not, the companies may be able to offset them in large part by making other economies. If, finally, the companies do announce price increases out of line with the general rate of inflation, and if they choose to stress government regulation as an important contributing factor, it may still be plausible to attack them for seeking to blame their own "greedy" and "irresponsible" price decisions on others.

In practice the companies recognize that airing disputes with public officials in the media tends to be a losing game for them. Thus while they stress potential inflationary effects in opposing proposed new requirements prior to adoption, they rarely stress government regulations in explaining actual price increases. On the whole, moreover, they have been able to keep their prices from rising more rapidly than the overall consumer price index, so the issue has been relatively moot.

4. The least acceptable innovations are those that entail substantial costs or interference with widespread patterns of behavior, imposed in such a manner that the blame is likely to fall squarely upon the public officials who adopt the innovation. Examples include gasoline tax increases, parking regulatory and surcharge measures, and seat belt use laws. Even within this category, the extent of political resistance will tend to vary with such factors as the degree of inconvenience, of public support at any given moment for the objective, and of recognition that the method chosen is the most appropriate way to serve it. Thus a small gas tax increase to provide revenue for highway maintenance and construction tends to entail little inconvenience, to be for a long-accepted public purpose, and to be viewed as the appropriate method of securing revenue for this purpose. By contrast, proposals for large increases to constrain demand entail the prospect of quite substantial inconvenience, in the service of a very new purpose,

and by a highly controversial method for implementing that purpose. The importance of shifts in public concern about an objective is well illustrated by the history of the 55 mile per hour speed limit. Adopted at the height of the Arab oil embargo, it would clearly have been unfeasible a few months earlier; and even in this crisis atmosphere more powerful conservation measures--which would have entailed greater inconvenience--were rejected. Given the intense action mood that existed at the time to do something meaningful about energy conservation, the attraction of the speed limit reduction lay largely in the fact that it was the mildest measure available (and among the most easily explainable) that might fit the bill.

Overall, then, measures tend to be more acceptable as the restraints they entail seem relatively trivial, as they fit comfortably within existing fields of public jurisdiction, as they are inexpensive, and as action moods prevail in problem areas with reference to which their efficacy has been established beyond controversy. Resisting cognitive dissonance the public strives, moreover, to evaluate measures consistently with reference to all of these criteria. Thus measures entailing the provision of improved services, to be used or not by consumers on a purely voluntary basis, tend to win relatively easy acceptance as cost-effective. (This is particularly the case insofar as they fit comfortably within the framework of existing agency mandates and staff capabilities. Such measures have ready-made sales staffs and constituencies, and few--except possibly taxpayers--have any reason to oppose them.) At the other extreme, where measures entail significant new elements of constraint on personal travel behavior, the media and the public tend to seize upon all negative evidence while ignoring or expressing distrust of most positive evidence as to their efficacy. The ignition interlock and Los Angeles diamond lane experiences well illustrate this phenomenon.

One final point, The bounds of feasibility are constantly evolving. Constraints that seem new and outrageous today may seem commonplace a few years hence. The most striking change of recent years has been the

growth in acceptance of business regulation to shape product performance characteristics. Mandatory insurance and safety inspection laws, together with traffic management innovations such as preference for high-occupancy vehicles and downtown pedestrian malls, indicate, moreover, that direct regulation of the motoring public is not impossible. This is the area in which politicians proceed with greatest trepidation, but we nonetheless expect continued policy evolution in the years ahead. The most likely candidates for early adoption appear to be inspection and maintenance requirements with reference to the new-car air pollution standards adopted in recent years, and more aggressive approaches to traffic management preference for high-occupancy vehicles. The least likely candidates for early adoption appear to be gas tax increases, parking restrictions, seat belt use laws, and other measures aimed at changing the daily behavior of large numbers of motorists.

The Problems of Urban Transportation

We have identified nineteen criteria that are frequently mentioned as bases for evaluating the current system of urban transportation and strategies for improving it. All entail aspects of personal mobility or external effects directly related to the functioning of the urban transportation system. We have explicitly omitted pork barrel criteria (such as the volume of jobs and contracts generated by transportation expenditures) from the list, on two grounds. First, such effects bear only an incidental relationship to the urban transportation system. Second, the inclusion of pork barrel effects as genuine benefits will almost always lead to the conclusion that public expenditures should be increased--since by definition, they yield their worth in payrolls and profits, in addition to whatever other benefits they produce. Given that this is a clear recipe for public make-work, and that virtually all economic activities (private as well as public) entail payrolls and profits, it seems appropriate to

treat the objectives of short-term economic stimulation and of a praiseworthy urban transportation system as quite distinct.

We judge that seven of the nineteen criteria are problems in the sense that many people view current system performance with respect to them as inadequate and view these inadequacies as high priority justifications for public remedial action. The seven are energy consumption, air quality, equity, safety, congestion, land use impact, and noise. The last of these, noise, we have treated only briefly because it has commanded little attention in urban transportation policy debates. We have examined the others at substantial length, however, arriving at the following summary conclusions with respect to their essential characteristics:

1. The energy demands of the current system are indeed profligate by international standards, and they entail the following major consequences: large and rapidly growing dollar outflows for oil imports, high vulnerability to the threat of a future oil embargo, and reduced national capacity for independent decision making in world (especially Middle Eastern) affairs. The monetary outflows in turn tend to weaken the dollar internationally, to reduce the American standard of living, and to compound domestic inflation. It appears probable, moreover, that all of these consequences will become more severe in the middle or late 1980s as world oil demand begins to press hard against limits on production capacity. In short, the national interest in curbing oil import requirements is acute. Urban transportation usage is only one component of this much larger problem, but it is a highly significant one that has reasonably been targeted by national policy makers for a major conservation effort.

2. Air pollution is primarily a health problem. There are major unresolved questions, however, about the health consequences associated with current air pollution levels in American metropolitan areas, about the appropriate targets toward which public policy should aim, and about the urgency with which these targets should be pursued. Current national policy is to strive toward the goal of perfectly safe air quality: levels of air pollution so low that no one, however feeble,

will suffer any ill effects, however minor. A comparable goal in the field of safety would require an absolute prohibition on travel. No other nation has adopted such an ambitious objective nor claimed that it knew how to translate it into precise ambient air quality standards. The United States, moreover, has clearly had second thoughts since adopting this goal, along with a set of standards and tight deadlines, in a mood of high enthusiasm in 1970--with negligible heed for considerations of dollar cost or of tradeoffs with other values. To date the goal and the standards have proven firmly resistant to change; (2) but the deadlines have proven highly flexible and policy instruments that would directly constrain individual consumer behavior have been put aside. In brief, then, little of a precise nature can be said about the severity of the health consequences associated with current levels of air pollution, and the national commitment to air quality improvement is far weaker than it appears to be on the surface.

3. The core of the safety problem is that 46,000 people a year are killed in motor vehicle accidents. Additionally, large numbers suffer serious injuries and property damage costs are high. While there has long been a clear consensus on the general objective of reducing this toll, controversy has been endemic on the questions of who should be blamed for it and what methods should be deemed permissible in seeking to ameliorate it. Until the mid-1960s the automobile industry's contention that the source of the problem was the "nut behind the wheel" faced little serious competition. More recently, however, multiple causation theories have achieved wide acceptance, and the focus of attention has shifted toward identifying levers of intervention that are both effective and politically acceptable. These much more frequently involve vehicle and roadway modifications than changes in driver behavior.

(2) Congress did in 1977 relax one of the target new-car emission standards, that for oxides of nitrogen. The other emission standards have remained unchanged, however, since their enactment in 1970, as have all the ambient air quality standards since their 1971 promulgation by the EPA administrator in accord with the perfect safety criteria specified in the 1970 election.

4. The nub of the equity problem is that the auto-dominant system simultaneously affords the adult driving majority unprecedented mobility while actually reducing the effective mobility of those without ready access to cars. We have defined mobility as ease of access to desired destinations. In the compact pre-automobile city, most desired destinations could be reached on foot or for the price of a transit fare. In the dispersed urban regions of the automobile era, numerous destinations are virtually unreachable--even by able-bodied adults--without a car. For those unable to walk substantial distances to and from transit stops or who have difficulty with stairs (into buses and/or rapid transit stations), effective mobility is particularly limited. Moreover current welfare standards are higher than in previous eras. And mobility-deprived groups, especially the elderly and handicapped, have become organized and outspoken in their pursuit of government assistance.

There are great uncertainties, however, as to the precise degrees of mobility deprivation suffered by the several main claimant groups, and even greater uncertainties about the extent to which these are remediable by transportation system changes. Older and handicapped people, for example, tend to have low rates of labor force participation and to be relatively sedentary in their lifestyles, even under conditions of equal travel opportunity. Significant numbers of them, moreover, are confined to their homes or to institutions and would be unable to travel in the best of transportation system circumstances. Finally a large proportion, particularly among the elderly and poor, have cars and driver's licenses and seem to achieve mobility rates quite similar to other urban residents.

Clearly, however, there are substantial numbers of elderly, handicapped, and low-income people who suffer from acute mobility deprivation that might be alleviated by transportation measures, and there is widespread agreement that their needs merit significant consideration and priority in the allocation of government resources for urban

transportation purposes. Prior to the 1970s, this agreement tended to be ritualistic, but it has rapidly taken on increased significance more recently. No overall minimum mobility standards have been adopted, nor have comprehensive programs been undertaken to deal with the mobility-deprivation problem. Rather government efforts have striven toward the limited objectives of making fixed-route transit services fully accessible to those with physical handicaps and of enabling those eligible for publicly supported medical and social services to make all necessary trips incidental to the receipt of such services. Additionally a variety of new programs designed to enhance the mobility of elderly and handicapped people have been undertaken, and it seems apparent that equity considerations receive far more consideration in general transit service planning today than they did in previous decades.

If urban transportation equity objectives tend to lack specificity, the primary reasons are doubtless as follows. First, while there is general agreement on the desirability of doing something about the problem of acute mobility deprivation, there is intense controversy about precisely which claimants are deserving, how much it would be appropriate to assist them even if resources were unlimited, and what priority their claims should receive in the actual environment of scarce resources. Second, there is significant disagreement about the extent to which problems of resource deprivation should be dealt with by the provision of specific services as opposed to general income assistance. In practice the United States tends to pursue a mixed strategy, but this leaves the question of the degree to which mobility deprivation should be viewed as a transportation problem very much open. Third, the mobility problems of elderly, handicapped, and poor people do not threaten national security, prosperity, or public health. Ameliorating them is primarily a matter of ethics insofar as the driving majority and most transportation providers are concerned, rather than one of self-interest. Not surprisingly, it has tended to be more difficult to reach agreement on ethical imperatives than on paths of self-interest, and having agreed, to secure resources for their implementation. The major change of recent years has been the upsurge of political

organization and militancy among the elderly and the handicapped, providing many elected officials, even if not the motoring majority more generally, with a motive of self-interest in responding to their concerns.

5. During the 1950s and 1960s, congestion was widely perceived as the main problem of urban transportation. It is unquestionably a source of annoyance to motorists. Conventional wisdom has it, moreover, that a great many other costs are associated with congestion: time losses for motorists, economic losses for businesses (due to delays), increased energy consumption and engine emissions, and higher accident rates. Our analysis failed to confirm the conventional wisdom. Little solid evidence on the costs of congestion is in fact available. That which does exist, however, suggests that the primary correlate of congestion is high density. Where travel speeds are low, people arrange to travel less. It follows that, at least over the long term, the primary benefit flowing from congestion relief is the opportunity for low-density living rather than time savings for motorists. Insofar as congestion relief measures facilitate increased travel and travel at higher speeds, their energy and air pollution benefits tend likewise to be vitiated. As for safety, the most striking bits of evidence available are that fatality rates are considerably lower in urban than rural areas and that temporally they are lowest during peak commutation hours.

Evidence on congestion trends is even harder to come by than evidence on the costs of congestion. Several points are clear, however. The vast majority of current urban growth is occurring in low-density suburban areas. Congestion is most severe on the approaches to major downtown areas. Travel to these downtowns tends to be increasing very slowly or not at all. Further, the classic instrument of congestion relief (highway construction) is least applicable in their vicinity, and they rely heavily on transit systems that would lose most of their patronage if congestion were suddenly eliminated.

