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Socioeconomic Reactions to Highway Development

JON E. BURKHARDT

ABSTRACT

A research project is described that used a case study methodology to examine the social and economic effects of highway improvements on the areas immediately adjacent to the highways. Using secondary data supported by interviews with key personnel and on-site observations, before and after comparisons were made for impact and control groups. Controls for other external factors were also used. Some frequent and consistent socioeconomic changes occurred in the impact areas. The effects were much stronger very close to the highways and did not necessarily result in decreases to neighborhood attractiveness. This indicates that active analysis of socioeconomic consequences and use of appropriate mitigative measures can substantially reduce undesirable socioeconomic consequences. No general models of change emerged because of substantial variations from site to site. The findings demonstrate the importance of including socioeconomic impact analysis in highway planning and the usefulness (and limitations) of the specific research methodology used here.

The social and economic impacts resulting from highway development have become key issues in highway planning. Disputes about the probable social and economic impacts of particular alignments have added years (and, in some cases, many years) to highway construction schedules, thereby enormously inflating highway construction costs. Even small-scale projects--those substantially less disruptive than new construction projects--sometimes involve significant controversies revolving around social and economic effects. A variety of social and economic impact assessment methodologies have been developed and disseminated. Unfortunately, these methodologies are largely theoretical and none of them has been adequately verified.

An increased ability to predict the consequences of various kinds of highway developments is needed. The reduced uncertainty of specific types of impacts will enable highway planners to prepare designs that avoid adverse consequences or to design mitigating features into the project from the beginning where adverse consequences cannot be completely avoided. The reduced uncertainty will reduce the fears of negative consequences, which are often exaggerated. This increased ability to predict and alleviate concern over adverse impacts can lead to reductions in highway construction costs by eliminating serious delays. The improved predictability will thus lead to better highway practice and better highways, less litigation (as well as less serious litigation), and fuller compliance with the National Environmental Protection Act, the Council on Environmental Quality, and other federal and state legislative provisions.

METHODOLOGY

The purpose of this study (1) was to determine empirically how the interaction of different types of highway projects with different community settings creates specific socioeconomic impacts. Although the most accurate way to identify determinants of impacts might be a series of longitudinal studies beginning at a time preceding the planning for a project and continuing past the initiation of facility operations, this approach has serious drawbacks: the cost of such research would be high and the research would have to be conducted over many years before results would be available. This study used a less costly, and substantially faster research methodology, namely, a compressed longitudinal analysis of historical data.

Using this approach, secondary data from various combinations of community and project were examined for points in time corresponding as closely as possible to five major stages of highway project development. A before and after methodology was employed to assess quantitatively differences between impact and control zones over the period of time from before the final plans to after the opening of the facility to traffic. The key elements of the methodology include the research methods, the major hypotheses, the effects to be studied, the major analytical questions to be investigated, and the process of selecting the case study sites.

Research Methods

The essential aspects of these compressed longitudinal analyses were the use of historical data, the selection of impact and control zones, measures for the different categories of impacts, and the selection of data points that represent conditions before, during, and after the construction of the highway. (The impact zone included the area traversed by the entire segment of the highway being studied and approximately 0.5 mile on either side of it. The control zone was near the impact zone but removed from direct impacts; it was not affected by another highway project, and it was similar to the impact zone in composition and characteristics of demographic, residential, and commercial trends.) Data were collected for five important points of highway project development: preknowledge, announcement of the highway plan, construction, facility opening, and stable operations (from 2 to 5 years after the beginning of operations). These data were needed to examine interim short-term changes as well as the before and after effects.

Hypotheses

For purposes of conducting the research, two hypotheses were established.

1. Highway construction would have a negative impact on neighborhood attractiveness in affected areas, and
2. As proximity to the highway increases, the extent of the negative impacts also increases.

These hypotheses were proposed because they fit some popular conceptions (or misconceptions) of the effects of highways on surrounding communities and be-

cause they can be expressed in an empirically verifiable fashion.

Socioeconomic Effects

This methodology separates obvious effects directly caused by right-of-way acquisition and displacement (such as declines in the number of housing units) from community responses triggered by highway-related activities (such as the value of the remaining housing units). This is based on the proposition that the reactions and responses of the community as a whole constitute the most useful indicator of the influence of the highway on the neighborhoods immediately adjacent. Substantial documentation (2-6) has been published on the effects experienced by those individuals and establishments displaced by the land acquisition necessary to obtain the right-of-way for the highway, and a substantial body of literature and legislation deals with compensating them (7-9).

Such community reactions and responses change the relative attractiveness of neighborhoods adjacent to the highway--positively or negatively--by either attracting or discouraging present and potential users of the neighborhood. To make neighborhood attractiveness a measurable concept, this study focused on individual components described in other studies (10-17) as

- Demographic changes,
- Housing market conditions,
- Business vitality,
- The use of local facilities, and
- Land use changes.

The first two were used as the key indicators because they are more representative of an assessment or aggregation of attitudes, because data for them were more readily available, and because changes in a particular direction were more readily categorized as positive or negative.

Residents of the area immediately surrounding the highway (the impact zone) can express their ultimate reactions to the direct effects of highway construction through two types of behavior: "voting with their feet" (they either choose to stay or they move away) and maintaining (or not maintaining) their properties. These behavior patterns, if large enough, will result in observable changes in the

- Average length of time people live in the area,
- Population composition (e.g., percentages of young, old, black, and poor),
- Percentage of dwellings that are owner occupied,
- Percentage of dwelling stock that is vacant,
- Percentage of dwelling stock that is substandard,
- Percentage of dwelling stock that is overcrowded, and
- Relative prices of housing and other buildings in the affected area relative to prices elsewhere.

The third step in the process is thus the reaction of the community as a whole to the changes occurring adjacent to the highway. These reactions take the form of the relative attractiveness of the impacted area vis-à-vis similar areas and find their expression in changes such as the

- Relative prices for housing and other buildings, and
- Percentages of land devoted to particular uses.

Figure 1 illustrates the change process.

The overall effect of these changes on the areas surrounding the highway is not obvious. On the one hand, properties adjacent to the highway may become less desirable because of increased noise and air

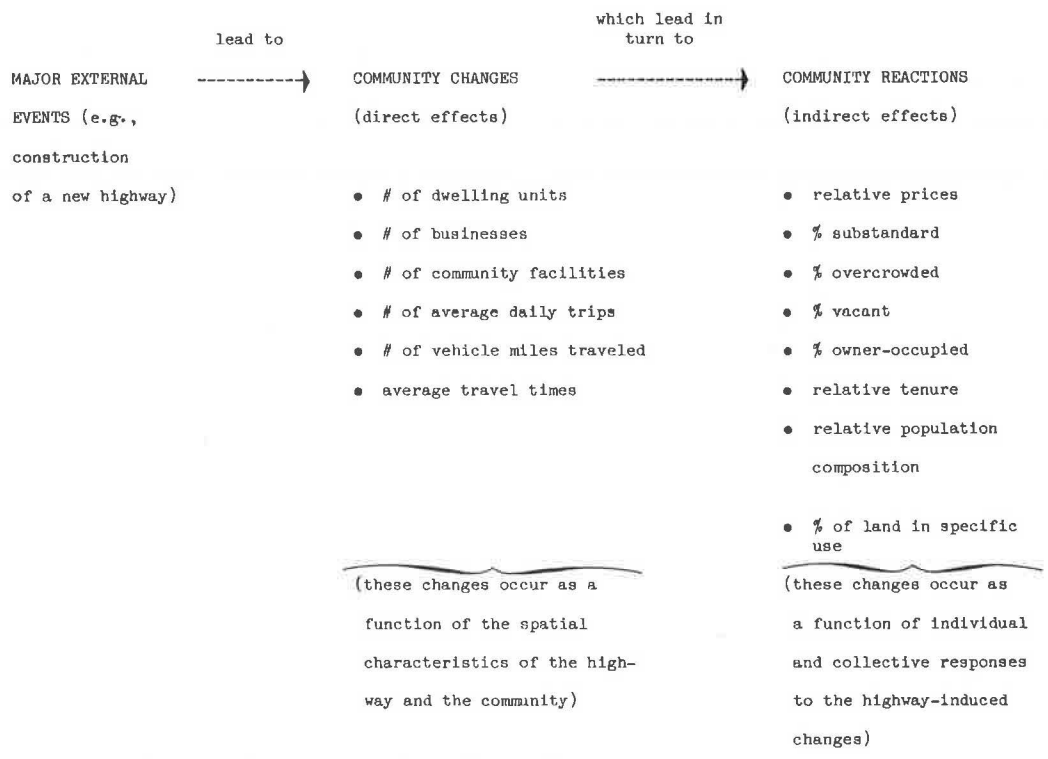

FIGURE 1 The urban change process: direct effects and community reactions.

pollution, and their relative prices will fall. On the other hand, areas of increased accessibility should be relatively more valuable, and their relative prices should rise. How these factors counterbalance is the subject of this research.

Major Analytical Questions

The analysis of the changes over time focused on the following key questions:

1. What was the attractiveness of the impact community before the highway was constructed?
2. What, if any, were the changes in the neighborhood's characteristics over time?
3. What, if any, changes can be linked to specific highway development stages?
4. What, if any, changes were unique to the remaining impact community?
5. What, if any, other factors (besides construction of the highway) were unique to the remaining impact community during the study periods?
6. To what extent are those changes, which are unique to the remaining impact community, attributable to the highway?

The ways in which specific impact variables could be expected to change, if the proposed hypotheses were correct, are given in Table 1. For example, based on the hypothesis that highways decrease neighborhood attractiveness, a decline in population in areas adjacent to highways would be expected to be even greater (proportionally) than the general decline in population that has been occurring in older central cities. Similarly, a slower increase in rents and in house values would be expected in the impact areas than in urban areas in general if the hypotheses were true as stated. The directions of expected changes for the other variables are also shown in the table. How they actually change at specific sites helped to determine the validity of the hypotheses proposed.

Case Studies

Potential candidates for case studies were identified by reviewing environmental impact statements, highway litigation involving potential socioeconomic impacts, and all other urban highway construction projects during the 1960s and 1970s. These reviews identified 16 sites and from these, case studies were conducted in Baltimore, Cleveland, Hartford, Wichita, and Wilmington. All of these cases involved the construction of new limited-access freeways through densely developed portions of urban areas. A portion of Pittsburgh was also briefly studied as an example of the effects on commercial activity created by an automobile-restricted zone. An example of a bypass around a small town was investigated but not pursued because of a lack of measurable impacts.

Summary

There were three major components to the substantive basis of this examination of the social and economic impacts of highways:

1. An overall view of the sequence and processes by which changes occur,
2. A list of specific measures by which the types and amounts of changes may be measured, and
3. A set of hypotheses that help establish expectations about how the specific impact categories will change.

Although this theoretical framework could be made operational through a variety of research methodologies, these impacts were viewed retrospectively by compressed longitudinal analysis at specific sites.

Any retrospective historical overview obviously misses many of the immediate details of impacts and resulting changes. When contrasted with a resident observer methodology (18) or in-depth interviews with persons in the area (19), compressed longitudinal analysis appears to overlook much of the disruption, discomfort, and even anguish at a personal level that has been shown to result when social and economic attributes of an urban area change in response to major changes in the area's physical structure.

Yet, it can be argued that the personal, social, and psychological effects that are not directly measurable by the compressed longitudinal analyses would, if they were so strongly positive or negative, influence observable variables. Effects of extreme intensity would either cause people to leave the affected area or attract them to it. They would show up in measures of changes in the relative quality of affected areas compared to similar but nonaffected areas or to the urban area as a whole; these changes, if significantly large, should be correlated with changes in transportation that occur and the preexisting characteristics of the community.

FINDINGS

Results of the Case Studies

Baltimore

The Baltimore case study involves the construction

TABLE 1 Hypothetical Changes in Neighborhood Attractiveness Resulting from Highway Construction

Neighborhood Attractiveness Indicators	General Central City Trends	Expected Trends in Each Impact Area Relative to the Rest of the Urban Area[a]
Total population	Decrease	Greater decrease
Percent minority	Substantial increase	Greater increase
Number of housing units	Decrease	Greater decrease
Percent vacant	Slight increase	Greater increase
Percent substandard	Decrease	Smaller decrease
Percent owner occupied	Slight decrease	Greater decrease
Percent overcrowded	Substantial decrease	Smaller decrease or even an increase
Median rent	Increase	Smaller increase
Median house value	Increase	Smaller increase
Change in land use	Mixed	(Not obvious)
Change in land use intensity	Mixed	(Not obvious)

[a]Based on the hypothesis that highways decrease neighborhood attractiveness in the impact areas.

of a major freeway that was to link the central business district (CBD) with the western suburbs. The segment directly to the west of the case study area, however, has been removed from the Interstate system plan so the facility may never serve the projected volumes of traffic.

All Baltimore transportation plans since the early 1940s had included a route through the impact area as one element of an overall transportation network. The impact area was seriously depressed and dilapidated before the construction of the highway. Construction began in 1973 and ended in 1978.

Based on the block-level analysis, the highway may have improved rather than depressed the surrounding community. This could be due to the initially deteriorated character of the impact zone. It could also be due to the extremely large investments in urban renewal, rehabilitation, and capital improvements throughout Baltimore--including both the impact zone and the control zone--during this period.

Cleveland

The Northwest-Clark Freeway, designated as I-90W, cut through a high-density, low-income, mixed land use area on Cleveland's west side. The demographic and housing characteristics of the study area, which has served as a port of entry for immigrants to the city, were somewhat more attractive than the city as a whole in 1960 than after highway construction.

Early acquisition of properties for hardship cases began in 1964. In 1975 a final statement of negative declaration of impacts paved the way for initial construction activities later that year. The eight-lane facility was opened to traffic in late 1978.

Blocks in the impact zone showed a deterioration in neighborhood attractiveness in contrast to the control zone and the city as a whole. Much of this decline appears to be attributable to the highway. The attractiveness of the neighborhoods adjacent to the highway declined in total population, number of housing units, percent vacant, percent substandard, rent receipts, and house values. The Cleveland case supports the premise that highway construction has negative effects on the surrounding area.

Hartford

Hartford's 3.3-mile section of I-84, known as the Yankee Expressway, spans the entire east-west width of the city. At most points, the highway is equidistant from the northern and southern borders. I-84 generally follows the alignment of an existing railroad and the course of the Park River. An east-west highway along this alignment has been in Hartford's transportation plans since the 1940s. Construction on I-84 began in 1962 and ended in 1972.

Hartford had lost one-sixth of its 1960 population by 1980, with most of the loss occurring in the 1970s. At the same time, the black population more than doubled to a total of 34 percent. The total housing stock declined; some housing market conditions improved while others worsened. The neighborhoods in the impact zone were the traditional points of entry into the city for successive waves of immigrants, forming a blue collar area of lower income groups. Recent urban renewal activities and other developments have attracted pockets of higher income population into the renovated downtown area south of I-84.

Because the railroad tracks along which the highway was built served as a social and economic dividing line within Hartford, the block-level analysis of highway impacts was performed separately for areas north and south of the highway. During the study period, in the area north of the highway, the attractiveness of neighborhoods closer to the highway became more positive. Population declined, but the percent of substandard housing also declined and rents and house values increased.

There were almost no significant differences between the southern impact and control zones. The only change south of the highway related to distance from the highway was house value; it appeared that proximity to the highway suppressed the increase in house values that was occurring south of the highway because of upgrading, renovation, and code enforcements during the construction period. After construction, there were no significant differences between the changes in the southern impact and control groups.

Wichita

The I-135 north-south route through Wichita follows the alignment of a storm runoff canal and thus has been called the Canal Route. Land was acquired over a 12-year period from 1962 to 1974; the project was under construction from 1974 to 1979. The project included development of a hike and bike trail and the acquisition of additional parkland to replace some taken for the right-of-way. The impact area was comprised predominantly of single-family homes, one-half of which were owner occupied. The neighborhood attractiveness indicators for the area were similar to the averages for the city as a whole.

Neither the impact group nor the control group showed a change in demographic or housing market indicators from before to after the highway. Based on analyses at the tract and block level, the highway appears to have had no impact whatsoever--either positive or negative--on the relative neighborhood attractiveness of adjacent communities. One suspects that this was probably due to the felicitous location of the highway along the drainage canal, which already separated existing neighborhoods; it might also have been influenced by the joint development of the hike and bike trail and the parkland substitution. This was the only case study to emphasize the avoidance of substantial socioeconomic impacts in the route location process and the only site to mitigate consequences by emphasizing and implementing joint development.

Wilmington

I-95, linking Baltimore and Philadelphia, was constructed through a high-density, lower-income section of Wilmington. It was one of the first federal-aid Interstate highways; plans were completed in 1957 and property acquisition began in 1958. Because of funding and scheduling problems, acquisition and construction were halted for long periods of time and the complete route through Wilmington was not opened until late 1968.

The impact area was considered somewhat dilapidated in the 1950s, with some blight, overcrowding, and lack of facilities. There were numerous strong ethnic neighborhoods in the area bisected by the right-of-way. The impact area reflected the problems of Wilmington as a whole, which included a substantial loss of population, a significant decline in industrial activity, and some dramatic changes in the composition of the population.

Between 1950 and 1970 the differences in the changes between impact and control zones were significant for seven of the nine descriptors of neigh-

borhood attractiveness: total population, percent minority, number of housing units, percent owner occupied, percent substandard, percent vacant, and rent. Most of the differences in the rates of change were associated with distance from the highway; the more unattractive conditions were generally closer to the highway. The highway appears to have made conditions worse in an already declining area.

In assessing the Wilmington case study, it is important to note that it substantially predates the other case studies. Therefore, the highway development process for this case was significantly different from the other cases, particularly with regard to public participation in the planning process and the procedures used and compensation paid for relocation. In addition, Wilmington's low-cost housing stock was significantly affected by a massive urban renewal project to the east of the CBD and by riots in the late 1960s. Even with these caveats and external influences in mind, however, it appears that the highway adversely affected the attractiveness of adjacent blocks.

Overall Conclusions

The following conclusions were drawn from a look at all changes in impact variables over all the case studies examined:

- General patterns or models are secondary to site-to-site variations.
- Decreases in neighborhood attractiveness do not necessarily occur.
- Fewer changes occur during interim time periods, but they are more often negative.
- Some frequent and consistent changes occurred.
- Distance from the highway has a strong effect.
- Distance-related changes show specific patterns.
- Block-level analyses show more effects.
- There are problems with the use of secondary data.

These conclusions are described in detail below.

General Patterns or Models Are Secondary to Site-to-Site Variations

Looking at the case studies as a whole, there are substantial variations in the size and direction of effects from site to site. The patterns of influence exerted by the highway construction process were much stronger within a site, however, than the overall influence of a specific impact or aggregations of impact categories.

Table 2 gives specific changes on a site-by-site basis. The strongest patterns in the table are vertical, which means that there is more consistency to the direction of effects within a particular site than there is for a particular neighborhood attractiveness indicator across sites. This implies the possibility of interactions among the indicators at a particular site so that the relative changes tend to reinforce each other. If the patterns indicated here are valid at other sites, it will be difficult to develop cross-site predictive indicators unless some underlying theme (such as the location of the right-of-way along neighborhood boundaries rather than through neighborhoods) is found. The data in the table indicate a large number of negative effects at some sites, basically positive effects at other sites, and essentially no effects in the remaining sites. This indicates that there are apparently large possibilities of either creating or mitigating social and economic consequences at particular sites, depending on the skills of local planners and other factors.

Certain effects occurred from before to after highway construction; however, this does not prove that these effects were caused by the highway, although the statistically significant differences between impact and control groups do suggest the possibility of some influence. For those instances where distance from the highway had a specific effect, the possibility of a causal linkage is much stronger.

TABLE 2 Actual Versus Expected Changes Across Sites Before and After Highway Construction

Neighborhood Attractiveness Indicators	Expected Change[a,b] in Impact Areas Relative to Control Areas	Baltimore	Cleveland	Hartford North	Hartford South	Wichita	Wilmington
Total population	Greater decrease		●	●			●
Percent minority	Greater increase	◎	●	◎			◎
Number of housing units	Greater decrease	●	●				●
Percent vacant	Greater increase		◎				◎
Percent substandard	Smaller decrease	○	●	○	○		◎
Percent owner occupied	Greater decrease	○					●
Percent overcrowded	Smaller decrease or even an increase	◎		○			
Rent	Smaller increase		◎	○			◎
House value	Smaller increase		◎	○			

Legend: ● Change occurred as expected.
○ Change occurred but was not as expected.
◯ Change was related to distance from the highway.
Blank spaces indicate that no significant change occurred.

[a] Changes for all sites are from 1960 to 1980 except Wilmington, where changes were measured from 1950 to 1970. Changes indicate statistically significant differences between impact and control groups for the specific indicators over the total time period.

[b] These are changes to be expected based on the hypothesis that the construction and operation of highways decrease the attractiveness of adjacent neighborhoods relative to the attractiveness of nonadjacent neighborhoods.

Decreases in Neighborhood Attractiveness Do Not Necessarily Occur

There is no overall support for the premise that highways decrease the neighborhood attractiveness of areas adjacent to highways, although that appears to be what happened in Cleveland and Wilmington. Similarly, no overall support was found for the premise that highways could be credited with stimulating improvements in the remaining neighborhoods, although, according to the criteria, the impact group showed more improvements than the control group in Hartford on the north side of the highway. Large-scale patterns of social change appear to have overwhelmed whatever influence the highway improvements might have had in Pittsburgh and Baltimore. In Wichita and on the south side of the highway in Hartford, there was little difference in the way the impact groups and the control groups changed. This suggests a low level of influence of these highways on the local urban dynamics. In Wichita and, to some extent, in Hartford, this lack of influence is probably attributable to the location of the right-of-way along a preexisting physical barrier. Based on the hypothesis that proximity to the highway reduces neighborhood attractiveness, events in Cleveland and Wilmington followed the expected pattern, Hartford north was contrary to the expected pattern, and Hartford south and Wichita were not influenced by the highway.

Fewer Changes Occur During Interim Time Periods, but They Are More Often Negative

The changes at each site were also examined over the various stages of the construction process. Between the before and after situations three separate stages were examined:

- Land acquisition process,
- Construction process, and
- Decade the highway was opened to traffic.

The data indicate that there were substantially more statistically significant changes over the before and after time frames than there were within any of the intermediate periods. Thus, the findings do not support either portion of the argument that there are many interim effects that are transitory: fewer changes are shown in the interim time periods than overall, and those changes that are significant tend not to go away but tend to occur over at least a 20-year time span.

Most of the changes that occurred only during interim time periods involved decreases to neighborhood attractiveness. Furthermore, about 60 percent of these changes were related to distance from the highway, whereas only 40 percent of the statistical changes over the entire study period were related to distance. Increases in overcrowding and deflated housing prices each occurred at two sites and were related to distance from the highway.

Some Frequent and Consistent Changes Occurred

Some frequent and consistent changes occurred across the sites, although not as many as expected. These consistencies, which are given in Table 3, provide some basis for developing theories about what kinds of socioeconomic changes are likely to occur when highways are built through urban areas. Of those changes that showed statistically significant differences between impact and control groups, the most frequent were changes in the percent substandard and the percent minority. The least frequent changes were percent overcrowded, percent vacant, percent owner-occupied, and house value. The most consistent changes were in total population, the number of housing units, the percent vacant, percent overcrowded, and percent substandard. The least consistent change was in percent minority.

TABLE 3 Across-Site Comparisons of Changes in Impact Areas Before and After Highway Construction

Category	Neighborhood Attractiveness Indicators	Frequency and Direction
Most frequent changes	Percent substandard	5 of 6 cases changed
	Percent minority	4 of 6 cases changed
	Total population	3 of 6 cases changed
	Number of housing units	3 of 6 cases changed
	Rent	3 of 6 cases changed
Least frequent changes	Percent overcrowded	2 of 6 cases changed
	House value	2 of 6 cases changed
	Percent vacant	2 of 6 cases changed
	Percent owner-occupied	2 of 6 cases changed
Most consistant changes	Total population	3 of 3 cases decreased
	Number of housing units	3 of 3 cases decreased
	Percent vacant	2 of 2 cases increased
	Percent over-crowded	2 of 2 cases decreased
	Percent substandard	4 of 5 cases decreased
Least consistent changes	Percent minority	2 of 4 cases increased 2 of 4 cases decreased

Although no attempt was made to have the case studies represent a statistical sample of all highway construction projects, the combination of these cases suggests that the highway construction process

1. Often results in greater than average declines in the percent of substandard housing in the impact zone;
2. Often results in significant shifts in minority populations, which have equal chances of being increased or decreased;
3. May result in greater than average decreases in total population and number of housing units; and
4. Will seldom result in greater than average increases in the percent of housing units that are vacant, greater than average decreases in the number of housing units that are overcrowded, and smaller than average increases in housing prices.

In general, it is possible to expect that the highway construction process will reduce population and housing densities in the remaining neighborhoods, will move seriously substandard housing conditions toward citywide averages but will decrease the relative marketability of residential properties in the affected areas (as evidenced by housing prices and vacancy rates). Local planners should consider whether such effects are desirable; and, if not, they should change the highway construction plans or design mitigative measures to reduce these expected impacts.

Distance from the Highway Has a Strong Effect

The research proved conclusively that the scale at which specific effects are observed is a critical issue. Effects that were found to have a significant association with distance from the highway when viewed on a block-by-block basis disappeared from

view when analyzed at the U.S. Census tract level. This suggests that the effects of the highway disappear within a very small number of blocks from the highway [which may suggest why other studies (20) have shown fewer measurable impacts]. Aggregating social and economic statistics to the level of a U.S. Census tract and then making comparisons on a tract-by-tract basis evidently masks the effects of proximity to the highway, because the scale of the analysis is too large.

Distance-Related Changes Show Specific Patterns

Of the statistically significant changes that occurred, those that were due to a strong distance-based relationship show several patterns, which are indicated in Table 2. One distinct pattern is that the distance-based effects often (although not always) involved decreases in the neighborhood attractiveness indicators for the impact zone. Another observable pattern is that within-site patterns are usually stronger than across-site variations, although the pattern of decreases in rent and percent vacant tends to occur across several sites. Otherwise, the effects that are distance-based generally follow the same patterns as all of the significant effects over time.

Block-Level Analyses Show More Effects

From these comparisons, it was concluded that the block-level analyses were much more likely to show significant changes than were the tract statistics. In addition, equations explaining the demonstrated differences in impact and control groups were much more highly associated with distance from the highway in the block-level groups than in the tract-level group. Therefore, future analyses should concentrate on block-level statistics rather than on tract-level statistics.

IMPLICATIONS FOR PLANNERS AND PRACTITIONERS

Large Socioeconomic Impacts Are Possible but Avoidable

This study showed that substantial variations in socioeconomic effects are possible from city to city. Therefore, social and economic considerations should continue to be a major criterion in the planning process while alternative alignments are being considered. From the limited number of cases investigated here, it appears that the entire range of influences on socioeconomic characteristics--from very positive through neutral to very negative--is possible and that, furthermore, the alignments that coincide with preexisting neighborhood boundaries are substantially less disruptive than rights-of-way that cut through established neighborhoods. Through consideration of such factors, it appears to be possible to avoid large negative impacts.

No Overall Model Was Found

Although the results point to certain patterns of impacts, the variations found do not permit the establishment of predictive models for impacts using the compressed longitudinal analysis methodology and the sites studied. A similar methodology should be used to examine additional case studies so that the data base will be more predictable. Further research with a larger number of cases would provide a better indication of whether or not standard patterns of influence are present. In addition, longitudinal studies using primary data collection techniques to investigate certain issues--in particular, community cohesion--appear to be mandatory for the resolution of these issues, because secondary data collection activities cannot provide enough depth or detail to address the appropriate questions. It must be recognized, however, that further studies could confirm the true absence of general predictive models and the need to focus on mitigative strategies instead.

High Probability Impacts Exist

Certain impacts appear to be more likely to occur than others, even if not predictable mathematically. They include greater than average decreases to population and housing densities in the impacted areas as well as greater than average improvements in measures of deficient housing conditions (percent substandard and percent overcrowded) when the pre-highway neighborhood showed unusually deficient and substandard conditions, but relative declines in the housing market neighborhood attractiveness indicators of housing prices and percent vacant. The transitory changes that occur in interim time periods, but not over the entire before and after time frame, quite often involve decreased neighborhood attractiveness; this is most frequently observed in increased vacancies and overcrowding and deflated housing prices. The changes that are related to distance from the highway often involve decreases in neighborhood attractiveness, showing the negative effects of being located close to the highway. Because of substantial site-to-site variations, a good deal of caution is required in applying these trends to a particular site. Nonetheless, it may be appropriate to consider these effects to be likely unless a good case can be made that other expectations are more probable.

Proximity Is Highly Significant

The finding that distance from the highway is such a significant factor and that measurable effects drop off so quickly as distance from the highway increases may have important policy implications. In particular, such an uneven distribution of effects suggests that persons living next to the highway suffer the majority of the discomfort and other negative effects (including diminution of property values) that are associated with the overall construction and operation of highway facilities. One of the implications of these observations is that persons living next to the highway have a good case for receiving compensation for the effects they incur, because these effects are measurable, fairly intense, and their incidence is limited to a relatively small and well-defined group of households. (Although this study did not attempt to quantify that point at which the social and economic effects of the highway were no longer noticeable, it appears, in terms of the specific cases studied, that this distance is on the order of 5 to 10 blocks away from the highway.)

Analyses Should Focus on Block-Level Statistics

One of the important products of this study is the methodology that resulted for the measurement of impacts. It showed that impact analyses should be conducted on a block-by-block basis, that retrospective analyses using secondary data sources are possible, and that even though certain effects could not be

measured (e.g., actual changes in neighboring, the use of local facilities, and other measures of neighborhood social interaction), major elements of overall neighborhood attractiveness (such as vacancy rates, prices for purchases and rentals, and population trends) were found to change in ways that indicated increases or decreases in attractiveness. This methodology--including the impact categories analyzed, the concept of the community reacting to changes, the block-level perspective, and the use of testable hypotheses concerning expected impacts--can be replicated in any instance where the social and economic impacts of highways are a concern.

Additional Training Programs Are Required

In addition to further research efforts, the findings of this study support the continuation of training programs to sensitize highway planners to the social and economic consequences of their decisions. These training programs should continue to focus on the identification of social and economic impacts, measurement techniques for these impacts, and the understanding of the instances in which they occur. Until there are better predictive models of impacts, the instructional process should focus on case studies of instances of large positive impacts, large negative impacts, and no highway-related impacts. A number of the case studies used for this project would provide good examples for the instructional process.

Relocation Assistance Is Crucial

Because it has been shown that through appropriate planning techniques, the social and economic consequences of highway construction on the remaining neighborhood can be made relatively small, the needs and problems of those individuals and families actually relocated from the right-of-way should continue to be emphasized. By focusing on relocation assistance and compensation programs, the greatest amount of assistance can be provided where it is needed most to alleviate the trauma of the displacement.

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Identification of Transportation System Problems: Public Involvement Through a Telephone Survey

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ABSTRACT

In connection with updating its areawide transportation system plan, the Northeast Ohio Areawide Coordinating Agency (NOACA) effectively combined public seminar/workshops with a random-digit-dialing telephone survey. The two techniques were combined to gather data on publicly perceived transportation system problems and to achieve an additional measurement for triangulation. Similarities and differences between the two techniques and resulting data sets are explored. The authors advocate combining traditionally accepted public meetings with surveys to achieve both research and public involvement goals.

The transportation planning process has, from time to time, included surveys of opinions, beliefs, preferences, and behavior of clients or other persons. These surveys have been carried out by mail [Pulliam et al. (1) and Lame et al. (2)]; in-home interview [Wachs (3,4) and Gamble and Sauerlender (5)]; telephone [Levinson and Gersten (6)]; and other methods. Surveys have been advocated (7)

> [A]s a relatively inexpensive way to gather information, attitudes, and opinions from a large number of people. . . . (The survey) is the only technique, other than talking to every citizen, which is capable of being statistically representative of all citizens, including the "silent majority;" it thus measures opinions and attitudes in a way which allows planners to understand the depth and magnitude of various points of view.

Surveys are not without their critics, however. Professional planners are less receptive to poorly designed studies, to those with low response rates, and to surveys that are used for situations in which other data collections and previous experience indicate that other public involvement techniques are more effective (7). The lesson may be drawn from this experience that surveys cannot always stand on their own merit (this is equally true for all other data collection approaches) but can often be effective as one of multiple data collection techniques applied to the same issue or research question. Social scientists have described this multiple-measure strategy as "triangulation" (8,9).

As a rule, staff planners concede that federal regulations necessitate consultation with the public during the program development process. This concession does not necessarily, however, translate automatically into acceptance of comments and concerns expressed by small groups of attendees at public meetings as genuinely reflective of broader public opinion in the affected community. Technical planners and planning agency administrators probably regard the requirement for public consultation as a nuisance at best and one to be addressed in the most perfunctory manner possible. As a result of these biases--the first derived presumably from allegiance to scientific canons of proper sampling techniques and the second probably steming from resistance to challenges to expertise per se--planners and planning agency officials tend to downgrade the credibility and relevance of input to the planning process derived from a public-meeting-based consultation process.

To counteract, at least to some degree, these sources of inertia operating against recognition and consideration of public input as part of what is generally perceived by planning practitioners as an essentially technical process, the citizen participation program manager will have to do more than just hold meetings to ensure that public input receives its due respect and will have an impact on the decision-making process. Experience gained from the project reported here indicates that meeting-based public input can and should be subjected to confirmation or refutation in the course of the public participation process. Recorded in this paper is the success with a random-digit-dialing telephone survey of selected households across the five-county area where transportation needs were being assessed for updating the long-range transportation system plan.

The more general lesson to be learned here appears to be that the random-digit-dialing telephone survey can be used to support the reliability of information and recommendations derived from meeting-based public involvement activities. Where results of the public consultation process survive the survey process--that is, where results of the public consultation and survey processes tend to converge--technical planners are served notice that public consultation process results are genuine and significant elements in the overall planning process. The authors believe that combining the two techniques significantly increases the reliability of data resulting from the public consultation process and, therefore, planners should treat these data as a meaningful contribution to the program development process.

The Northeast Ohio Areawide Coordinating Agency (NOACA), Cleveland, Ohio, has recently updated the long-range transportation system plan for the metropolitan area. The update was in three phases: (a) system problem identification, (b) development of alternative systems, and (c) evaluation of alternative systems. The seminar/workshops and survey discussed in this paper generated output from the first phase and provided input to the second phase. NOACA has found it desirable to test technically feasible solutions to areawide problems against broader civic and social standards. Therefore, it has established a continuous process of public involvement that is designed to assist responsible public officials in canvasing community opinions and preferences. The process involves recognizing that public involvement does not make decisions, but does contribute to a public opinion context in which decisions are made.

In the course of updating its five-county long-range transportation system plan, NOACA effectively combined a random-digit-dialing telephone survey with three public seminar/workshops to facilitate public involvement in transportation system problem identification (10). NOACA seminar/workshops are public meetings, available to the public at no cost, that focus on a particular developmental stage of a planning program. The sessions consist of a short, instructive seminar presentation by NOACA technical staff, followed by workshop discussions carried out in small, informal groups. Discussions typically culminate in participants completing a data collection form relevant to the project being discussed. The complete seminar/workshop lasts about 2.5 hours. The term seminar/workshop is intended to connote a forum characterized by dissemination of public information and conversational interchange rather than a public meeting or public hearing, which often connotes confrontation and controversy.

Seminar/workshops held in downtown Cleveland in the morning or afternoon generally attract from 30 to 50 participants. Downtown session participants are more likely to be those professionally affected by a planning program--representatives of corporations, governmental agencies, interest groups, or private nonprofit organizations. Other seminar/workshops are held in the evening at locations outside the central business district and within an outlying community of northeastern Ohio. These tend to attract participants who reside in the surrounding neighborhood, municipality, or county in which the session is located (although all NOACA seminar/workshops are open to any resident within, or user of, the five-county NOACA area).

Seminar/workshop attendees can be conceptualized as representing either themselves or interest groups to which they belong or by which they are employed. Logically, these persons are either "interested and available but not necessarily affected" or "interested and affected and available." Seminar/workshops are probably poorly attended by "affected and available, but not interested" persons or "interested and affected but not available" persons. Thus the federal directive to involve interested and affected parties raises a surprisingly complex sampling problem.

During the process of updating NOACA's long-range transportation system plan, it was necessary to convene public seminar/workshops in local community facilities in sufficient numbers to provide an opportunity for interested and affected persons to consult with program planners about proposed planning recommendations and to voice their concerns about them. Although seminar/workshops were publicized, as usual, through newspaper advertising, news releases to printed and electronic media, and other promotional activities, it should be understood that attendees were a self-selected civic-interest group, with a somewhat higher than average interest in civic concerns in general and transportation matters in particular.

Public officials may want to know more about active and organized potential supporters and opponents than about the usually unorganized public at large. The seminar/workshop is particularly useful to draw out views of opinion leaders and other interest group representatives whose comments reflect important concerns that are not necessarily widely shared among the general public. Therefore, although self-selection participation is an understandable problem in a formal research design sense (where statistical representativeness is a concern), it is not always crucial in matters of public policy development.

On the other hand, the pluralistic model of political participation embraced by a number of scholars, for example, Dahl (11) and Riesman (12), is constructed on the assumption that the American political system is open to new participants as issues become increasingly important to them. This model is based on an assumption that individuals are free to join or to form interest groups. On any given issue, the roster of participant groups and the nature of political controversy is rendered unpredictable. This means that, even though many issues are resolved by established interest groups, which influence the decision making of responsible officials, general public opinion remains an important input to policy decisions because it can become galvanized without prior notice. Further, the reality of local electoral politics makes it desirable for elected officials to sample public opinion broadly.

A long-range plan for the five-county area served by NOACA was originally developed in 1969 (13). It specified system improvements then thought necessary through 1990. Federal regulations require that areawide system plans be updated every 10 years. Accordingly, NOACA developed an updated document, projecting transportation system needs through the year 2000. (In June 1982 the revised transportation system plan was approved by the Policy Board.)

To facilitate the testing of technical analyses, NOACA planned to consult the public during the following key phases: (a) an analysis of the existing transportation system and current areawide problems and conditions, which would be compared with the existing system plan (13); (b) development of computer simulation programs as alternative test systems; and (c) evaluation of alternative test systems and development of a recommended system plan.

The NOACA telephone survey took place during the first of these three planning phases to seek information on currently experienced transportation problems and on future needs and expectations for improving the system. The survey was intended to make it possible to compare responses from seminar/workshop attendees with those from a statistically representative sample of areawide households. Questions were asked about specific and general current problems, proposed solutions to those problems, and locations that are considered to be attractive yet inaccessible via the existing system.

METHODOLOGY

NOACA's survey was conducted by telephone with residents in 149 households in the region of Cuyahoga, Geauga, Lake, Lorain, and Medina counties during August 1981. All calls were made within area code 216. The list of telephone numbers was developed by a random-digit generation process, using all working residential exchanges in the five-county area (as identified through the assistance of Ohio Bell). Exchanges outside the downtown Cleveland local call area were assigned a prefix of one and local exchanges were assigned a prefix of zero. A computer program was used to select an exchange randomly and match it with four random digits. No attempt was made to screen within exchanges for working number groups, as suggested by Waksberg (14), because the survey was small in scale. Therefore, the share of completed calls in each exchange, municipality, township, or county was expected to be roughly proportional to the share of households in each exchange, municipality, and so forth (15,p.76). The sampling process was not stratified by smaller political subdivisions and, therefore, does not permit intra-area comparisons.

A questionnaire was developed jointly by NOACA's Community Involvement and Transportation Planning Divisions in consultation with the executive di-

rector of the agency. It was based on one previously developed for and used in public seminar/workshops and was abbreviated and modified to suit a 5-minute interview. In both response situations respondents were asked to identify (a) one specific "worst" travel problem encountered recently in northeast Ohio, (b) other problems, (c) solutions they considered feasible for these problems, and (d) locations in the area they "would like to go to more often" if the attraction were easier to reach. It was hoped that these open-ended questions would provoke sufficient commentary from which general themes could be extracted. Some differences between seminar/workshop and phone survey results may be attributable to the placement of the one "worst" problem question as the third question of the seminar/workshop questionnaire and as the first question of the telephone survey instrument.

Calls were made in two time periods--from 12 noon to 4 p.m. and from 5 p.m. to 9 p.m. This was done to secure sufficient numbers of working persons (especially males), who were more likely to be available in the evening period. No screening procedure was used to alternate within selected households among young and old, male and female members. This was considered too time consuming. Nor was the respondent asked to indicate his or her sex, but all interviewers concurred that approximately equal shares of males and females were contacted, based on the perceived voice pitch and other impressions. Further support for this conclusion stems from the effort made to offer respondents an opportunity to request further informational mailings from NOACA.

Of the 70 respondents requesting information, 30 were male and 33 female (7 names were not classifiable by sex). Calls were terminated if a nonresidential phone was reached, a recording was heard indicating a nonworking number, a busy signal was heard, 10 rings went unanswered, a residential respondent was under 16 years old, or a respondent refused to participate. Several calls were completed to automatic answering machines. This recent development of electronic technology is rarely discussed in telephone survey manuals. This was resolved by treating such calls as no answers. To leave a message might have biased the sample toward persons with higher incomes and certain occupations. There is no analogous way to leave a message for other persons not at home at the time of the initial call.

RESULTS

The 1,165 dialings produced 149 responses, a ratio of 7.82 to 1. This compares favorably with the efficiency of other telephone surveys that have run as high as 10 dialings per completed call. The 1,165 dialings to an eligible respondent included 27 callbacks invited by respondents. Results were distributed as follows:

Result	No.
Completed interview	149
Refusals	95
Contacts with ineligibles (businesses, juveniles, and so forth)	84
Not working or no answer	810
Initial invitations to call back later	27
	1,165

To assess the effectiveness of the sampling procedure in producing a representative sample, a tabulation was made of the shares of completions and refusals for each county and compared with the 1980 population and housing unit counts for each county. (Neither "population" nor "housing unit" is the precise equivalent of "household." But either can be used as a proxy in estimating expected county shares.) Table 1 gives the success rate by county. The close approximations to actual household shares by county suggest that the random-digit-dialing process was effective in sampling representative area-wide public opinion. It also suggests that the large number of calls made to Cuyahoga County was reasonable because of its relatively large share of the area's population and housing units.

Completed surveys were reviewed by the transportation planning staff of NOACA and treated as data to be included in the formulation of alternative test systems. Although the interests of the transportation planning staff focused on specific problems, facilities, and locations cited in individual comments, an attempt is made here to draw out inductively recurrent themes from survey responses and to compare them with outcomes of three related public seminar/workshops.

Answers to open-ended questions on specific and general problems and their solutions were combined into a composite response for each respondent and coded according to whether or not the respondent

1. Mentioned concern for the maintenance of roads, bridges, or other system elements;
2. Had encountered traffic congestion (without regard for its location, supposed cause, or supposed cure);
3. Identified the need for or otherwise supported one or more transportation system management (TSM) techniques, such as signal coordination, enhanced law enforcement, ridesharing, flextime, and so forth (16);
4. Commented on a public transit problem or concern; and
5. Expressed support for new construction of

TABLE 1 Results of Telephone Survey

County	Percent of Area Population	Percent of Area Housing Units	Calls Completed		Refusals		County Refusal Rate[a]
			Number	Percent	Number	Percent	
Cuyahoga	68.9	71.9	109	73.1	63	74.1	36.6
Geauga	3.4	2.9	5	3.4	2	2.4	28.5
Lake	9.8	9.1	16	10.7	5	5.9	23.8
Lorain	12.6	11.6	15	10.1	11	12.9	42.3
Medina	5.2	4.6	4	2.7	4	4.7	50.0
Area total	99.9[b]		149		85		36.3

[a]Refusals/(Completions + Refusals).

[b]May not equal 100 percent due to rounding.

specific lanes, ramps, interchanges, routes, and so forth, or for new construction in general.

It was also noted whether the respondent

6. Experienced at least one transportation-related problem; and
7. Identified at least one attractive potential destination that was considered to be hard to reach or inaccessible.

Table 2 gives the distribution of these themes among the seminar/workshop participants on the one hand and the telephone survey respondents on the other. Some similarities and differences are noteworthy.

TABLE 2 Distribution of Composite Responses to Seminar/Workshops and Phone Survey

Problem Theme	Seminar/Workshop Participants[a]		Telephone Survey Respondents[b]	
	Number	Percent	Number	Percent
Better maintenance	27	58.7	72	48.3
Traffic congestion	26	56.5	39	26.2
Specific TSM	21	45.7	37	24.8
Public transit problem	3	6.5	12	8.1
Support construction	25	54.3	46	30.9
At least one travel problem	43	93.5	125	83.9
At least one inaccessible destination	26	56.5	36	24.2

[a]Number of respondents was 46.
[b]Number of respondents was 149.

A somewhat surprisingly low level of concern was expressed by both groups for public transit. This might mean any of several things. Either the public is satisfied with the area's public transit, or some persons do not use public transit (either because of unavailability or because of past dissatisfaction). Northeast Ohio residents are well aware of transit opportunities but may have a somewhat lower level of loyalty to transit in comparison with other urban areas in the nation. Because the questionnaire did not probe for reasons why a person mentioned or did not mention a given theme, this assessment is highly speculative.

Another similarity in both groups is the high level of concern for road and bridge maintenance. It is probable that the commitment of funds to maintain the existing system will continue to receive support from a majority of the public.

Contrasts are also apparent between the two groups. Telephone survey respondents showed a generally lower level of interest in TSM solutions and road construction, had experienced less traffic congestion, and less frequently identified inaccessible destinations.

Seminar/workshop participants were, perhaps, more likely to identify TSM problem solutions because of prior personal or professional interest in transportation planning or attendance at previous NOACA public involvement activities. For example, seminar/workshop participants were more likely to respond in terms of traffic signal coordination while a typical phone survey respondent making essentially the same comment would speak in terms of timing the lights. Thus the very language used reflects somewhat different interests and experiences between the two groups. Because special efforts are made to include interested parties in seminar/workshops (in addition to general newspaper advertising and other notices to the affected general public), such differences should not be too surprising.

Another contrast is that more seminar/workshop participants reported experiencing traffic congestion than did survey respondents. But traffic congestion can result from insufficient roadway capacity (too few lanes or no alternative routes), an inefficiently operated transportation system (involving, for example, uncoordinated traffic signals and lax enforcement of parking laws), or poorly maintained roadways (resulting in lower average speed). Thus percentages of persons experiencing traffic congestion do not necessarily inform planners about which of several alternative solutions might be preferred. It is instructive, however, to note that far fewer telephone survey respondents than seminar/workshop participants commented on traffic congestion. This may be attributable to the holding of seminar/workshops in more heavily populated locations, where participants are more likely to experience congestion. The large turnout at an afternoon, downtown Cleveland seminar/workshop is a likely contributor to this phenomenon.

Similarly, areawide residents contacted through the telephone survey show less support than seminar/workshop participants for new road construction (31 percent versus 54 percent). Because responses were coded as supporting new construction if even a project as small as adding a lane or exit ramp were mentioned, these percentages may be somewhat inflated. A parallel result (25 percent versus 57 percent) holds for the identification of inaccessible locations--many of which could be reached better, presumably, over newly constructed roadways. (Supporting construction and identifying an inaccessible location appear to be independent of each other. Chi-square = 1.60 with 1 degree of freedom and alpha = 0.05; phi = 0.10.) These results suggest that seminar/workshop participants may be more supportive of capital intensive construction projects than members of the general public.

Neither the seminar/workshop questionnaire nor the telephone survey schedule included extensive background questions about respondents. This was attributable to both time limits and political sensitivities related to such probes by a public agency. Nevertheless, it has been possible to cross-tabulate results on four key themes by community per capita incomes and by the ratio of vehicles to adults in a household. Although other indicators might be desirable from a theoretical viewpoint, pragmatic considerations related to the mission of the agency conducting the research limited the scope of such analyses.

Community per capita income was assigned to each completed call by matching the list of municipalities and townships served by an exchange with 1977 survey data (1980 Census data are not yet available). Where more than one local jurisdiction was served by an exchange, an unweighted mean per capita income was computed for the cluster and assigned to each call from that exchange area. It should be apparent that per capita income is not a measure of individual-level or household-level income. Instead it is a contextual factor (17). Here an analysis of the differences in prevalent themes among the varying communities is based on an aggregate measure. There remains the possibility that a respondent's income was actually well above or well below the amount assigned to his or her call. Perceptions of per capita income levels, then, are affected by differences in perceptions among people who live in residential areas of different economic levels, irrespective of the respondent's own individual income. In the ideal situation, one would control statistically for the effects of individual-level income before assessing the effects of the contex-

TABLE 3 Telephone Survey Responses by 1977 Community per Capita Income Group and Major Transportation Problem Theme

Theme	Low[a]		Medium Low[b]		Medium High[c]		High[d]		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Better maintenance	23	52.3	18	58.1	19	40.4	12	44.4	72	48.3
Support construction	13	29.5	13	41.9	16	34.0	4	14.8	46	30.9
At least one inaccessible destination	7	15.9	9	29.0	13	27.7	7	25.9	36	24.2
Public transit problem	3	6.8	3	9.7	6	12.8	0	0.0	12	8.1

Note: Survey was conducted among 149 respondents in a random-digit-dialing survey of all active, residential telephone exchanges in NOACA's five-county area.

[a]Less than $5,780; n = 44.

[b]From $5,780 to $6,600; n = 31.

[c]From $6,600 to $7,350; n = 47.

[d]$7,350 or more; n = 27.

tual variable. This was not possible in the present case.

Table 3 gives quantities and percentages of telephone survey respondents in each community income group for four of the key themes. By comparing down the columns, it can be observed that maintenance is the highest concern of each group when compared with other themes. The second highest priority for all except the highest community income groups is support for new construction.

Comparing across rows, it can be observed that support for new construction is greater among residents of the two medium-income community groups than among low- and high-income groups. This same pattern holds for public transit problems as well as the citation of at least one inaccessible desirable destination. Such a curvilinear relationship suggests that a "relative deprivation" explanation may account for the phenomenon (18,19).

Residents of low-income communities may perceive fewer transportation problems (given different personal priorities) because they lack the resources to use even the best available transportation system. Residents of wealthy communities, on the other hand, may experience relatively fewer problems because of their abundant resources. Those in this second group may be more likely to use private means to overcome even the worst transportation system.

Persons in the middle-income groups, however, have enough resources to take advantage of an existing public system of transportation facilities yet are not able to move through the system with maximum satisfaction. That is, middle-income groups are more likely to experience the gap between the ideal and the actual transportation system. It is these persons who are most likely to make extensive cost-benefit calculations about prospective changes in the transportation system.

Table 4 gives the distribution of the four key themes by automobile availability. It may be reasoned that access to a private vehicle conditions perceptions of areawide transportation problems. The ratio of vehicles to adults was computed for each household of respondents. Table 4 is constructed with two values of this ratio--less than one for those who have no vehicle or who must share a vehicle with at least one other adult, and one or more for those who have exclusive use of one or more vehicles. As the data in Table 4 indicate, some differences appear between these two groups. Independents are more supportive of road maintenance and new construction. Sharers tend to be more concerned about inaccessible destinations than their counterparts. Little difference is found between the two groups on frequency of complaints about public transit.

TABLE 4 Responses by Vehicle/Driver Ratio and Major Transportation Problem Theme

Problem Theme	Sharers[a]		Independents[b]	
	Number	Percent	Number	Percent
Better maintenance	30	43	38	50
Support construction	20	20	26	34
At least one inaccessible destination	18	26	17	22
Public transit problem	6	9	6	8

[a]Sharers live in a household where the ratio of available vehicles to adult drivers is less than one; n = 69.

[b]Independents live in a household where the ratio of available vehicles to adult drivers is at least one; n = 76.

CONCLUSION

The random-digit-dialing telephone survey has been demonstrated to be an effective supplement to public seminar/workshops held in connection with NOACA's update of the transportation system plan. The survey results provided additional data on types and locations of problems for technical transportation planners. In addition, seven major themes were extracted from responses to open-ended questions, and comparisons were made between the distributions of seminar/workshop and phone survey responses. The results of this comparison suggest that seminar/workshops are effective in eliciting opinions and information from key persons representing broader, usually organized constituencies. But both support and opposition encountered from such assemblages may reflect greater depths of interest than expressed by the general public. This, of course, does not mean that either seminar/workshop or surveys need to be selected as the better data collection technique. Instead it is an indication that public involvement is important at the data collection phase of planning and can effectively combine both techniques. That is, seminar/workshops can be useful in identifying prominent problems and issues, and statistically representative, follow-up surveys can be used effectively in assessing the degree to which these viewpoints are generally shared by the public.

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The Open Format and Citizen Participation in Transportation Planning

BENT FLYVBJERG

ABSTRACT

Recent developments in transportation planning and policy indicate that citizen participation and openness may receive less emphasis in the future in favor of more closed methods of decision making and control. Have the merits and drawbacks of citizen participation and openness changed significantly recently? This is hardly so. A survey revealed that the claimed advantages and disadvantages of the open format have been virtually the same since its early history. The evaluation of advantages and disadvantages, however, has changed. Citizen participation and openness are closely related to values and power, and the very existence of the open format is dependent on the kind of power that dominates societal development in a given period of time. When the open format was introduced, a general commitment to social reform, environmental issues, and democratization of decision making dominated societal development. The open format was a result of, and well in line with, this commitment, which explains its rapid development and spread. Today a commitment to efficiency, neoclassical economics, and budget cuts dominates development in many instances. The trend for openness is being reversed along with the trend for considering social, environmental, and ethical issues in transportation planning and policy.

When citizen participation and openness were introduced in transportation planning in the 1960s and early 1970s a strong commitment existed to social reform, environmental issues, and to democratization of decision making in the public sector. The open format was claimed to result in more democratic decision making, in more comprehensive, coordinated, and effective problem solving, and in plans better adjusted to diverse and changing societal trends.

After a number of case studies of the open format in transportation planning had been carried out, it became clear that the merits of the open format may have been overestimated initially. Open planning appeared to be more time- and money-consuming than closed planning. Participants often seemed not to be representative of the political body. In some cases participation looked like manipulation; in others it appeared to lead to polarization, conflict, and stalemate of programs.

In the following sections the claimed merits and drawbacks of the open format in transportation planning will be examined. Furthermore, recent changes in attitudes toward public planning and policy and their impacts on citizen participation and openness will be described. But first a short explanation of what is meant by citizen participation will be given.

WHAT IS CITIZEN PARTICIPATION?

What is citizen participation? Although it might be expected that studies dealing with open, participatory planning would contain a fairly precise answer to this question, this is not the case. The question is, if addressed at all, often answered in vague terms. Like the concepts of democracy, freedom, equality, and others with strong ideological connotations, there appears to be, or to have been, a widespread consensus that participation is desirable, but only a few specific interpretations have been given of what participation actually means. This circumstance was observed in 1969 by Arnstein (1,p.216):

> The idea of citizen participation is a little like eating spinach: no one is against it in principle because it is good for you. . . . But there has been very little analysis of the content of the current controversial slogan: "citizen participation" or "maximum feasible participation."

Later there were both theoretical and empirical analyses of participation. In the field of transportation planning the most well-known and best documented studies probably are those on the Boston Transportation Planning Review and the Metro Toronto Transportation Plan Review (2-4). Many other studies could be mentioned, both in America and in Europe (5-11); however, these studies cannot be said to agree on, or in some cases even to give a clear definition of, participation.

One could, of course, define citizen participation as Sloan does (2,p.156):

> The operative notion of citizen participation is the direct involvement of people--people who are not part of any officially created government organization or structure, elected or appointed public officials, agency staffers or consultants in the employ of public bodies--in government processes normally the exclusive province of agency staffs and officials.

Or as Yukubousky does (6,p.2):

> Citizen participation in transportation planning is "defined" (by this author) as the involvement in the transportation planning process of members of society who are not on the payroll of the sponsor or coordinating planning agency. Thus "citizen participation" can, for example, refer to the involvement in systems planning, project planning or design of elected officials, other government administrators at all levels of government, members of community, religious, educational, business and local civic groups, as well as private citizens.

Semantic definitions like these are typical of the literature on citizen participation in transportation planning. Even so, apart from differing, such definitions are also rather empty, cognitively speaking. They lack content in that they fail to consider citizen participation in a specific social, economic, and historical context. What the many studies of citizen participation in transportation planning--and in other fields as well--really appear to show is that citizen participation cannot be defined adequately in semantic terms. Citizen participation is best understood in the social, economic, and historical context out of which it evolved.

So why not adhere to one of the few definitions that recognize this circumstance (1,p.216)?

> My answer to the critical what question is simply that citizen participation is a categorical term for citizen power. . . . In short, it is the means by which they (have-not citizens, m.r.) can induce significant social reform which enables them to share in the benefits of the affluent society.

By linking participation to power, this answer to the what question has the further advantage of pointing out that different degrees of citizen participation exist and must be considered when discussing the concept. Thus Arnstein's term, Ladder of Citizen Participation, ranges from manipulation by informing and consultation to citizen control. [See Flyvbjerg and Petersen (12) for a more general and comprehensive account of the social, economic, and historical context of citizen participation.]

TYPES OF OPENNESS

Despite a lack of consensus on the substance of citizen participation in transportation planning, there appears to be an agreement in both theoretical and empirical studies on an aspect of form, namely that citizen participation involves some sort of "openness" towards the environment of a political or administrative system.

Three types of openness can be distinguished. First, openness toward any member of the public who is expected to be affected by, or who has an interest in, a program. This could be citizens in general, political parties, interest groups, or the specific target population of a program (i.e., the users). To many writers this kind of openness is identical to citizen participation (see the quotation from Sloan mentioned previously).

Second, openness toward other kinds of planning can be distinguished. From the point of view of transportation planning this implies openness toward, for instance, urban and regional planning. Some writers include this kind of openness, together with the first type, in the concept of citizen participation [see the quotation from Yukubousky (6)].

The third type of openness that can be identified is different in character from the first two. It is not necessarily an openness toward a specific actor but toward general societal development as this is expressed in economic, political, and ideological changes. This could, for instance, imply awareness in the planning process of the impact of changes in real income, energy policy, or social values on transportation policy and planning. Because no specific actor necessarily is involved, this type of openness is often not considered; however, it may be important to the development of sound transportation programs.

It can be argued that a fourth type of openness ought to be considered: openness toward prospective operators of a planned program. In bus transit planning for example, it may be of crucial importance to the success of a program that bus drivers be involved in the planning process at an early stage. This can be said to be an internal matter, however, as prospective operators often will be on the payroll of the planning agency. In reality, this type of openness may still be as external to the planning staff and the planning process as any other type of openness.

The employment of one or more of these types of openness is typically claimed by advocates of open planning to be an alternative to, or an improvement on, the closed traditional paradigm of rational comprehensive, expert-based transportation planning. In the following paragraphs this claim will be examined by investigating the advantages and disadvantages of open transportation planning.

Considering first openness toward the general public, it was mentioned previously that many writers see this type of openness as the most important, and it is certainly the type that has received the most attention in the literature. The reason may be that this type of openness implies an actual opening of the total political administrative system to the population that surrounds it (i.e., direct involvement in planning and politics by groups other than professionals and politicians). Studies of this type of openness have focused on three major advantages:

- More democracy in planning.
- Less scope for dominant ideologies (e.g., the technocratic paradigm of planning).
- More comprehensive, coordinated, and effective problem solving.

Direct Democracy

The argument that citizen participation results in more democracy in planning and policy making is probably the most widely used argument in support of citizen participation. A typical formulation of this argument is put this way (9,p.6):

> The purpose of citizen participation is to see that the decisions of government reflect the preferences of the people. The basic intention of citizen participation is to insure the responsiveness and accountability of government to the citizens. Secondary reasons for citizen participation are: it helps create better plans, it increases the likelihood of implementing the plan, and it generates support for the agency. In the final analysis, however, its contribution to the democratic process is the significant factor.

To the extent that involving people is regarded as a positive action, citizen participation can be claimed to be valuable. Whether planning and policy making actually become more democratic through this involvement is another question. The answer to this question depends on the degree to which citizen power actually determines the product of the planning and policy process. [In this connection it becomes particularly important to distinguish between different types of participation (1).]

More Balanced

Closely related to the issue of democracy is the claim that planning with citizen participation leaves less scope for dominant ideologies than tra-

ditional closed planning. It is argued that involvement of different groups with different sets of values and interests reduces the likelihood that any one set of values and interests will dominate the process and outcome of planning. Of particular interest has been the challenge of the customary way planners structure and solve problems. Ralph Gakenheimer touches on this issue in referring to what he calls the intuition of planners (3,p.339):

> Every professional has rules of thumb and an intuitive sense of judgment that quickly settle the unchallenging parts of a problem and guide him without delay to the aspects of the problem which need analysis or more open judgment. In the open study he is repeatedly forced to reexamine his intuition and justify it to clients. This is a healthy necessity, but it is bound to be a disturbing one.

More Effective and More Comprehensive

The challenge of customary ways and viewpoints may lead to a broader approach to planning and result in more comprehensive, coordinated, and effective problem solving. It is maintained that by involving citizens in the planning process the outcome is improved by ensuring that social and environmental considerations are adequately treated. Moreover, the combination of the technical skills of planners with citizen knowledge is seen as a means to develop technically sound plans that are politically feasible [see, for instance, Manheim et al. (13)].