In brief, then, we found no reason to judge that congestion is in fact a major urban transportation problem. This is not to argue that congestion relief efforts should be abandoned, any more than it is to argue that families should give up their aspirations for more luxurious cars. But it is to distinguish sharply between congestion and the more consequential problems associated with the contemporary American system of urban transportation.

6. The wide diffusion of automobile ownership and government highway expenditures have doubtless been among the major contributors of post-war urban sprawl. In judging whether transportation system impacts on land use constitute a significant current problem, however, it is essential to ask two further questions: What is the basis for viewing the trend toward lower urban densities as a negative development? and What is the likelihood at this late date that transportation policy shifts, if designed explicitly to stem the tide of urban dispersal, would be able to do so?

In response to the first of these questions, the evidence seems overwhelming that Americans prefer low-density living. If they could, about two-thirds of current apartment dwellers would live in single-family homes, whereas almost none of those living in single-family homes would opt for apartments. Similarly about 85 percent of large metropolitan area residents indicate that they would prefer to live in non-central locations. To our knowledge, no American state or region (let alone the national government) has adopted increased urban density as a policy goal. Specific programs have indeed been adopted to facilitate central city renewal, but these fragmentary initiatives have been more than offset by other programs supportive of dispersal. Local zoning has focused overwhelmingly on holding densities down. And at the regional scale virtually all American officials have been content to let overall density outcomes be determined in the marketplace.

While admitting that low-density living is a luxury most Americans seem anxious to purchase, recent critics have argued that the objective costs of sprawl are in fact much higher than generally recognized, so

high indeed that the nation can no longer afford the laissez-faire policies that have prevailed to date.

Our own review of the evidence suggests that the picture is far less dramatic. Low-density development does absorb substantial amounts of land, it does entail hardship for those without cars, and it does involve somewhat greater energy usage than high-density patterns. It is far from clear, however, that it need be more expensive, more damaging environmentally, or very much more costly in terms of energy consumption. Likewise, it seems improbable that moderate increases in residential densities would save a great deal of land or significantly alter the circumstances of those without cars. Dramatic reductions in land requirements and in automobile reliance would depend on the achievement of very high densities indeed, much higher than anyone has seriously proposed for mass consumption, and much higher than could possibly be achieved without a virtual revolution in American housing and land use regulatory policies. As long as most new housing is financed in the private marketplace, developers will aim to satisfy the desires of relatively affluent urbanites, those who have traditionally been most determined and best able to express their taste for low-density living. The obstacles to achievement of a sharp increase in the average density of new urban development would seem particularly severe, moreover, in a period when most new urban development is occurring in the nation's lowest density metropolitan areas.

Overall, then, it seems more plausible to concentrate on alleviating the specific harmful effects of sprawl than to launch a fullscale assault on low-density living itself. The worst excesses of leapfrog development, poor site planning, poor home insulation, and inadequate mobility alternatives for those without cars are all susceptible to very significant amelioration without forcing new development into patterns reminiscent of the preautomobile era.

In response to the second question, it does not appear that transportation measures alone can have a major impact on land development patterns in the current period. Highway access is already ubiquitous throughout (and well beyond) American metropolitan areas, and there is

so much spare capacity in suburban and exurban areas that even a total cessation of new highway construction would have virtually no impact on development for many years to come. In this bountiful highway environment, transit improvements can have only a modest impact on the relative accessibility of the locations served. In a few selected locations, where a high market potential for core area development exists and where numerous government policy instruments are being deployed to help fulfill this potential, transportation improvements will normally have a significant supporting role to play. To act on the premise that transportation improvements can do more than play a supporting role where other conditions are favorable to development, however, is simply to invite frustration.

Other Evaluation Criteria

Urban transportation policy decisions frequently hinge on other considerations than effectiveness in ameliorating the "problems" associated with the current system. These include, most typically, impacts on other criteria among the nineteen we have identified as bases for substantive evaluation of the system and porkbarrel effects.

As noted in the previous section, we categorized seven of our nineteen substantive criteria as problems--in the sense that many people consider them priority candidates for remedial attention. We categorized the remaining criteria as follows:

- Those with respect to which system performance in the steady state tends to be grudgingly accepted, but which frequently become major foci of controversy when potential improvement actions threaten, as by products, to generate significant increases in their magnitude: public dollar costs, user dollar costs other than tax payments, and neighborhood and environmental disruption.

- Those with respect to which current system performance is generally considered good, at least from the standpoint of the adult majority with a high degree of automobility: reliability, speed, convenience, flexibility, personal security, comfort, consumer freedom, privacy, and recreation.

The central distinction between these and the problem criteria is not one of intrinsic significance, it is rather between those aspects current system performance that are widely considered candidates for remedial attention and those that are not. As attention turns to the appraisal of remedial options, it is only to be expected that impacts on the nonproblem criteria will at times outweigh those on the problems themselves.

As explained above, we view pork-barrel effects as irrelevant to overall substantive evaluation of the urban transportation system and of alternative improvement strategies. They are certainly of great political relevance, however, and they are central to substantive evaluation from particular microperspectives--those, for example, of contractors, suppliers, organized construction workers and transit employees, state and local jurisdictions, and particular government agencies. Not surprisingly, those with the most to gain tend also to be the most active politically and to exercise disproportionate influence on public decision-making processes. (The losers, by contrast--taxpayers and claimants who would prefer government allocations of greater immediate benefit to themselves--tend to be diffusely affected by any particular decision, and thus to be much less active.) In brief, then, whatever weight one **thinks** they deserve on merits, pork-barrel effects are clearly central to any understanding of how public officials in fact appraise program options.

Innovations

We have labeled innovative any policies or service concepts that, if widely implemented, would significantly alter the performance characteristics of the urban transportation system. Our focus, in short, has been on potential impact rather than on intellectual originality. Thus we have treated major increases in highway capacity and fixed route transit service as innovative even though, from another standpoint, they would simply involve "more of the same." By the same token we have emphasized that nearly all current activities are noninnovative, in that

their aims are to provide for the maintenance, operation, and routine expansion (to accommodate development trends) of the existing system--in short, to reinforce it--rather than to change it in any fundamental respects.

We have delineated eight broad types of innovative measures for consideration:

1. Highway capacity expansion.
2. Fixed route transit service expansion.
3. Demand responsive transit (dial-a-ride, shared-ride taxi).
4. Government efforts to promote increased private ridesharing (carpooling and vanpooling).
5. Traffic management techniques giving preference to high occupancy vehicles.
6. Business regulatory measures concerned with product performance characteristics (such as automobile fuel economy).
7. Regulatory measures aimed directly at consumers (e.g., gasoline rationing, seat belt use laws).
8. Price, including tax, increases designed to bring about reductions in vehicle miles of travel (VMT) and/or in gasoline consumption.

Some of these measures may be more effective and politically acceptable in combination than individually. Consumers are more likely to respond to vanpool promotional efforts, for example, if they also face parking restrictions at their employment sites; such restrictions in turn are likely to be more palatable if high-quality alternatives to single-occupant automobile commutation are made available. While noting such interactive effects where they appeared to be of particular significance, we have sought for the most part to analyze the separate additive impacts of the individual measures under review in typical applications.

The first four, it bears note, predominantly involve the distribution of benefits, to be taken up or not by travelers and transportation providers on a voluntary basis. The last three, by contrast, entail the imposition of constraints. The fifth, preferential traffic management, combines elements of both, though as implemented to date

it has almost invariably entailed new benefits for high occupancy vehicle users far more noticeably than the imposition of new constraints on other travelers. The exceptions, such as the Los Angeles diamond lanes have tended to be few and short-lived.

Classification along this dimension becomes more complicated when costs borne by others than travelers and providers (such as, taxes and disruptive neighborhood impacts) are brought into the equation. It is highly instructive to begin, however, as most politicians do, by examining the likely consequences of innovative options for travelers and providers. On the whole, only those that survive this initial screening are evaluated seriously with reference to their other potential impacts.

Highway Capacity Expansion

We have explicitly focused on the dimension of highway capacity expansion rather than on that of highway program expenditure. Substantial increases in highway spending may well be necessary in the years ahead simply to provide for maintenance and for the reconstruction of long-neglected older facilities (especially bridges). These will not be innovative as here defined, however, because their predominant aim will be to perpetuate current performance characteristics of the urban transportation system in the face of threatened deterioration, rather than to bring about significant improvements.

In practice, we have judged, capacity expansion does not have much potential for improving system performance with reference to any of our problem criteria. One might expect it to appear promising at least as an instrument of congestion relief. In the very corridors where congestion is most severe, however, the social, environmental, and dollar costs of new construction tend to be most prohibitive, and citizen opposition tends to be most intense. Combined, these factors have brought major capacity expansion efforts virtually to a halt in densely settled urban areas during the 1970s. And in our view quite properly so; the costs of such construction almost invariably outweigh the potential benefits.

Where substantial highway capacity expansion is feasible in urban areas--most notably on the fringes--the major benefits tend to be speed increases (due less to congestion relief than to improved connections between specific points and higher design speeds) and improvements in the accessibility of land along the affected corridors. The land use effect tends to be an additional fillip to sprawl. Given that highway construction is an energy-intensive activity and that capacity expansion tends to induce additional travel, the energy consequences appear to be negative. The new roads are generally safer than the old per mile of travel, but much of this benefit is likely to be vitiated if they facilitate high speeds and to be further diluted over time as they induce additional travel mileage. Additionally, there are a wide variety of more cost-effective ways to enhance motor vehicle safety--including some that involve highway investment--than capacity expansion.

Although there seems little to be said on behalf of highway capacity expansion from a cost-effectiveness standpoint, it ranks extremely high on the political feasibility dimension. Specific projects that would impose concentrated costs on the residents of established neighborhoods or that would significantly disrupt the natural environment have become unfeasible during the 1970s in most urban areas, but a great deal of capacity-expanding highway construction is possible (particularly in low-density regions and outer suburban areas) without violating these constraints. And on a more general plane--when it comes to enacting program authorizations and appropriating funds--highway construction continues to be relatively noncontroversial.

The most striking political assets of highway construction are the force of inertia and its pork-barrel effects. More specifically:

Highway construction fits perfectly within an existing institutional framework; indeed, it would involve far more political inconvenience to drop the program than to continue it.

Large numbers of people--militant, well organized, well financed, and spread throughout every congressional district--have become accustomed to earning their livelihoods building highways. And they have enjoyed considerable success in persuading public officials that government has an obligation to keep them fully employed in this activity.

It seems obvious to most people that with the vast majority of urban travel occurring on highways, with a good deal of congestion observable at peak periods, and with overall traffic volumes continuing to grow by several percent a year, a highway construction program must be necessary.

State and local officials find it enormously attractive (so long as projects do not stir up intense neighborhood and environmental opposition) to distribute contracts, construction jobs, land development opportunities, and user benefits financed by a combination of federal aid and long-term state bonds. The benefits are clear and immediate; the costs are widely diffused and, at the state level, predominantly deferred.

This combination is so attractive that where opportunities exist to increase a state's share of federal highway aid allocations, extraordinary goldplating is likely to occur. The interstate program, which since 1956 has been the main locus of highway expansion activity (and which entails a 90-10 matching ratio) provides such an opportunity. Congress has chosen to express the long-term ceilings on the interstate system in terms of mileage rather than dollars, and each state's annual dollar allocation (within a fixed appropriation ceiling) is based on the ratio of its estimated cost of interstate system completion to the national total. Thus states have a powerful incentive to make each mile as expensive as possible.

The full inflationary potential of the interstate decision process has become apparent only in the 1970s, as state highway officials have come under increasing pressure to avoid community and environmental disruption. The challenge has been to remain in business without causing such disruption--and the most ingenious have recognized that neither costs nor any need to provide transportation benefits need significantly constrain them. The most expensive projects, and the least cost-effective from a transportation standpoint, have been developed in the densest urban settings, where ordinary expressway construction was halted years ago. Thus, instead of reconstructing the old West Side

Highway in Manhattan or getting along with an at-grade arterial on the same alignment, New York designed the Westway, a depressed and (predominantly) covered freeway with an estimated cost of \$1.2 billion for four miles. Simultaneously, Massachusetts proposed depressing its Central Artery in downtown Boston at a cost of \$1.0 billion for three miles. Like their state counterparts, federal highway officials have been predominantly disposed to build whatever they can in urban areas. To reinforce this favorable predisposition, state officials--in cooperation with highway contractors, suppliers, and construction labor unions--have brought intense pressure to bear through their congressional delegations. And to date they have achieved an unblemished record of success.

Despite these political assets, the federal-aid highway program has declined in real (inflation-adjusted) terms since the early 1960s. Moreover the proportion of total spending devoted to capacity expansion--as opposed to environmental amenities, relocation payments, safety, and the reconstruction of existing facilities--has dropped sharply over the years. The consequences of these developments have been most apparent in the interstate program, whose estimated completion date has been extended from 1972 to sometime after the turn of the twenty-first century.

Nor is there significant pressure today for increases in the level of highway expansion activity. In pursuing budget growth, highway officials themselves have come in the 1970s to focus on deferred maintenance rather than capacity expansion needs. Their construction-oriented constituents have recognized, furthermore, that from a pork-barrel standpoint repair and reconstruction programs may be preferable (on a dollar-for-dollar basis) to capacity-expansion programs. They can support projects in many more legislative districts during any given time period; they entail negligible controversy; they can bring projects quickly from initial conception to the point of contract-letting; and they minimize the use of highway program dollars for such

"frills" as land taking, relocation, environmental impact analysis, and legal representation.

It appears probable, then, that even if total urban highway spending rises more rapidly than the cost of living in the years ahead, little or none of the increment will be devoted to capacity expansion. Indeed unless some increases (for maintenance purposes) do occur, deterioration of the existing highway network may well merit attention as a significant problem of urban transportation during the 1980s.

Fixed Route Transit Service Expansion

In thinking about transit performance characteristics, it is vital to distinguish between current averages and those that would be associated with new service increments. After decades of explosive sprawl, only a small proportion of urban travel is concentrated along corridors in volumes and patterns with substantial potential for generating high transit load factors. After decades of service contraction, most transit vehicle mileage is currently in these corridors. The core of the potential transit market, in short, is already being served. As transit service is extended into less promising markets, or as service frequencies are increased in the corridors already served, the percentage growth in patronage will generally fall far short of the percentage increases in cost and vehicle mileage.

Our analysis has suggested that transit service expansion will normally provide negligible benefits, if any, with respect to energy, air quality, safety, or congestion. Properly targeted, however, it might be quite central to strategies aimed at improving the equity characteristics of the urban transportation system. And, where other circumstances are favorable, transit service improvements may at times play a significant supporting role in strategies aimed at promoting core area investment. Political factors, however, have tended to minimize the extent to which transit service improvements have been able to perform these equity and land use functions in practice.

In estimating the effects of particular expansion options on energy consumption and air quality, the key factors to bear in mind are as follows: the incremental load factor (the increase in passenger mileage divided by the increase in vehicle mileage); the time and capital cost required to bring the new service to the point of carrying passengers; the changes in prospect over the next couple of decades with respect to automobile fuel economy and emission characteristics;⁽³⁾ the proportion of new transit patrons drawn from the ranks of automobile drivers (as opposed to automobile passengers, pedestrians, and individuals utilizing the new service to increase their total amount of travel); the extent to which access to the new service will be by car (the first few miles of auto travel after cold starts are by far the least energy efficient and the most polluting); and the likelihood that temporary congestion relief as some drivers shift to transit will call forth new automobile trips previously suppressed by congestion itself.

In general, we found, the type of service expansion most likely to yield energy and air quality benefits is express bus service in corridors where automobile commuters experience severe congestion delays and the buses can avoid these delays by utilizing special lanes, access ramps, and/or preferential traffic signal systems. Insofar as the special lanes or ramps require new construction, however, the energy costs of the construction itself must be taken into account. And if the preferential measures entail a worsening of congestion for other traffic, increases in energy consumption and air pollution due to this congestion effect must be entered in the ledger. Express bus services in congested corridors, however, do often have the potential to attract high load factors, drawn largely from the ranks of automobile drivers. On the negative side, there appear to be relatively few corridors in which congestion is severe, express transit service is currently lacking, and ready opportunities exist to provide major savings for express bus patrons without substantially inconveniencing other

(3) The improvements likely with respect to transit fuel economy and emissions are, by comparison, relatively meager.

highway users. Thus, despite a sprinkling of widely publicized successes, the number of cases nationally in which express buses have been afforded significant time advantages over other vehicles in congested corridors remains small enough to be counted on one's fingers.

A transit energy-saving measure that might be far more widely applicable, at least in principle, is fare elimination (or sharp reduction) not accompanied by service expansion. This strategy would entail significant service degradation for current riders, however, in the form of intensified crowding, and probably no more than one-quarter of the new patrons attracted would be former drivers. Thus the tax cost per barrel of oil conserved would be very high, even assuming that transit operators firmly resisted all entreaties to relieve overcrowding by providing more services. Insofar as they responded to these entreaties, of course, the dollar cost would rise even as the energy savings dissolved.

Broad regional strategies of bus service expansion, and most rapid transit construction projects,⁽⁴⁾ are likely to entail increased energy consumption. In the former case, the reason is simply low incremental load factors. The latter case is far more complicated and will vary widely with the details of specific proposals. Key elements that fre-

(4) The potential exceptions are those involving at-grade improvements on existing rights-of-way in circumstances where high patronage volumes can reasonably be anticipated. The prototype example to date is Philadelphia's Lindenwold Line, which involved quite modest improvements on an existing rail right-of-way in a severely congested corridor radiating from one of the nation's largest concentrations of downtown employment. Even the Lindenwold Line does not seem actually to have saved energy, however. What can be said is that it has significantly enhanced mobility and facilitated development in its corridor while roughly breaking even in energy terms.

Some rapid transit advocates claim that up to a dozen Lindenwold-type opportunities are available elsewhere in the United States. We are quite skeptical. There may indeed be a dozen corridors that are comparable in terms of right-of-way availability and traffic potential. What seems less likely is that designs of the Lindenwold type will be brought forward as serious proposals in more than a couple of them. The Lindenwold Line was developed by a revenue bond authority without federal aid or substantial citizen involvement, and prior to the enactment of most current environmental laws. No rapid transit proposals of the 1970s have evolved in circumstances comparably conducive to parsimony.

quently point toward increased energy usage, however, include the following: projects that involve substantial tunneling are likely to incur, as BART did, up to half the energy cost (and probably air pollution as well) of their initial half-century during the construction period, before they ever carry a revenue passenger; by the time new rapid transit lines currently in the planning stage become operational, automobile fuel economy and emission characteristics will be dramatically improved relative to the mid-1970s; long-term patronage forecasts based on estimates of residential and employment patterns several decades hence are intrinsically uncertain, and forecasts based on hopeful assumptions that long historic trends (for example, toward dispersal), currently operating with undiminished force, will be reversed during such a time period are particularly error-prone; most patrons of new systems typically arrive by car; and the only studies available, of the BART transbay and Lindenwold lines, indicate that drivers shifting to the new rapid transit services were almost instantaneously replaced on the highways by new drivers. The last is a particularly counterintuitive finding, but less surprising on reflection than at first glance. The rapid transit (like the express bus) potential for auto diversion is greatest in severely congested corridors, and it is well known that such congestion normally suppresses a certain amount of potential traffic demand. As even the most successful new transit services have induced fewer than 10 percent of motorists to switch, and as these have been in extraordinarily congested corridors, it is perhaps not so remarkable that the motorists in question have proved to be quickly replaceable.

Even at their most successful with reference to energy and air quality objectives, moreover, transit improvements are trivial and cost-ineffective instruments for achieving these objectives. The reason is primarily that the current base of transit patronage is so small. Even a doubling of transit patronage, with the increment drawn entirely from the ranks of automobile drivers, would reduce automobile VMT in urban areas by less than 3 percent. In practice, at least half the new patronage would probably be drawn from other sources, and transit vehicle mileage would have to be vastly increased. Thus, the automobile travel

reduction would be under 1.5 percent, and it would be largely offset by increased transit energy consumption and emissions. The dollar cost of such a strategy would under the most optimistic assumptions have been about \$6.7 billion a year in 1975. By 1990, when automobile fuel economy and emission characteristics are sharply improved, it would not only cost far more but it might even--unless the transit load factors were extremely high or some unexpected breakthrough had occurred with respect to bus fuel economy and emission characteristics--have negative energy and air quality consequences.

Transit service expansion likewise has negligible potential with reference to safety, and the primary reason again is that it has so little potential for reducing automobile passenger mileage. Additionally motor vehicle fatality rates are lowest during peak commutation hours, and transit fatality rates per vehicle mile are several times greater than those for private motor vehicles.⁽⁵⁾ The latter finding suggests that increased transit patronage attracted at the cost of low incremental load factors (and these largely composed of others than former automobile drivers) might well involve a slight increase in the urban transportation accident toll.

Transit has often been sold as a means of reducing congestion; and it is true that in corridors where the transit share of peak hour travel is currently high a cessation of transit service would severely intensify congestion. There is little evidence, however, that transit service expansion can significantly reduce congestion. This apparent paradox is explainable as follows. The present transit share is high

(5) The overall transit bus and rail rapid transit fatality rates per vehicle mile in 1975 were 3.7 and 6.0 times as great, respectively, as the urban automobile-truck rate. Considering nonoccupants alone, the bus and rapid transit fatality rates were 7.3 and 11.7 times the automobile-truck rate per vehicle mile.

mainly on the approaches to the nation's largest, most concentrated, downtown employment centers. These have developed over many decades, premised on the availability of good transit access. Peak period congestion on the approaches to them is severe. On the one hand, this congestion serves to sustain transit patronage; on the other, it signifies the existence of a great deal of latent highway travel demand, ready to be expressed as and when additional highway capacity becomes available. Except in such corridors, new transit service generally has negligible potential to attract automobile drivers from their cars. And in such corridors, when it does attract them, they tend to be quickly replaced on the highway as noted above with respect to the BART and Lindenwold studies.

To the extent, moreover, that transit improvements induce higher density development over the long term than would otherwise have occurred, they will normally bring about an increase in traffic congestion. Congestion is a function of the ratio of traffic demand to road system capacity. As density increases within any area, the transit share tends also to increase, but so does the absolute level of highway traffic demand per unit of road capacity. By comparison, land use dispersal has the opposite effects; transit shares decline, but so does the absolute level of highway traffic demand per unit of road capacity. The results are so readily observable that it is something of a wonder anyone can propose transit service expansion seriously as a long-term congestion relief measure. The nation's (and the world's) highest density cities are invariably characterized by severe traffic congestion as well as by high transit modal splits. In contrast, at any given population scale the lowest-density urban areas tend to be characterized by the least congestion as well as by the least reliance on transit. Insofar as congestion is the problem, it has been aptly remarked, diffusion is the simplest solution.[1]

Transit service expansion can significantly ameliorate mobility deprivation, particularly among the carless poor who live at reasonably high densities. Unless carefully targeted for this purpose,

however, transit improvements are likely to produce quite meager equity benefits. To date they have rarely been targeted for this purpose.

The primary needs of the carless poor are not for improved high speed, peak period, downtown-oriented commuter services. Their mobility deprivation applies overwhelmingly to other types of trips. It can best be ameliorated by off-peak and crosstown service improvements. Such improvements, however, typically attract very low incremental load factors and almost no automobile drivers. Rather they reduce waiting and walking times for existing low-income users; they afford new trip-making opportunities; they reduce the dependence of carless individuals on others for automobile "lifts" and they replace some burdensome walking trips. Politically such improvements attract no support from downtown business interests; they generate no construction jobs or contract⁵; they do not expand the base of transit system support (typically weakest in the suburbs); they cannot plausibly be sold as instruments of congestion relief or as spurs to core area development; and they are entirely lacking in technological excitement. In short, they have neither glamour nor significant pork-barrel value; the benefits are hard to measure; and they typically come at rather high cost per trip served.

It is scarcely surprising, then, that the great preponderance of recent transit service expansion has aimed at serving the potential transit markets of least relevance to the problem of mobility deprivation. The prime target clientele has been suburban commuters to downtown jobs, a group characterized by income and auto-mobility levels well above average. This strategy is quite comprehensible in terms of other policy and political objectives, but it has served to minimize the equity value of transit service expansion.