Closely related to this argument is the claim that openness toward other kinds of planning--the second type of openness considered--would increase the probability of developing truly comprehensive programs. In both cases the claim is closely related to a critique of traditional, rational, comprehensive transportation planning, which is argued to be--despite its name--narrow in its approach: The benefits of high accessibility over long distances in large one-mode transportation systems have been overrated; and the costs, which are often local and socially biased, have often been underrated, if rated at all. Thus, the traditional studies have been criticized for not considering adequately pollution, noise, energy, urban environment, equity, safety, and the relationships between modes.

As an alternative, the openness of one type of transportation planning to other types of transportation planning has been seen as important to the balance of modes: this would ensure that no one mode would dominate the others. Similarly, openness toward planning and government activities other than transportation has been regarded as a means to ensure that the many, and often complex, interrelationships between transportation and other activities would be taken into account.

In Scandinavia and Great Britain the integration of transportation planning into the overall framework of urban and regional planning has been stressed as particularly important. Also, a more rigorous integration into overall economic planning (i.e., budget planning) has been advocated to ensure that transportation programs are evaluated economically on equal terms with other programs. Finally, integration of environmental planning, social planning, housing, education, health, and so forth, has been claimed to be equally important in securing a holistic view of transportation decisions.

Obviously all these kinds of integrations have strong implications for organizations and institutions. Part of advocating this kind of openness is a commitment to organizational development and to changes in institutional structure (14-16).

Better Adjusted

Finally it has been argued that openness toward changes in general societal development (i.e., economic, political, and ideological changes) would help transportation planning to be better adjusted for diverse and changing needs in mobility.

Traditional expert-based transportation planning has been criticized for relying too much on simplistic forecasts and for not taking into account structural changes in societal development, even where they may be expected to have substantial impact on travel. For instance, the Danish National Highway Administration has been reluctant to change its basic forecasting assumptions of growth in number of cars and car use despite the oil crisis of 1973 and later economic changes. For example, a comparison of end-of-year figures with those forecast by the highway administration will show a substantially lower increase in the car fleet than that forecast. The forecast number, which is assumed to apply to each year until 1990 or beyond, will obviously bias the decisions for highway construction.

Even though the case of the Danish National Highway Administration may be extreme, studies from other countries suggest that it is not unique (3,4, 17-20). It can be understood in terms of an institution trying to perpetuate its own existence; nevertheless, it does leave the institution open to criticism and suggestions for change.

As mentioned previously one suggestion has been to open the transportation planning process so that it will reflect societal changes (21-23) (i.e., less reliance on simplistic and self-perpetuating questions and methodology and more on broader analysis, to promote discussion of changing needs and the development of adequate measures to accommodate these needs).

Along with this type of openness, and for the same purpose, openness toward changing values has been stressed as a central characteristic of open transportation planning. The criticism that has been made of traditional, rational, comprehensive transportation planning has been that this type of planning adheres, with great rigidity, to the values of expert-based, elitist planning and social organization while changes in society are making ever stronger demands for more open and political planning.

A STRONG CASE FOR OPEN PLANNING?

The preceding sections focused on claimed advantages of open transportation planning. A first impression from the many studies that point out these advantages and explain how to organize and implement the open format is inevitably that the case for open transportation planning is a strong one. This impression is sustained by the number of studies that argue the case for the open format versus the number that argue against it or studies that evaluate both the merits and the drawbacks.

Yet, a close look at the latter kind of studies reveals an interesting fact: for each claimed advantage of open transportation planning there appears to be at least one claimed disadvantage (and vice versa). The following sections point out the disadvantages and contrast them with the advantages in order to reach tentative conclusions about the conditions under which the different claims hold true.

Nonrepresentative

One fundamental criticism of planning with citizen participation has been that often the participants have not been representative of the political body. Empirical studies reveal that people with low incomes and few years of education are less likely to be participants than people with higher incomes and more years of education. Moreover, women are less likely to participate than men and older people are less likely to participate than younger people. In short, a participant most likely will be a young middle-class male professional, implying that citizen participation is not very successful in meeting the claim of strengthening direct democracy in planning (2,5-7,24-27). Another argument used against this claim, and against the claim of less scope for dominant ideologies, has been that small, but highly vocal, pressure groups tend to dominate the process and outcome of participation (2,3,28).

Manipulation

Also weakening the argument for direct democracy are the case studies that indicate the established political administrative system may be unwilling to give away power in determining the outcome of planning. A detailed study of citizen participation in the Downtown People Mover Project in Los Angeles concluded that the interest of local government in obtaining federal funding for the project overrode the intentions and obligations for citizen participation. Citizens were able to affect the planning process, but not the planning product (24,p.57):

> . . . , CRA's (the Community Redevelopment Agency of the City of Los Angeles) orientation toward obtaining DPM (Downtown People Mover) funding did not leave the agency open to making program changes that would be responsive to citizen input. Herein lies the strongest basis of CAP's (Citizen Advisory Panel) inability to affect the product of the C/DS (Central Business District Circulation/Distribution System) Program.

Other studies have come to similar conclusions, leaving the overall impression that citizen participation is sometimes used to justify decisions already made. In such instances what is named citizen participation would more properly be called consultation, informing, or even manipulation. At a certain level evidence like this clearly weakens the argument for citizen participation. If the two main parties involved--the citizens and the political administrative system--act in ways that hinder successful participation, why bother about participation at all?

Responsibility of the Political Administrative System

The question is posed too simplistically, however. First, the behavior of the citizens and the political administrative system may be interrelated; i.e., citizens may not participate because they do not expect that they can influence decisions, or the political administrative system may not take seriously the involvement of citizens because participants are not expected to be representative.

Second, there have been actual examples of successful citizen participation (i.e., cases where the participants have reaped some of the claimed advantages of citizen participation). Examples have been reported, for instance, of local experience influencing programs to make them more reflective of local needs and thus easier to implement. Studies of these examples indicate that the claimed advantages of citizen participation are most likely to occur where the program at issue is specific in character, where it concerns a relatively homogeneous population in a small geographical area, and where the major parts of both benefits and costs fall on the population involved (10,27).

Furthermore, because participation is often institutionalized by law and carried out on the initiative of the political administrative system, this system clearly has a strong influence on the success of participation. A substantial degree of commitment to the participatory process by the political administrative system appears, therefore, to be a prerequisite for successful citizen participation, at least if participation is to be an integrated part of institutionalized planning. Lack of commitment may result in counter-planning (i.e., participation outside and contrary to government programs).

The political administrative system may also institute measures to make up for apparent biases in participation such as lack of representativeness among participants. One such measure could be local ballots as they have been used in Switzerland and other parts of Europe.

An example is the claimed biased character of environmental groups, which has been challenged by recent research. Nordkolt (29-31), which up to this time is the most comprehensive research project on urban transportation in the Nordic countries (sponsored by the Nordic Council of Ministers from 1972 to 1978), strongly implies that the role of environmental groups should be reconsidered. What these groups have been pointing out since the early 1960s--that urban transportation policy has been narrow, one sided, and biased in favor of the car--is demonstrated to be true. Detailed studies of eight medium-sized towns in Sweden, Norway, Denmark, and Finland have demonstrated that the social and environmental costs of the current urban transportation system, as compared with two more balanced alternatives, are too high to justify the higher mobility (by car) in the current system. It is demonstrated that traditional transportation planning has contributed significantly to this state of affairs. Seen in this light, it appears that the viewpoints of environmental groups should have been considered in policy making and planning at an early stage. There are reasons why this has not happened, however, as the following paragraphs will show.

Polarization, Conflict, and Stalemate of Programs

It has been argued that openness may lead to polarization and conflict, which could be unpleasant to established politicians and planners and which could also lead to a stalemate of programs.

Conflict may arise between citizen groups and the administration, between different citizen groups, and between different parts of the administration. This is likely to be unpleasant to politicians, who typically benefit from the impression that their decisions have positive impacts for the many and negative impacts for only a few. It could also be unpleasant to planners, because conflict often reveals there is no objective conception of, or solution to, the problem.

Nevertheless, it has been argued that real conflicts should not be glossed over by planners with artificial compromises. Conflict may indeed be necessary to obtain some of the claimed advantages of open transportation planning, that is, more demo-

cratic decisions and more comprehensive, coordinated, and efficient problem solving (3,p.340 ff.)

In some instances it could be true, of course, that the political administrative system and certain interest groups are not interested in actualizing these advantages. That is, the "advantages" are not seen as advantages, but instead as obstacles to the attainment of the goals of a specific agency in the administration or a specific interest group. It is likely that resistance to open planning is often caused by the fear of established agencies that they may lose power, and this fear may be well founded, because the outcome of planning is less predictable in an open process. Also there is less likelihood that specific interests will be taken into account.

If the open format leads to polarization and conflict and this in turn leads to a stalemate of programs, one could say that the open format only achieves negative results (2,p.162):

> It could be said of the participatory process in Boston that it achieved only negative results--to block a program that was quickly falling out of favor. The question is whether a participatory process can produce positive results. Can decisions be made to do something, rather than to block something? On this the evidence from Boston is scanty.

Again, a stalemate could be seen as real progress when compared with the proposed action from the point of view of some interest groups; for example, this would be the point of view of a local citizen group attempting to prevent heavy rail or a freeway from running through its neighborhood.

In any event, the impact of participation on decision making is strongly related to the specific organizational structure of the political administrative system. For instance, a comparative study of 12 cities in the United States, Canada, and Europe indicates that the lack of a single political entity in U.S. cities has made it difficult to organize and implement successful citizen participation and has resulted in the Boston experience described by Sloan. In cities with a single powerful government, on the other hand, the decision making process was found to be much more sensitive to citizen input and to allow not only for stopping projects but also for formulating and carrying out alternative policies. The 12 cities included in this study by Colcord (14,pp.97-99) were Atlanta, Minneapolis-St. Paul, Miami, Seattle, Toronto, Montreal, Hamburg, Manchester, Leeds, Stockholm, Gothenburg, and Amsterdam.

More Time- and Money-Consuming

Finally, it has been argued that open planning is more time- and money-consuming than traditional planning and, in this sense, less efficient.

It is apparent that it does take time and money to arrange and implement citizen participation, collaboration with other planning agencies, and surveys of general societal development. In addition, the planning process may develop less efficiently when citizens and other agencies are involved; some issues may have to be iterated over and over in the process, and participants may raise new issues for consideration that were not originally planned for. It should be mentioned, however, that participation could take, and has taken, forms under which participants accomplish a major part of the work involved, for instance in data collection. In extreme cases one might find institutionalized planning replaced by the work of volunteers.

It is difficult to arrive at definite conclusions as to the resource requirements of open versus closed planning as it would take controlled experiments, the conditions of which would be difficult to establish in practice. A Norwegian study of 16 cases of open transportation and land use planning tentatively concludes that the planning process tends to be more time- and money-consuming when organized in accordance with the open format but that this may be offset by smoother implementation and less need for revision of the outcome (10).

ON BALANCE . . . HISTORY DECIDES

The examination of claimed advantages and disadvantages of open transportation planning reveals one thing clearly: there is no simple bottom line to the question of whether the open format is desirable or not. The question is too fundamental in character, involving, for instance, classical (direct) democracy versus representative democracy and equity versus efficiency. Thus the question concerns ethics, values, and vested interests, i.e., it is a political question.

Using the ideal of classical (direct) democracy as a measuring rod, it is difficult to make a case against open planning. This type of planning is more in accordance with the classical ideal than closed, expert-based planning. In retrospect it is easy to understand, therefore, that the open format appeared on the planning scene in a historical era, the 1960s, when democratization and equity movements were strong. It is equally easy to understand that the open format is vulnerable today, when the main trend demands more efficiency, more reliance on market mechanisms, and less public involvement in societal development. Recalling Arnstein's (1) linkage between citizen participation and power, it can be observed that the very existence of citizen participation depends on which kind of power dominates societal development in a given era.

Reformism

During the 1960s it became increasingly clear that economic growth resulted in substantial negative impacts and that growth was not unequivocally beneficial to all citizens. Representative democracy was endangered by conflict, protest movements, and in some cases by outright riots that approached civil war. In the big cities of the United States and Great Britain, openness and participation were actually introduced as a kind of social engineering aimed at dampening conflict and urban crisis.

Open planning spread from these cities rapidly and with an impact that, for a while, made the open format an established part of the dominant paradigm in transportation planning and also in other forms of planning. Thus, in the mid-1970s an American transportation researcher could write with confidence (3,p.330):

> Is it here to stay? I believe the answer is that in its essentials the open study is clearly here to stay. Abandonment of the open format would require the substantial change or reversal of the major national trends that have given rise to it.

This conviction, which is typical for the late 1960s and the beginning of the 1970s, is closely related to the previously mentioned problems of representative democracy and to a belief that these prob-

lems could be solved by supplementing representative democracy with elements of classical democracy. In a larger context the conviction is related to a belief (generally held at that time) in social and other reform, that is, a belief in public involvement in the regulation of spontaneous development with the aim of controlling economic growth and obtaining a more equitable distribution of the social product.

In the field of transportation this reformism has manifested itself in regulations for more equality in the geographic and social distribution of services. The supply and pricing of public transportation has been used as an important means in this endeavor, for instance, creating better services for the transportation disadvantaged. Other methods are traffic management schemes, standards for air quality, safety, and--since 1973--energy preservation measures.

This author's view is that the open format is best understood as an integrated part of reformism, which has been developed to increase equality and democratization in the planning process.

New Liberalism

Today, the mainstream attitude toward reformism has changed. Regulations and other public involvement in societal development are under severe attack. What could be called a "new liberal" trend is gaining force in the political administrative system and in society in general. Up to the present, this development has been most pronounced in Great Britain and later in the United States. In these countries one could ask whether the "major national trends", referred to by Ralph Gakenheimer in 1976 as the sound basis for open planning, have not been reversed, even if this may have appeared unlikely in the mid-1970s to ever happen.

The term liberalism is used here in the original sense of the word (i.e., meaning reliance on private initiative, competition, and the free market in the allocation of scarce resources). This is the sense of the word used by Adam Smith and the sense used in Europe since then. In the United States, however, the term has come to stand for something close to the opposite of its original meaning, namely, the same as what is called reformism above.

Generally speaking the content of new liberalism is the reestablishment of market mechanisms and private initiative in the capitalist economy. The background for this can be seen in the breakdown of Keynesian interventionist macroeconomic policy in a situation where inflation, unemployment, and deficits in the balance of payments are simultaneously high. Macroeconomic policy appears to fail on its own assumptions.

After a period in which economic policy was paralyzed on the one hand by the inability to stimulate demand because of inflation and the balance of payments and on the other by the incapacity to tighten up fiscal and monetary policies because of the social and political effects this would have, the outline of new liberalism has become increasingly clear and powerful. Fighting inflation, dampening rising costs, and securing a sufficient profit level is at the heart of the new paradigm for economic policy.

As a consequence, growth in the public sector must be limited and the use of public funds made more efficient. Neoclassical economics (i.e., economic efficiency) becomes sovereign again after a period of economic policy based on both efficiency and equity. This line of development is taking place more or less parallel and more or less pronounced in all developed capitalist societies that receive strong policy recommendations from international organizations such as the Organization of Economic Cooperation and Development, International Marketing Federation, General Agreement on Tariffs and Trade, and the World Bank (32,33).

Like macroeconomic policy, transportation policy has been weak and incoherent. Public transportation has been planned and operated in economically inefficient ways in many cities and has not lived up to expectations of increases in ridership, reductions in urban automobile use, or more equity in the availability and price of transportation. Programs for the transportation handicapped have proved to be uneconomical; also programs for safety, air quality, energy, and--as mentioned previously--citizen participation have been blamed for lack of success in achieving goals (34,35).

This state of affairs is well suited to support arguments for cuts in public involvement in transportation; and, indeed, it is used in this way with the result that social, environmental, and democratization considerations get less emphasis in transportation policy and planning. A Danish transportation researcher reports from Great Britain, which until now has been the country where the new liberal trend has had the greatest impact (36,pp.84-85):

> The Buchanan-like comprehensive town and traffic plans are things of the past. . . . The traffic planners work persistently with traffic planning techniques, that by and large focus on bringing as many cars as possible, as safely as possible through the road network. And the town planners are occupied with the individual land-parcel, where regard to private profit interests of individual land owners carries great weight. In this game long-range goals are left unconsidered, and what is more, the collaboration with citizens, that was one of the important goals of planning, cannot be carried out.

In this connection it is interesting to recall that citizen participation was introduced in the 1960s partly with the purpose of dampening conflict and riots in big cities, and it is discouraging to note that in 1981 riots reappeared in Great Britain only a few years after new liberalism was introduced as the dominant policy paradigm in that country (37).

If the consequences of greater efficiency and increased reliance on market mechanisms are increases in social and economic inequality, further strain on the environment, and the possible reoccurrence of riots, the policy paradigm of new liberalism should, in this author's view, be critically reassessed. The concept of efficiency may, in this case, turn out to be too narrow and too related to specific interest groups to justify its use in the public domain.

In the field of transportation there were cogent reasons for the trend of the 1960s and 1970s that enlarged the scope of the traditional paradigm of policy and planning to include the relations between modes, social and environmental considerations, participation, and ethical issues. It may be that attempts to include these issues in transportation policy and planning have not always been particularly successful. This does not mean, however, that the need for a holistic view no longer exists or that a more narrow view will be more successful in solving the problems. To break or reverse a trend, developed through so many years, may backfire. The question should be asked whether it would not be a more sound line of development to learn from mistakes as well as from successes and thereby improve programs instead of giving up programs altogether.

In this author's view, current development in Europe as well as in the United States indicates that the holistic paradigm of transportation policy and planning is essential if the transportation sector is to solve the problem of mobility of society in the long run.

SUMMARY AND CONCLUSIONS

Transportation planning with citizen participation and openness has been introduced as an alternative to traditional, expert-based and closed transportation planning. The advantages that have been claimed to be associated with the open format can be summarized in a number of partly overlapping points: (a) more democratic decision making, (b) less scope for dominant ideologies, (c) more comprehensive, coordinated, and effective problem solving, and (d) plans that are better adjusted to diverse and changing societal trends.

On the other hand, transportation planning with citizen participation and openness has been associated with the following disadvantages: (a) participants are not representative of the political body, (b) citizen participation can be used to manipulate the public, (c) open planning may lead to polarization, conflict, and a stalemate of programs, and (d) open planning is more time- and money-consuming than closed planning.

The examination of claimed advantages and disadvantages makes it clear that there is no simple bottom line to the question of whether citizen participation and openness are desirable in transportation planning. Each claim holds true under its own specific circumstances. It does appear to be clear, however, that citizen participation and openness are desirable when the classical (direct) ideal of democracy is used as the measuring rod.

It appears equally clear that the benefits of citizen participation can best be achieved when the program at issue is specific in character, when it concerns a relatively homogeneous population in a small geographical area, and when the major parts of both benefits and costs fall on the population involved. Moreover, a strong commitment by the political administrative system to the open format is an important prerequisite for successful citizen participation.

When the open format was introduced in the 1960s and early 1970s, this commitment existed together with a strong, general commitment to social reform, environmental issues, and to democratization of decision making in the public sector.

Today commitment to the open format is often absent or weaker than before and is exposed to a commitment to efficiency, neoclassical economics, cuts, and more closed methods of decision making and control. The trend established in the development of transportation planning and policy during the 1960s and 1970s--including citizen participation and openness--is being reversed in ways that to this author often appear as retrogression. To break such a long-standing trend may backfire, and the question must be asked whether it would not be a more sound line of development to learn from past mistakes and successes so as to improve programs instead of giving them up altogether or cutting them back to a state in which the likelihood of malfunction is very high.

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Automobile Restricted Zones in Downtowns: Lessons from UMTA's Demonstration Program

PHILIPPOS J. LOUKISSAS

ABSTRACT

The implementation process, though critical to the success of any project, is not well understood by transportation planners. Implementation of innovative programs is a costly and time-consuming process. The experience from an innovative transportation program is summarized in an effort to contribute to better understanding of this important process and communicate some lessons to planners and decision makers. In 1975 UMTA's Office of Service and Methods Demonstration launched a program to test the concept of automobile restricted zones (ARZs) as a means of revitalizing the downtown environment. This would be achieved by improving transit access, pedestrian amenities, and circulation. A status report of the progress for the four demonstration sites--Boston, Memphis, New York City, and Providence--is presented. Information is based primarily on reports from planners in those cities responsible for the ARZ demonstration program.

Restricting automobiles in the central business district (CBD) by establishing pedestrian or transit malls is still considered an innovative and controversial technique because it attempts to solve downtown problems through structural change; however, it is not a new idea. Separation of pedestrian and vehicular traffic has been applied successfully in many European cities since the middle 1940s in response to high congestion in dense, historic urban centers. U.S. cities slowly have developed an interest in the technique as a means of improving the economic vitality of urban centers. Examples of other objectives of automobile restricted zones (ARZs) are to improve traffic conditions, encourage public transit and nonautomobile modes of travel, achieve better urban design, create a more relaxed and pleasant atmosphere for pedestrians, improve

environmental quality through the reduction of noise and air pollution, and increase safety by eliminating conflicts between pedestrians and automobiles.

According to Rubenstein (1) and Brambilla et al. (2), by 1977 about 90 U.S. cities had implemented downtown ARZs. The first ARZ was built in Kalamazoo, Michigan, in 1959. Subsequently, more malls were established in other cities at the rate of about one mall per year. This rate accelerated to about ten malls per year in the early 1970s and then declined in a pattern of development that resembles the s-shaped curve suggested in the literature on adoption of innovation (3). It is uncertain whether the decline observed during the latter years can be attributed to an expected slowing of the rate of adoption, or to a worsening of general economic conditions--inflation and cuts in governmental spending.

Assuming that the information on malls cited earlier (1,2) is complete, only 2 percent of all U.S. cities with populations greater than 5,000 had built ARZs before 1977. The proportion gets higher as city size increases. For example, one in four cities in the more than 0.5-million population category have implemented ARZs; this proportion drops to less than one in ten for cities with a population of less than 100,000. On the other hand, most malls (60 percent) have been built in urban areas of less than 100,000 inhabitants. This finding is not surprising because most cities fall into this population group. Although geographic distribution of ARZs provides little evidence that there is a spatial basis for the spread of malls, it appears that there is a higher concentration of such projects in a few densely populated states (i.e., California, Illinois, Michigan, and Pennsylvania).

Most of the ARZ literature focuses primarily on the study of impacts (4-8). There is another body of literature on malls that is characterized by its preoccupation with physical design features (1,2). Thus far, little attention has been paid to issues that relate to the planning and implementation process.

Analysis of ARZ experiences by Voorhees (5) has led to the identification of a number of key factors that are critical to successful planning and implementation. The preexisting characteristics of the area and the type of implemented automobile restriction measures appear to determine the magnitude and distribution of impacts. The level of downtown activity and maintaining accessibility are the two most important dimensions. The size and design of malls and their effect on overall transportation is another factor. Finally, political and institutional factors, such as quality of local leadership and support by the public, are also seen as important factors that influence successful implementation.

Despite the success of the first few malls in the early 1960s, imitation has been limited and modest in scale; they are usually confined to a single street and no more than a couple of blocks in length (5). According to Knack (9), most of the malls constructed in the U.S. have not failed outright, but few have lived up to their expectations.

Some malls have acted as catalysts for other redevelopment projects by demonstrating a firm commitment by the public sector to improving the downtown area (7). However, malls have not proven to be a panacea for the ills of our cities. Automobile restriction alone cannot reverse a situation or trend of decay in a downtown area that no longer has many activities because they have relocated, for example, Trenton, Pomona, and Riverside (6,2). The associated private commitments and how the ARZ links with existing developments determine the success or failure of a project.

Implementation of an ARZ project, especially in slow-growing cities or cities with a declining population, may improve conditions in the affected zone, but it is unlikely to generate new sales trade overall. Merchants in other downtown locations or in other city neighborhoods may lose or gain customers as a result of changes in traffic management. Similarly most of these changes may be expected to redistribute traffic, thus creating problems in neighboring streets (10). In another evaluation study of 10 cities with malls, the before and after conditions of businesses on the mall street were compared with other streets in the city. The study found a consistent reordering of types of businesses and an increase in retail-oriented businesses on the mall street, an increase in offices on the parallel streets, and a consistent large decline on the cross streets with no compensating gains in any particular sector of business (11).

ARZs are rarely supported by interest groups. Moreover, they are opposed frequently by the public and special interest groups. Among the potential problems associated with implementation of ARZs are diversion of traffic, reduction in user access to the zone, lack of vehicle mobility within the area, and delivery of goods. Merchants, especially those with small businesses, often have been the chief opponent of automobile restriction when it hampers the delivery of goods (12). Another survey showed that merchants fear decreased visibility and security, especially during evening hours because of the lack of automobile flow and parking on the street (6).

Assessments of effectiveness have come primarily from mass media articles and hearsay that have no scientific validity. It is unfortunate that opinions formed in this way tend to stress the short-term negative aspects of ARZs. Negative media reports coupled with the predominance of the private car as the transportation mode in America tend to perpetuate feelings of uncertainty and fear about automobile restrictive measures in many cities. Federal and city planners have gone so far as to avoid even the use of the term ARZ because of its negative connotations. Most evaluation studies have used designs that consist of individual before and after and ex post facto case studies, or comparisons of case studies. Only limited general conclusions about effectiveness can be drawn from such studies.

Over the last 8 years UMTA's Office of Service and Methods Demonstration (SMD) has played a pioneering and critical role in sponsoring the development, demonstration, and evaluation of innovative transportation techniques and in disseminating this information to the public. Funding for SMD projects usually covers planning and data collection costs, and additional funds for capital and operating expenses are solicited from other sources (13). The development of the ARZ program is one of UMTA's SMD initiatives. In this paper some background on the history and progress of SMD's ARZ program is provided and an attempt is made to draw lessons from that experience as a guide to urban planners.

UMTA ARZ DEMONSTRATION PROGRAM

In 1975 UMTA's Office of SMD launched a comprehensive project to determine the feasibility and effectiveness of ARZs in U.S. cities. The SMD's concept of an ARZ goes beyond the traditional scope of pedestrian malls. It refers to managing automobile use in a larger geographic area with a transit intensive orientation. The purpose of the study was to investigate existing experience, evaluate the feasibility of concepts, identify and evaluate potential sites for suitable demonstration projects, and de-

sign demonstration programs for selected sites (14).

As part of the project, 75 cities were contacted to determine their interest in a demonstration program. Forty-five cities responded favorably with information about their plans. The process to determine the probable success used indicators of past performance, present commitment, and future planning in the areas of institutional performance, transportation factors and urban form, and opportunities that would be supportive of the ARZ concept (5,11, 14).

As a result of this process, five cities with the highest potential for a successful demonstration were selected: Boston; Burlington, Vermont; Memphis; Providence; and Tucson. Burlington dropped out of the SMD program at an early stage; however, it did receive an UMTA capital grant to implement the Church Street Mall in 1982. Tucson's plan was to implement a temporary ARZ in connection with a local festival. This was done without much preparation or public information. The local traffic congestion that resulted created strong opposition in both the media and with the political leadership, which killed the project. Traffic congestion had never been a problem and there were few pedestrians (15). New York City was selected later as the fourth site.

A brief description of the status of the program in the four cities is given in the next section. The descriptions are based primarily on reports from planners in those cities who are responsible for the ARZ demonstration program. Their presentations were delivered at the 1982 Annual Meeting of the Transportation Research Board. A summary of the ARZ project characteristics is given in Table 1.

CASE STUDIES

Boston: Downtown Crossing

Boston's ARZ project covers an area of approximately 100 acres in the heart of the active CBD of a metropolitan area of 3 million persons. The area is characterized by an old, narrow, irregular, and congested street pattern. The land use in the area is primarily office and retail with a high employment density that attracts a high volume of pedestrian traffic. Even before the ARZ, more than 50 percent of those with destinations in the downtown area used the public transit system.

The proposed ARZ had several objectives: reduce vehicle and pedestrian congestion and conflict; achieve economic revitalization in terms of support, expansion, and diversification of the existing activities; and improve the image and physical appearance of the area.

The ARZ plan attempted to meet these objectives by eliminating automobiles and parking within a zone of 12 blocks, which included six different streets (see Figure 1). This represents a departure from traditional linear malls. The design simplified the maze-like traffic routes and created needed space for pedestrians; the mall was then improved by removing curbs, widening sidewalks, and paving with

TABLE 1 ARZ Project Characteristics

Site	Description	Main Objectives	ARZ Plan Characteristics	Funding: Estimated Amount ($M)	Funding: Source	Associated Developments: Cost ($M)	Associated Developments: Type	Project Status and Evaluation
Boston: Downtown Crossing	Population: 641,000 Office and retail uses High employment density High transit use High pedestrian traffic	Reduce vehicle congestion Economic revitalization Improve image and attractiveness	Total to partial elimination of vehicles for 6 streets Improve pedestrian environment Revise transit routes Transit mall	2 1.5 1.5 Total cost estimate of project: 5	UMTA SMD UMTA and FHWA capital grants City[a]	30 100 21	Apartment and retail Hotel and retail Faneuil Hall-Quincy Market	Construction completed in 1979; transit mall eliminated Evaluation completed Spring 1982 reported increase in volumes of pedestrians, reduction in automobile trips, and strengthened retail activity
Memphis: Madison Avenue	Population: 623,000 Office, banking and retail uses, hub of transit system	Extend revitalization effects of existing mall Encourage reuse of vacant buildings Improve transit services	Shuttle bus service between CBD and Medical Center Major bus terminal Street sidewalk improvements Transit marketing	1 0.1 0.3 Total cost estimate of project: 1.4	UMTA SMD State City[b]	40	Office investments	Construction completed in 1982; successful redevelopment, and shuttle bus service very successful Evaluation study in progress
New York City: Broadway, Times Square, theater district, and retail uses	Population: 8,000,000 High transit use High pedestrian traffic High traffic congestion	Eliminate conflicts between pedestrians and vehicles Economic revitalization Improve pedestrian environment Improve traffic flow	Close traffic for 4 blocks Create 3 pedestrian plazas Transit mall one block Revise vehicle circulation TKTS ticket booth	3 1.5 2.3 Total cost estimate of project: 6.8	UMTA SMD FHWA City[c]	320	Portman Hotel proposal	EIS[d] completed in 1980 Mall lost support May 1982 and has been delayed indefinitely
Providence: Kennedy Plaza	Population: 156,000 Financial, retail, and governmental center High employment density	Eliminate conflicts between pedestrians and vehicles Improve attractiveness Improve transit services	Create transit mall and pedestrian plaza Improve transit interface Revise vehicle circulation	1 5.1 1.3 Total cost estimate of project: 7.4	UMTA SMD UMTA capital grant City	 100 100	Improvements to Union Station Office buildings Capital Center project	Plan reached consensus in spring 1982; construction expected to start summer 1983

[a] Implemented by the Boston Redevelopment Authority.
[b] Implemented by the Center City Commission.
[c] New York City capital budget.
[d] Environmental Impact Statement.