Evidence bearing on the transit potential for shaping land use in the current period is both sparse and ambiguous, but it suggest that the

land use impact of even the most massive improvements (new rapid transit systems) will rarely be more than marginal. Where service extends well out into the suburbs, moreover, the predominant direction of impact may be toward dispersal rather than concentration.

It is important to distinguish between concentration and clustering. Concentration refers to the proportion of development occurring near the regional core; clustering refers to the precise configuration of development within any sector of the region. In practice, new rapid transit systems often generate intense clustering around their downtown (though rarely their suburban) stations, but they do not seem to have substantial concentration effects. It is readily understandable why this might be so. Given the ubiquity of highway access throughout contemporary urban regions and certain inherent limitations of transit (either the vehicles must stop frequently and travel on local streets, or the average patron must expend considerable time and effort reaching the stops that do exist), transit improvements can have only a modest impact on the relative accessibility of even the best-served locations. Given all the other factors that go into location decisions by investors, this impact will rarely tip the balance between locating downtown and locating elsewhere. Having once decided to locate downtown, however, investors are likely to be quite strongly influenced by considerations of transit accessibility as they evaluate specific alternative sites.

Major transit investments appear most likely to have significant concentration effects in circumstances where numerous other factors as well are highly conducive to downtown investment, and then to do so primarily because of their symbolic value--as tokens of government commitment to the future of downtown. The San Francisco case, often cited in support of the view that transit investment can touch off a downtown investment boom, illustrates these points. The San Francisco core was experiencing a construction boom even prior to the BART referendum (1962),

and BART in practice has had only a modest impact on downtown accessibility (since excellent bus services were already available in the corridors it serves). The public commitment to construct BART undoubtedly reinforced the confidence of potential investors in the future of downtown San Francisco. But there is wide latitude for debate about whether BART made more than a slight difference and about whether a vigorous program of bus service improvements on existing streets and highways might have yielded comparable benefits at a fraction of BART's cost. What does seem indisputable is that BART played a supporting rather than a leading role, and in a setting where the preexisting market potential for downtown investment was extremely strong.

There is another side of the coin as well, however, in estimating the long-term impacts of transit service improvements--like BART--extending far into the suburbs. People who commute to downtowns do so because that is where they earn their livelihoods. If long-distance commutation is difficult, many of them will choose to live relatively close in. Dramatic transit service improvements will not induce large numbers of downtown workers to move farther out immediately, but they are indeed likely to have some effect in this direction over time. Thus whereas the most notable short-term effect of transit improvements serving distant suburbs may be to attract some commuters who already live there out of their cars, a longer-term effect may be to induce more commuters to live there. It is not difficult to imagine circumstances in which the dispersal effect would be stronger than the concentration effect. The key variables, probably, are the inherent attractiveness of the downtown and the specific configuration of the rapid transit system. Thus consultants to the city of Detroit have recently argued (correctly, in our view) that a rapid transit system there would do the city little good if it extended substantially into the suburbs.

Transit might be most effective in promoting high density as part of a comprehensive policy package including moratoria on public facility

improvements in the suburbs, zoning and property tax policies driving investors toward the core, metropolitan school districts, and concentration of the transit improvements themselves in the inner portions of the region. But there is virtually no political constituency in any region for such a policy package. Moreover a key objective of central city and transit agency officials in recent years has been to secure regionwide transit financing; and the price of suburban tax contributions has been promises of improved suburban service. Local transit proponents themselves have generally deemphasized the objective of high density, recognizing it as one of the least consensual values that might be served by transit. They have sought (successfully) to present transit investment as one among many distributive policies (financed, moreover, predominantly by higher levels of government), not as part of a comprehensive package involving moratoria on other popular programs and new regulatory constraints.

Transit service improvements may also be justified, finally, with reference to the modest aim of improving the quality of life for current users. We have stressed above that the existing system of urban transportation provides extremely high quality service from the standpoint of those with ready access to automobiles. From the standpoint of most transit users, one need scarcely add, its service characteristics are distinctly inferior.

Turning from substantive to political analysis, the most puzzling question is how a mode with such a narrow patronage base, concentrated in such a small proportion of the nation's congressional districts, and of such dubious value in serving the main objectives that have typically been cited to justify increased spending on it, could have enjoyed such a run of funding growth as transit has during the 1970s. From fiscal 1970 to 1978 (estimated), federal transit aid obligations rose thirty-fold. As of fiscal 1978, the transit share of federal spending for urban transportation purposes is expected to be 52 percent, whereas the transit share of urban personal travel is under 3 percent

and its share of freight travel is 0 percent.

The keys to the recent political successes of transit, in our judgment, have been as follows: First, the intense negative reaction stirred by the interstate highway program in some quarters during the late 1960s and early 1970s provided a vital source of mobilizing energy. Second, the antihighway movement needed a positive as well as a negative ideology and program--an alternative strategy for providing improved mobility, attracting federal aid to urban areas, and (where rapid transit was remotely plausible) generating construction jobs and contracts. Third, the decline of transit was perceived by downtown business interests and central city officials as a severe threat to their investments and tax bases, brought on in significant part by the "imbalance" of massive federal and state highway investment combined with a near-total neglect (until the late 1960s) of transit. Fourth, mass transit proved to be a program with extremely wide ideological (even if not market appeal, able to attract support from such disparate interests as the central city poor, downtown businessmen, environmentalists, and construction workers, and stirring negligible opposition once the basic idea gained acceptance that urban transit was a public service of national concern rather than simply a local business. Fifth and finally, the combination of antihighway sentiment, urban area demands for increased transit funding, and continuing support in many other quarters for highway funding generated a political marriage of highway and transit program supporters in the Congress (commencing in 1973) and in numerous states with large urban areas. The essential terms of this marriage were a cessation of generalized attacks on the highway program by transit program advocates, in return for large-scale increases in transit funding and substantial flexibility for urban areas to use their highway aid allocations for transit purposes.

In brief, then, transit has proven to be a distributive, unifying policy capable of being incorporated into the much larger highway (now highway transit) coalition. But at the same time its fiscal appetite has proven to be quite voracious, and the absolute level of transit

spending has now reached a point at which large percentage increases also involve large amounts of money in absolute terms. There has been a dramatic shift of predominant national mood since the early 1970s, moreover, from one of fiscal abundance to one of austerity, and there has been a gradually spreading recognition that transit may not be a cost-effective instrument for pursuit of many of the objectives associated with it by its more enthusiastic advocates. Thus it seems probable that the period of transit service expansion, brief and modest though it has been, is drawing to a close. The predominant concern among state and local elected officials, and among transit labor union leaders, is now to secure additional operating subsidy assistance for the maintenance of existing service levels. The elected officials are anxious to avoid tax increases, fare increases, service cutbacks, and labor turmoil; the labor unions hope to achieve wage and fringe benefit increases and to avoid layoffs. These objectives are far more immediate and compelling than any associated with service expansion.

In practice the fiscal pressures are such that service cutbacks have already occurred in numerous metropolitan areas during 1976 and 1977, and most of those that had previously been aggressive in expanding service are no longer doing so. The transit prospect, in short, much resembles that in the highway field. The challenge of the next few years is more likely to revolve around avoidance of system deterioration than a new round of expansion. Two important differences, however, bear note. First, users respond more immediately to transit service cutbacks because they are more visible (at least over the short term) than cutbacks in highway maintenance. Second, the transit fiscal pressures are more severe; transit appears to require larger percentage increases in spending each year to maintain current service levels, and it is in direct competition with all other claims on general revenues; the highway maintenance fiscal crisis, on the other hand, could probably be resolved with a penny or two increase in the gas tax every few years.⁽⁶⁾

(6) Until the oil crisis of 1973-1974, such increases were routine at the state level. Since then, however, elected officials have been extremely skittish about actions that might lead voters to view them as one of the causes (and the one most vulnerable to retaliation) of gasoline price inflation.

Demand Responsive Transit (DRT)

The key dimensions of transit service responsiveness are spatial and temporal. Spatially, DRT may at one extreme be as flexible as exclusive-ride taxi service; at the other, it may simply offer slight deviations from fixed routes. Temporally, DRT operators may strive for instant response to individual trip requests, they may condition their acceptance of individual demands by requiring substantial advance notice, or they may serve only recurrent trips on a subscription basis. Our concern has been primarily with DRT services at the more responsive end of the spectrum--those involving doorstep service (or a close approximation thereof) between a wide variety of points and responding to individual trip requests.

Not surprisingly vehicle productivities (trips served per hour of operation) tend to decline as the degree of responsiveness increases and as the density of demand drops.⁽⁷⁾ Costs, in turn, are a function both of vehicle productivities and of costs per vehicle hour. Because DRT is a highly labor-intensive service, the overwhelming determinant of cost per hour is the nature of labor arrangements--including wages, fringe benefits, and work rules. DRT combines conventional taxi and transit service concepts, and it can be provided at least as well by taxi as by transit organizations. In general, taxi rates of labor compensation (including fringe benefits) are less than half those of transit employees, and taxi work rules are considerably more flexible. The result is not simply that DRT service normally costs less than half as much when provided by taxi companies; it is also that highly responsive DRT (many-to-many, nonsubscription) provided by transit agencies typically costs more per passenger mile than exclusive-ride taxi service in the same locales. This is not to say, of course, that fares are higher; in practice, subsidized fares have frequently been comparable to those for fixed route service. But it is to emphasize that the public costs of DRT, and particularly of transit

(7) Demand density--the number of trips per square mile per hour--varies with a wide range of factors in addition to land use density. These include the demographic characteristics of the population served, restrictions on service eligibility, service quality, the fare level, hours of service, and the characteristics of any competitive transit and taxi services in the same area.

agency-provided DRT, tend to be extremely high.

DRT may be approached as primarily an instrument for enhancing the equity of the urban transportation system or as a community luxury. In the former case, the emphasis will typically be on serving the handicapped, the carless elderly, and the carless poor who live at densities too low to make fixed route service a plausible option for relieving their mobility deprivation. In the latter case, the emphasis is likely to be on serving children, on taking commuters to and from fixed route transit stops, and otherwise relieving household members of the need to chauffeur one another about.⁽⁸⁾

Both equity and convenience objectives can frequently be served by the same DRT system, but their relative weights are likely to have a determining influence as choices are made with respect to service area boundaries, patterns of operation, eligibility and fare policies, degree of advance notice required, system scale, and predominant sources of financing. An equity-oriented system, for example, is likely to concentrate on serving human service facilities and low-income neighborhoods, to require advanced notice as a means of facilitating the grouping of trips, to restrict eligibility for service (or at least for heavily subsidized fares) to selected mobility-deprived groups, to hold down the number of vehicles even if this entails significant sacrifices with respect to wait and travel times, and to rely heavily on contracts with human service agencies rather than more conventional sources of transit funding.

Given the very high cost of DRT service it is difficult to justify as a federal, state, or regional funding priority except for the purpose of aiding mobility-deprived groups who cannot effectively (or at

(8) Doubtless the best-known example of this type is the Westport, Connecticut, DRT system. Westport is one of the most affluent commuter suburbs of New York City, and its reported motives for supporting DRT are almost entirely of the convenience rather than the equity variety.[2]

any lower cost) be aided with fixed route strategies. Affluent localities, on the other hand, may reasonably choose to finance convenience-oriented DRT systems as community amenities. Other communities may find that they can add convenience features to DRT systems that are justified basically on equity grounds at quite tolerable incremental cost. And in practice a certain number of low-density communities are likely to find themselves with federal and state aid allocations for which they have no other palusible use; a high proportion of the systems implemented to date have apparently been stimulated in this manner.[3]

Because most of the mobility deprived are handicapped, enfeebled by age, and/or resident in low-density neighborhoods that are unsuitable for blanketing with fixed route transit service, DRT must be viewed as an extremely promising instrument for enchancing urban transportation system equity. Additionally DRT may be utilized to provide superior service at no greater cost than fixed route transit in certain areas of moderate and high density during late evening hours and on weekends; and most of those who utilize transit during such periods are mobility deprived. The central questions are how to hold down costs and how to finance the high per-trip subsidies that are bound to remain in the best of circumstances. The answers are fairly obvious but often difficult to implement politically.