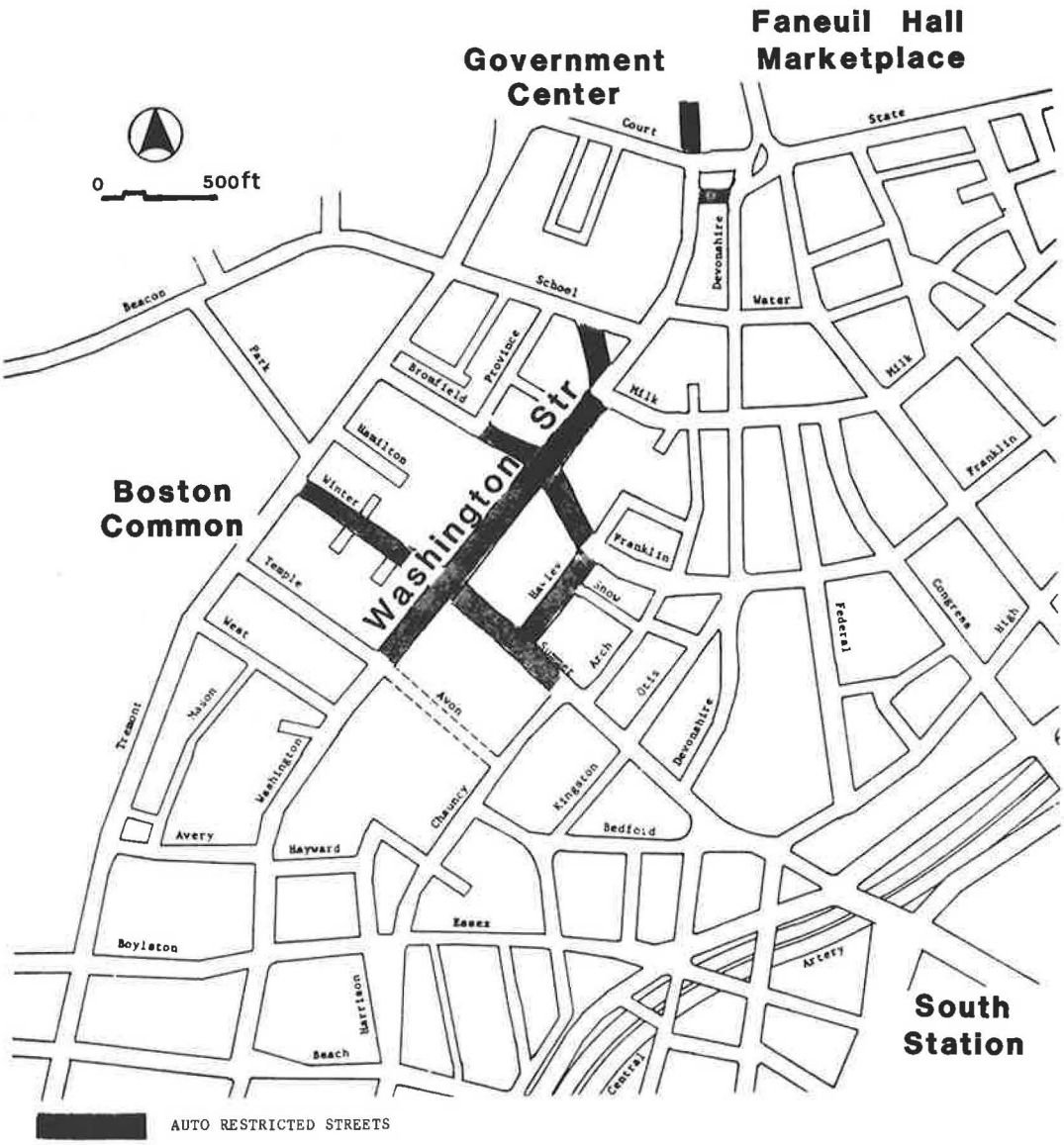

FIGURE 1 Boston: Downtown Crossing.

bricks. In contrast to other pedestrian and transit malls, Downtown Crossing includes a minimal amount of street furniture.

Transit flow was also improved by revising route patterns for local and express buses. Bus extensions that were a result of the revised routing were eliminated at the end of the grant period, 27 months after initiation, because of the loss of transfers to the Metropolitan Boston Transportation Authority (MBTA), which meant a loss of revenue. Another feature of the ARZ plan was a transit mall on Washington Street. The incremental approach followed in implementing the project provided the city with the opportunity to test the concept and the flexibility to modify the project design. Initially the transportation changes were implemented without any physical improvements. After a trial period, area merchants believed that conflict between pedestrians and buses was detrimental to their business. Washington Street was closed to buses, making it exclusively a pedestrian mall.

The Boston ARZ was completed in 1979 and was the first SMD project to be implemented in a relatively short time--only 2 years after the completion of the feasibility study. Final costs were about $5 million of which $2 million for noncapital expenditures was funded by an UMTA SMD grant, and more than one-half of the $3 million for capital costs was funded by FHWA and UMTA grants. The rest was financed by the city of Boston. The project was implemented under the direction of the Boston Redevelopment Authority. Strong merchant support has led to the formation of a centralized merchant group, the Downtown Crossing Association, which coordinates promotion and assists with maintenance (8).

Several other developments were in progress or being planned in the vicinity. The Faneuil Hall-Quincy Marketplace, a $21 million project nearby, financed through Federal Renewal Funds, opened before the ARZ started. Two other developments were expected to have a positive effect on the ARZ by drawing higher numbers of pedestrians into the area. These were a $30-million combined apartment and retail building and a $100-million combined hotel and retail building.

Cambridge Systematics, Inc., the consulting firm responsible for evaluating the Boston ARZ, has measured impacts in six major areas that are directly related to the ARZ objectives. These include travel, economic, and institutional impacts. Data were col-

lected during four time periods: before implementation, during construction, 6 months to 1 year after implementation, and 18 months to 2 years after implementation. The data collection involved a combination of surveys, pedestrian traffic counts, business inventories, interviews, records, and observations (16).

The final report was issued in the spring of 1982 (17). The results indicated increased volumes of pedestrians especially at lunchtime, a slight increase in transit use, a decrease in automobile trips to downtown, an increase in occupancy of automobiles visiting downtown, an increase in restaurants and chain stores opening in the area, and retail activity that had not increased but was strengthened by the growth in minor business transactions by the lunchtime crowds. Surprisingly, the expected increase in traffic on nearby parallel streets did not occur. The historical trend of decreasing retail activity in the downtown area was halted by the implementation of the project. The relationship between reduced automobile traffic and long-term economic revitalization, however, is complicated by a variety of other factors that are occurring simultaneously, such as other major developments, physical improvements, and promotional activities in the Downtown Crossing (8).

Memphis: Madison Avenue ARZ

Memphis, a city of more than 0.5 million people and once the office and retail hub of the Mid-South, had experienced two consecutive decades of decline and disinvestment (18). In an effort to reverse this trend, the local government and concerned downtown property owners funded the development of a master plan to change the image of the downtown. Part of the plan was accomplished by establishing a 10-block pedestrian mall (one of the largest in the United States) on the main street, which is the center of retail business and the hub of the public transit system. The funds for the construction of the $6-million Mid-America Mall were raised from the downtown property owners through the creation of the Central Business Improvement District. The mall, which was completed in 1976, did not immediately solve the downtown problem; however, it created an attractive atmosphere and a functional space and attracted a large number of users. In 1977 the Center City Commission (CCC), a full partnership between government and the private business community, was established. An UMTA ARZ demonstration grant was awarded, not to create an ARZ, but to continue the ongoing redevelopment process (18). The ARZ plan adopted a unique approach. Emphasis was directed away from major new facilities or services to consideration of selective improvements that could be made to expand and enhance the automobile restricted area.

The grant objectives included linking the Medical Center (a nearby concentration of employees and visitors) to the downtown, improving conditions for transit riders, extending the effects of the mall and downtown revitalization, encouraging reuse of vacant buildings, and maintaining high levels of accessibility and circulation.

The actual ARZ program included a downtown bus terminal, shuttle bus service ("Hustle") on Madison Avenue between downtown and the Medical Center, a bus terminal canopy and Medical Center bus shelter, streetscape improvements, and marketing. The street and sidewalk improvements experienced delays because of a problem with underground structures (see Figure 2).

The project was financed by a pledge of $100,000 from the state of Tennessee and a $960,000 grant from UMTA in September 1978. The ARZ project exceeded its budget by $333,000. The additional funding was provided by a capital improvement fund

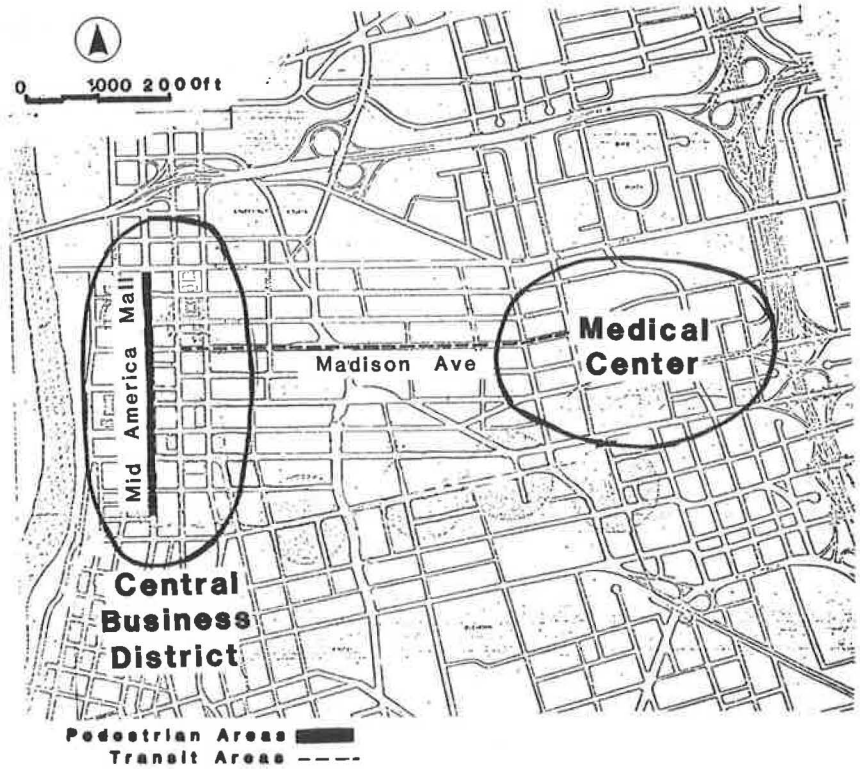

FIGURE 2 Memphis: Madison Avenue ARZ.

(which was established at the request of the CCC shortly after the grant was awarded) in the city and county budget. The ARZ program was instrumental in creating this fund.

Because of construction delays, only 70 percent of the contract was completed by January 1982. Charles Rivers Associates, the consulting firm responsible for the evaluation study, has not yet completed the evaluation. So far information available indicates that the ARZ is successful. Downtown private investment has increased substantially, from $250,000 in 1977 to $40 million in 1981. Buildings are being purchased, restored, or renovated. The bus terminal, Hustle bus, and a new streetscape all played a role in the decision to reuse buildings. The marketing for the shuttle bus also appears to be successful. It averages 62,000 passengers a month and there are reports of increased downtown patronage by Medical Center employees (18).

New York City: Broadway Plaza

New York City's proposed Broadway Plaza is located in the heart of Times Square and the theater district in Manhattan, a densely populated area that is the center of the city's tourist, entertainment, and convention industries. Broadway runs on a diagonal in what otherwise is a pure orthogonal grid system of streets. New York is the most transit-oriented U.S. city; during rush hour 90 percent of the trips are made by transit, and 60 percent of the midday traffic consists of taxis. Broadway carries a volume of traffic that is 60 to 75 percent of that carried by 7th Avenue.

The objectives in creating Boradway Plaza were to improve the pedestrian environment, eliminate pedestrian conflict with automobiles, help revitalize and maintain the area as a focus for theater and tourist activities, and improve traffic flow by eliminating the complex Broadway and 7th Avenue intersection.

The ARZ plan developed four blocks as a series of integrated pedestrian and transit plazas between 45th and 49th streets, one of which shared space with a transit mall closed to automobile traffic. The plan also included a motorist, tourist, and theater information center that would incorporate a new TKTS discount theater ticket booth (see Figure 3). Enforcement of parking regulations was also a component of the ARZ plan.

In 1980 an Environmental Impact Statement prepared by UMTA documented the city's selection of Broadway Plaza as the preferred alternative (19). The cost estimate for a revised scaled-down plan (two blocks were dropped in the May 1981 budget) was $6.8 million to provide a quality environment; $3 million were expected from UMTA, $1.5 million from the FHWA's Federal Aid Urban System Program, and $2.3 million from the capital budget of the city of New York and the state with possible participation from the Economic Development Administration (EDA) and the Urban Development Action Grant (UDAG) program.

The idea of closing Broadway for a mall had been discussed by the city since 1974; it received support from the Department of City Planning and Transportation and had the endorsement of Mayor Koch. The Broadway Plaza proposal had become linked with the popular Portman Times Square Hotel Project. City officials in favor of the mall project have acknowledged privately that as a condition to the approval of the hotel project, an architect had been asked to redesign the hotel's entrance so that it would become an integral part of the pedestrian plaza (20). The 2,000 room hotel, including a 1,500-seat theater, had received wide public support; therefore,

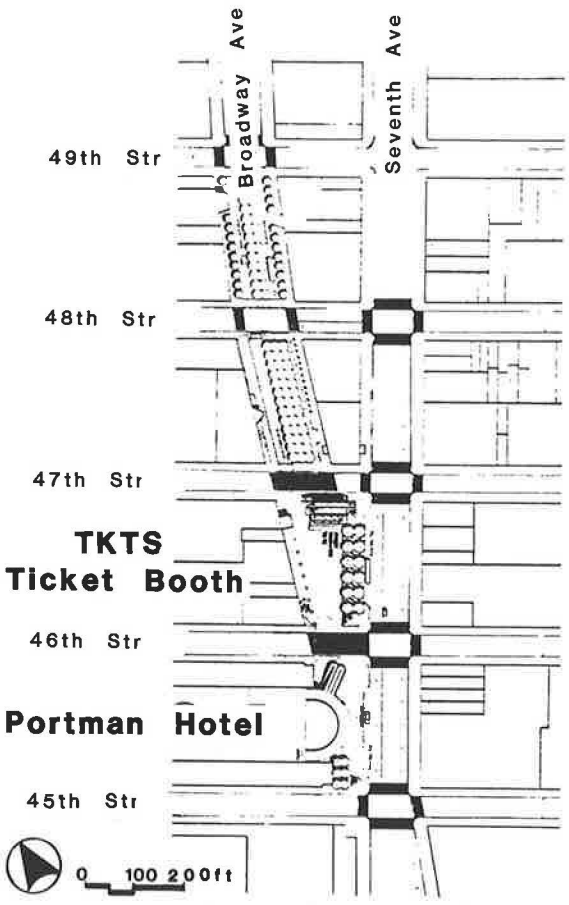

FIGURE 3 New York City: Broadway Plaza.

the hotel became a key element in the Broadway Plaza implementation strategy (21).

As of January 1982, the Broadway Plaza proposal had been endorsed by all major business groups and taxi drivers and it appeared ready for implementation. Since then, support has rapidly eroded. Three historic theaters were demolished to clear the site for hotel construction. This event, although not directly linked to the plaza, caused a public outcry. The hotel developer withdrew support by stating his intent to abandon the mall, thus signaling the end of the project. The project had never received the unqualified support of either the city council or the theater community in the Times Square area. The area is an important site in terms of symbolic value to many who were reluctant to see it change. Many expressed concern about both traffic problems and the possibility that a pedestrian mall could become a gathering place for loiterers in the theater district (20). Finally, theater interests, which had supported the mall when the city had said it was necessary to the construction of the hotel, withdrew their support in the spring of 1982.

Providence: Kennedy Plaza

The city of Providence, with a population of 150,000 in a metropolitan area of approximately 1 million, serves many regional and statewide functions. The city has declined somewhat in recent decades; however, the downtown remains active, primarily because of the concentration of government employees. The Providence ARZ is proposed to be located in the Kennedy Plaza, a large traffic oval around a central

park, adjacent to the major activity generators of the CBD, retail and financial district, the civic center, Cathedral Hill, and Union Station (see Figure 4). The area has a high employment density. Activity peaks at lunchtime and between 4 and 6 p.m., but diminishes at the end of the business day and is moderate to light on weekends.

There is a railroad station at the edge of downtown and Rhode Island Public Transit Authority (RIPTA) buses carry 30,000 passengers per day to and from the CBD. The ARZ includes a multiple-legged intersection. Congestion and conflicts in the compact, irregular downtown are a problem. Pedestrianization has been popular in Providence since the creation of Westminister Mall in 1965.

Providence's primary objective for creating an ARZ is to improve the attraction of the downtown and the interface between transit and pedestrians. By providing an ARZ it is hoped that more varied activities and around-the-clock use of the downtown will be encouraged. Other objectives are to improve conditions for transit riders, eliminate conflict and congestion among vehicles and pedestrians, and provide adequate vehicular circulation.

There are several components to the ARZ plan. Pedestrian areas are to be created, connecting the various districts and nodes of activity to the retail district. The pedestrian area in front of Union Station and Kennedy Plaza is to be increased and developed as a new focus for the downtown. Pedestrian areas would include amenities such as benches, lighting, landscaping, and widened sidewalks. The circulation would be improved by revising the routes, eliminating some parking spaces, and developing a transit mall.

Part of the major downtown intersection would be closed off for the creation of City Hall Plaza. Each street would have its own plan for deliveries. Loading zones would be improved and parking restrictions enforced. Transit conditions would be improved by designation of exclusive busways and the provision of amenities such as bus shelters and better connections to the pedestrian network by rerouting buses to provide through service in the downtown. Rerouting would reduce the need for transfers and the walking distance required of transferring patrons. The plan suggests a downtown free-fare zone from 10 a.m. to 3 p.m., and includes recommendations for managing the activity program (22).

The final costs are estimated to be $7.4 million, of which $960,000 will be for operating costs covered by the UMTA Section 6 grant. The city will contribute $1.3 million to complete the project.

At the time of the ARZ proposal, Providence was also seeking funds for other projects. They were preparing an urban renewal plan for the Union Station-Kennedy Plaza area. Since that time the Federal Railroad Administration has decided to proceed with station renovation, thus making it possible to include this important link in the transit and pedestrian improvement plan. Additional future investments include major public projects such as the Capital Center project, which will cost close to $100 million. Other private sector projects of more than $100 million have been committed or are projected to add substantially to the investment within downtown Providence; thus the Kennedy Plaza project assumes the role of catalyst for all of these other projects (23).

The plan has undergone several evolutionary changes starting with the 1977 concept plan that was the basis of the UMTA application. Attempts to refine the concept plan revealed several problems, most of which involved an attempt to fit too many pieces into too little space (24). Other problems dealt with conflicting objectives of various downtown interests and the transit authority. More recently the city, in consultation with the Kennedy

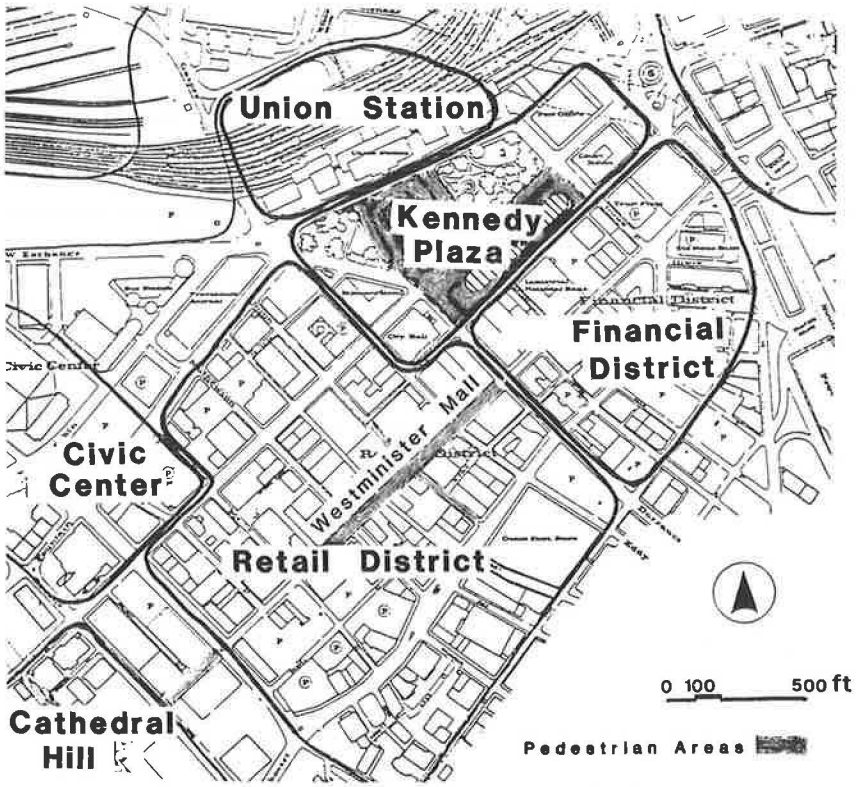

FIGURE 4 Providence: Kennedy Plaza.

Plaza Advisory Committee, has developed a consensus plan that is said to meet the original objectives of the demonstration program and also allow a degree of flexibility (23,24). According to the latest information, construction was expected to start in the summer of 1983.

CONCLUSIONS AND LESSONS FROM THE SMD ARZ EXPERIENCE

UMTA's experience with the ARZ demonstration program has been lengthy and full of obstacles. Great effort and determination are required in all steps of the process from planning and design to construction and management to ensure successful completion of a project. Of the six cities originally selected more than 7 years ago, only two have implemented ARZs within the SMD program and a third is approaching the construction phase. Boston is the only city to complete a successful full-scale ARZ on time. The Memphis ARZ essentially involved improving transit circulation and upgrading the streetscape of an existing mall. The project encountered several construction delays.

In Providence, after many delays in reaching an agreement, a substantially scaled down design has achieved concensus and construction is expected to start soon. In New York the project's popularity had its ups and downs but never received official city endorsement. Tucson and Burlington dropped out of the SMD program in the early planning stages.

The experience of the ARZ programs leads to the conclusion that the technical ability is insufficient to plan and complete successfully an ARZ project that is responsive to problems in a particular area. The political and managerial problems associated with the coordination of both public and private interests during the process of adopting an acceptable ARZ plan have been found to be formidable. Unexpected obstacles are frequent and even when circumvented, cause delays that are costly in dollars, momentum, and support.

Planning decisions in a pluralistic society result from a complex, dynamic interaction among actors in the community (public, planners, and politicians) who have different objectives, perceptions of reality, and power to influence events. Any decision inevitably produces some successes and some failures. For example, some businesses (e.g., chain shops and fast-food restaurants) tend to do better than others when automobiles are restricted. One recurring problem is that cities are perhaps attempting to satisfy too many objectives, some of which may be conflicting.

Automobile restrictive zones have been promoted by UMTA primarily to improve traffic conditions and encourage public transportation. Cities have developed an interest in the technique as a means of revitalizing their downtowns. These two goals appear to be mutually compatible. Traditionally federal agencies have offered attractive financial incentives to promote innovative demonstration projects. Cities generally respond because of the money involved; but they try to ameliorate unpopular aspects, such as automobile restriction, to make them more palatable to opposition groups. The effects of such compromises on achieving the original federal objectives and meeting local needs has been a subject of debate.

Although the ARZ demonstration program has not been completed, some important lessons in project implementation have emerged that can be useful to urban decision makers. The implementation successes and failures of the ARZ demonstration will be examined in view of the critical factors identified in the Voorhees study (5), and the evaluation criteria will be reviewed for future use. Boston was successful because its downtown possesses an ideal combination of many of the preconditions, in terms of economic vitality, accessibility, and transportation infrastructure. The Downtown Crossing case demonstrates that under the appropriate conditions an automobile restriction project can be an important activity that contributes to the economic revitalization of the CBD.

Under the current competition for capital funds, amenity-related transportation projects can only be advanced when they are part of a comprehensive urban development strategy. All four cases examined had concurrent major urban revitalization programs in their respective areas and the ARZ improvements were intended to build on, extend, and solidify those programs.

The experiences in the four case studies highlight timing as an important factor. The critical nature of timing was observed best in the Broadway Plaza case where the relative strength of project support was reversed before the plan could be completed. In the Boston case the timing was favorable. Although downtown retail interests had previously prevented implementation of automobile-free zones in Boston, the opening of the Faneuil Hall Marketplace turned merchants into enthusiastic supporters and the project was swiftly implemented.

Agreement on the size and design of the ARZ was found to be a source of difficulty and a cause of delays. Providence, in particular, encountered many problems in reaching a consensus on the design. There is much to be gained by maintaining an experimental attitude and flexibility in management and enforcement so that the ARZ may be adapted to the needs of the particular area. For example, during the trial period in Boston, the high pedestrian volume on Washington Street was observed as contributing to conflicts between pedestrians and buses. The merchants came to the conclusion that the buses were more of a detriment than a help to their business and asked that they be removed (8). Automobile restriction does not appear to be a serious detriment to automobile circulation, as was feared. In the case of Boston, where the evaluation study has been completed, it was discovered that the change in travel demands has been accommodated fairly easily (8).

Finally, institutional and political influences proved to be another key factor. It is important that private interests be involved in the planning, funding, implementation, and operation of ARZs. Some of the most successful malls (e.g., Minneapolis) were initiated locally and financed primarily with private funds. The success of the Boston and Memphis ARZs can be attributed to strong support from the political and business community. In Providence it was not until the city developed a strong citizen participation program that it was able to reach the final project implementation phase. It can be argued easily that one of the reasons New York City has been unable to implement its plan has been the inability to solidify the support of various interest groups.

Personal Comments and Need for Further Research

There are two categories of issues that deserve further attention. One deals with substantive questions about the nature of the ARZ as a planning strategy and its effectiveness, and the other deals with the general procedural questions about the decision-making process, particularly the implementation phase.

To address fully the issue of ARZ effectiveness,

some methodological questions need to be considered, such as the following: Once some changes have been observed in the downtown, with what confidence can the observed changes be attributed to the ARZ demonstration projects? What has been learned from such demonstrations that is transferable to other cities?

Although SMD programs have made a significant contribution to the promotion of experimentation and scientific evaluation of innovative programs, it is only a beginning. It is essential that studies such as these, which involve systematic monitoring and evaluation of experimental projects, continue so that understanding will improve and conclusions can be drawn that will be applicable to a wide range of situations. (See the last paper in this Record by Loukissas.)

The second set of questions that needs to be addressed concerns the procedural aspects of local decision making and implementation. What are the critical sociopolitical and environmental factors responsible for the initiation, formation, and implementation of ideas regarding CBD revitalization and ARZ projects in particular? How are development decisions generated and how does the original idea grow and mature to the level of a project? In fostering acceptance and endorsement of innovative ideas, what is the role of personal and organizational motives, the timing of decisions, external factors, preconditions of the environment, and community needs? How does the ARZ technique compare with alternative strategies to achieve the same CBD revitalization objectives? Although evaluation studies are conducted for cases that have been successfully implemented, little is known about the many cities that have attempted to institute ARZs but have not been successful.

The literature on implementation provides only a limited conceptual framework that can assist in answering these questions (25). The author has been commissioned by UMTA to conduct an assessment of the implementation problems of the ARZ demonstration program. The focus of this study will be to investigate the implementation process that communities undergo while attempting ARZ projects, as well as other CBD revitalization projects.

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The Automatic Guideway Transit Experience in Cleveland, Houston, Los Angeles, and St. Paul

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ABSTRACT

Extensive interviews were held with participants in and observers of the automated transportation systems planning processes carried out in Cleveland, Houston, Los Angeles, and St. Paul while each of these cities was participating in the Downtown People Mover Demonstration Program (1975-1981). The purpose of these interviews was to document in detail the specific institutional, political, economic, and technical factors that were addressed and ultimately influenced each city's decision whether or not to continue in the demonstration program. Of particular interest were the factors that were unique to a new automated technology as opposed to factors that might be confronted by any large capital project. The results of this analysis can be used by the federal government in shaping new initiatives (irrespective of whether they are oriented to new technologies) and by local planners to aid in understanding the types of factors, nontechnical as well as technical, that must be faced in similar future projects.

In 1976 UMTA selected six cities to participate in the Downtown People Mover (DPM) Demonstration Program. Two of these cities--Detroit and Miami--were encouraged to consider using UMTA funds previously committed to fixed guideway systems to build downtown circulator systems. Four other cities--Cleveland, Houston, Los Angeles, and St. Paul--were declared eligible for newly committed federal funds to cover 80 percent of the cost of designing and implementing automated circulation systems in their downtowns.

Early in the program, Cleveland and Houston decided to withdraw. Subsequently, St. Paul also chose to withdraw from the program and Los Angeles stopped its plans for an automated downtown circulator when federal funding of the DPM program was suspended. Although no longer part of a demonstration program, planning and construction of automated downtown circulators is continuing in both Miami and Detroit with federal participation.

In an effort to understand the local factors and circumstances that led to the withdrawal of four cities from the program, extensive case studies were conducted in each of these cities. The purpose of the case studies was to document in detail the specific institutional, political, economic, or technical factors that led to each city's decision and to attempt to distinguish which of these factors were unique to a new automated technology and which factors might have confronted any large capital project. The results of this analysis can be used by the federal government in shaping new initiatives (irrespective of whether they are oriented to new technologies) that may confront a similar set of factors at the local level and by local planners to aid in understanding the types of factors, nontechnical as well as technical, that must be faced in similar future projects.

The findings from all four case studies are synthesized in this paper. The issues that were common to all cities as they considered participation in the DPM program have been identified along with unique issues confronted in each city that still may have some significance at the national level.

The material in this paper has been drawn from a report to UMTA (1) that also includes full case studies for each of the four cities. The site visits were structured to include interviews with representatives from local, regional, state, and federal agencies as well as local and state elected officials, representatives of the business community,

journalists assigned to cover the project, and various community groups that were effective in supporting or opposing the project.

To integrate the major site-specific issues into a set of general conclusions of the institutional and political barriers to the implementation of automated guideway transit (AGT) systems in urban areas and the design of federal programs that will minimize the effects of these barriers, the site-specific issues have been grouped to reflect the following aspects of the DPM program:

- The construction of large-scale capital projects with federal funding in specific urban areas.
- The focus on local downtowns, their transportation needs and facilities.
- The emphasis on new transportation technologies.
- The design of the program as a demonstration of the effectiveness of automated technologies in urban settings.

These issues progress from those that generally apply to many federal programs to those that are unique to the DPM program. The issues related to each of these aspects of the program are discussed in the sections that follow.

LARGE-SCALE CAPITAL PROJECT ISSUES

In each of the four cities, the fact that a DPM system was a large public-sector-funded capital project led to a number of issues including the following:

- Difficulties in estimating capital and operating costs,
- Long lead times required for project completion,
- Conflicts in cost-effectiveness criteria, and
- Decision making in a complex institutional environment.

Estimating Costs

Fluctuating estimates of capital and operating costs caused problems as DPM planning progressed in each of the four cities, but the extent to which this issue was a significant problem varied directly with the amount of progress made before withdrawal from the program. Where active planning continued over a period of years, cost estimates were raised periodically, creating a problem for project supporters that was difficult to avoid.

Although this problem faces all large-scale capital projects, it was reinforced in the DPM program by the high rates of inflation in the years from 1976 to 1981 and by the uncertainties associated with the DPM technology. Cost estimates were relatively minor issues in both Houston and Cleveland mainly because they were overshadowed by other factors that led to early withdrawals of these cities.

In St. Paul increasing cost estimates exacerbated the difficulties in arranging for funding the local share of capital costs. In Los Angeles increasing costs did not become a factor until system supplier bids were received; then the earlier underestimates became evident, leading to revised estimates that were so high they were a significant factor in increasing local disillusionment with the project, which became evident just before the final withdrawal of federal commitments.

Lead Times

In each of the cities, the time required for DPM planning and engineering was sufficiently long to allow related political or institutional trends to change significantly, always to the detriment of the DPM project. In each case the project itself was not the source or basis for these changes; instead the project was affected negatively by broader trends.

In St. Paul and Cleveland these changes were basically political--the composition of the state legislature and the city administration, respectively. In Houston and Los Angeles the changes were institutional--the formation of new entities responsible for transit planning and development. In each case the DPM project suffered almost inadvertently because of the shifts in priorities and interests that accompanied these broader changes. By carefully positioning itself with respect to these changes, the Los Angeles project team was successful in avoiding being overcome by related local events; however, even in Los Angeles this was becoming increasingly difficult in the final months. In each of the other cities, the project teams were not able to prevent delays caused by these broader political and institutional trends.

Cost-Effectiveness Criteria

In each city the controversy over whether or not a DPM system should be built focused partially on differing definitions of cost-effectiveness. System proponents claimed that only the local share of total costs was relevant--that the federal share would go elsewhere if a DPM system were not built. Opponents, on the other hand, saw federal funding for the DPM system in competition with UMTA funds for regional transit systems. Their cost-effectiveness criterion was therefore based on total system costs. In spite of whatever proponents or UMTA said about the independence of federal funding decisions for DPMs and regional systems, many would not believe that complete independence existed.

Complex Institutional Environments

In each of the DPM cities, as in all U.S. metropolitan regions, transportation decision making takes place within a complex environment of statewide, regional, county, and municipal agencies with varying responsibilities for the planning, implementation, operation, and regulation of transportation facilities and services. The DPM program could not avoid these environments, but it could have sought out an existing structure instead of allowing the areas to set up what were essentially new structures for the DPM program.

For example, if UMTA had required the local metropolitan planning organization (MPO) and the agency that would be responsible for system operation (usually the regional transit operator) to submit a joint proposal as DPM grant recipients in each area, the agencies usually responsible for transit planning and operations would have been encouraged to work together on the DPM project as they must in other areas of transit development.

Without organizational requirements such as these, a number of ad hoc institutional arrangements were set up that severely hampered DPM planning progress because even though they may have been ultimately workable, they required new and different institutional relationships to be defined. The results of these problems were especially evident in Cleveland and St. Paul, where municipal agencies found themselves in a new and uncharted role.

Los Angeles found itself in a similar situation but set up a new agency and carefully established

workable relationships with existing agencies. By avoiding the question of who ultimately would be responsible for system operation, Los Angeles was able to avoid the pitfalls discussed earlier, but not without significant effort. Houston's grant recipient, the transit operator, came closest to the model suggested. The transfer from a municipal to a regional agency during the DPM program, however, hampered the potential effectiveness of this choice of local leader.

DOWNTOWN CIRCULATION ISSUES

In each local area many of the questions debated as the DPM decision-making process unfolded were related to the context in which the systems were to operate--the downtowns. In each city the downtown area traditionally had been the center and highest concentration of retail and commercial activities. The types of issues falling into this category include the following:

- The extent to which problems were perceived to exist in the downtown that could be alleviated by building a DPM system.
- The relative effectiveness of the proposed DPM system as a means of meeting the downtown's needs.
- The limited groups of beneficiaries of a DPM system, in relation to the entire region's population and economic community.
- The problems of integrating the relatively limited DPM system with the much broader regional transportation system.

Perception of Downtown Problems

In each of the cities there were individuals and groups who questioned whether downtown circulation per se was a real problem or was an issue with a priority high enough to warrant an expensive capital solution. The importance of the opposition of these individuals and groups to the DPMs, however, varied significantly from city to city.

In Cleveland this issue was a minor one, because for a number of years many in the city had recognized the need for a better way to distribute rail transit users to and from the single central business district (CBD) station. Also it was agreed that CBD development should proceed at a faster pace and that existing activities should be revitalized. DPM proponents in Los Angeles emphasized the impending lack of parking facilities where they were most needed and the need to link separate activity centers within the CBD.

Because of the downtown's rapid growth at the time, as well as its long walking distances, few disagreed with these statements of need. A number of opponents did, however, fail to accept the need for the DPM as an incentive to future development and revitalization when they observed that the parts of the CBD that would be served best by the system were already developing rapidly and that the parts most in need of revitalization would be poorly served.

In both Houston and St. Paul proponents placed significant emphasis on future transportation needs--the higher levels of congestion and the scarcity of parking expected in the future. In both cases, however, the consensus of the general public reflected its inability to accept these problems as real, in view of the minor degree to which they existed at the time. The relatively high levels of development going on at that time in each of these areas inhibited the perception of an urgent need to use the DPM to promote more development. These failures to perceive the stated future needs in Houston and St. Paul were significant factors in their decisions to withdraw from the DPM program.

Relative Effectiveness of DPM Solutions

DPM opponents in each city were able to cite alternative systems that were considered to provide a more effective means of addressing their downtown transportation needs: skyways in St. Paul, loop buses in Cleveland, a bus priority system in Houston, and the downtown portion of a regional rail transit line in Los Angeles. In the first three cases these alternatives would be significantly less expensive than a DPM system. In Los Angeles this would probably not be true, but the regional rail system was believed by many DPM opponents to meet additional, higher priority transportation needs not addressed by the DPM.

None of the cities argued that improved bus or walkway systems would have a significant impact on CBD development or revitalization, but many doubted the claims of the effectiveness of the DPM systems in achieving these goals. In general, the DPM systems were viewed as having very high costs in relation to their expected benefits.

Limited Groups of Beneficiaries

Public sector investments in CBDs tend to provide direct benefits to a segment of the total regional population that does not represent many socioeconomic groups. The prototypical beneficiaries are thought generally to be high-income business and professional people who work downtown, CBD property owners, and large business firms with downtown offices.

Building a regionwide constituency in favor of added travel and development benefits for these groups often is difficult. Care must be taken to convince a broader constituency that investments designed to improve the health of the CBD will provide the entire region with valuable indirect benefits. Alternatively, trade-offs can be packaged that broaden the number of those directly benefited; this was one of the motivations for Los Angeles' Four Part Transportation Program, which included the DPM.

None of the local DPM projects was able to overcome completely the difficulties of building an effective and stable regionwide constituency, yet each needed regionwide financial (and hence political) support to provide the local share of capital and operating costs.

Integration of the DPM with the Regional System

To be effective downtown distributors, DPM systems must be tied in closely with regional transit systems. For a number of reasons this integration proved to be difficult in three cities and was not addressed fully in the fourth, Houston, before that city withdrew from the program.

Even in Cleveland, where a clear-cut need for a downtown circulator generally was acknowledged, no easy way to integrate the system directly with the downtown rail transit station was found before the project was terminated. In both St. Paul and Los Angeles the DPM project staff wanted to eliminate duplication of transit service by having many regional buses stop at DPM terminal stations; most bus riders would, therefore, be forced to transfer to the DPM to reach their CBD destinations. These plans

were not received well; both the public and the transit operators saw these plans as reducing the level of service for the entire transit trip to the CBD, thus tending to reduce use of the bus system.

In Los Angeles rail transit planning and DPM planning were taking place concurrently, but the two agencies involved failed to develop a plan that would avoid a high level of duplication of service. In the plan the two systems had a number of stations within a block of each other. Clearly, using the DPM in addition to the regional system would provide only a marginal increase in the level of distribution in the CBD.

INNOVATIVE TRANSPORTATION TECHNOLOGY ISSUES

Because of the strong focus in the DPM Demonstration Program on innovative transportation technologies, local decisions to withdraw from the program tended to be interpreted immediately as repudiations of these technologies. More careful analysis reveals that although issues related to the technology to be implemented did enter into the decisions made, they were not the overriding concerns. Instead, as reflected in the structure of this summary, they merely represented one category of a broader range of issues. The types of issues falling into the innovative technology category include the following:

- The degree of local familiarity with AGT systems before the DPM program and the changes in this factor that occurred as the program continued.
- Concerns about the risks and uncertainties of implementing these systems in CBD settings.
- The credibility of patronage and induced development forecasts for the new systems.

Local Familiarity with AGT Systems

Of the four demonstration cities, only Houston failed to consider sufficiently in advance the application of new technologies in the CBD. This lack of advance planning was a contributing factor in Houston's subsequent lack of interest in remaining part of the DPM program. The planning that had taken place in each of the other cities--since the early 1970s in each case--was important not only in providing a basis for the DPM proposals to UMTA but also in providing a core group of advocates for the system.

As planning progressed, familiarity with the DPM concept increased in each local area, but the reputation of AGTs generally declined both nationally and locally because of the well-publicized high initial costs and operational difficulties of the Morgantown system. Additional negative impacts occurred in Los Angeles and St. Paul. In both cities systems at nearby recreational facilities provided many with the perception that some of the candidate systems were either toys, Toonerville Trolleys, or too unreliable for DPM settings. The unwillingness of both the local project staffs and UMTA to state that such systems would not be chosen further fueled negative reactions to the systems in both of these cities.

The deterioration of the general perception of DPM systems continued throughout the planning process in Cleveland, Los Angeles, and St. Paul and finally resulted in their being likened more to elevated railroads than to modern innovative systems. This occcurred especially in Cleveland and Los Angeles, where opponents questioned why elevated DPMs should be constructed when other cities had been tearing their elevated transit lines down for years because of their negative impact on communities.

Project staffs failed to create a sufficiently positive familiarity with the potential of AGT systems among the general population to provide the required level of support for implementation. It is not clear whether this could have been done in the light of the reputations and operational difficulties of some automated systems at that time.

It will be important in future new transit technology programs, however, to develop a more effective way to make local area constituencies familiar with the new technologies and their advantages over alternative solutions to local transportation and development needs. UMTA's continuing program to evaluate the Detroit and Miami circulator systems will provide a portion of the data base for such future efforts. This data base will consist of impact studies, assessments, costs, and reliability experience for the systems as implemented in urban settings.

Risks and Uncertainties of DPM Systems

UMTA's original design for the DPM program emphasized the reduction of technological risks by limiting the range of appropriate systems to those that had proved to be feasible in other regular passenger service settings--airports, recreational parks, or non-CBD activity centers. This requirement was relaxed later when suppliers were successful in obtaining UMTA's agreement that prior passenger service was not required and that only successful operation on a test track would be required. Concerns about the technical feasibility of the systems under normal operating conditions, however, were only a minor negative factor in any of the local areas.

Other concerns existed, however, that were related to the lack of previous experience with automated systems in the CBD settings and under winter climate conditions. These concerns focused on doubts about the levels of safety and personal security that could be assured without operators on board. Other concerns were visual effects and the effects of noise and dirt on occupants of nearby buildings as well as on pedestrians, automobiles, and bus users along the right-of-way of the DPM, and the effects on traffic flow and on-street parking in locations where existing street rights-of-way would be required.

These types of concerns continued to be critical in each of the local areas, in spite of efforts by the project staff to address them. These efforts varied in intensity from city to city, but the basic lack of existing examples to point to prevented even the best efforts from succeeding.

Credibility of Forecasts

The two major types of forecasts required in the DPM planning process were future system ridership and level of system-induced development. The preparation of these forecasts was made difficult both by the CBD setting and by the uncertainty of how travelers and developers would react to a new technology. The CBD setting made it difficult to use existing models and procedures oriented to the regional scale, but new approaches could be based on observations of existing travel and development behavior.

The need to focus on a new technology provided a more complex forecasting problem. There were no existing AGT systems operating in downtown settings

and thus there was no actual experience with how travelers might react to and use these systems. Planners found it necessary to project new patterns of traveler and developer behavior based on previous responses to systems, such as the Bay Area Rapid Transit in San Francisco and the Washington, D.C., Metro, which lacked the uniqueness of function and advanced technology of the DPM. An enhanced modal image was assumed to reflect these differences. The resulting forecasts of future DPM ridership at times called for as much as 10 times the existing use of bus routes providing downtown circulation; and, in addition, significant levels of system induced development were predicted.

The local population found these forecasts hard to believe. Where more detailed study of the ridership forecasting procedures was carried out, in Los Angeles and St. Paul, credibility was further weakened as assumptions of modal images, high rates of diversion of bus users to DPMs at transfer stations, and limitations of future increases in parking capacity at fringe locations served by DPMs were identified and reviewed publicly. Similar investigations of DPM-induced development potentials called into question the effectiveness, over and above existing trends, of the DPM systems.

ISSUES RELATED TO THE STRUCTURE OF THE DPM DEMONSTRATION PROGRAM

The final category of issues that affected the local DPM projects are those that arose specifically from the structure of the DPM Demonstration Program. Although these issues are unlikely to confront other federal programs, they provide valuable guidance for new technology demonstration programs that might be devised in the future. By learning from the problems that became evident in the local areas during the DPM program, UMTA can significantly enhance the effectiveness of such future programs.

Four types of issues have been identified in this category:

1. Conflicts and inconsistencies caused by the sequence of local activities,
2. Conflicting program objectives at the federal and local levels,
3. Issues related to the acceptance of ad hoc local institutional arrangements, and
4. The lack of effective program commitments at both the federal and local levels.

Sequencing Local Activity

The history of local DPM projects strongly suggests that there were two major problems with the sequence defined by UMTA for local planning and engineering activities:

1. Final selection of demonstration cities was based on hastily prepared proposals, and
2. System suppliers were not selected until after completion of preliminary engineering.

UMTA made a final selection of the cities to be included in the program based on proposals that had to be developed in just 3 months. Events proved that this provided the local areas with too little time to reach a consensus on whether or not they should build a DPM system and who should be responsible for leading the planning and implementation effort. By being forced to make these decisions in a short time, three of the four local areas later found it necessary to reverse themselves. In both Cleveland and St. Paul this happened in spite of significant levels of new technology planning.

Choosing the DPM technology at this stage is inconsistent with the subsequent need for an objective look at alternative systems as Environmental Impact Statements (EIS) are developed. Houston, the only city to fulfill this requirement, later felt too constrained by looking at a single technology and ultimately withdrew because it concluded that a bus system was preferable to a fixed guideway system. If the program structure had been flexible enough to accommodate Houston's approach to preliminary engineering and alternatives analysis, the problems generated at both the local and federal levels by Houston's withdrawal from the program might have been avoided.

Before it withdrew from the program, Cleveland found itself in a tug-of-war between those who wished to see an unbiased feasibility study carried out and those who hoped to move directly to preliminary engineering of a DPM system. To a lesser extent, this same conflict existed in St. Paul and Los Angeles. In the latter city the conflict did not surface fully until after the draft EIS was completed and commented on in public hearings.

The timing of selecting system suppliers only after completion of preliminary engineering also created problems. This sequence of events was appropriate for providing an opportunity to specify carefully the desired system performance, thereby ensuring that local needs would be met. It was also consistent with the sequence of activities carried on in conventional transit system implementation programs. However, using these procedures for a new technology with more widely varying specific systems caused both technical and public relations problems. At the technical level, the local areas were required to keep limitations of aspects such as turning radii, support spacing, and guideway width general enough to avoid disqualifying too many systems and eliminating too many suppliers.

Public relations during preliminary engineering also were made more difficult by the aspect of the program that required this sequence of implementation. The local project staffs could not say with authority that specific existing systems that had bad reputations because of operational difficulties or cost overruns elsewhere would not be eligible for selection as the local DPM. As a result local staffs were hampered in their ability to deal effectively with an important concern of the local population before it generated additional opposition to a DPM system. If federal procurement regulations had allowed UMTA to foster the early formation of joint ventures, each consisting of a system supplier and a local area, these types of problems could either have been reduced or limited to only those joint ventures that involved a system supplier that had experienced problems with its previously implemented systems.

Conflicting Program Objectives

In the DPM Demonstration Program, the primary federal objective was to demonstrate that automated transportation technologies could serve local transportation needs effectively and promote downtown development and revitalization. In the local areas, however, there was a greater focus on serving transportation needs and promoting CBD growth than there was on new technology. There was no inherent conflict in these varying emphases, but experience indicates that a strong potential for conflict did exist. After being selected as DPM cities, there were varying degrees of interest in each local area

in carrying out feasibility studies or analyses of alternatives to determine what transportation systems should exist downtown instead of proceeding immediately to DPM preliminary engineering. Many wanted to determine the most cost-effective way to meet future CBD needs after considering all alternatives, not just DPM systems.

Each city viewed being a laboratory for what was considered a federal experiment as more likely to be negative than positive. Thus, for example, UMTA's requirement that three different system suppliers be selected by the first three DPM cities was considered a conflict with each city's desire to obtain what it considered to be the best system for its needs.

Local Institutional Arrangements

Both the short time available for the local areas to prepare their DPM proposals and the systems' limited service areas resulted in selection of lead DPM agencies that were inexperienced in working with UMTA and that had to develop new sets of working arrangements with other transportation planning and operating groups in their regions. This was especially true in Cleveland, where the proposal was prepared by the mayor's office, and in Los Angeles, where the Community Redevelopment Agency prepared the proposal.

In St. Paul the joint city and Metropolitan Transit Commission (MTC) proposal included the regional transit operator but required the transit operator and the city to work out the terms by which they would cooperate. Subsequently, the state legislature failed to provide the funding required for MTC to continue its involvement in the project.

Houston's proposal by the transit operating agency within the city government initially prevented the type of problem confronted in the other cities, but the subsequent transfer of DPM planning activities to a new regional transit authority resulted in significant time and effort being devoted to organizational issues.

It is not clear whether UMTA could have adopted program guidelines that would have significantly reduced potential local organizational and political conflicts. A requirement that both the regional municipal planning organization, or a designated representative agency, and the intended DPM system operator be parties to the planning and implementation process would, however, appear to have merit. Also, in future programs of this type, UMTA should be careful to evaluate both the present and expected future organizational and political support for a local project before selecting the local areas to be funded. Cities proposing to use institutional arrangements that have proved to work well in the past for system planning, implementation, and operation should be favored over those defining completely new relationships.

As the DPM program progressed it became increasingly clear that the private sector--downtown employers and property owners--had a significant stake in the local projects. The innovative public and private arrangements partially worked out in St. Paul and Los Angeles represented important firsts for UMTA-funded projects. In both cities, however, involvement of the private sector was too late and too indefinite.

This suggests that it would be desirable in future DPM-like projects to require that a plan for private sector involvement be outlined in the original proposal or application and to require that it receive final approval early in the planning process. This would allow UMTA to select cities after considering the likelihood of successful private sector participation and also would help the local areas to tie down this participation as early as possible in the planning and implementation process.

Lack of Program Commitments

At both the local and federal levels, the DPM program suffered from lack of commitments that were strong enough and long-term enough to complete the local projects. At the local level some of these commitments involved multiple agencies, but the more critical lack was in getting commitments of financial participation from the private sector. St. Paul was the most successful in arranging such commitments, but there the commitments did not come in time to avoid the defeat of local DPM funding at the polls.

In Los Angeles, tacit agreement of the private sector's willingness to participate in tax increment financing was obtained, but the details were never completely worked out. The Cleveland business community contributed toward DPM planning costs but resisted making commitments to provide funds for capital or operating costs. In each case the planning process would have proceeded more smoothly if firmer commitments could have been obtained, even if the ultimate no-build decision could not have been changed.

As the only originally chosen city in the DPM program at the time it was suspended, Los Angeles was the only city affected by the federal government's difficulty in making multiyear commitments. The understanding that UMTA was committed to a Los Angeles DPM was proved wrong when Congress eliminated the program funding (all multiyear government commitments are subject to annual approval by Congress). Because this reality had not been stressed previously, it was extremely difficult for proponents of a DPM system in Los Angeles to understand how this system could have been halted so quickly.

Changes in federal initiatives that would address the need for stronger commitments earlier at both the local and federal levels may be difficult to achieve. The private sector can be expected to propose contributing at low levels, or not at all, until they are convinced by events that more support will be required. Future programs are likely to benefit, however, from the precedent of obtaining private sector funding by mechanisms such as tax incentives and joint development, which are now more common in transit projects. At the federal level, strong support for specific systems will have to be maintained for long periods of time.

A final program structuring strategy that would address many of the problems identified throughout this section would be to integrate a program such as the DPM Demonstration Program into the standard transit planning and funding process. This would require UMTA to provide a high level of staff support and information to local areas considering alternatives involving automated technologies in high-activity urban areas. Also, UMTA would clearly state to local area transit and CBD planners that if innovative transportation system technologies were preferred for their CBD, UMTA would consider funding such a system under one of its normal discretionary capital grant programs. After UMTA approval of such a grant, the local area could form a joint venture with a system supplier for final engineering, construction, and initial operation.

By making such a grant conditional on an acceptable and impartial consideration of a full range of alternatives, UMTA could minimize the likelihood

that system suppliers would prematurely oversell their particular technology. The local area would also be encouraged to formalize private sector funding arrangements at this stage. UMTA would provide specialized help, as required, to the local area in all aspects of planning and implementation related to the use of innovative and therefore unfamiliar technologies.

To encourage further the acceptance of new technologies, UMTA would also provide 100 percent funding for any costs above those required for planning and engineering a conventional system, as well as the full costs of evaluating the innovative systems to provide guidelines for other DPM systems. Federal grants toward construction costs, however, would require the same local cost sharing that is required for conventional systems.

By integrating new technology demonstrations in this way into well-established transit planning and funding programs and at the same time encouraging local areas to consider these technologies as potentially viable alternatives, UMTA could improve its encouragement of applying new technologies in urban settings in the following ways:

1. Existing planning and implementation procedures, and the local institutional arrangements used to carry them out, would be retained as much as possible.
2. Enough time would be provided for the local areas to be relatively sure they had a sufficiently strong commitment to an innovative technology alternative before UMTA would be asked to contribute to the project.
3. System suppliers could be selected early enough in a project to minimize costly unnecessary engineering work. UMTA could decide whether or not to fund a system in a given city based partly on which system supplier was involved, or could withold final approval until a joint venture was formed. (Note that revisions in the federal procurement regulations may be necessary to allow such joint ventures to be formed.)
4. Federal demonstration objectives would be added to local objectives only after the local area had selected a new technology, and their added costs would be fully paid by federal grants. This should prevent conflicts due to differing federal and local objectives.
5. Private sector involvement would be sought and finalized as early as possible in the planning and implementation process.

Although all of these factors should be considered in designing any new federal initiative, it should be stressed that no single factor led to the decision by any of the four cities to withdraw from the DPM program. In the case of Los Angeles, however, the decision not to proceed with DPM planning was clearly forced by an overriding factor: the suspension of federal funds.

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The information on which this paper is based was obtained through interviews with more than 60 individuals in Cleveland, Houston, Los Angeles, and St. Paul who had been involved or had been close observers of the AGT planning process in these cities. The authors wish to thank each individual interviewed for their helpful assistance in the study.

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All views expressed in this paper are the authors' and not necessarily those of UMTA or the local governments in the case study cities.

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Status and Prospects of the Automated Guideway Transit Industry in the United States

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ABSTRACT

Since the late 1970s, many changes have taken place in the firms that are active in providing automated guideway transit (AGT) systems. Many U.S. firms once active in the industry have withdrawn, and at the same time a number of foreign firms have demonstrated that they can compete effectively within the United States. Recent history of the U.S. portion of the industry is reviewed and interpreted in the light of the nature of the AGT market; the types of firms that were at one time in the industry as well as those that remain; and the dynamics of entry and exit in the industry. Based on this background, the future prospects for the industry are discussed. The importance of the role of the federal government, and as a result, the existence of two AGT markets--federal and nonfederal--is emphasized. The primary focus is on the federal AGT market, and the following implications of both U.S. and foreign governmental roles for U.S. firms are explored: high business development costs, frequent lapses in program continuity, high levels of dependence on local decision making in spite of federal funding for system planning and implementation, and disparities in levels of support for AGT research and development from country to country.

The present status of the United States automated guideway transit (AGT) industry depends strongly on a history of activities that goes back at least a quarter century, when General Motors was conducting in-house research on automated highways and a number of other firms were beginning to think about systems involving driverless vehicles on separate guideways. As shown in Figure 1, at least six of these firms had committed significant resources to AGT by 1965 and two firms--General Motors and Westinghouse--were operating test or demonstration systems. By 1970 the number of firms had almost doubled and three systems were in regular use at recreation centers--Disneyland in California, Sacramento's California Exposition, and Hershey Park in Pennsylvania.

As shown in Figure 2, federal involvement in supporting AGT systems began in a significant way in 1963, when UMTA's predecessor agency provided a grant to Westinghouse to assist in the construction of the South Park test facility in Pennsylvania. Soon thereafter, this agency, now within the U.S. Department of Housing and Urban Development (HUD), funded a series of studies, culminating in the report entitled Tomorrow's Transportation, New Systems for the Urban Future (1), which was submitted by President Johnson to Congress in 1968. This report contained conceptual studies of a number of automated passenger systems and provided significant impetus to both industry and government throughout the 1970s.

Since the establishment of UMTA within the new U.S. Department of Transportation (DOT) in 1968, UMTA's role in supporting advanced technologies has focused on three major activities: research and development (R&D), demonstration, and implementation. The R&D component has emphasized advanced systems design and testing, including the dual mode feasibility studies carried out between 1973 and 1975 and what began as the High Performance Personal Rapid Transit (HPPRT) program in 1974. Preliminary studies of dual mode transit system feasibility were carried out by General Motors, Otis, and Rohr. Each proposed to continue development of systems that would be under driver control for passenger pickup and distribution functions and under automated guideway control for the line-haul portion of their routes. Because of a lack of DOT funds, however, the dual mode program was halted at the conclusion of the preliminary studies.

In the HPPRT program, later renamed Advanced Group Rapid Transit (AGRT), three firms (Boeing, Otis, and Rohr) were funded, beginning in 1974, to develop a third generation of automated systems that would go beyond the sophistication and flexibility of the existing systems. This program has continued, with some significant funding gaps and changes in focus, to the present. Test track experimentation by the two firms remaining in the program (Rohr discontinued its involvement both in the AGRT program and in automated systems development in 1978) is currently funded through 1984; however, the emphasis is now placed on advanced control subsystems rather than on complete vehicle-control guideway systems.

UMTA's involvement in programs structured to demonstrate AGT systems in various environments began with its funding of TRANSPO '72, an exhibition of America's transportation capabilities held at Washington's Dulles International Airport. In the AGT area, funds were provided to four firms (Bendix, Ford, Otis, and Rohr) to implement systems that operated during the exhibition and to continue their testing after it closed.

A much more ambitious demonstration program began in 1975, when U.S. cities were invited to submit proposals for Downtown People Mover systems, which would demonstrate available AGT systems in dense urban environments. In 1976 six cities were authorized to carry out system planning activities. Cleveland, Houston, Los Angeles, and St. Paul also received promise of new construction funds if the planning results showed automated circulators to be warranted. Detroit and Miami were encouraged to use previously committed fixed guideway funding from UMTA for DPMs.

As local planning activities were carried out, three cities--Cleveland, Houston, and St. Paul--decided not to continue in the program. In 1981 when the DPM program was suspended by UMTA, Los Angeles halted the planning for its system. Partially because both Detroit and Miami were not dependent on commitments originating in the DPM program and partially because of strong congressional support, they were able to proceed toward system implementation.

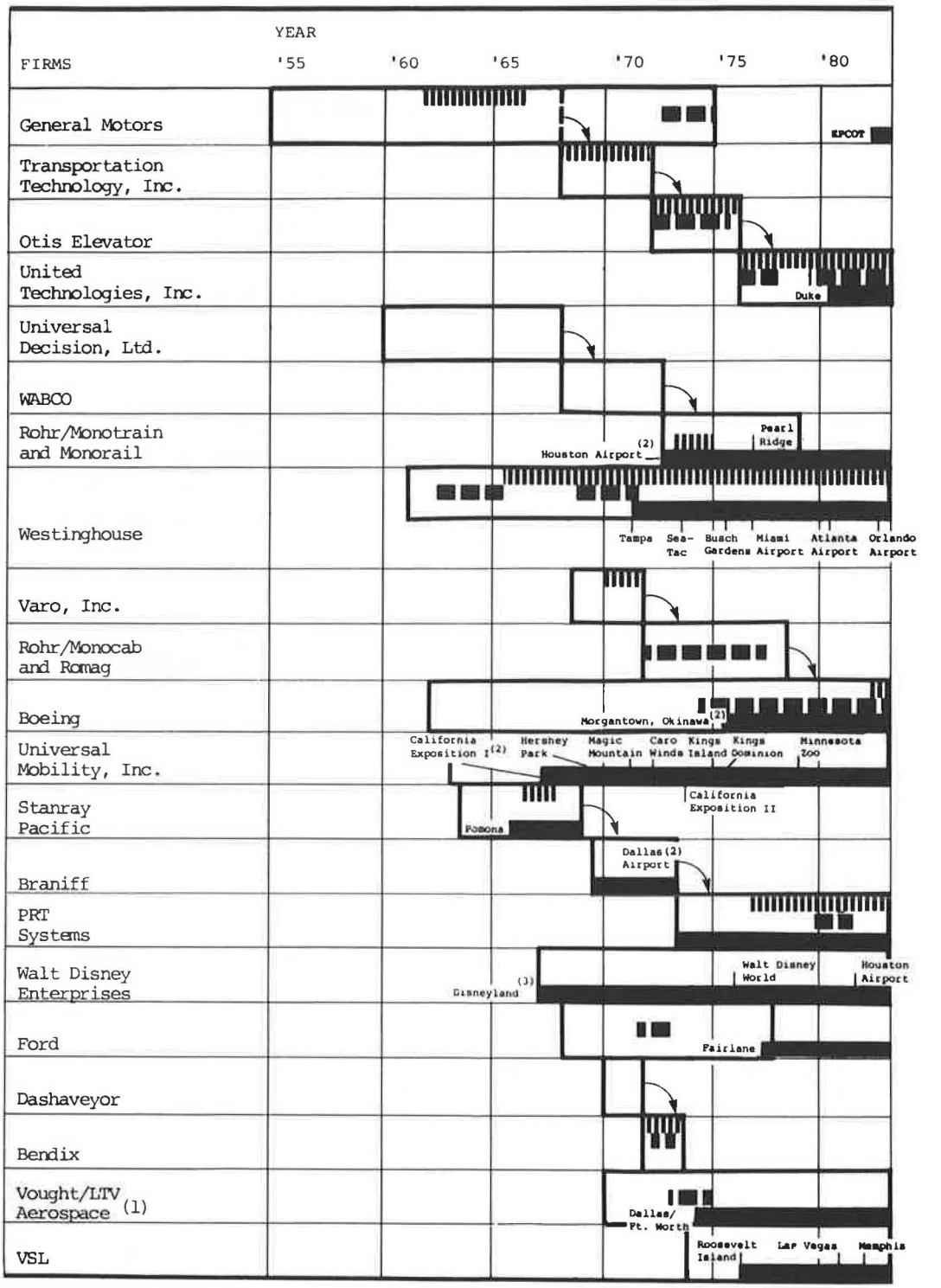

FIGURE 1 Summary of major involvements by U.S. firms in the AGT industry.