A central element of any cost-minimization strategy must be to rely on taxi companies or other private contractors rather than public transit agencies to provide the service; but transit labor unions and many public transit officials oppose this tactic (the latter mainly to keep peace with the former). Yet unless DRT is able to operate at costs per vehicle hour more closely approximating taxi than transit operations, its future appears dim. Those concerned with transit budgeting are likely to conclude that its costs are absurdly high for any but the most compelling equity purposes, and that even these can be met more cheaply by purchasing conventional taxi service.

The bright side of the picture is that equity-oriented DRT services have the potential to thrive even in the midst of more general transit austerity. The elderly and the handicapped in particular have long been neglected by transit policy makers, and their recent lobbying efforts have evoked positive responses from most elected officials. Additionally, insofar as DRT funding comes from human service agency sources (or from specially earmarked federal and state transit aid appropriations), it may be relatively insulated from the broader urban and transit fiscal crises. In order to capitalize effectively on these fiscal opportunities, DRT service planners will have to concentrate on serving the elderly, the handicapped, and human service recipients more generally, and they will have to demonstrate that their costs are reasonable by comparison with exclusive-ride taxi service.

DRT does not, finally, appear to have any potential for alleviating other urban transportation problems than equity. Operating with very low load factors and serving high proportions of new (along with former pedestrian) trips, DRT service expansion generally entails increased energy consumption and emissions. Operating mainly in low-density areas and serving few commuter trips, it is irrelevant to the problem of congestion. Nor does it seem likely to have any noticeable impacts on safety or land use.

Increased Private Ride Sharing

Private ride sharing refers here to all motor vehicle travel in which the driver is accompanied by at least one passenger, the driving function in uncompensated (or compensated in only nominal fashion), and the vehicle is owned or leased by an individual for personal use or by an institution for the use of its employees. So defined, ride sharing is already the predominant mode of American travel. The average automobile occupancy per vehicle mile is 2.2. And although occupancies are considerably higher for nonwork than for commutation trips (2.5 versus 1.6), many more people carpool to work--indeed many more ride as passengers in carpools--than commute by transit. (Nationally 18.3 percent

commute as auto passengers, 7.5 percent as transit riders. Considering urban areas alone, the figures are 18.2 percent and 10.4 percent.)

The question, then, is not whether large numbers of people will ride share, but whether much can be done to increase the amount of ride sharing--and particularly to increase the proportion of private motor vehicle users traveling as passengers. If so, one would expect the potential to be greatest with respect to commuter trips, which currently involve both the lowest occupancies and the greatest bunching of trips in time and space.

If in fact large numbers of additional commuters could be induced to ride share, significant benefits would accrue with respect to energy consumption, emission levels, and congestion. As ride sharing became more prevalent and formally organized, moreover, disproportionate benefits would accrue to carless employees, who would now find it both feasible and socially less awkward to enter into ride-sharing arrangements. The quality of service would be extremely high by comparison with transit: doorstep service and a seat for every passenger. And costs would be very low. Indeed private commutation costs would be significantly reduced. Public costs, it has generally been assumed, would be confined to publicity, technical assistance (to employers), and the provision of matching services. Unlike fixed route transit, finally, private ride sharing seems at least as applicable in low-density as high-density areas.

In practice, however, current patterns of travel behavior are quite firmly rooted in the circumstances and preferences of individual travelers, and apparently it will take a great deal more than government promotional efforts and matching services to bring about significant increases in ride sharing. Those who now ride as passengers include very high (though not precisely known) percentages of individuals who cannot drive and/or who are members of the same households as their carpool drivers.

As one considers strategies for inducing large numbers of commuters

who presently drive alone to ride share, it is essential to bear in mind that although ride sharing is cheap monetarily it is far from costless. It involves travel time delays due to route circuitry and waits for other passengers. It is extremely rigid temporally--much more so than transit, let alone single-occupant auto travel. It is highly resistant to intermediate stops (such as for shopping on the way home from work). It involves social relationships, possibly including agreements on cost sharing, that many find unpleasant. And it typically requires frequent search costs, because individual pool members are changing jobs, shifts, residential locations, and modal choice preferences all the time.

These costs are easy to overlook--and are in fact relatively insignificant--when ride sharing is spontaneous, when the typical pool is small (two or three people), and when most sharing is among people with close personal ties. They rapidly become conspicuous, however, as organized efforts are made to generate major increases in ride sharing, predominantly among strangers and in relatively large pools.

To date, substantial increases in ride sharing have been achieved only where employers have played vigorous promotional and organizing roles. By contrast, regionwide publicity campaigns and offers of free matching service aimed directly at commuters have been virtually without impact. It is unclear precisely why employer commitment should make such a difference, but it seems likely that the key variables have been to make ride sharing somewhat fashionable within a relevant social setting and to provide social reinforcement for precise clock-watching, which might in other circumstances be frowned upon by supervisors. Additionally, some employers have organized vanpool services--an activity that has involved them in purchasing and insuring vehicles, screening drivers, and deducting fares from paychecks and many more have set aside desirable parking locations for carpools. (The latter is likely to be significant only where parking is in very short supply or where much of it is remote from the work site.)

A central question, then, is how to obtain vigorous employer commitments to ride sharing. No ready answers are available. The vast majority of effective employer efforts, and all the spectacular cases that are regularly cited to demonstrate the great potential of ride sharing, were undertaken for compelling business-related reasons. Several large employers have faced severe impending parking shortages due to expansion on a constrained site; one constructed a nuclear power plant at a location with severely limited road access; still another from Manhattan to New Jersey, leaving many employees with no ready means of getting to work.

A limited number of major employers face such problems each year, and with these precedents before them they are likely in the future to consider undertaking ride-sharing programs. Even if they all decide positively, however, the regionwide and national effects of their decisions will be trivial. And there appear to be fairly significant deterrents to involvement by very many other employers. Ride-sharing programs, especially those that include vanpooling, typically involve substantial hidden subsidies in the form of staff services; they are likely to absorb significant amounts of top management energy; most employers feel that they have much higher priority concerns than telling their employees how to commute; and they fear that any deployment of truly powerful incentives--such as reductions in parking space availability for single-occupant commuters--would generate adverse employee reactions. Additionally many employers prefer to have their employees free to stay beyond normal quitting time when necessary to complete items of work, and they are reluctant to take on a responsibility for providing backup transportation service home whenever employees do so.

On the whole, then, we judge that government promotional and technical assistance efforts by themselves are unlikely to bring about significant increases in private ride sharing, increases large enough, for example, to show up in national surveys of commutation travel behavior.

Indeed, as the incidence of automobile ownership continues to grow and (probably) average household size continues to decline, the normal expectation would be that the incidence of ride sharing will continue its long historic decline.⁽⁹⁾

At the same time, we view ride sharing as the nation's major backup transportation system for dealing with any acute oil shortage that may occur abruptly (due to embargo or war) in the next several decades. The shortage would apparently have to be more severe than that experienced during the winter of 1973-1974, when the vast majority of motorists coped simply by cutting back on noncommutation travel. In a crisis that threatened economic paralysis, however, the level of ride sharing could be quickly and sharply increased. By contrast with mass transit, furthermore, ride sharing could serve the most dispersed as well as the most concentrated employment sites; it could do so without requiring new vehicles, or subjecting commuters to intense overcrowding, or forcing them to give up doorstep service; and it would actually save a considerable amount of money. (As congestion disappeared, some commuters would even save time.)

Short of such an oil crisis, the most likely strategy for bringing about increased ride sharing would be government restrictions or surcharges on employee parking, but the political appeal of ride sharing to date has been premised on the assumption that it is a purely distributive strategy--entailing benefits for those choosing to avail themselves of the technical assistance and matching services made available by government, but no coercion. There seems no likelihood that the use of

(9) National data on automobile occupancies over time are unavailable. The New York Port Authority has periodically collected occupancy data on vehicles utilizing its trans-Hudson bridges and tunnels since the 1920s, however. These indicate that the average passenger car had 2.50 occupants in 1925, 2.40 in 1940, 2.18 in 1950, 2.04 in 1960, 1.88 in 1979, and 1.83 in 1972. The Nationwide Personal Transportation Study reported an average occupancy of 1.9 in 1970.

These figures, parenthetically, include weekend travel, whereas regional transportation surveys are almost invariably of travel on average weekdays. A large majority of the latter found have found occupancies in the range of 1.45-1.63. The trans-Hudson weekday figure in 1974 was 1.64.

A number of urban areas have conducted surveys of internal trips at more than one point in time during the postwar period. These have invariably found occupancies declining or essentially unchanged.[4]

auto-disincentive measures to stimulate ride sharing will become feasible in the near future. Thus far there has even been an unwillingness to consider subsidy strategies, on the substantive ground that cost is not among the principal barriers to increased ride sharing and on the political ground that there is no constituency for such a new subsidy program. Even the companies most involved in ride sharing have judged that the political and bureaucratic complications associated with a subsidy program (for example, to cover the capital cost of vans) would surely outweigh the benefits.

Preferential Traffic Management

Traffic management provides the illustration most frequently cited to explain how all the members of a society can enhance their effective freedom by accepting certain constraints. Prior to the interstate program, moreover, virtually all expansion of highway capacity in developed urban settings occurred by traffic management innovation. And, after two decades in the shadow of that ambitious effort to expand capacity by brute force (and massive spending), traffic management has again won recognition in the middle and late 1970s as the main instrument for dealing with urban highway problems. One may usefully divide traffic management measures into three categories.

- Those that benefit all vehicle users more or less equally.
- Those that discriminate in favor of high occupancy vehicle (HOV) users without imposing noticeable costs on other travelers.
- Those that discriminate in favor of HOV users and/or pedestrians at some obvious cost to other travelers.

Prior to the 1970s, the overwhelming focus of traffic management, as of urban transportation policy generally, was on measures in the first category. Insofar as exceptions were made, they were to recognize certain claims of pedestrians and adjacent landowners: to be able to cross streets safely and to have certain residential streets free of through traffic. Other trade-offs had to be made between vehicle users themselves at times--most notably between through travelers and those desiring to park--and occasional parkways were declared off-

limits to heavy vehicles (including buses). But the primary objective was clear: to improve traffic flow for all vehicles equally. During the first two postwar decades, moreover, even the other values traditionally recognized by traffic engineers were very much on the defensive. Faced with an apparently inexorable tide of rising traffic, highway officials strove insofar as possible to narrow sidewalks and eliminate parking on through streets, to resist neighborhood demands for through-traffic disincentives (such as frequent stop signs), and so on. They also thought little of cutting swaths through neighborhoods to provide optimal paths for new expressways.

In the 1970s, as major new construction has ground to a halt in the developed portions of most urban areas, the focus of attention has returned to the question of how to get the most from existing streets and highways. Widespread consensus has developed, moreover, around the following propositions: that traffic management should focus on optimizing person flow rather than simply vehicle flow; and that in some circumstances it should give higher priority to such values as neighborhood and pedestrian amenity, air quality improvement, and the encouragement of HOV travel than even the optimization of person flow.

Our primary concern has been with measures giving preference to HOV vehicles--usually just buses, sometimes carpools and vanpools as well--in congested traffic streams. The primary measures in this category are exclusive lanes and preferential signal systems. The most dramatic successes have been achieved in several situations where it has been feasible to develop new or contraflow HOV lanes on severely congested freeways without imposing any obvious costs on non-HOV travelers. Indeed where the HOV volumes have been high--as on the I-495 contraflow lane approaching New York's Lincoln Tunnel and the Shirley Highway busway in Washington, D.C.--other travelers in the peak-flow direction have actually reaped significant congestion-relief benefits.

The opportunities to provide major time savings for HOV users without imposing costs on other travelers are extremely limited, however.

The construction of new HOV lanes in severely congested corridors typically involves great expense and may involve considerable disruption as well. And contraflow lanes are extremely difficult to justify except in corridors with very high peak period bus volumes.⁽¹⁰⁾ There are many more circumstances in which substantial HOV benefits might be provided by reallocating with-flow lanes currently in general traffic service, but such measures, involving obvious and substantial reductions in highway capacity for already-congested general traffic streams, remain highly controversial.