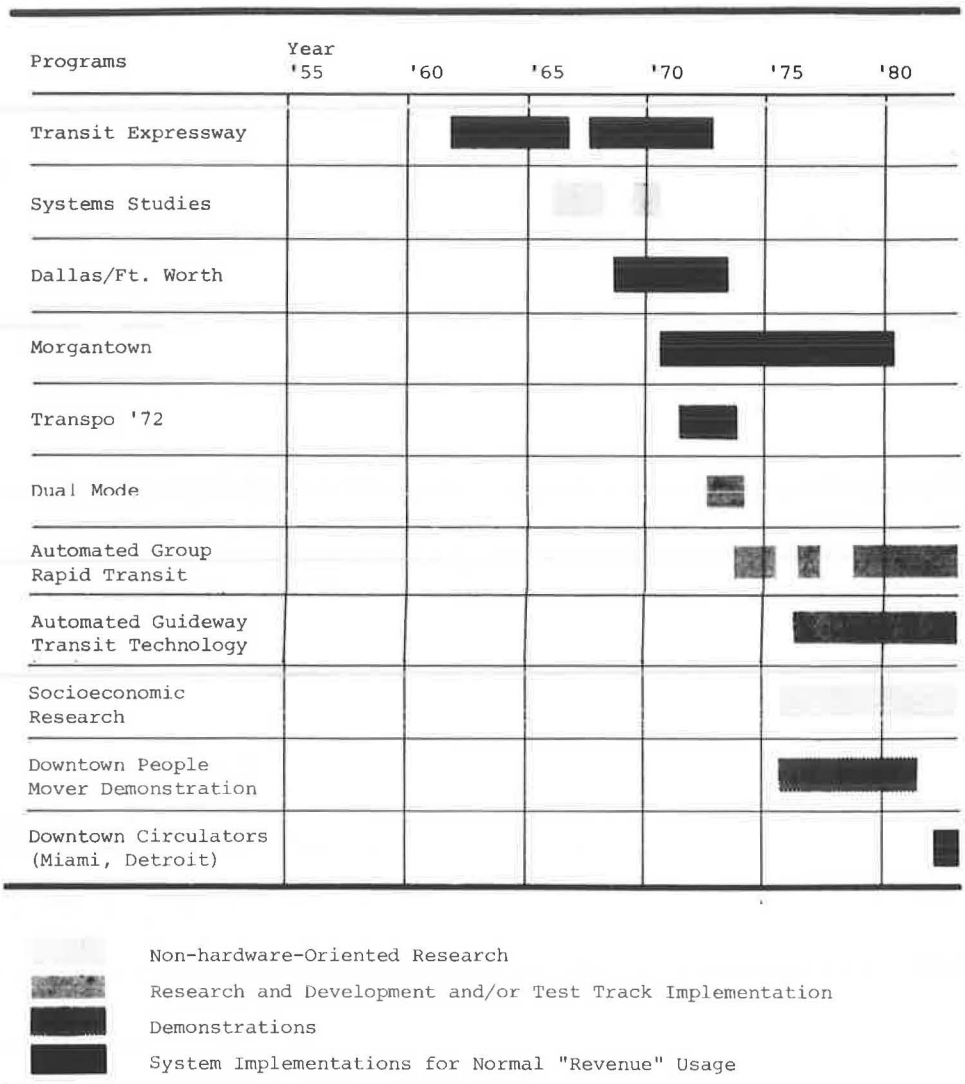

FIGURE 2 Summary of major HUD and UMTA AGT programs.

These cities have selected UTDC (a Canadian firm) and Westinghouse as their system suppliers and have proceeded with final engineering and construction activities. Thus what began as the DPM Demonstration Program is continuing as an UMTA-funded automated system implementation activity in both Detroit and Miami.

UMTA's previous involvement in AGT implementation activities was mainly through its support of the Dallas-Fort Worth Airport system (AIRTRANS, developed by LTV Aerospace) and the Morgantown PRT system for which Boeing had system management responsibilities. Construction of both systems began in 1970; UMTA's role was quite small in the AIRTRANS system implementation effort, but UMTA was the major funding source for the Morgantown system.

UMTA's major support of AGT activities since 1970 has not been the only impetus to progress in this technological area. During the same period significant progress has been made in implementing systems in restricted environments such as airports, recreation centers, and other private high-activity locations. As of 1983 there were at least 25 systems in normal operation, and additional ones are being built. At least five others were built but never placed in normal service, replaced by more advanced systems, or otherwise removed from service. The number of firms continuing to offer such systems, however, has declined significantly.

Three firms--Disney, Universal Mobility, Inc. (UMI), and VSL--continue to offer airport or recreation center systems, but only one U.S. firm, Westinghouse, is now actively involved in supplying systems for public transportation services. (UTDC, a Canadian firm, is currently the only foreign firm that has sold a system in the United States--the Detroit People Mover. Thus UTDC has been included in this survey of firms involved in the U.S. AGT market. A number of other foreign firms also have an interest in the U.S. market but have not been considered in this analysis except as potential competitors to the U.S. firms.)

Two firms--Boeing and Otis--continue to be involved in AGRT research and development. Both have plans for future marketing of the control subsystems they are now beginning to test under more realistic conditions than the laboratory tests to date have allowed. Two other firms retain marginal levels of AGT market activity--Budd as a marketer for the foreign manufacturer of a magnetic levitation system and LTV, which retains the option to become active again if future market conditions warrant.

This settling out of the AGT supplier market is a phenomenon common to many technological areas (for

example, automobile manufacturers in the period from 1920 to the present), but it has been highly dramatized by the speed of the process for AGT. Two other factors have further highlighted this rapid narrowing of the number of suppliers:

1. The federal government, through UMTA, has invested a significant amount of money--more than $200 million--in AGT-related research, demonstration, and implementation. One explicit goal of this funding has been to support enough firms to allow a competitive AGT market to exist.
2. Foreign suppliers in France, Germany, Japan, and Canada have taken the lead in implementing AGT systems to the extent that they are now often considered to have a competitive advantage over U.S. firms in spite of the "Buy America" restrictions imposed on UMTA-funded procurements. In some instances, U.S. firms have obtained licenses to market foreign systems in this country.

The purpose of this paper is to provide information required to understand why these rapid changes have occurred in the U.S. AGT industry and where the industry is likely to go in the near future. The focus is on the industry as it is viewed by the suppliers themselves; these views were obtained from both published materials and personal interviews with representatives of nine of the past, present, and potential suppliers. The material here has been drawn from a report to UMTA (2), which also includes summaries of these personal interviews.

This study also draws on, and provides an update for, two previous studies prepared by the Office of Technology Assessment in 1975 and 1979 (3,4). The analysis is based heavily on events since 1978, especially as these have been influenced by activities of the DPM Demonstration Program and the AGRT program. The DPM program reached its peak of activity, from the system suppliers' viewpoint, in 1980 just before the end of the program in early 1981. The AGRT program has continued since 1975 but has experienced a number of slowdowns and redirected activities.

The remainder of this paper is organized into four sections: the nature of the AGT market; the types of industries likely to become involved in the public AGT market; the dynamics of entry to and exit from the AGT industry; and prospects for the future of the industry.

THE NATURE OF THE AGT MARKET

Even at the peak of involvement by U.S. firms in AGT, only about 12 producers were active. To date, buyers and potential buyers are similarly limited--a few airport authorities, recreational park developers, and cities or transit agencies. Furthermore, when the AGT products available from the U.S. firms are carefully classified, it becomes clear that there are really two AGT markets--one in which DOT is not involved directly and one in which it has been the primary system buyer, either directly or by providing the funds to be used by other entities to purchase systems.

The first AGT market may be termed the nonfederal market; it is represented by all but one of the AGT systems now operating in the United States--those at airports, hotels, shopping and medical center complexes, and amusement and recreational parks. With two exceptions (Westinghouse and Otis), the suppliers of these systems have not been involved in both the first and second AGT markets. None of the firms involved solely in the nonfederal market--UMI, VSL, and Walt Disney Enterprises--appear to be interested in the second AGT market. None chose to bid to provide the DPM systems in Los Angeles, Detroit, and Miami, for example, although each has been a source of two or more nonfederal systems successfully operating on a continuing basis.

This market could be subdivided further into (a) the amusement and recreational market served by and selling to private firms in the recreation ride industry and (b) the other nonfederal market served by some of the firms that are also involved in the federal market. This latter market includes airport systems that require no federal support because typically they are locally funded by airport revenue bonds.

The primary focus in this paper is on the second AGT market in which the U.S. government, specifically UMTA, is the sole direct or indirect system buyer. This market has many similarities to markets for military and space equipment and, in recent years, those for public bus and rail vehicles. This market includes applications of AGT technology to public transportation outside of activity centers; it is represented currently by only one operating system--that in Morgantown.

There are a number of implications of the government's dominance in this market that are highly relevant to the present status and future prospects of the AGT industry. These implications include

- Business development costs,
- Program continuity,
- Local decision making, and
- Foreign competition.

These implications are discussed in the subsections that follow.

Business Development Costs

To protect the interests of taxpayers and to promote healthy competition, the federal government has developed complex procurement procedures that significantly affect the costs of obtaining government contracts. Because allowable overhead rates designed to cover these (and other) costs have been established by the federal government, firms that are successful in obtaining contracts are able to recover many of these costs. However, firms must pay these costs up front, and must be prepared to incur the additional costs required to meet the accounting and record keeping standards specified by the government. Furthermore, no allowances are made to cover any of these costs incurred by firms that compete unsuccessfully for federal contracts.

Clearly, firms that have not previously carried out government contracts are at a distinct disadvantage. As discussed in the next section, this disadvantage has prevented many firms not previously involved in government work from entering the AGT market. Conversely, many firms active in the military and aerospace industries found it relatively easy to enter the market.

Program Continuity

The maturation of a high-technology market involving large costs per system must take place over a long time period--decades rather than years. This time scale is hard to reconcile with that of the federal government where Congress changes to some extent every 2 years and the Executive branch, including the major policy makers within the U.S. Department of Transportation, has changed at least every 4

years in recent times. Funding gaps in the AGRT program and the curtailment of the DPM Demonstration Program are two examples of this discontinuity.

As in many other areas of government, the UMTA technical staff has found it impossible to keep the development of the AGT market on a sufficiently fixed course in the face of conflicting legislation by Congress and the intentions of the Administration. This aspect of the AGT market is a more severe manifestation of similar problems in the military and space areas. Clearly, the latter enjoy a greater consensus concerning their desirability and importance than AGT does.

From the viewpoint of the suppliers, these discontinuities and redirections represent added risks and higher potential costs. Only when these factors can be minimized by being relatively unimportant components within a large total volume of business are firms likely to remain involved in the AGT market.

Local Decision Making

During the abbreviated life of the DPM Demonstration Program, a new feature of the AGT market became increasingly evident, i.e., the importance of local area decision making. In spite of UMTA's continuing importance as a supplier of funds for AGT systems, plans to implement DPMs had to be approved by the local areas involved. In this regard the AGT market is quite different from the markets for military and aerospace systems. Between the announcement of new funding for DPMs in four cities in 1976 and the end of the program in 1981, three of the local areas had decided to drop out and an elected official from the fourth was instrumental in getting its DPM funds suspended at the federal level.

Clearly, new standards of public participation for all transportation projects and current limitations on local funds, when added to long-standing characteristics of local area governments, such as avoidance of risk and uncertainty and preferences for tried and true approaches, indicated important newly revealed limits on the size of the AGT market. These indications were rapidly understood by the firms active or potentially active in the AGT market.

Foreign Competition

A final factor related to the important role of the government in the AGT market is the impact of foreign competition on the U.S. AGT industry (4,5). In recent years, it has become clear that firms in Canada, Germany, France, and Japan have reached levels of AGT technological advancement equal to, or greater than, that of firms in the United States. Also it is accepted generally that the high rate of foreign progress is closely related to the extent to which foreign governments support both AGT research and development and AGT sales in the United States. Foreign governmental support appears to be concentrated on fewer firms per country (except in Japan), to emphasize implementation assistance more than in the United States, and in many instances to provide funding specifically to finance exports. This approach is different from that of the United States and originates, to a large extent, in a basic difference in philosophy between U.S. and foreign governments concerning the relationship of government and individual firms and in the level of support that should be provided to a given market. From the perspective of AGT firms, however, the result is seen as a worldwide market in which nearly all non-U.S. firms have significant advantages not available to domestic firms. This is true even though "Buy America" legislation penalizes foreign suppliers bidding on U.S.-funded transportation systems.

Experience has shown that the 10 percent cost advantage given to U.S. firms competing with vehicles or systems that represent less than 50 percent of domestic materials or costs is often more than offset by lower bids from foreign firms. In the case of the DPM system procurements, U.S. firms obtained no advantage from "Buy America" provisions, because the value of guideways and other civil construction components could be counted toward the 50 percent domestically originated requirement. As a result, foreign firms could import complete or nearly complete vehicle and control systems, to be combined with domestic civil construction components and final assembly, and avoid the penalty provisions of the "Buy America" act.

THE NATURE OF FIRMS IN THE AGT INDUSTRY

In general terms, the firms now, or previously, involved in the AGT industry chose this role based on the resources they had available for the required research, system development, and business development; on their areas of experience and expertise; and on their expectations for the future of the AGT market.

The large level of funds and facilities required for success in the AGT market, combined with the technological risks and uncertainty of the market, effectively have prevented new or small firms from using outside capital to become established in the AGT market. Table 1 gives a list of firms that are now or previously have been active in the federal AGT market. In addition to these firms, four small firms--Alden, Mobility Systems and Engineering, PRT Systems, and Uniflo--have at various times been active in the AGT market. Alden and Uniflo have withdrawn from the industry; Mobility Systems and PRT Systems remain somewhat active in AGT system development and marketing but neither has sold any systems.

Instead a set of large firms or firms with unusually large internal cash funds available to commit to AGTs have dominated the industry. This is borne out by the second column of Table 1, which indicates that the lowest annual revenue in 1980 for any firm in the AGT market was $517 million. In 1980 these firms had revenues large enough to be ranked among the 500 largest industrial firms in the United States (ranging from 2nd to 425th). By contrast, some of the firms involved only in the nonfederal market are quite small.

Six columns in Table 1 are used to explore the impacts of previous experience and expertise on a firm's decision to enter the AGT market. Four of these columns show the involvement of a firm in the three areas of expertise chosen as potentially relevant for developers of AGT systems:

1. Experience in producing either complete vehicles or major components used in vehicle construction.
2. Experience in developing vehicle control systems involving some degree of automation.
3. Experience in constructing complete transportation systems involving some degree of automation and including vehicles, control systems, and guideways.

The first two areas of expertise, along with guideways, represent the three major subsystems of a complete AGT system. Guideways were not a primary area of expertise for any of the firms considered as

potential participants in the AGT market, although some of the firms do have divisions dealing with general industrial or civil construction activities. Usually, however, these divisions had a low level of involvement in the AGT development programs of their respective firms. The development of complete transportation systems is the area of expertise most closely allied with the AGT industry and also is a common characteristic of the more active AGT firms.

The last three columns of Table 1 give the status of the current role of each firm listed. Four firms with experience in developing complete transportation systems in related fields are currently active in the industry. In addition, with the exception of one firm, each of the active firms has the experience gained in developing previously sold AGT systems. The other is involved to the extent of forming a joint venture for marketing systems produced by other firms. Of the firms that have withdrawn, all possess related experience in developing vehicle components or (more commonly) complete vehicles and two deal with control systems, but none have related experience in the development of complete systems.

Clearly, previous experience in the high-technology aspects of transportation systems has been a bigger factor in a firm's successful involvement in the AGT industry than its ability to build vehicles. Furthermore, previous experience in integrating the various subsystems into a complete automated system has been more important than simply having expertise in one or both of the two major subsystems--vehicles and control capabilities.

The fifth column under the general heading of related experience in Table 1 provides a general statement of the major activities of each of the firms. The few firms that are representative of firms whose major activity is vehicle production--either rail or automotive--have had the smallest role in the past in the AGT industry, and except for Budd's remaining joint venture marketing role, have all withdrawn from the AGT field. The largest group of firms involved are those in the aerospace industry, but only one of these remains.

Other firms remaining in the industry represent a mixed bag of major activities from entertainment and recreational parks (Disney) to materials transportation and heavy construction (VSL). Two specialize in passenger transportation systems; one of these is based in Canada (UTDC) and one operates exclusively in the private recreational park AGT market (UMI). The only U.S. firm currently active in the public market (Westinghouse) is a large electrical equipment firm that has also dominated the airport systems segment of the nonfederal market.

The levels of involvement of the firms remaining in the AGT market are strongly related to the relative size of their resources. The smaller firms have limited their involvement to the nonfederal market. Only the large firms have become involved heavily in UMTA-funded R&D and in selling systems in the federal market. Of course, this correlation is not entirely due to management decisions: a number of firms have bid on AGT work, including system construction in the public AGT market and participation in UMTA-funded R&D, but with limited success.

A final important factor in a firm's decision to participate in the federal AGT market is summarized in Table 1 in the last column under the heading of related experience. This column indicates the extent of each firm's prior experience in bidding for and carrying out major U.S. government procurements, or local procurements, which are partially funded by UMTA. The only firms without this experience are UTDC (a corporation with major funding by the Province of Ontario and with the major share of its activities involving public sector markets in Canada), VSL, and Disney. A fourth firm, UMI, has had some involvement in UMTA-funded R&D but has not become active in the federal AGT market. The correlation between prior experience with federal procurements and past or present involvement in the federal AGT market is very strong.

This section can be summarized by giving profiles of the typical firms with past or present involvement in the AGT industry. When all such firms are considered, the typical firm is a large Fortune 500 aerospace firm that has prior experience with government procurements that involved developing and constructing vehicles or complete automated transportation systems. In almost every case, the firm's involvement in the AGT market represented a small fraction of total revenues and resources.

When only those firms that remain in the federal AGT market are considered, the typical firm continues to be large and have prior government experience; however, it is probably not an aerospace firm and is more likely to have prior experience in developing and constructing complete systems. Finally, the typical firm currently involved in the nonfederal AGT market is a smaller firm without prior experience in either major transportation systems or components, or in government procurements.

THE DYNAMICS OF ENTRY AND EXIT IN THE AGT INDUSTRY

To explain why a large number of firms became active in the AGT industry in the period from 1965 to 1970 and why many of these withdrew over the past 5 years, the characteristics of the firms and the environment in which they found themselves over the past 15 years must be considered. Figure 3 shows the rate of change, in constant dollars, of the U.S. economy for the period from 1967 to 1982. Growth rate peaks occurred roughly every 4 years, in 1968, 1973, 1977, and 1981. The range of peak growth rates of the gross national product (GNP) during these years was +1.9 to +5.8 percent, and the average peak rate was +4.5 percent. The intervening low points were periods of real decline in total economic activity. The range of low growth rates was -1.8 to -0.2 percent, with an average of -0.9 percent.

A time series analysis of total revenues by individual firm reveals similar patterns. The highs and lows of the firms oriented more toward the consumer and the private sector (Westinghouse, Otis, GM, and Ford) tended to coincide with the highs and lows of the GNP. The firms oriented toward the public sector and others involved in the AGT market tended to have wider and more frequent fluctuations in revenue growth that were less likely to match the timing of the GNP pattern. In the 1968 to 1975 period, however, most firms were passing through the same low-high-low growth sequence shown for the GNP in Figure 3. Conversely, in the 1980 to 1982 period, most AGT firms were passing through low growth periods without the slight improvement in 1981 experienced by the economy in general.

A second important external factor for the AGT firms oriented toward the public sector was the pattern of government expenditures for their products during the period from 1968 to 1982. In the beginning of this period in which the Vietnam war ended and the U.S. program to put men on the moon was completed, aerospace and military supplier firms were experiencing significant reductions in the scale of their government work. Significant growth in this source of revenue was not to occur until 1981-1982, when the government's military spending levels greatly increased.

TABLE 1 Summary of Characteristics of Major Firms with Past or Present AGT Involvement

		Related Experience						AGT Involvement		
		Vehicles								
Firm	1980 Revenue ($ x million)	Components/ Complete Units	Types	Control Systems	Complete Transportation Systems	General Classification	Major US Government Contractor	Past Role	Present Role	Major Activities
Budd (Thyssen AG)	1,285 (a) (15,493)	Both	Rail pass & freight; highway trailers	--	--	Freight Vehicles	Yes	Joint Venture	Joint Venture	With UMI previously; now with foreign firm to market Maglev systems
Pullman (Wheelabrator-Frye Industries)	3,210 (b)	Complete	Rail pass & freight; highway trailers	--	--	Freight Vehicles	Yes	Joint Venture, R & D	Withdrawn	With Bendix for Las Vegas system; never built
General Motors	57,700	Complete	Autos, trucks buses, locomotives	--	--	Automotive	Yes	R & D	Withdrawn	Air cushion technology, dual mode; constructed system for its own EPCOT display
Bendix	3,895	Components	Autos, aircraft, military, space	Military, space	--	Automotive/ Aerospace	Yes	Demonstration system	Withdrawn	TRANSPO '72
Rohr	517	Both	High speed ocean vessels; aircraft & space components	--	--	Aerospace	Yes	Demonstration system tem, R&D	Withdrawn	TRANSPO '72, dual mode, AGRT
Ford	37,100	Complete	Autos, trucks	Military, space	--	Automotive	Yes	Demonstration systems, non-federal market systems	Withdrawn	TRANSPO '72, two systems built
LTV	8,010	Both	Aircraft, military & space vehicles; aircraft components	--	--	Steel/ Shipping/ Aerospace	Yes	Non-federal market system, DPM bidder	Inactive, re-entry a possibility	AIRTRANS; Los Angeles DPM bid
Boeing	9,426	Complete	Aircraft, military, space	--	Military	Aircraft/ Aerospace	Yes	Federal market system	R&D	Morgantown, AGRT

Otis (United Technologies, Inc.)	1,183 (c) (12,399)	Complete	Elevators (Auto components, aircraft)	Military	Elevators, escalators	Elevators/ Aerospace	Yes	Demonstration system, DPM bidder in joint venture, non-federal market system	R&D, some activity in non-federal market	TRANSPO '72, DPM bids with MATRA, Duke University system, AGRT
UTDC	--(d)	Complete	Rail Transit	--	--	Passenger Transportation	No(e)	Federal market (DPM) system sale	Active in US federal and Canadian markets	Detroit DPM
Disney	915	--	--	--	--	Entertainment	No	Non-federal market systems	Active in non-federal market	1 airport, 2 recreation area systems
VSL (Losinger, Ltd.)	--(f) (22)	--	--	--	Cable/ materials handling	Cable Transportation	No	Non-federal market systems	Active in non-federal market	3 private cable systems
Universal Mobility	--(d)	--	--	--	--	Recreation Transporta-	No(g)	Non-federal market systems	Active in non-federal market	8 recreation area systems
Westinghouse	8,514	Both	Elevators, escalators; rail (intercity & transit); military, space components	--	Elevators, escalators	Electrical Machinery	Yes	Non-federal market systems, federal market system (DPM) sale	Active in federal and non-federal markets	1 recreation area, 5 airport systems; Miami DPM

Note: The firms are listed in increasing order of present or previous involvement in the AGT industry. Dashes indicate not applicable.

(a) Revenue shown for 1977, last year of independent operations. The 1980 revenue of the parent firm, converted to US dollars using average 1980 exchange rates, is shown in parenthesis.

(b) Revenue shown for 1979, last year of independent operations.

(c) Revenue shown for 1975, last year of independent operations. The 1980 revenue of the parent firm is shown in parenthesis.

(d) No information on revenue available.

(e) UTDC does have extensive experience as a contractor with Canadian governmental units.

(f) No information available on VSL revenue. The 1979 revenue of the parent firm, converted to US dollars using average 1979 exchange rates, is shown in parenthesis.

(g) Limited US Government contracts for AGT R&D.

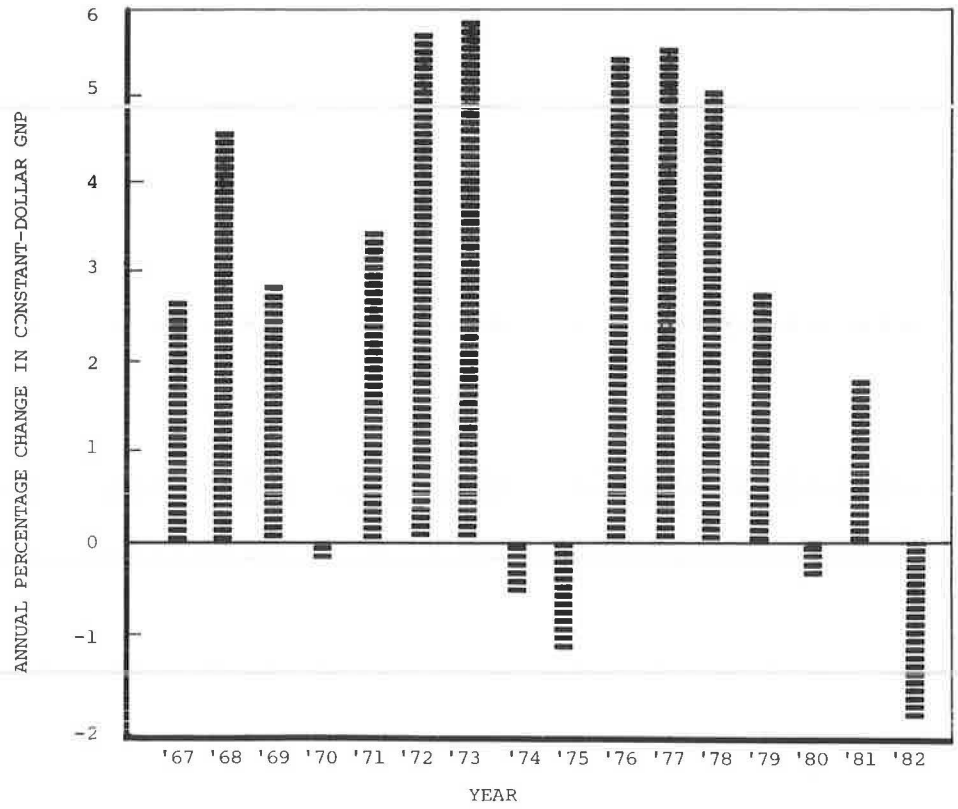

FIGURE 3 Gross national product annual growth rates, 1967-1982 (*5*).

The decisions of individual firms now or previously in the AGT industry, especially the public sector portion of the industry, can be readily understood. In the years between 1968 and 1972 many of these firms were looking back on a decade of above-average growth that provided ample funds for new ventures as well as for research and development. At the same time they were experiencing the prospects of reduced revenues in their aerospace and military systems activities. As they looked for new market areas, it was natural for them to choose AGT systems for a number of reasons:

1. They expected their experience in developing and building complete transportation systems for aerospace and military applications to be highly transferable to AGT systems.
2. Their experience gained by operating in the arena of government procurements provided them with a base of administrative support that also could be easily transferred to the new area.
3. Following the work done on the 1968 HUD report (3) and the creation of UMTA in the same year, this new agency was highly receptive to the idea of developing AGT systems. During this period, this receptiveness was expressed, among other ways, in a steadily increasing level of funding for AGT research, development, and demonstration activities. Firms considering entry into the AGT industry were thus likely to have high expectations for continuing future government support.

Although not all firms entering the AGT industry during this period fit exactly into this pattern, many did, including LTV Aerospace, Rohr, Bendix, and Boeing. Other firms, which had some of the characteristics described above, became interested in what appeared to be a new and promising industry. They included several large consumer-oriented firms with resources available for internal investment (General Motors, Ford, Westinghouse, and Disney) and, in limited ways, rail vehicle suppliers (Budd and Pullman). Also a number of new ventures were formed specifically to enter the new market, often as spin-offs of AGT activities in larger firms: Transportation Technology (later purchased by Otis), Universal Mobility, PRT Systems, Uniflo Systems, Alden Self Transit Systems, and Mobility Systems and Equipment.

By 1979 changes had taken place in each of the factors discussed previously. Most of the firms with some AGT involvement were looking back on more than 6 years of significant fluctuations in revenues, profits, and costs, most of which were related to the 1973-1974 and 1979 energy crises. Corporate funds for research and development and for new ventures were much scarcer than they had been in the earlier period. The level of federal funding available for the AGT industry was significantly reduced from that expected between 1968 and 1972 and was frequently only available on an intermittent basis.

The only major federally funded AGT system that had been completed was Morgantown, and the DPM program had not reached the stage of selecting system suppliers. Two of the originally selected DPM cities, Houston and Cleveland, had decided to withdraw from the program, and local opposition was causing delays in two others, Los Angeles and St. Paul. Detroit and Miami remained in the program; however, in these cities the preliminary engineering phase (to be completed prior to selection of a system supplier) was a lengthy process. It became clear to each of the firms involved that the growth of the public AGT market would continue to be much slower and its ultimate potential much lower than they had previously expected.

Another negative factor arose at about this time--the emergence of significant levels of foreign

competition. System development, demonstration, and implementation activities in France, Germany, Japan, and Canada were accelerating. Based on the successes of foreign firms in winning U.S. contracts to supply rail transit vehicles, U.S. firms could expect tough foreign competition for the few public AGT systems that would be built.

The AGT industry was also affected by the bad press associated with the significant start-up problems and higher-than-expected costs of such systems as AIRTRANS and Morgantown. In both cases, the start-up problems were eventually overcome, but the damage to each system's reputation was hard to repair. These damages spilled over to the entire industry and clearly had a significant impact on decision making both at the local level and in Congress.