The best-known example to date of an effort to reassign with-flow lanes for HOV use was the diamond lane experiment on the Santa Monica Freeway in Los Angeles. The diamond lanes were introduced with substantial accompanying publicity to the effect that they were intended both to increase total peak-period person flow and to enable bus and carpool users to avoid congestion entirely. Before the experiment was terminated, its main sponsor (the California Department of Transportation) claimed that these objectives had in fact been achieved. During the early weeks, however, as travelers adjusted to the new arrangement, general traffic congestion was sharply intensified, accident rates were up as well, and overall person flow was down. Public and media reaction took firm shape during this period, and in retrospect the experiment is generally viewed by traffic officials across the country as a modest technical success but a great political fiasco.⁽¹¹⁾

(10) It is generally considered unsafe to open contraflow lanes to carpools along with the buses; their operating costs--for putting down and taking up lane markers each day--are relatively high; they typically impose slight additional congestion costs on travelers in the off-peak direction; and traffic engineers worry that when bus frequencies are low, some oncoming motorists are likely to forget the existence of the contraflow lane.

(11) In fact, even the technical claims of success are weak. The eventual time savings associated with the diamond lane project were attributable mainly to its ramp metering components rather than to the diamond lanes themselves.

easily. Thus even where benefits are modest, they may easily justify their cost; and even where cost-effectiveness is uncertain, there may be little risk in experimenting.

We emphasize these points in order to underline our judgments both (a) that preferential traffic management measures have a high potential for cost-effectiveness with reference to a wide range of important objectives and (b) that they have little potential for substantially alleviating any of the main problems of urban transportation.

In selected circumstances, for example, preferential treatments in highly congested corridors may induce as many as several thousand commuters to shift from driving to riding as HOV passengers. The opportunities to generate such diversions are relatively few, however, and even the most spectacular successes in the nation to date have reduced regionwide automobile travel by only a small fraction of 1 percent. It is difficult to imagine how even the full range of measures likely to be feasible in any urban area during the foreseeable future could bring about an aggregate reduction of more than 1 percent. Thus the potential of preferential traffic management as method of conserving energy and of reducing air pollution on a regionwide basis would appear to be meager. Auto-restricted zones, on the other hand, may provide a highly effective technique for reducing pollution concentrations on particular downtown street with heavy pedestrian volumes (and thus high rates of human exposure).⁽¹²⁾

Preferential measures can provide dramatic congestion relief for HOV occupants in many settings, but this will often be at the expense of other travelers except where the HOV vehicles are utilizing new (or previously underutilized) lane capacity.

(12) The price of this site-specific benefit, it should be noted, will normally be a slight increase in regionwide motor vehicle travel. Although they may induce a few core-bound travelers to leave their cars at home, auto-restriction schemes will also in most cases force large numbers of motorists to take more circuitous routes to their destinations than they would have chosen themselves. Additionally, unless measures are implemented to increase capacity on the bypass routes around the zone, it must be anticipated that they will become more congested.

By contrast, more limited preferential measures--such as special access ramps or lanes for HOV vehicles onto metered freeways--have aroused little controversy. These do not reduce the amount of highway capacity available for general traffic; they simply provide some temporal preference for HOVs (rarely more than a few minutes) in gaining access to this capacity. There is, further, increasing acceptance of the view that much stronger restraints on general traffic are probably justified on downtown shopping streets and in residential neighborhoods than on major traffic arteries. Numerous cities have implemented pedestrian malls, transit-pedestrian streets, and exclusive bus lanes on downtown streets in recent years. And, with vigorous federal encouragement, some are currently designing more extensive auto-restricted zones. The predominant aims are to enhance pedestrian amenity (creating something of the ambience of the suburban shopping mall downtown) and to facilitate transit operations. Meanwhile neighborhood residents in many locales have made substantial headway during the 1970s pressing the view that child safety and quiet should take near-total precedence over through traffic demands in the management of residential streets.

This serves to highlight a key political point: there are activist constituencies for traffic restriction in residential neighborhoods and (at least a few) downtown shopping areas, and these consist of adjacent land users. HOV users, on the other hand, have never to our knowledge mobilized on a traffic management issue. Thus preferential traffic management on expressways and arterial streets remains a technocratic initiative. The main supporters are professional transportation officials, and--since traffic management measures are generally cheap and nondisruptive--they can often implement their ideas even without an active constituency. Whenever, their proposals do arouse substantial opposition, however, elected officials--sensing the lack of politically relevant support--tend quickly to run for cover.

In considering cost-effectiveness of traffic management measures, the most important fact to bear in mind is that their costs (social and environmental as well as fiscal) tend to be extremely low. Additionally they can be implemented quickly and, if necessary, reversed

with-flow lanes are reserved, however, time losses for non-HOV travelers are likely to exceed time savings for HOV occupants unless the HOV volumes are high. And even where new lanes are constructed, they might frequently provide greater congestion relief if assigned for general traffic use; the issue again turns on the volume of HOV usage. (13)

There is also a certain equity appeal about giving priority to people over vehicles in the allocation of scarce highway capacity. But the main beneficiaries thus far have been downtown commuters, in general an affluent and able-bodied group. The major equity issues in urban transportation, of course, revolve around the types and amounts of service that should be provided the carless poor and the physically handicapped rather than marginal differences in travel time for specific categories of peak period highway users.

Pedestrian amenities on downtown shopping streets are likely to have some positive impact on downtown sales, but no one has suggested that they are likely to have a substantial impact on overall development trends. Similarly traffic restrictions in residential areas may significantly improve pedestrian safety and reduce noise within them. As long as the streets to which traffic is diverted have little amenity value to begin with, the net quality-of-life gain may be very worthwhile. But annoyance with traffic on residential streets is not generally considered to be one of the primary reasons why urban residents have been abandoning the central cities in such vast numbers during recent decades.

Finally preferential traffic management can make a significant contribution to holding down transit costs by reducing bus congestion delays. But it is hard to imagine even the most aggressive regionwide program of preferential traffic management achieving more than a several percentage point reduction in transit operating costs.

(13) Nonpreferential traffic management measures (such as one-way street systems, freeway metering, traffic-actuated signal systems, and channelization) are, by contrast, able to yield significant congestion relief in a much wider range of settings. The primary reasons are simply that they do not require large HOV volumes or sufficient lane capacity to segregate types of traffic in order to yield their potential benefits.

To sum up: The potential benefits of preferential traffic management and of traffic restriction in the interest of adjacent land users are significant, varied, and frequently available at low cost. We anticipate that the bounds of feasibility with respect to these concepts will continue to be pressed outward in the years ahead. Their greatest potential, however, appears to be with reference to enhancing pedestrian and residential amenity at the microscale. We see little evidence that measures in this category can substantially improve the aggregate performance of the urban transportation system with reference to any of the problem criteria on which we have focused in this book.

Business Regulation

The predominant scholarly view is that business regulation, by impeding market entry and by placing a heavy burden of proof on those proposing to compete in new ways has tended to retard the pace of technical and service innovation.[5] Our concern in the present study, however, has been with a special and relatively new type of regulation: aiming explicitly to accelerate the pace of innovation with reference to selected product performance characteristics.

Such regulation dates only from 1965 in the field of urban (or, more precisely, motor vehicle) transportation. But since then, it has been by far the most significant locus of policy innovation in this field. While there is room for substantial controversy about the degree to which it has in fact accelerated the pace of technical progress, there seems little question that it has profoundly affected the research and product design priorities of the regulated businesses (most notably the auto manufacturers, secondarily the oil refiners) and sharply accelerated the pace at which relevant technical developments have reached and become standard in the consumer marketplace.

We have stressed that the American political system is strongly oriented toward reliance on benefit distributing rather than constraint strategies wherever possible. As action moods have developed around the issues of safety, air quality, and energy during the 1960s and 1970s, however, there has been a widespread recognition that distributive strategies were unlikely to affect them more than tangentially. It has

gradually become apparent to elected officials, moreover, that as constraint strategies go, product performance regulations are among those entailing the least risk of voter backlash. Those constrained directly, and most obviously, are a few large companies rather than large numbers of voters. And since the initial battle over safety (1965), the companies themselves have resisted each extension of the scope of regulation far more tepidly than might have been expected. Accepting the basic decisions to regulate as nearly inevitable, they have concentrated primarily on heading off "unrealistic" technical demands (with respect to deadlines, standards, and enforcement procedures) and on making clear that all costs would ultimately be borne by consumers. The consumers themselves have been all but invisible in the key (legislative and administrative) decision-making arenas. Thus where pressure from the media or from activist groups for regulatory action has been intense, countervailing opposition has been surprisingly weak.

The companies and other critics of performance standard regulation have made much of the fact that all costs are ultimately borne by consumers. But in practice these costs tend to be uncertain, blurred, and deferred--characteristics that minimize their potential for evoking voter backlash. It is rarely implausible at the time standards are adopted to hope for technological breakthroughs and/or dramatic economies as existing existing prototype technologies move into mass production. Increased new-car purchase prices may be offset by reductions in other dollar expenditures (for gasoline, medical care in the aftermath of accidents, and so on). The mandated costs may simply substitute for others that would have been incurred in the absence of regulation (for example, safety versus annual style changes, fuel economy versus horsepower). When and if the costs do appear, they are invariably mixed in with many other causes of inflation. And there is always room for dispute about whether the companies have exaggerated in estimating the costs of regulation in order to minimize their own responsibility for price increases. Finally, these costs generally appear, if at all, quite a few years after the publicized decisions of elected officials. If, indeed, they appear too great as deadlines approach, the requirements can be relaxed. The public mood will almost surely be quite

different by this time. Meanwhile several elections will have intervened, and those who voted for the original legislation will have reaped the benefits of allying themselves with the action mood when it was most intense.

From a consumer standpoint, the degree of perceived constraint associated with performance standard regulation has typically been mild, and seems likely to remain so.⁽¹⁴⁾ The typical consumer, after all, has long been accustomed to choosing from among the range of options available in dealer showrooms. Few have spent much time grouching about the lack of still other options. With performance standard regulation the companies continue to stress the differences among models, trying to focus consumer attention on the choices that are available. It seems probable that they will continue to succeed about as well as they have in the past, especially since the predominant effect of regulation will be to shift the range of options rather than to narrow it. Cars with fuel economies of less than about 20 miles per gallon in combined city-highway driving are likely to be taxed off the market by the late 1980s, for example, but the range of fuel economies available will probably be greater than that available prior to 1975, when regulatory targets were first enacted. Similarly all cars will come equipped with air bags or automatic seat belts; but prior to the enactment of safety regulation in 1966, occupant restraint equipment was itself unavailable.

Additionally it bears emphasis that even distributive programs generally entail constraints--eventually, even if not immediately--in the form of taxes. And most regulatory programs involve hidden taxes in the form of higher prices. So long as consumers retain a wide range

(14) The main exception was the ignition interlock requirement, which entailed behavioral as well as hardware regulation. (The interlock system prevented ignition until front seat occupants had fastened their seat belts.) This regulation encountered little opposition until the first interlock-equipped cars appeared in the marketplace. But criticism was intense thereafter, and many owners found ways to disconnect their interlock systems. The regulation was withdrawn by an act of Congress about a year after it first became effective.

of choice about how much to spend on auto transportation and what features to spend it on, and so long as the add-on costs of mandated equipment remain a small percentage of the total cost of auto travel, it seems unlikely that many voters will focus on government-imposed product performance standards as among the more onerous constraints on their own behavior.

If product performance regulation has proven to have surprising political appeal, it has also gained increasing recognition as an instrument of great substantive power. Around 1970, indeed, there was a tendency in many quarters--illustrated by the Clean Air Act Amendments of that year--to believe that the companies could achieve virtually any target by any deadline. It subsequently became apparent that their actual capacities were far from unlimited, and there has been a constant tug-of-war between public and company officials in the years since over precisely what these capabilities are. But the companies have in fact made remarkable strides toward improving fuel economy, emission control, and safety. These performance criteria have two notable features in common: they largely involve characteristics of individual vehicles as mechanical systems rather than more complex interaction effects, and they had long been neglected by the auto manufacturers until recent years. The significance of the latter feature is that the companies have been able to exploit substantial backlogs of available technologies and promising ideas accumulated during the long years of neglect.