For a number of firms, the potential market for their systems appeared to be further reduced: the specifications being developed for the DPM systems called for large vehicles and the ability to form multivehicle trains. A number of existing systems could not meet these specifications without major new development work. Neither the funds nor the time required for this work was available.

As these negative factors became clear to the firms in the AGT industry, a number decided to withdraw from the public AGT market. These withdrawals began to occur before 1975; by 1979 five of the firms had withdrawn from the market.

Although the status of the AGT market presented a discouraging picture in 1979, some positive elements existed and these have subsequently been strengthened. The firms remaining solely in the nonfederal AGT market--Disney, UMI, and VSL--have shown no signs of withdrawing, and have continued to sell and implement systems for airports, recreation parks, and hotel complexes. The two firms active in both federal and nonfederal markets--Otis and Westinghouse--have sold private systems recently and have continued their involvement in UMTA-funded R&D, downtown circulation development, and system marketing. In addition, Boeing continues to be active in AGRT R&D; and LTV, although presently inactive, retains the option of returning to an active role. As of mid-1983 the AGT market outlook was brighter than it had been for several years.

The initial uncertainty associated with changing federal priorities has been reduced as federal funding has been continued for the Detroit and Miami downtown circulator systems and for a significant portion of the AGRT R&D program. Firms suggesting at the end of 1981 that their withdrawal from the industry was a significant possibility are now planning to market control subsystems that represent spin-offs of their UMTA-funded R&D. It has become clear, however, that at least one foreign firm, UTDC, will continue to be an active competitor in the U.S. market; its contract to build the Detroit circulator plus its sales of two systems in Canada virtually assure this.

FUTURE PROSPECTS FOR THE AGT INDUSTRY

It would be a mistake to assume that the present relatively stable, if significantly reduced, level of involvement of firms in the AGT industry will continue indefinitely. The rapid rates of change observed in the past 15 years may not continue into the future, but further changes are sure to occur. Predicting whether the overall effects will be a stronger or a weaker industry, with more or fewer firms involved, is difficult under any circumstances. If probable trends in the various relevant factors discussed previously are considered, however, educated guesses can be made with increased assurance that they will be borne out by future events. Before reaching conclusions on the future of the AGT industry, these various trends will be reviewed.

Positive Trends

The GNP growth rate is currently moving upward and is expected to continue to do so for more than a year. This growth is likely to be reflected also in the revenues and profits of the firms in the AGT industry. These trends can be expected to strengthen the AGT industry in two ways: the firms now involved will be less likely to withdraw and the level of sales activity in the nonfederal AGT market is likely to increase. Another positive trend is that the public reputation of AGT systems has improved as the early start-up problems tend to be forgotten and the continuing successful operations of the existing systems become more generally known. A final positive trend is the realization by AGT firms that the control subsystems and other AGT components they are developing and testing, such as electric motor speed controls for conventional rail systems, may represent significant spin-offs into potentially large related transportation markets.

The existing trend in the demand for AGT systems represents a factor that can have mixed impacts on the AGT industry. Interest in building nonfederally funded systems appears to be increasing slowly as the general economy improves. There is likely to be a wait-and-see attitude in the federal market until the systems now being constructed in Miami and Detroit have proved themselves. If these systems are implemented without major operational or financial setbacks, and are well accepted by the local residents, the demand for similar systems in other areas will begin to materialize. Any setbacks that occur will undoubtedly be highly publicized; and even if they are subsequently overcome, they will inhibit the demand elsewhere.

Negative Trends

The generally low levels of corporate profits over the past 2 or 3 years mean that there are now reduced levels of internal funds available for R&D. As a result, currently involved firms will continue to be cautious about expanding their investment in AGT systems, and other firms will be highly unlikely to consider entering the industry.

Major increases in federal funding for AGT programs are generally recognized to be quite unlikely. Congress has kept the existing R&D and implementation activities going at reduced levels, but high federal deficits and many competing programs are likely to keep AGT funding levels from growing significantly.

Trends in government policies are also likely to be negative factors in the foreseeable future. Fiscal constraints will be hard to overcome even if the current administration, or a future one, were to change its policy on funding new transportation technologies. Also, the levels of government funding in the industry's competing areas of aerospace and military systems are not likely to decrease drastically.

A final negative factor is the reality of continued strong foreign competition. Although the present demand for AGT systems remains lower in all countries because of the recent worldwide economic recession, foreign firms have been successful in the

U.S. rail transit vehicle market and in competition for the Detroit downtown circulator. As a result, foreign firms can be expected to continue to compete actively for both federally and nonfederally funded U.S. systems in the future.

Summary

When these positive and negative trends are considered together, they suggest that the AGT industry will remain at its current reduced level for the foreseeable future. The market for nonfederally funded systems may grow slowly but probably not enough to attract new firms. The uncertainties of the continuation of a market for federally funded systems will surely keep new firms from entering this market, but the existing firms are likely to remain to compete for any new work that does materialize because they will continue to be involved in the larger closely related nonfederal and foreign markets.

The firms now involved in the AGRT R&D program will continue this role as long as federal funding is available and will also look for opportunities to expand into sales of related products. However, because the objectives of the present R&D activities are control subsystems rather than complete AGT systems, these firms are not likely to return to the complete-system market. Also, they will be seeking to broaden their product applications to include conventional rail transit vehicles, aerospace systems, and so forth.

There are likely to be both positive and negative impacts on the U.S. AGT industry because of the expansion of activity in the market by foreign firms. The number of AGT system sales by U.S. firms may be reduced, but many of the components of these systems will be produced in the United States, often by the same firms marketing U.S. systems. In addition, the formation of multinational joint ventures to assemble and market foreign systems in the United States is likely to continue, providing a way for both present and new U.S. firms to keep involved in the AGT industry.

It must be emphasized that these expectations apply to the foreseeable future, based on observed trends in each of the factors believed to be important to those deciding on corporate strategies in the AGT industry. It is only possible to speculate on what might occur in the more distant future. Cycles of general economic growth and decline are sure to continue, but their timing will always be highly uncertain. If the current growth pattern is sustained for a number of years, potential U.S. AGT firms will again have the resources required to invest in the industry. Whether they will do so, and the extent to which they will focus on the federally funded portion of the market, will depend strongly on their perception of whether the demand for AGT systems is growing, on how the related markets for aerospace and military systems are changing, on stated federal policies concerning support for AGT development and implementation, and on the continuing and stable existence of programs funded by UMTA in these areas. Clearly, significant changes from current trends in many of these areas will be required if the AGT industry is to experience a major expansion. Furthermore, it is clear that the federal government, and UMTA in particular, will have a high level of influence on any changes that occur in these trends, and thus in the AGT industry, in the coming years.

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Much of the information presented in this paper was obtained in meetings held with representatives of each of the firms that are potential, past, or present participants in the North American AGT industry. The authors wish to thank each individual interviewed for their helpful assistance in the study.

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All views expressed in this paper are those of the authors and not necessarily those of the federal government or of the representatives of AGT firms who were interviewed.

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Current Use of Public Involvement Techniques by State Highway Agencies

FLORENCE MILLS

ABSTRACT

In 1983 a 5-year-old survey of citations by state highway agencies of their use of public involvement techniques was updated. One additional technique was added to the original 30. The 31 techniques were analyzed by (a) the stage at which they were used in the highway project development and planning process, (b) the types of communication they engendered between the agency and the public, and (c) the size of public group for which they were used. The percent change in numbers of states citing use of a technique between 1977 and 1983 is also presented. States are continuing to move away from reliance on the public hearing as the principal vehicle of involvement to increasing use of techniques such as informational meetings, informal meetings associated with hearings, workshops, and public forums. These techniques provide a procedural setting for two-way communications between the agency and the public. This suggests that public involvement is reaching a maturity that is characterized more by effective use of known techniques than by discovery of new techniques.

Since the early 1970s, public involvement specialists have urged the use of a broad variety of formal and informal techniques to involve the public in the development of highway projects and plans. The early and flexible use of a variety of involvement techniques suited to different types of public groups and to different objectives within an overall public involvement process was considered a way to overcome the widely perceived weaknesses and rigidity of the public hearing when it is used as the sole means of involving the public (1-5). A review in 1977 of documented participation by state highway agencies (SHAs) in the public involvement processes found evidence that these agencies mentioned the use of a wide variety of involvement techniques (6). Early in 1983 a similar survey was conducted in an effort to gain a broad overview of how SHAs were involving the public in federally funded highway projects (7). This information allows a comparison over the last 5 years of the diverse techniques used by practitioners at different stages in highway project planning and development, as well as a comparison of the types of public groups in, and purposes of, the involvement process.

In the early 1970s a number of studies identified comprehensive lists of public involvement techniques thought to be, or known from experience to be, effective in transportation planning and project development (2,8-10). These studies included classifications of techniques by purpose or function in a public involvement program, descriptions of their utility at different stages of planning or project development, and generalized methods for selecting techniques to compose an involvement program. The high level of interest in research on how to involve the public was a response to the uncertainty of how to meet effectively the increased federal requirements and public demand for public involvement.

Wood, in 1977, assessed some parameters of how SHAs and the Federal Highway Administration's (FHWA) Direct Federal Program were responding to the need to use a larger variety of involvement techniques in a more flexible manner (6). Some of the considerations relevant to using these techniques were purpose to be accomplished within the public involvement process, character and size of the public group, and timing in the overall project planning and development process. Wood's analysis of State Action Plans that document each state's approach to public involvement identified 30 techniques as suitable for use. The 30 techniques were divided evenly into two groups: those appropriate mainly for one-way communication to the public and those appropriate for two-way communication with the public. Some techniques in each group were appropriate to large groups and some to small groups, and the Action Plans indicated that the public involvement techniques, as appropriate, were used in all phases of the project development and planning process. Wood concluded that the number of techniques was impressive, that there did not appear to be an uneven focus on techniques of a particular type, and that the indication of use throughout project planning and development was encouraging.

METHOD

In early 1983 the FHWA regional field staff was asked to update the printed tabulation of Wood's 1977 data to reflect current (January 1983) state written procedures on public involvement, either in the Action Plans or elsewhere. The federal requirements for Action Plans were dropped in early 1982, and some states now document their public involvement processes and procedures in other procedural manuals. All regions responded to the written survey; one region responded that there were no real changes in use of techniques by states in the past 5 years. In most regions the survey was completed by division level staff who work closely with the individual state agencies, and state staff were often consulted in the survey.

The 1983 data are analyzed using the same categories used in 1977. That is, they are classified according to how the SHA and the public interact through use of a technique as well as the size of the intended public group. Then, the types of techniques and combinations of techniques are related to their theoretical and actual patterns of use in the stages of the project planning and development process.

USE OF PUBLIC INVOLVEMENT TECHNIQUES, 1983

Typology of Techniques

A list of the 31 public involvement techniques used by SHAs and FHWA's Direct Federal Program (7) is as follows:

1. Public hearings
2. Information meetings
3. Legal notices
4. Mass media advertisements
5. Mailing lists
6. Citizens committees
7. Speaking engagements with interested parties
8. Circulation of project reports
9. News releases
10. Prehearing and posthearing meetings
11. Surveys
12. Public workshops
13. Direct contact with affected property owners
14. Response forms
15. Newsletters
16. Personal interviews
17. Audiovisual presentations
18. Public forums
19. Project field office
20. Published project development schedule
21. Telephone hotlines
22. Televised planning discussions
23. Project field review with citizens
24. Mass mailouts
25. Citizens band radio announcements
26. Resource base analysis
27. Announcement on local bulletin boards
28. Public information displays
29. Billboard advertisements near project
30. Press conference
31. Handouts distributed by local institutions

Although the survey included a request that additional techniques be added to the original 30, only one, handouts distributed by local institutions such as utilities, was added.

The 31 techniques can be divided into two types: (a) public information techniques such as legal notices or mass mailouts, resulting in a one-way transfer of information from the SHA to the public and (b) public involvement techniques such as speaking engagements or information meetings, resulting in a two-way exchange of information and views between the SHA and the public. The involvement techniques can be divided further into those that are most appropriate for large groups at a specific moment (e.g., public hearings) and those that are most appropriate for small groups over a period of time (e.g., direct contact). The information techniques can be divided into those useful for broad exposure of information to a mass audience (e.g., legal notices or mass media advertisements); for conveying information to a narrower community located near the project (e.g., bill boards located near the project of public information displays); or for disseminating information to specific individuals or groups (e.g., response forms or mailing lists).

Techniques by Project Planning and Development Stage

The 31 techniques are used as appropriate in five stages of the highway planning and project development process. These five stages are as follows:

1. Systems or programming stage. The need for a project is established at this stage. Typically, demographic, economic, travel, and land use data are collected and analyzed to forecast future conditions, which may establish the need for a plan or program.
2. Corridor or location stage. Alternative routes are discussed, and the most feasible alternatives selected. The assessment of environmental impacts and preparation of the appropriate environmental document take place at this stage.
3. Project design stage. The proposed project proceeds from approval of a generalized location through preparation of preliminary design plans to approval of design. Additional environmental impacts are analyzed and mitigation measures identified or permits obtained. Project plans are prepared for final approval at the end of this stage.
4. Right-of-way, construction, and implementation stage. This stage commences with approval of the design and includes acquiring the right-of-way as well as actual construction. Relocation and carrying out agreed-upon mitigative measures occur at this stage.
5. Occasional use. Used for techniques that appear in a written manual or procedure but are used so infrequently by the state that they are not normally associated with any particular stage.

Tables 1-3 list the techniques under each type and the number of states using these techniques for each project stage. As was apparent from a similar tabulation prepared by Wood, the states use an impressive variety of public involvement techniques throughout project planning and development. Some techniques, such as public hearings or meetings associated with hearings, are used widely by nearly every state; others are only of local significance.

Tabulation of all techniques across the project planning and development stages indicates there are more state uses of techniques for the corridor stage (590) than for design (491), systems (346), or implementation (54). This reflects, in part, the emphasis on completing the environmental documentation with associated public hearings as early as possible, when a project has passed from systems to project development. A number of states have combined the corridor and design stages into a single environmental impact assessment stage.

The following discussion of the data in Tables 1-3 will relate the use of techniques to the characteristics of each project stage as developed from the 1977 study of Action Plans. It should be remembered that this classification scheme reflects the primary use of a technique. Most techniques have several uses, and a secondary use such as one-way transfer of information for public meetings and workshops may be significant.

Systems planning is based in part on the federal requirements of the 3-C process, which calls for continuous, cooperative, and comprehensive planning activities between highway agencies and local jurisdictions in urban areas. At the time the 1983 data were collected, FHWA was altering its approach to urban systems planning from actively encouraging public involvement to viewing the participation of local jurisdictions in systems planning as a local matter to be addressed by local and state officials.

Thus, though information meetings and other large informal gatherings are widespread, only about one-half of the states continue to use formal public hearings at the systems stage. Small group techniques are used widely in systems planning; many citizens find it difficult to understand and participate in the rather abstract, future-oriented and technical subject matter of systems planning. Thus, ongoing citizens committees that offer a setting in which the public can accumulate expertise have been found to be useful. Associated with these techniques are a

TABLE 1 Number of States Using One-Way Information Techniques by Stage, 1983

Audience and Technique	Number of States by Stage[a]				
	Systems	Corridor	Design	Implementation	Occasional
Mass audience					
Legal notices	19	52	52	1	1
Mass media advertising	22	34	31	3	5
News releases	21	36	29	5	10
Audiovisual presentations	9	28	23	0	11
Publish project development schedule	4	8	4	1	6
Mass mailouts	3	12	10	1	7
Press conferences	2	5	4	0	8
Handouts distributed by local institutions	1	1	1	0	0
Specific community					
Billboard advertisements	0	3	2	1	3
Local bulletin boards	3	6	5	0	6
Public information displays	3	13	9	0	14
Specific individuals					
Mailing lists	29	44	40	1	1
Circulate project reports	18	25	14	2	5
Newsletters	12	12	5	1	9
Response forms	6	20	14	1	11
Citizens band radio	0	1	1	0	2

Source: FHWA environmental field staff and state highway agencies.

[a]Includes the District of Columbia, Puerto Rico, and federal highway projects.

TABLE 2 Number of States Using Two-Way Involvement Techniques for Small Groups by Stage, 1983

Technique	Number of States by Stage[a]				
	Systems	Corridor	Design	Implementation	Occasional
Citizens committee	43	22	13	4	9
Speaking engagements	20	33	25	4	11
Surveys	16	13	3	0	13
Direct contact	0	25	33	13	7
Personal interviews	7	12	10	1	7
Project field office	1	10	11	5	9
Telephone hotline	4	4	3	2	4

Source: FHWA environmental field staff and state highway agencies.

[a]Includes the District of Columbia, Puerto Rico, and federal highway projects.

TABLE 3 Number of States Using Two-Way Involvement Techniques for Large Groups by Stage, 1983

Technique	Number of States by Stage[a]				
	Systems	Corridor	Design	Implementation	Occasional
Public hearings	24	53	52	0	1
Information meetings	48	47	37	2	3
Prehearing or posthearing meetings	6	30	29	1	6
Public workshops	9	18	9	1	8
Public forums	11	10	9	0	3
Televised planning discussions	2	1	0	0	4
Resource base analysis[b]	1	4	1	0	7
Project field review[c]	0	6	7	1	5

Source: FHWA environmental field staff and state highway agencies.

[a]Includes the District of Columbia, Puerto Rico, and federal highway projects.

[b]Use of maps at large meetings for the public to indicate areas of concern.

[c]Explanation of the features of a project in its future setting; this technique makes it easier for the public to understand the project.

variety of public information techniques similar to those used for corridor and design with the exception of legal notices. Legal notices are used for public hearings, and their low level of use at the systems stage parallels the low level of use of public hearings.

During the corridor stage, the project, its alternatives, and their potential impacts become increasingly well defined. It becomes more important to the agency to gather information from individuals and groups with a direct knowledge of the project area and to communicate with persons or groups who will be directly affected by impacts or relocation. Very large or small segments of the public may be involved; and as the project becomes more specific, it is easier for the public to identify an interest in the project. Public hearings are usually held at this stage; however, it has been found that effective public involvement requires that hearings be supported by other, less formal, types of meetings. The evidence from the states is that information meetings, meetings before or after hearings, and workshops are used widely. Involvement techniques suited for small groups are used widely also. As project impacts become specific enough for individuals to realize that they will be affected directly,

direct contact becomes an appropriate technique.

These involvement techniques are supported by a wide variety of information techniques at the corridor stage. Legal notices are nearly universal because of their association with public hearings. Many states have found that legal notices are unread and that mass media advertisements in other sections of the newspaper or in other media are more likely to attract attention from a wide audience. As the project impacts and areas are better defined, it is easier to assemble mailing lists or use other information techniques suited for specific audiences. Some of the information techniques are used in the context of a meeting or hearing to convey or collect information more effectively. Audiovisual presentations, response forms, and public information displays are used widely for these purposes.

Design is the last project stage during which the public can influence the detailed plans for the project; however, most decisions have been made on the major design features at this stage, and some states do not separate corridor and design. Also for small projects or 4R-type projects (resurfacing, restoring, rehabilitating, and reconstructing) separation of corridor from design is inappropriate. Thus, there are fewer techniques identified for this stage. Public hearings are used widely; however, in comparison to the corridor stage there is a tendency to rely less on informal meetings to support hearings and more on direct contact with individuals or small groups. Design issues are often specific and relocation is a growing concern. The use of information techniques is generally similar to the corridor stage with the exception of newsletters, which are used best for large, complex issues that require time to resolve. Such issues usually are settled by the design stage.

The opportunity for public input in most states continues through the implementation or construction stage. Additional contact with the public may be required by relocation assistance, monitoring construction for adverse impacts, or unforeseen project developments. Such contacts are typically with specific segments of the public about specific issues. Not surprisingly, involvement techniques suited for small groups or individuals, particularly direct contact, are used most widely in implementation. There is no indication of a corresponding concentration in information techniques suited to specific communities or individuals in the implementation or design stages.

COMPARISON OF 1983 WITH 1977 DATA

States used basically the same techniques in both years, but techniques are used with greater frequency in 1983. Only one technique, distribution of handouts by local institutions, was added to the 1977 list. The stability in the types of techniques is corroborated by an independent survey made in early 1983 by the Bureau of Environmental Services of the Ohio Department of Transportation (ODOT). The 11 ODOT district offices and 12 Ohio metropolitan planning organizations that responded did not add techniques to a list of 20 techniques similar to the FHWA list.

Because the 1977 data are fundamentally limited to techniques mentioned in Action Plans and the 1983 data include techniques used by states in addition to those mentioned in their Action Plans, it is to be expected that, overall, more techniques would be mentioned in 1983. This increase is shown for three stages below:

Stage	Percent Increase
Systems	+25
Corridor	+92
Design	+85

As can be observed the percent increase is not the same for all stages, and the lower level of increase in the systems stage may indicate a change in state practice. This change appears to result specifically from a decline in the use of formal public hearings as an involvement technique as well as from overall lower rates of increased mention of other techniques for the systems stage.

Now states appear to be relying more heavily on information meetings and other less formal large meetings at the systems stage. Much of the increase in the corridor and design stages results from the more widespread mention of informal meetings before and after hearings, workshops, and public forums. There is little change in the numbers of states using hearings or information meetings, which were nearly universally used in both 1977 and 1983. Direct contact also showed a large increase in numbers of states using it between 1977 and 1983.

Among the information techniques, news releases and audiovisual presentations had the largest increase; indeed these two mass audience techniques had the largest increase in numbers of states using them of all techniques at any stage. There were also substantial increases in some information techniques for specific individuals or groups (e.g., mailing lists and circulation of project reports). In comparison to 1977, the overall picture in 1983 is an increased concentration on information techniques that reach either mass audiences or specific communities or neighborhoods.

States are thus continuing the movement, apparent in 1977, away from excessive reliance on the formal public hearing as the vehicle of public involvement. By supporting their hearings with informal meetings, states are now taking specific steps to provide the public with the opportunity to become involved in projects in informal settings conducive to communication between the agency and the public as contrasted to the one-way flow of information and statements of fixed positions on projects characteristic of the public hearing. Likewise, workshops, now used by about a third of the states, are a specific procedural step used by states to provide a specialized setting for gathering usable information from the public. This information from the public can then be incorporated into the development of the project. These changes are supported by recent FHWA regulation [23 CFR 771.111(h)] and technical guidance, which focuses on the state design of public involvement procedures for federal-aid highway projects that will effectively involve the public under the unique conditions prevailing in that state.

CONCLUSIONS

The evidence is that the practice of public involvement by SHAs is entering a period of maturity. Public involvement has been a part of the highway project, planning, and development process for nearly 30 years. Comparison of the two FHWA surveys as well as the ODOT survey indicates that significant numbers of new techniques are not now entering highway practice. Instead SHAs are using known techniques more extensively and more effectively to provide the public with involvement settings that increase the opportunity for the public both to gather information from the agency and to give usable information to the agency.

In moving away from reliance on the public hearing as the vehicle for public involvement, the evidence is that SHAs are beginning to make procedural changes that are conducive to improved public involvement. As the data indicate, this trend does not yet include all states. The FHWA has, and continues to, support the evolution of SHA public involvement toward informal meetings that are conducive to communication between the agency and the public. Specific federal measures include training courses for SHA staff, regulatory changes that focus attention on state design of public involvement programs (rather than meeting specific federal requirements), and ongoing technical assistance.

For the research community the data suggest that the skillful use of combinations of compatible techniques that form an effective public involvement program is the growing edge of public involvement practice. The most useful future research in public involvement, then, should focus here rather than on the discovery of new techniques.

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The Effectiveness Evaluation of Transportation Projects: Three Case Studies in Pennsylvania

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ABSTRACT

Issues relevant to the conduct of effectiveness or postimplementation evaluation studies are addressed within the context of urban transportation projects. In particular, the conceptual rationale underlying development of the experimental plan is discussed in detail. An experimental plan serves to rule out systematically factors that might cause an observed difference between measures of effectiveness. Several such recurrent factors--called threats to internal validity--are described as well as are experimental plans useful in ruling them out. These more theoretical notions are discussed subsequently within the contexts of three transportation projects in Pennsylvania. These include a safety improvement project, a ridesharing program, and a transit fare reduction study. The findings of the study, which resulted from a review of the literature and interviews with transportation officials, suggest an unnecessarily wide gap between the state of the art and the actual practice in the design of effectiveness evaluations. The authors offer some suggestions for improving the conduct of such studies as a means of improving the way decisions are made, particularly at the state level.

Effectiveness evaluations are addressed as they relate to transportation projects and programs. An effectiveness evaluation is a postimplementation study to assess whether or not a particular project was successful in achieving its objectives. Effectiveness evaluations are contrasted with the preimplementation evaluation of alternative plans and with administrative evaluations of processes by which decisions are made and implemented. Within the transportation field, effectiveness evaluation is the least well understood and the least frequently practiced type of evaluation. Although there are many financial, institutional, and political explanations for this, insufficient technical training also inhibits the conduct of strong effectiveness evaluations. In particular, the design of such evaluation studies is not a part of the usual training received by the transportation engineers and planners who are responsible for conducting them. In the past few years, several documents in the transportation literature have addressed the technical issues underlying the development of evaluation plans (for example, 1-3). In the judgment of the present authors, these documents would be improved by a more precise explanation of what constitutes a strong effectiveness evaluation. In response, the purpose of this paper is to present the conceptual rationale underlying evaluation plans.

The information presented here has been gathered in two ways. The first was by reviewing relevant literature on evaluation methodology in the fields of transportation, planning psychology, and education. In addition, about thirty transportation professionals, representing the federal government, the Pennsylvania Department of Transportation, local transportation agencies in Pennsylvania, and private consulting firms were interviewed in person or by telephone.

There are three major sections in this paper. The first section is theoretical and presents the nature and structure of experimental plans or research designs. The theory is then applied through discussions of the evaluation plans associated with three transportation projects in Pennsylvania. The final section addresses other technical and nontechnical issues related to evaluation studies and discusses means for improving state level evaluation capabilities.

EXPERIMENTAL PLANS

An experimental plan, also called a research design, is the central element of an effectiveness evaluation. It is also the least well understood element. In psychology and education experimental plans are understood as arrangements of treatments and observations in time. A treatment is some intervention: a particular program or a set of countermeasures. An observation is the value of a measure of effectiveness (MOE).

One way to view the decision to implement a transportation project is to consider it as an attempt to change the value (single value, average value, or distribution) of an MOE by implementing a program or a set of countermeasures. Within this context, the purpose of an effectiveness evaluation is to answer three related questions.

1. Was the value of the MOE changed?
2. If so, did the program or countermeasures cause the change?
3. If the program caused the change, are the results applicable to other situations?

The first question is a statistical one. A statistical test is performed to determine if there is a significant difference between two or more values of the MOE. The second two questions, which are answered through the experimental plan, are the focus of this paper. Such a research design permits the evaluator to conclude that certain obvious factors besides the program or countermeasures did not cause the difference between MOEs. The more factors that can be eliminated by an experimental plan, the stronger or more internally valid that plan is considered to be. In attempting to answer the third question, the evaluator addresses the issue of external validity.

The True and the Quasi-Experiment

Current theory about experimental plans constitutes

a generalization of the rather refined methods used by laboratory scientists, who make explicit use of the technique of experimental control. Two primary ways in which experimental control is realized are random selection and random assignment. In a field situation it is difficult to conduct true experiments because the use of random selection and assignment may not be appropriate or feasible. In this case the researcher must systematically eliminate the possibility that other factors were responsible for the change by developing a quasi-experimental plan (4).

By strengthening the external validity of an evaluation plan, an evaluator is attempting to approximate the effects of random selection. Conversely, by strengthening the internal validity of a plan, the effects of random assignment are approximated. These two types of validity are discussed in more detail in the next section.

Internal Validity and Experimental Plans

In a nonexperimental situation, there are always numerous possible alternative explanations for observed differences between MOEs. Psychologists and educators working with D.T. Campbell (4) have classified types of such explanations that arise frequently. Six of these types are described below, along with ideas for experimental plans by which they might be ruled out. They are often referred to as threats to internal validity.

1. History. It is quite possible that some event other than the treatment under investigation resulted in all or part of any difference between observations at the project site. Consider, for example, a safety improvement project implemented during the same time period that the national speed limit had been reduced from 65 to 55 mph. If a reduction in the number of accidents was observed, an evaluator could have no way of indicating which event--the project or the speed-limit change--might have reduced the number of accidents. Generally, a comparable group or site likely to experience the same set of historical events between observation times is sufficient to "control" for history.

2. Maturation. Maturation is a natural change over time in the MOE being observed. Failure to account for a trend of accidents occurring at a site before a project is implemented makes it impossible to separate the effect of the project from the maturation effects. Controlling for maturation necessarily depends on detecting a preexisting trend or cycle.

3. Selection. As a threat to internal validity, selection is a problem whenever project groups and comparison groups differ in a significant way. If project sites are not selected for funding at random, there may be reason to suspect that they are different from the control group. In many situations, it is quite plausible that this difference could explain differences observed between treatment and control groups. To control for selection bias, it is important to match comparison sites to experimental sites and to estimate the impact of possible differences between the sites on the appropriate MOEs.

4. Interactions with selection. If the experimental group is different somehow from the comparison group, it may react differently to historical events or it may change differently over time. In other words, selection may interact with either history or maturation. As an example of a selection and maturation interaction, consider a high-accident project site and a comparison site, both having the same number of accidents during the year previous to project implementation. If the project was effective, one would expect the number of accidents at the project site during the year following implementation to be lower than the number at the control site during the same year. Suppose the number of accidents at the project site was increasing over time while the number at the control site was decreasing. In this case even if the accident rate at the project site were reduced, a faulty inference might be made that the project was ineffective. In this situation multiple observations at both sites before implementation of the project would help reduce the plausibility of this interaction effect.

5. Regression. Regression is the observed tendency of extreme scores to regress or move toward the average score. If a group of sites is selected as being eligible for funding because each has a high number of accidents, the average number of accidents at sites within this group will probably be lower the next time accidents are counted. The only way to account for regression effect is to estimate it by measuring the average decrease among all untreated members of the group.

6. Instrumentation. The instruments here are devices or procedures used to generate the MOEs. Instrumentation is a problem that arises when an instrument changes over time making comparisons of MOEs impossible. If an instrumentation problem is to be overcome, one must make some adjustments in the values of the observations to account for the changes in the instrument.

Although this list of common threats to internal validity could be made longer, major threats to transportation projects and programs have been covered. Familiarity with this list will allow the evaluator to determine those specific threats that are plausible for a particular evaluation. When the relevant threats have been determined, an appropriate experimental plan may be developed.

External Validity

In the absence of random selection, there are always threats to external validity. Generally speaking, these threats mean that there is something unique about the project situation that prevents the results from being applicable to other situations. Consequently, the results of the study might be due to an interaction between the project and the unique attributes of the experimental group or site (selection, setting, or history).