Though business regulation is in fact a powerful instrument, it also lends itself to the enactment of "morality plays" in which politicians strike antibusiness postures and proclaim grand accomplishments while skimping on effective enforcement and reliable monitoring.[6] The most blatant case has been that of air pollution control. Compliance by the manufacturers has been judged exclusively on the basis of tests performed on prototype, professionally maintained cars. Though the average vehicle life is slightly over ten years, the testing procedure assumes a "useful life" of five years or 50,000 miles, whichever comes first; and--astonishingly--the companies have been permitted to replace deteriorating control equipment as needed during the test so long as they have also called for such replacement in the manuals provided

vehicle purchasers. Though performance degradation of on-the-road vehicles is known to vitiate most of the benefit of new-car emission control standards, inspection and maintenance have to date been almost totally neglected.⁽¹⁵⁾ Despite all of these facts, most official forecasts have been premised on the assumption that vehicles will perform in accord with official new-car standards throughout their actual (10+ year) lives.

The bases for this morality play syndrome are easily comprehensible. The media and activist citizens' groups focus overwhelmingly on one or two policy symbols with respect to each performance criterion, of which the most notable are the new-car standards. The companies, on the other hand, actively lobby with respect to every implementation detail. Public officials, for their part, find it convenient to make some concessions to the companies on matters about which only they seem actively concerned, to avoid mandating the cost and inconvenience of lifetime maintenance so long as there is little public awareness or concern about on-the-road degradation, and to claim as much accomplishment as they can reasonably hope to get away with.

Thus it is easy in some circumstances to exaggerate the benefits of performance standard regulation--most notably, with respect to components that degrade substantially over time in the absence of maintenance, whose levels of performance can be determined only with expensive testing equipment, and whose failures predominantly entail external costs rather than adverse consequences for vehicle owners themselves. These factors are extremely significant in the case of emission control but much less so in the cases of safety and fuel economy. Even with respect to emission control, however, performance standard regulation stands out as by far the most powerful and cost-effective

(15) The Clean Air Act amendments of 1977 do look toward the implementation of inspection and maintenance programs in regions expected to remain in violation of ambient air quality standards after 1982, but they are vague as to when such programs may become operational.

approach available. And it seems likely to become much more powerful over time--as the manufacturers shift to emission control technologies less prone to degradation and/or as environmental groups turn their attention to the inspection and maintenance issue. It seems reasonable to assume, finally, that the federal government will require less degradation-prone technologies as it becomes clear they are available at reasonable cost, and that the companies feel under substantial pressure to deal with the degradation problem before it becomes (as it easily could) a hot public issue.

Direct Consumer Regulation and Price Disincentives

Both of these last two categories of policy instruments involve constraints imposed directly on large numbers of individual travelers. Regulatory measures prohibit and penalize specific types of behavior; pricing measures leave consumers free to allocate their own resources but reduce the incidence of disfavored behavior by increasing its dollar cost.

Our concern has been primarily with measures intended to reduce overall VMT and/or gasoline consumption. But we have also considered a wide range of more limited constraints, ranging from peak period congestion tolls on specific routes to mandatory seat belt use laws to requirements for the periodic inspection and maintenance of emission control equipment.

All of the consumer regulatory and pricing measures examined in this book have proven to be politically unfeasible thus far. Motorists have accepted a variety of other direct constraint measures (such as driver licensing, mandatory insurance, and periodic safety inspection) with relative equanimity over the years, however, and thus it would be rash to assume that the current bounds of feasibility are fixed. In seeking to estimate where the next breakthroughs are likely to occur, we judge that the variable on which to concentrate are the following:

To what extent would the proposed constraint require changes in daily behavior? Clearly, strategies that aim at curtailing VMT require

more behavioral change than those designed to ensure near-universal seat belt usage, which in turn require considerably more change than inspection and maintenance requirements.

• To what extent does the policy objective command acceptance as a critical public need--particularly on national security, health, or safety grounds? Gas rationing has been accepted in wartime, and public opinion polls indicate that it would be again if the nation were faced with a prolonged oil embargo. Safety inspection laws have presumably won acceptance as a legitimate public safety measure, and emission control inspection laws are likely to do the same as, when, and where the public becomes persuaded that the violation of ambient air quality standards involves substantial health effects.

• How obvious is the linkage between the actions by elected officials and the inconvenience or discomfort perceived by travelers?

President Carter's 1977 proposal for a gasoline surtax met instant, all but unanimous, Congressional rejection. His proposed crude oil tax, on the other hand, received House approval and was accorded a serious chance of enactment until the final stages of conference committee deliberations on the president's energy package. The crude oil tax, like other business taxes (and costs attributable to regulation), would have reached consumers as an indistinguishable component of private sector prices rather than as a clearly labeled tax. The difference appears trivial when so described. Considering, however, that popular debates almost invariably proceed from the assumption that business tax and regulatory costs fall on stockholders, and that as of mid-1977 fewer than half of all American adults knew that the nation imported any oil at all, elected officials may be forgiven for judging that a little sleight of hand can go a long way. (16)

• How vulnerable is the proposed measure to charges of unequal impact, particularly in such a way as to discriminate against low-income

(16) Only 48 percent of the respondents in an August 1977 national poll carried out by CBS News and the New York Times knew that the United States had to import oil, and little more than one-third of these knew that the United States currently imported more than 40 percent of the oil it consumed. Only 38 percent of the respondents believed that in fact there was a real oil shortage; 49 percent believed that the claims of an oil shortage were simply a ploy to enable the oil companies to charge higher prices. [7]

people and/or against the residents of whole states or regions of the country? Numerous polls have indicated that the public would prefer gas rationing to large gas tax increases as a means of limiting demand in a crisis, though virtually all serious analysts view rationing as an administrative nightmare that would eventually entail far greater bureaucratic, economic, and even equity costs than a well-designed tax disincentive system. To the average voter, it seems apparent that a tax system would discriminate against the poor, against residents of nonurban areas, and against others with a legitimate need for above-average fuel consumption, whereas a rationing system would be at the same time more egalitarian and sensitive to special needs. In practice, a rebate system such as that proposed by President Carter in 1977 can make a tax program redistributive in favor of the poor, and the higher rebates for rural residents. The claims of special need, moreover, are what eventually turn rationing systems into administrative jungles. But these arguments have never carried much weight politically, and the nation's standby plan for any future acute oil shortage is to impose rationing.

Political feasibility aside, regulatory and pricing measures have enormous potential for ameliorating the main problems of urban transportation at relatively modest cost. Specifically:

1. Gas rationing and taxation are relatively interchangeable as effective means of curtailing fuel consumption, with the following qualifications. Rationing is a blunter and more expensive instrument, but it is also more certain--particularly insofar as quick and/or sharp cutbacks in usage are sought. If combined with an effective program of supply curtailment, rationing can bring about whatever reduction in usage is desired, and it can do so virtually overnight. The elasticity of demand, by contrast, is much greater over the long term than the short, and it is considerably more uncertain where large price changes are concerned--as virtually all available estimates are based on studies of the impacts of quite modest changes. The other side of the coin is that the administrative costs and economic distortions associated with rationing tend to grow over time, whereas these costs, slight to begin with, tend to diminish over time insofar as price disincentives are utilized. In short, taxation appears to be a preferable

method where only modest and/or gradual reductions in demand are sought, and when it is anticipated that the program of demand curtailment will be long-lived.

If increases in the relative price of gasoline tend over time to become more powerful in their effect on fuel demand, they tend to become less powerful in their effect on VMT. The reason is simply that consumers can, and do, respond over time by purchasing more energy-efficient vehicles. Congress has already enacted legislation requiring average new-car fuel economy to double from 1974 to 1985, and it seems clear that a tripling would be feasible if absolutely required. Thus even assuming a long-term elasticity of demand for gasoline in the range of unity (which is about what most economists do estimate), price increases would have to be extraordinarily severe to bring about significant long-term reductions in VMT.

Only a small proportion of the VMT reduction occurring in response to supply curtailment and price disincentive measures, it bears note, would be translated into increased transit patronage. Motorists tend to give up or consolidate certain trips, particularly of a recreational and personal business nature, before they shift to transit. The New York Regional Plan Association (RPA) has estimated that even during World War II, when transit was relatively ubiquitous in the areas of urban settlement, only 37 percent of the reduction in urban automobile passenger mileage (nationwide) was translated into transit patronage growth. With transit service now much more inferior to auto travel for the vast majority of trips that people wish to make in urban areas, the elasticity of transit demand in response to constraints on automobile travel is doubtless much lower than during World War II. It is impossible to test this proposition rigorously in the absence of constraints comparable to those of the war period. Far milder constraints did bring about a reduction in auto travel between 1973 and 1974, however, and RPA estimates that the transit capture rate during this episode was only 7 percent. (See table 11.1.)

2. Regionwide restrictions or surcharges on employee parking would,

Table 11.1

Billions of Passenger Miles of Travel by Mode

	<u>1940</u>	<u>1944</u>	<u>Change 1940-44</u>	<u>1973</u>	<u>1974</u>	<u>Change '73-'74</u>
Commuter Rail	3.997	5.344	+1.347	4.245	4.692	+ .447
Rapid Transit	15.245	17.037	+1.792	11.998	12.082	+ .084
Trolley	14.858	23.790	+8.932	.621	.450	- .171
<u>City Bus</u>	<u>11.932</u>	<u>27.200</u>	<u>+15.268</u>	<u>14.217</u>	<u>15.177</u>	<u>+ .960</u>
URBAN TRANSIT	46.032	73.371	+27.339	31.081	32.401	+1.320
URBAN AUTO	291.339	217.630	-73.709	962.850	943.418	-19.432
TRANSIT 'CAPTURE' RATE:			37.1%			6.8%

Source: Boris Pushkarev and Jeffrey Zupan, Public Transportation and Land Use Policy (Bloomington: Indiana University Press, 1977) pp.8-9.

if effectively enforced, doubtless have a substantial impact on commutation VMT, on air pollution in the immediate vicinity of major employment sites and travel arteries, and on congestion. Because their impact would be confined to commutation travel, however, and because many of the cars left at home would be used during the day by other household members, the impact on fuel consumption and regionwide air pollution would be far less notable.

There are, it should be noted, substantial enforcement problems associated with parking restriction. It is usually possible to crowd a great many more cars on any given amount of parking lot space than is currently the norm at employment sites, and it is often possible for employees to find off-site parking spaces within walking distance of their jobs. Thus simple enforcement actions like roping off portions of employer parking lots (the EPA proposal in Boston) might have negligible effect. A more complex enforcement program, involving frequent on-site inspections and strong measures to deter off-site parking by employees, would be considerably more expensive as well as more onerous from the standpoint of commuters.

Core area parking restrictions are easier to defend politically, since transit service is normally best to the core and air pollution is worst within it. Typically fewer than 10 percent of regional employees work in the central business district, however, and a substantial proportion of these already arrive by transit. (Where the CBD share of employment is higher, so generally is the proportion of CBD workers commuting by transit.) Thus the impact of such restrictions on regionwide emissions and fuel consumption would tend to be extremely modest. Additionally, core area parking disincentives would tend to have a decentralizing land use effect by encouraging those with choices to satisfy their travel objectives at other locations. Restrictions directed solely at employees would tend to have the least dispersal effect, but even these might stimulate employment shifts over time. Little is known about the precise magnitude of these potential land use

effects; in the absence of certainty that they would be nonexistent, however, central city officials and downtown business people can be expected to argue with particular passion against parking restrictions confined to the core. If, on the other hand, these dispersal effects did prove substantial, the most significant long-term result of core area parking restrictions might be additional VMT regionwide.

3. All components of mechanical systems deteriorate with extended usage, and this is particularly so with respect to components that involve moving parts and/or chemical reactions. Insofar as policy makers are concerned with the lifetime performance characteristics of motor vehicles, rather than simply with new-car performance, they must give serious consideration to inspection and maintenance (I/M) requirements. It is possible to implement such requirements as pure business regulations by requiring the manufacturers to provide lifetime warranties. Such warranties would tend in some cases (most notably, emission control) to have a major impact on new-car prices, however, and they would still require motorists to expend time and energy arranging for the I/M work. Additionally, the warranties would normally leave the companies free to deny free service where the motorist had neglected some routine maintenance or operated the vehicle improperly. The longer the warranty, the higher the proportion of motorists who would find, to their dismay, that it failed to cover their own cases. If, on the other hand, the warranty provisions did not include requirements for proper maintenance and vehicle operation, owners would have little incentive to avoid the need for warranty repairs, and the original cost of the warranty provision would have to be that much higher. The price, finally, would entail substantial cross-subsidization from the careful to the careless.

The I/M issue is most urgent with respect to air pollution. EPA surveillance studies indicate that the performance of emission control systems degrades rapidly in the absence of I/M. Illustratively, actual carbon monoxide and hydrocarbon emissions after one full year of operation were essentially unchanged from the 1971 to the 1974 models, though the new-car standards called for reductions on the order of

one-third between these two model years.[8] After only about a half-year of operation, on average, 63 percent of the 1975 models tested in five cities were in noncompliance with at least one of the three standards for that year.[9] And an EPA study of 1974 models concluded that whereas the new-car standards for that year called for carbon monoxide and hydrocarbon emission levels about 60 percent below the 1970 standards, in practice they would achieve lifetime reductions of only about 20 percent in the absence of I/M.[10]

Congress in 1977 specified that air quality control regions expected to be in violation of ambient air quality standards after 1982 would have to file schedules for the implementation of I/M programs. It did not specify what these timetables should be, however. And while it mandated stiff penalties for regions neglecting to file them, it provided only minor penalties for regions neglecting to implement them.

Given that the ambient air quality standards have been set at levels intended to protect even the most feeble from the most trivial adverse health effects, it does appear sensible to confine I/M programs to regions in violation of the standards. At the same time, because most current forecasts are based on the assumption that new-car standards will be maintained over actual vehicle lifetimes, many more regions will actually be in violation during any specific future year than current official forecasts anticipate. At some point it seems likely that environmental organizations will seize upon this anomaly and that the political system will begin coming seriously to grips with the I/M issue.

Even without government I/M programs, most owners are likely to take corrective action to deal with major performance degradation of safety and fuel economy control systems. Further, most states already have safety inspection programs and require in connection with them that automobile mufflers (which are important safety as well as noise control devices) be in good working order. Even so a Department of Transportation safety study has recently estimated that more intensive

brake and tire I/M requirements would probably save a considerable number of lives.[11] Estimates are unavailable of the extent to which maintenance neglect may threaten realization of the full potential of the federal new-car fuel economy program; this would certainly appear to merit high priority as a topic for future research.

4. The Department of Transportation study cited in the previous paragraph concluded that, aside from vehicle modifications, the most cost-effective measures that might be taken in the field of automobile safety were the adoption and enforcement of mandatory seat belt use laws (even with quite modest fines and infrequent enforcement checks), strict enforcement of the 55 mph speed limit, and alcohol safety countermeasures (including the use of special enforcement patrols to detect and arrest alcohol-impaired drivers during high-risk periods). Additionally it ranked mandatory helmet use laws for motorcyclists as among the most cost-effective safety measures available. The study did not even consider such stronger measures as jail sentences for alcohol-impaired drivers (imposed in some other countries) and reduced speed limits on older roads that were unaffected by adoption of the 55 mph expressway speed limit in 1974; but it seems reasonable to assume that the neglect of these measures was attributable to the fact that they seemed so far beyond the American political pale rather than that they appeared cost-ineffective.

5. Finally road use pricing and core area supplementary licensing schemes have enormous potential for alleviating congestion, because the elasticity of demand for travel on particular roads at particular times is much higher than the overall elasticity of motor vehicle travel demand. Contrary to most economists, we judge that the average motorist even after trying road use pricing, would continue to express a preference for congestion. If the only problem of concern were congestion, however, it would be difficult to imagine a quicker or more cost-effective solution. And even with all complexities considered, we judge it far superior to highway construction as a method of relieving congestion in high-density urban areas. (This is by no means to suggest that one or the other ought to be chosen; our own first preference

in the vast majority of cases would be to do neither.)

In brief, then, consumer regulatory and price disincentive measures have great technical potential for alleviating most of the significant problems of urban transportation in cost-effective fashion. For the most part, however, they are viewed by elected officials as politically un-touchable. We anticipate that inspection and maintenance requirements, helmet use laws, stricter speed limit enforcement, and other constraint measures that entail very little behavioral change for most people will become gradually more feasible in the years ahead. But the most obvious and direct forms of consumer restraint--large gas tax increases, parking restrictions, congestion tolls, and so forth--seem likely to remain beyond the pale for many years to come.

Concluding Remarks

The current American system of urban transportation, we have emphasized, is not itself a problem. From the perspectives of the vast majority of American adults--those who are licensed to drive and who live in car-owning households--it can more appropriately be labeled a resounding success. It affords them an unprecedented range of residential, employment, and other locational choices at prices that most appear quite willing to pay in the marketplace. These prices include some modest hidden subsidies--mainly in the form of adverse external effects for which no payment is made--but the attractions of the system are such that the full internalization of these costs would have only the most trivial impacts upon urban travel behavior.

At the same time, there are a number of important problems associated with this system. Our own judgment, and that of the political system as well, appears to be that four of these command the highest priority for remedial attention: The high energy requirements of the system, its air pollution impacts, the large number of motor vehicle fatalities and serious injuries associated with it,

and the equity issues posed by the fact that substantial numbers of handicapped, elderly, and very poor urban residents are unable to achieve high levels of "auto-mobility."

In seeking to ameliorate these problems, we have noted, it is essential to bear a number of key political constraints in mind. The American governmental system is highly resistant to measures that directly constrain voters to alter their behavior, that threaten to disrupt sectors of the economy, or that involve the repudiation of ongoing programs with well-organized clienteles. Since about 1970, it has also been highly resistant to measures that threaten neighborhood and environmental disruption. Prior to the mid-1970s it was relatively receptive to spending proposals but several factors have joined to make fiscal ceilings another key constraint during the past several years. First, voter resistance to tax increases has severely intensified. Second, a number of techniques for increases, which were extremely important during the 1960s and early 1970s are no longer available.⁽¹⁷⁾ Third, the costs of existing services have been rising more rapidly than revenues at constant tax rates. In consequence of these factors in combination, the fiscal resources available (or likely to become so in the near future) are severely strained simply to maintain current service levels. Indeed it seems more likely that the next few years will witness cut-backs in existing services than that substantial resources will become available for new or expanded services.

(17) These fell into two main categories. At the federal level, the triumph of Keynesian economic theory permitted a dramatic increase in the annual gap between revenues and expenditures during the late 1960s and early 1970s. By the mid-1970s, however, economists were generally agreed that still higher budget deficits would be extremely inflationary. At the state and local levels, borrowing increased even more dramatically from the 1950s through the mid-1970s, despite the fact that operating budgets were generally required to be balanced each year. In the wake of the New York City fiscal crisis, however, state-local accounting and borrowing practices became subject to extremely close scrutiny by investors, taxpayer associations, and the media, with a consequent dramatic slowdown in the rate of debt increase.

Our analysis has suggested, in any event, that only one of the four main problems of urban transportation--inequity--is susceptible of effective attack by spending measures. Fixed route and demand responsive transit services are the most likely instruments for enhancing the mobility of those without ready access to automobiles. We have emphasized, however, that transit service improvements are likely to yield major equity benefits only if they are carefully targeted to do so. Most transit improvement efforts to date have focused on the travel demands of downtown commuters--an ablebodied group with above average incomes on the whole--rather than on those of the mobility deprived. The resultant services, on the whole, have done little or nothing to enhance system equity.

The most promising strategies for curtailing energy consumption, air pollution and the motor vehicle accident toll all entail business regulation aimed at improving the performance characteristics of automobile hardware. Such regulation entails constraint, but in a manner that is not particularly noticeable from the standpoint of the average consumer. It taps the technological and organizational resources of the private sector more effectively than even government contracting (since it leaves incentives for cost control and for competitive technical approaches intact). And its potential is particularly great where a performance criterion has--like the three in question--long been neglected by the industry. In these circumstances there is likely to be a substantial backlog of available and almost-available technology ready to be applied within a relatively few years.

In the case of emission control, most of the benefit of regulation to ensure improved new-car performance apparently tends to be lost in the absence of effective lifetime maintenance. Owners have negligible incentive, moreover, to carry out such maintenance in the absence of public regulation. Thus inspection and maintenance requirements are the obvious next step in regions with air pollution problems that would otherwise remain significant through the 1980s and beyond.

The cause of fuel economy might be pursued as effectively by pricing and/or rationing measures as by business regulation, but these are extremely unpalatable politically. Similarly the cause of safety might be pursued in highly effective fashion by such measures as mandatory seat belt and (for motorcyclists) helmet use laws, by strict speed limit enforcement, by tough measures to keep alcohol-impaired drivers off the roads, and by the application of more stringent brake and tire inspection standards. While several of these are doubtless more acceptable than gas taxation or rationing to curtail demand (some states, after all, do have helmet use laws and relatively strict speed limit enforcement), the disposition of political decision makers has been to view rapid progress in the use of such direct consumer regulatory measures as unfeasible.

In brief, then, effective attacks on the major problems of urban transportation must necessarily entail constraint strategies (in three cases) and transit improvement priorities sharply different from those that have traditionally prevailed (in the fourth). In the first three cases, however--energy, air pollution, and safety--there are opportunities for dramatic progress by applying the constraints directly to only a few large corporations, challenging them to achieve the policy targets by technical innovation and to recoup their costs incurred along the way in the private market place. Though never applied prior to the 1960s, this particular category of constraint measures has proven to combine great problem-solving power with high political acceptability. In the fourth case--equity--the measures called for arouse no discernible opposition in principle. But they are expensive, they are unglamorous, and the competition for transit resources is likely to be particularly fierce during the years immediately ahead. If it were not for the effective recent mobilization efforts of the elderly and handicapped, and the accompanying evidence of high receptivity to their

claims by elected officials, we would severely doubt the likelihood of much equity-oriented service expansion in the near future. Even as it is, we consider this a matter of extreme uncertainty.

What does seem clear is that the major problems of urban transportation can be effectively addressed without significant behavioral change. A prolonged embargo or war-induced oil shortage may, of course, at some point require dramatic short-term behavioral adaptation (mainly, we judge, by the curtailment of nonessential auto travel and by private ride sharing). But aside from such unforeseeable crises of a political nature, there do not appear to be any developments on the horizon that would require urban Americans to alter their patterns or volumes of automobile travel.

Notes

1. Cf. B. Bruce-Briggs, "Mass Transportation and Minority Transportation," The Public Interest 40 (Summer 1975): 43-74.
2. Westport Transit District, "Summary of Services and Methods Demonstration of Integrated Conventional Transit and Paratransit Services" (April 1977).
3. Reid Ewing, "Demand Responsive Transit: Problems and Possibilities" (Ph.D. diss., Massachusetts Institute of Technology, 1977), chap. 1.
4. The New York Port Authority data on Trans-Hudson automobile occupancies come from Boris Puskarev and Jeffrey Zupan, Public Transportation and Land Use Policy (Bloomington, Ind.: Indiana University Press, 1977), exhibit 0.2. The auto occupancy estimates from surveys in various metropolitan areas are reported in Federal Highway Administration, "Estimating Auto Occupancy" (Washington, D.C., FHWA, 1972), tables 2, 3. The Nationwide Personal Transportation Study (NPTS) occupancy estimate is from FHWA, NPTS Report 1, "Automobile Occupancy" (Washington, D.C., 1972), table 1. The NPTS survey was almost unique in that it distinguished among trips by length: it found that average occupancy per vehicle mile was 2.2.
5. Cf. James Q. Wilson, "The Dead Hand of Regulation," The Public Interest (Fall 1977): 39-58.
6. Bruce Ackerman has previously referred to the politics of clean air as a morality play. Cf. his article, "Clean (Cough) Air," New York Times, August 20, 1977, p. 21.
7. Anthony Parisi, "Poll Finds Doubt on Energy Crisis," New York Times, September 1, 1977, pp. 1, 58.
8. Alan P. Berens and Michael Hill, Automobile Exhaust Emission Surveillance Analysis of the FY 1974 Program, prepared for the Environmental Protection Agency, EPA-460/3-76-019 (September 1976), pp. 5, 12.
9. Ibid., p. 8.
10. David Burnham, "Cars Said to Fail Pollution Rules," New York Times, February 4, 1975.

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