An additional threat to external validity occurs when the treatment itself changes over time. Many programs undergo revisions on a periodic basis. When the effects of a program are cumulative over time, it may not be clear what is being generalized. In such instances it is useful to separate the effects as closely as possible and to keep careful records of how the program changes. In this way, not only will effects be more easily associated with particular program or project elements, but the generalization of effects will be more valid. A related and prevalent difficulty arises when several treatments are applied at the same time. Basically, the difficulties with generalization may be overcome only by replication of the treatment to several representative groups at different sites and at different times.

REVIEW OF CASE STUDIES

A review of the literature and interviews with

transportation professionals at various levels of government revealed that, in general, there is no demand for evaluation studies beyond the administrative or clinical type (professional opinions of the efficiency with which bureaucracies perform their functions). In the transportation field, more formal evaluation studies are usually conducted in response to federal or state requirements, either as part of a strategy to justify a continuation of funding or to assess the effectiveness of federally funded demonstration programs.

Three transportation projects in Pennsylvania have been selected to illustrate experimental plans typically used for the purposes described previously. The first is a highway safety improvement project in State College anticipated by the district office of the Pennsylvania Department of Transportation (PennDOT), the second is a ridesharing program undertaken by the Delaware Valley Regional Planning Commission, and the third is a current transit fare reduction demonstration project in Scranton, Pennsylvania, conducted by the local transit authority. The responsibility for evaluation in both the safety improvement and ridesharing projects lies with the implementing agency. The transit fare reduction project, on the other hand, is being evaluated by the Transportation Systems Center. In two of the three cases, the evaluation studies had not been completed when this paper was written. In the first case, PennDOT indicated that the evaluation plan would be the type traditionally used in such projects. In the third case, the document describing the evaluation plan to be used was also evaluated.

These three cases represent three classes of transportation decisions: a physical modification, the institution of a program, and a policy change. Not surprisingly, the nature of the intervention and the study objectives have implications for the type of evaluation design that is appropriate. The purpose of discussing these cases is not to criticize particular evaluation designs. Instead it is to make more clear the ideas of internal and external validity by discussing them within familiar contexts and to assess the state-of-the-practice of evaluation studies.

A Safety Improvement Project: North Atherton Street, State College, Pennsylvania

PennDOT has funded a safety improvement project along a section of North Atherton Street in State College. This project is illustrative of a large class of physical countermeasure projects regularly undertaken by transportation agencies.

Interest in the North Atherton Street project began when PennDOT obtained a low skid reading that obligated the department to take some corrective resurfacing action. Because the 1.2-mile stretch of four-lane state highway has experienced a relatively high accident count over the past 5 years (420 reported accidents with no fatalities), it was considered for further funding as a safety improvement project.

In addition to resurfacing the entire project section, proposed design solutions included a 2-to-4 foot widening over most of the section to allow for a fifth left turn lane at several of the intersections. The resurfacing and channelization are expected to reduce the number of accidents appreciably. Because of minimal widening and the addition of a lane, the other lanes had to be narrowed from 11 to 10 feet. This narrowing is expected to reduce automobile speeds, thereby responding to a major concern of local residents.

According to the guidelines specified in FHPM 8-2-3 (5), when safety improvement projects are implemented an effectiveness evaluation is required. The evaluation content must have three elements: a statement of the project costs and safety benefits; a record of the accidents before and after project implementation; and a comparison of accident numbers, rates, and severities after implementation with those expected if the project had not been implemented.

In practice, at least in the Commonwealth of Pennsylvania, it is generally assumed that if the project had not been implemented, the before observations would remain unchanged. This evaluation plan is called a before and after design. To comply with the reporting procedures outlined in FHPM 8-2-3, the raw before and after data are summed over projects assigned to the same safety classification code and, as appropriate, summed over 1, 2, or 3 years. In its 1980 annual report (6) PennDOT does not draw any inferences about the effectiveness of the projects.

The before and after design is not internally valid even if it is assumed that a significant difference between MOEs (here number of accidents) has been observed. There are four serious threats to internal validity--instrumentation, maturation, regression, and history--that prevent any conclusion as to whether or not the project was responsible for the difference. For the moment, the threats of selection and interactions with it may be ruled out because only one group is specified in the experimental plan.

Additionally, there was a change in the accident reporting procedures. Under the new motor vehicle code enacted in 1977, a dollar threshold criterion for reportable property damage only (PDO) accidents was replaced by a towaway criterion. An accident that was reported in 1976 might not have been reported in 1978; consequently, the annual figures are not comparable. PennDOT has responded to this instrumentation bias by including only injury and fatal accidents in its before and after evaluations. The authors conducted a study for PennDOT in 1982 where procedures are recommended to make pre-1977 data comparable to post-1977 statistics (7).

The most serious threat to the internal validity of the before and after study is maturation. If the accident counts are increasing over time, then it is quite reasonable that the proposed project could be effective even if the after observation is higher than the before observation. An extended number of observations is necessary to establish a valid trend. This might be achieved by considering monthly instead of yearly accident data. Thus, 3 years of data would yield 36 observations. This number will be sufficiently large to test for a trend, if the seasonal variations are not too large. This procedure, however, would demand a fairly large number of accidents.

By adding several more before and after observations, the authors have constructed what is called an interrupted time series design. The use of this design in the North Atherton Street case would allow an evaluator to control for maturation by measuring the trend and the cycles. As an added benefit, potential difficulties arising from statistical regression can also be estimated.

The final threat to the internal validity of a before and after study is history. The results of the study are rendered uninterpretable if some extraneous event that might be plausibly related to a reduction in accidents were to occur between the two observations. In this case, the completion of any one of several other local transportation projects might reasonably affect the accident count or rate on North Atherton Street. Increased police surveil-

lance along the site, as requested by local residents, might reduce speeds and, thereby, the number of accidents.

Controlling for the potential threat of history necessitates the addition of a comparison site to the design. The comparison site must be carefully chosen so that it reflects the effects of historical events in a way similar to that of events at the project site. In the present example, sections of North Atherton Street on either side of the project site might well be appropriate. Accident data for a comparable period of time would also have to be collected for each comparison section.

The reader will note that the possibility for a selection bias has been introduced along with the comparison sites. In what ways do the sections on either side of the project site differ from the project site? One difference is that the average daily traffic counts are smaller, suggesting that accident rates rather than counts might be appropriate. Other differences will probably be apparent to the district traffic engineers. If it is deemed possible to relate these differences to accident rates, then appropriate evaluation design responses will be in order.

The before and after design is also subject to the treatment by setting and treatment by selection threats to external validity. It was suggested earlier that the most effective strategy for handling these threats was replication. Safety improvement projects are replicated frequently and the evaluation results should be analyzed according to project site type and accident type. Such analyses are not difficult given the available data base, and they would provide valuable information about those situations for which particular countermeasures are particularly effective.

Evaluations of typical safety improvement projects also suffer from problems with multiple treatment interactions. As this project has been described, there are at least four countermeasures being implemented in different combinations along the project site. It is unlikely that this particular mix of countermeasures will be applied to any other site. If information that can be generalized is to be gleaned from the North Atherton experience, then the countermeasure applications themselves must be able to be generalized.

One way to address this issue is to consider the North Atherton Street project as several projects instead of a single project. The site may be divided geographically into sections to which only one, two, or three countermeasures are being applied. Defining several project sites in this way results in what is called a multiple treatment design. The requisite information may be easily collected from available collision diagrams. The results from a multiple treatment design are more useful because single as well as the interactive treatment effects will be available. Additional analyses by accident type will make the results more valuable. These latter analyses serve as an explicit test of the expectations stated by the traffic engineers. By partitioning the available data set according to treatment type and accident type, the maximum amount of information can be gained from the North Atherton Street project.

The Ridesharing Program in the Delaware Valley Region

The ridesharing program was originally developed in response to the oil embargo of 1973. The Emergency Highway Conservation Act of 1974 authorized localities to use federal-aid highway funds to implement services encouraging the use of high-occupancy vehicles (carpools and vanpools). Later emphasis on transportation system management has stimulated renewed interest in the program and has made it an integral part of the transportation improvement program. Ridesharing program activities originally included information and matching procedures, service to major employers and individual applicants, resolution of institutional and legal barriers, and promotion by mass media.

The Delaware Valley Regional Planning Commission (DVRPC) is the metropolitan planning organization (MPO) in charge of ridesharing activities in the Philadelphia region. In the 3-year period between 1974 and 1977, it received $360,000 for project activities. At the end of the period, the FHWA requested all implementing agencies to submit a report documenting both program activities and degrees of participation. The DVRPC spent approximately $30,000 and compiled a 158-page evaluation document (8) summarizing the events, accomplishments, impacts, and current status of the program administered in the Pennsylvania counties within the MPO. A consulting firm was retained to assist DVRPC's staff in the development and administration of several surveys. Following the program's inception, energy supplies became less erratic. As a consequence, many ridesharing projects were abandoned. Subsequently, the scope of the program narrowed to implementation of employer-based ridesharing programs. Concomitantly, the evaluation requirements were substantially reduced.

In 1978 DVRPC received an increased 3-year contract under Urban Systems funds and was required by PennDOT and local county governments to show cost-effectiveness of the program to justify continued funding. During that period, DVRPC produced annual closing reports. The 1979-1980 report will be reviewed here. This type of evaluation study can be categorized as ex post facto. The 46-page evaluation report (9) describes implementation activities for the contract period.

The program was assessed as being successful on the basis of the 38 new companies processed and the 107 newly formed vanpools in the 15-month program period. These figures represent a substantial increase when compared with the period between 1974 and 1977. The mass media marketing campaign is claimed to have resulted in an increased number of inquiries during the contract period. The last and perhaps the most heavily relied on measure of effectiveness used in the report is the estimate of travel cost savings. These savings were calculated to be $1.3 million annually, yielding a benefit/cost (B/C) ratio of 8/1 (average annual project cost was $170,000). This savings figure does not include the indirect benefits of reducing pollution and congestion or the cumulative benefits of operations from previous years.

Implicit in these calculations is the assumption that the 107 new vanpools and about 850 new carpools were formed as a result of project activities. The estimation methodology suggested by the U.S. Department of Energy and the Pennsylvania Governor's Energy Council also assumes that the riders are diverted from driving single occupancy vehicles (occupancy rate 1.3), that the car left at home is used an average of 1.7 miles per day, and that the vanpools or carpools once formed remained in operation for the remainder of the contract period.

The evaluators admit failure to control the relevant threats to internal validity for history. External factors did occur during the contract period and may have contributed to an increased interest in ridesharing. Such factors include the 100 percent increase in gasoline prices during 1979. However, management's motivation to combat absenteeism or

tardiness resulting from gasoline supply interruption, to substitute noncash benefits in lieu of salary increases, and to improve employee morale may have contributed to participation quite independently of the program.

Besides the history and selection related problems, another threat that might be called treatment concretion is apparent. As the ridesharing program matured, institutional problems were ironed out and the initial inertia was overcome. At the same time companies and individuals became more willing and open to the idea of sharing a ride. There is a tendency in corporate management to follow the example of other successful programs, ridesharing included. Significantly, about one-half of the new vans were based at companies where original pools were established between 1974 and 1977, suggesting that existing vanpools acted as internal advertisement, which promoted new vanpools.

Another problem with attributing an increase in ridesharing to the program itself is that this is a service program, which by its very nature, has to respond to demand. Therefore the growth of the program may be the effect rather than the cause of spreading ridesharing. That service aspect of the program makes any advance planning or program innovation difficult, and, therefore, the usefulness of feedback information becomes limited. For example, a month-long strike by transit employees tied up the entire DVRPC staff in providing emergency matching assistance to commuters.

Although no attempt is made in the report to generalize from past experience to other geographic areas, there is a tendency to draw inferences on the basis of experiences with the first large companies to participate. The companies that willingly decided to promote ridesharing during energy shortages are not directly comparable to other companies of different sizes under different energy supply conditions. Unfortunately the format of the report might lead ridesharing project operators from other cities to believe that they can transfer the Philadelphia experiences to their own situations.

One major problem not addressed in the report is that measurement of the effectiveness or success of the project does not reflect the original intention of the program. The ultimate objective of the ridesharing project is to save energy by encouraging single occupancy automobile drivers to change their style of commuting. A survey to determine whether or not such changes have resulted in net energy savings and what happens to the car left at home would be more informative than the number of new carpools or vanpools formed.

One criticism that has been made of the program by member governments of the DVRPC Board is that ridesharing promotion is attracting commuters from the suburban rail system. The recent sharp increase (doubling in the past 2 years) in transit fares has made vanpooling and carpooling an attractive alternative for commuters. As a result, some of the suburban counties are faced with the threat of a reduced commuter rail service because of a loss in ridership. Another reason for opposition to the program is that the counties want to get a share of DVRPC's funds and they want to participate in the program. In recent years there has been a shift toward greater involvement of counties in paratransit brokerage services.

A final point to be raised concerns the quality of performance in estimating the impacts of ridesharing. The evaluators readily admit that there is a high degree of uncertainty in their estimates; however, they justify them by stating that the additional surveys necessary to obtain more reliable estimates would be more costly than the project budget allows. The project manager determines the amount of effort, content, and methods to be used in monitoring the program, subject to the approval of the DVRPC Board. Evaluation does not usually exceed 5 percent of the project's budget; and from the point of view of the implementing agency, the closing report fulfills a requirement and provides an opportunity to demonstrate the need for continuation of funding. There is no evident desire on the part of board members to increase the research and evaluation allocations.

A substantial portion of the evaluation report is devoted to recommending the maintenance and expansion of existing services and programs to serve the growing demand. The 1981 closing report, entitled "A Policy Paper," devotes most of its discussion to proposals for program continuation (10). Incidentally, during 1982 the ridesharing budget will be almost doubled from existing levels with the addition of planning and federal aid funds. The rationale is that ridesharing is both an alternative to those portions of commuter rail service that are inefficient and a method for achieving the 1982 air quality standards. Although budget cuts are affecting most other transportation programs and staff are being laid off at DVRPC, ridesharing is increasing its budget and its staff. This year, for the first time, PennDOT has developed a set of guidelines for program process review.

The U.S. Department of Transportation (DOT) realizes the importance of most of the problems of evaluation that are addressed here. Wagner (11) in a study prepared for the FHWA, reported significant deficiencies in the 1977 (original) evaluation methodologies used by agencies across the nation. For example, sample results were extrapolated to the wrong populations, and frequently extra travel mileage attributable to carpooling was not considered. The information in the report suggests an experimental plan that stratifies the population into segments that are either exposed or unexposed to different elements of carpool matching and promotion activities. The purpose of the plan was to determine (a) the net changes in commuter travel modes caused by project activities and (b) the portion of the changes in commuter travel attributable to different types of project activities.

In 1979 the FHWA staged a 2-year National Ridesharing Demonstration Project. The objectives of this program were to implement and evaluate (cost-effectiveness of measures and effectiveness of organization) comprehensive and innovative approaches to ridesharing at 17 sites that are representative of various geographic areas and population sizes. The Transportation Systems Center of DOT has been assigned the responsibility for the evaluation. The data collection will be performed by the grantees. DVRPC is one of the agencies chosen.

The evaluation will consist of a detailed documentation of each case, a cross-cutting comparative analysis of all projects on common technical and institutional problems and special studies at a few sites to address travel behavior research questions (12). The evaluation design proposed in the FHWA effort appears to address the most critical questions.

If the objectives of the ridesharing evaluation are to provide an account of what happened, convince grantors that there is a need for a continuation of the program, and show that it meets the criteria (B/C ratio) set by PennDOT and the local governments, the effort invested by DVRPC in evaluating the program has been successful. The fact that the budget is increased every year justifies this conclusion. They have learned from experience that they can be most effective by selling the business com-

munity on the program and they have concentrated their efforts to that end. Common sense, good judgment, effective public relations, and sensitivity to political realities are requisites for selling the idea to the public and for convincing funding agencies of the need for additional funding in the future. However, if the objective of the evaluation is to explain the effects of the program on travel behavior and to be able to use this knowledge for future decisions, it has failed. In this era of conflicting interests and limited budgets, expansion of ridesharing means that some other program will be cut or some area or group of people will be adversely affected. It appears, therefore, that there is an increased need for a more conclusive effectiveness evaluation. Some hard decisions will have to be made about where the money for improved evaluations and monitoring will come from. It may be advisable to assign the task of evaluation to an independent party to avoid any possible bias.

The Promotional Reduced Fare Program in Scranton, Pennsylvania

The third project is the promotional reduced fare (PRF) program being conducted in Scranton, Pennsylvania, by the County of Lackawanna Transit System (COLTS). Primary funding for the project is provided by an UMTA Service and Methods Demonstration (SMD) program grant. The total cost of the program is estimated at $235,671; approximately one-half of this amount is being used to cover lost revenues and roughly one-third is being used to cover planning and evaluation costs. Eighty percent of the funding is being provided through the SMD grant; the remainder is provided by COLTS. The Transportation Systems Center is responsible for the technical direction and supervision evaluation, and the responsibility for conducting the evaluation is being subcontracted to Vista Systems of Princeton, New Jersey (13).

The UMTA SMD program addresses the need to improve public transportation services by sponsoring demonstrations of innovative transportation services and management techniques. The SMD projects focus on innovations with applicability to a diversity of settings and operations. The PRF program is under the SMD Pricing and Service Improvement Program (14).

The objectives of the PRF program are to determine the range of the effects of experimental transit marketing policies. Instead of being interested primarily in the effectiveness of the program in attaining local goals, UMTA's interest in the program is in the ability to generalize the findings to transit agencies around the nation.

The PRF program was implemented in January 1981 to determine the effects of 1-month fare reductions on transit ridership and public attitudes toward transit. In addition to the effects on total ridership, the program was designed to determine

1. The market segments of prior riders who increased their rate of transit use because of the fare reductions;
2. The market segments of new riders who began using the transit system because of the fare reductions;
3. The portion of the new ridership generated by the fare reductions that is retained after the reinstatement of the regular fare; and
4. The actual costs and future revenue benefits of the promotions.

The PRF program consists of reducing the 45-cent regular base fare to 20 cents, 5 cents, and free fare for 1-month periods, with 5 months of regular fare between each promotion. The evaluation design consists of two components: an interrupted time-series design and an equivalent-time sample design with multiple, related (not identical) treatments. Historical ridership and revenue data, which is already being collected by COLTS on a daily basis, will be analyzed to show the effects of the reduced fares on aggregate ridership levels. Monthly checks on schedule adherence and crowding will be made to assess the operational impacts of the reduced fares.

The collection of data on historical trends rules out several of the threats to the internal validity of the evaluation. Inspection of the historical trend data can ensure that the fare reductions are not implemented at a time when ridership levels are unreasonably low, controlling for any regression threat. The long-term ridership data (from the previous year, for example) can be analyzed to account for any seasonal or increasing trends, accounting for the possible maturation threats. Finally, there is no reason to suspect the presence of an instrumentation effect.

The main threat to the internal validity of this design is the possibility that factors other than the reduced fare program may have caused any observed increases in ridership. Because no control group is present, the occurrence of any event that could influence ridership levels concurrent with the implementation of reduced fares would seriously weaken the interpretability of the results. It should be noted that consideration is being given to using the city of Wilkes-Barre, Pennsylvania, as a control site.

Two factors may help moderate, though not eliminate, this possible history threat. First, a specific temporal pattern of the ridership response to the reduced fares was hypothesized before the start of the demonstration program. It was hypothesized that a large increase in ridership would occur immediately when the reduced fare was introduced and that this ridership level would decline gradually as the novelty of the new fare tapered off. It was expected that a sharp decrease in ridership would occur when the regular fare was reinstated and that ridership would then stabilize at a level higher than the ridership level before the reduced fare month (reflecting the retention of new riders and new trips). If this response pattern is observed, the inference that the fare program is responsible for the ridership increase is strengthened. This specification of the expected response is encouraged when a time-series design is employed, particularly when the response to an intervention is expected to be delayed rather than immediate.

Second, if a rival event is present, the three fare reduction months can be regarded as repetitions of a class of treatments (fare reductions) and inferences can be drawn as to whether fare reductions increase ridership. However, no inferences could be made regarding the differential effects of the varying levels of fare reduction.

Five on-board surveys and three telephone surveys are being conducted to collect disaggregate information on the number of new riders attracted by the reduced fare months, new trips generated, and market segments attracted by the promotions. Because this aspect of the demonstration evaluation is oriented toward answering more specific, exploratory issues rather than the effectiveness of the program, this part of the design will not be described in detail here. However, two points should be mentioned. First, this additional data collected from individuals will provide more information on the particular influences of the promotions and will help determine whether extraneous influences are present. Second,

the collection and analysis of this survey and interview data account for a large proportion of the evaluation costs.

Although the surveys may provide valuable information on the nature of any changes observed, the effectiveness of the program can be determined without incurring the cost of surveys and interviews. Although answers to these exploratory questions are necessary in federally funded demonstration projects, adequate archival data for determining program effectiveness, such as ridership and revenue figures, are frequently available at little marginal cost.

Two factors lend strength to the external validity of the design. First, the design could be regarded as a replication or refinement of numerous free fare and fare reduction programs conducted both formally by UMTA (15) and as marketing programs conducted by transit properties across the nation. The rigor of the evaluations of these programs varies dramatically; however, viewing them as a whole can provide indications of the extent to which the findings of the PFR program can be generalized. Granted, this question cannot be answered conclusively, but this background of experience can provide important information.

Second, the random sampling procedures used for selecting the respondents for the telephone surveys increase the likelihood that the samples are representative of the given population. Although the population sampled (and treated, for that matter) is still specific to one setting (only one city, Scranton, Pennsylvania, is included), for practical purposes this random sampling procedure is the optimal route for ensuring that the results will have general application. Nevertheless, the critical reader of the study must still ask, How representative is Scranton of all cities (or medium-sized cities, etc.) and how representative is COLTS of all transit systems?

One remaining problem involves an aspect of the program not mentioned earlier. After the first fare reduction was implemented and the regular fares were reinstated, the decision was made that the retention of new riders was not high enough to ensure that the revenues lost during the fare reduction period would be recovered within the same fiscal year; this was an objective regarded as highly desirable by all the parties involved. Therefore, implementation of an employer-subsidized pass program on a continuing basis is being considered as an attempt to increase the number of new riders retained after the reinstatement of the regular fare. This pass-subsidization program can be regarded as an additional treatment affecting some of the new and prior riders.

Therefore, some of the information on the effectiveness of fare reductions alone in increasing and retaining ridership may be lost (i.e., it may be difficult to determine what the effects on ridership would have been if the pass-subsidization program had not been implemented). The introduction of the pass-subsidization program will not, however, make the results of the evaluation completely uninterpretable. The pass-subsidization program will affect only one segment of the ridership: the riders working for employers who are participating in the pass-subsidization program. Because the PRF program is collecting data from individuals (instead of aggregate ridership data), information on the effects of the program on market segments not affected by the pass-subsidization program will still be available. Also, the telephone surveys can be tailored so that they provide some information on the additional effects of the pass-subsidization program on travel mode choice.

The PRF program evaluation illustrates the problems and the benefits of conducting studies in a dynamic environment. Because of the many known and unknown factors that may be influencing any given behavior or occurrence, attributing any change to a single cause is difficult in an open setting. Even when an evaluation is designed so the influence of many possible extraneous factors is controlled, there are frequently numerous constraints, including financial and political constraints, that may be more important than the particular questions being addressed and that must be considered by the decision makers.

The implementation of the pass-subsidization program is such a case. COLTS and UMTA realized that an important objective, the recovery of lost revenues within the same fiscal year, would not be attained as the program existed; therefore, they fine-tuned the program to try to meet this objective. The management can hardly be faulted for making changes to improve the cost-effectiveness of the program's operation. The potential benefits of the pass-subsidization program far outweigh the cost of the loss of some of the information, particularly in today's financial and political climate. It should not be overlooked, however, that it was a well-designed evaluation that provided the management of the PRF program the information necessary to suggest the need for this fine-tuning.

SUMMARY AND EXTENSION

The primary focus thus far has been the experimental plan. Valid experimental plans are crucial because they provide an evaluator with the basis for inferring a causal relationship between a project or program and an observed difference between MOEs. Critical assumptions permitted by uses of random selection and assignment are more difficult to justify in nonexperimental situations. The necessary conditions may be approximated by explicitly controlling threats to internal and external validity. Six classes of threats to the internal validity were described. Experimental plans that control these threats generally take the form of either nonequivalent control groups or interrupted time-series designs. Replication was suggested as the best way to deal with threats to external validity.

In the review of the three case studies that followed, it became obvious that there is an unnecessarily wide gap between capability and practice in the design and conduct of evaluation studies. The authors do not claim that findings from this small sample of case studies can be generalized to all evaluations. The intention was to demonstrate the implications of using a strong evaluation plan in selected cases and to place them in perspective with the implementing agency's objectives.

The first two evaluation plans, consisting of a before and after design and an ex post facto design, were found to be deficient thus rendering the results of little use either to the implementing agency or to the decision makers. In the case of the safety improvement project, maturation and history were found to be the most serious and probable threats to the design's internal validity, and multiple treatment interaction was judged to be a serious threat to its external validity. In response a multiple treatment, interrupted time-series design with a nonequivalent control group was recommended.

Although the reports of the ridesharing program are successful in meeting the agency objectives of continuation of the program, they fail to address the threats of history, maturation, selection, and interaction. Furthermore, they do not attempt to generalize to other situations. The Wagner report

and the new FHWA initiatives do propose experimental designs that may be able to address most of these issues.

The experimental plan associated with the promotional fare reduction program is considerably stronger, and several important points are implicit in the example. The explicit a priori statement of hypotheses, or expected results, strengthened the evaluation. This strength is achieved if the hypotheses are supported because of the existence of a much smaller set of rival hypotheses that predict identical results. In addition, intermediate results from the evaluation provided valuable feedback to decision makers that allowed for desirable programmatic adjustments. The implementation of these adjustments, however, illustrates the sensitivity of experimental plans to changes in the intervention. These projects and their associated evaluation plans, threats to validity, and suggested remedies are summarized in Table 1.

In general, the ideal of a completely valid effectiveness evaluation is unattainable. It is clear, however, that relatively little effort is required to strengthen most experimental plans substantially. Given that the results of a single study will never be entirely conclusive, the evaluation has certain obligations. The interpretation and utility of a given study require that the evaluator state explicitly both the assumptions underlying the experimental plan and the validity threats that cannot be effectively eliminated.

The experimental plan has been discussed here independently of the other components in an effectiveness evaluation. This picture is not completely accurate because all the components are interdependent. The selection of an appropriate MOE, the methods by which data are collected, and the appropriate application of statistical tests are also important components of an effectiveness evaluation. Each of these areas also has a gap between theory and practice. For example, a heavier reliance on attitudinal or nonarchival, unobtrusive MOEs could alleviate frequent difficulties experienced between sampling models and sample sizes. Another potential area for improvement is the integration and more efficient use of existing data bases. The reader is directed to Highway Safety Research Center (2) and Goodell-Grivas, Inc. (3) for discussions of these related issues.

The development of a strong evaluative capability depends on more than the existence of the requisite technical capability. Some of the important institutional, financial, and attitudinal barriers that inhibit institutionalizing this capability are addressed in the following paragraphs.

The conduct of valid effectiveness evaluations is expensive, both in time and money. For this reason, the issue of when to evaluate deserves consideration. Effectiveness evaluations are quite often desirable for two types of projects. These include controversial projects and demonstration projects or, more generally, any project in which the impacts are uncertain.

As Quade (16) points out, "A demonstration project is by its nature an experiment; and unless the results can be evaluated properly, all that may be demonstrated is that it is possible to spend public funds in a particular way." Many demonstration projects are currently evaluated, and generally quite well, on the national level through UMTA's Office of Service and Methods Demonstration. Given the funding mood of the current administration, it is probable that some portion of the financial responsibility for evaluating innovation and demonstration projects will be passed to the states. The possibility of adopting the federal SMD model on the state level merits further examination.

The second category of projects for which evaluations are often desirable is the controversial ones. These include projects with conflicting objectives or projects with potentially adverse side effects. For example, although the addition of an extra lane for left turns on North Atherton Street in State College might reduce vehicle accidents, some residents believe that it might create an unsafe condition for the pedestrians crossing the street. Similarly the expansion of the ridesharing program in the Delaware Valley attracts commuters from the local rail service that is in opposition to the interests of saving the commuter lines. In such adversary situations it is often advisable to assign a third party the task of evaluating the projects. In the past there have often been sufficient funds to satisfy conflicting needs and interests; however, this is no longer the case. The equitable resolution of such conflicts necessitates an increased accountability of the expenditure of public monies. Valid effectiveness evaluations are the preferred method for assessing this accountability.

Accountability is closely linked to objectivity and believability within the implementing or evaluating agency. Assumptions and results may unduly favor one perspective over another. This lack of objectivity is often the result when agencies are forced to evaluate their own work for the purpose of securing additional funding. On the other hand, the evaluation may be strengthened by integrating the planning and evaluating functions. The administrator's dilemma of how to allocate funds can be solved by segregating the funding sources of planning and implementation from those of evaluation.

In addition, the prevalent administrative atmosphere does not appear conducive to the productive integration of social experimentation with more traditional decision making modes. Because funding decisions are usually separated from implementation decisions, administrators are locked into support for their particular project for fear of losing funds or their jobs. A solution has been offered by Campbell (17). He suggests that administrators shift

TABLE 1 Summary of Case Studies

Type of Project	Implementing or Evaluating Agency	Evaluating Agency Objectives	Experimental Plan	Major Threats to Validity	Suggested Remedies
Highway safety improvement	State district office	Fulfill federal requirement	Before and after	History, maturation, regression, instrumentation, treatment interaction	Multiple treatment, interrupted time series with a nonequivalent control group
Ridesharing	Metropolitan planning organization	Fulfill state and local requirements and secure continuation of funding	Ex post facto	History, maturation, selection, interaction with selection by history, treatment concretion, external validity	Multiple treatment with a nonequivalent control group, comparative case study analysis (redefine MOEs)
Promotional reduced fare	Transit authority and federal research center	Evaluate innovative ideas and conduct exploratory research	Interrupted time series with multiple related treatments	External validity	Reapply treatment

from advocating a specific program to advocating the seriousness of the problem being addressed and offering their recommended solution as the best of several alternatives.

Given the trend at the federal level toward a reduction of funds for transportation projects and toward a transfer of power and responsibility to the states, there is a need to improve planning and research. The wise use of past experience through the regular application of effectiveness evaluations will contribute to this improvement. A firmer understanding of the nature of experimental plans by both transportation professionals and other administrative decision makers is a necessary step. Evaluation funds, wisely spent, may be quickly recovered in the form of improved decisions. In the coming years states will have to assume a greater initiative in the development of new corrective and creative programs. Effectiveness evaluations of key programs can provide states with the information necessary to tailor these programs to their own specific needs.

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