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Statistical Controls in Ridesharing Demonstration Programs

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The application of scientific experimental designs in ridesharing demonstrations is discussed. A review of typical designs, particularly those that use test and control groups and over-time observations of behavior, suggests that the numerous problems that jeopardize the validity of studies could be reduced or eliminated. Nine possible outcomes of demonstrations are reviewed and interpreted against the need for experimental designs. Two applications in the ridesharing area are then described: one conducted during a period of rapid background change (1979 energy crisis) and the other in a recent period of stability (1981). In both cases (conducted at employer and community sites in the Albany, New York, area), the use of a control group and before-and-after background surveys permitted isolation of the true effects of the demonstration. In the first case (1979 energy crisis), this included the direct effect of the program (from coordinator records), indirect effects (from the existence of the ridesharing program itself), and external effects (from the energy crisis). In the second case (stable background), the indirect and external effects were found to be negligible. From this study it is concluded that the use of scientific designs in ridesharing analysis should be increased and expanded.

Government-sponsored carpooling programs were begun as a response to the 1973-1974 energy crisis and focused on matching services by using grid systems and computerized match-ups for interested employees (1). But consumer interest fell sharply as the crisis abated, and two-thirds of the programs initiated were discontinued. For those programs that did continue, promotional campaigns were expanded and the focus was on consumer economic savings. Public interest again increased during the 1979 energy crisis, but again subsided. Although this suggests that consumer interest in carpooling was closely related to the energy crises, the precise nature of this relation was not determined, and subsequent federal policy treated carpooling as a viable transporation system management (TSM) option.

A basic problem in carpool program evaluation is that most programs are not set up with careful evaluation in mind. As a result, most programs contain numerous technical problems that prevent a fair assessment of their impacts. Few programs separate existing and newly created carpoolers or follow up on carpools actually formed from inquiries. In addition, high failure rates have prevented a careful look at many programs.

Basic problems with carpool evaluations include failure to (a) sort out background (e.g., energy crisis), (b) separate created from discovered carpoolers, (c) consider carpool breakups, (d) account for additional travel by cars left at home or circuity of carpool trips, and (d) generalize to the appropriate population. It is recognized that these programs suffer from such lack of control that evaluation of true effects is generally not possible. Considering that the effect of such failures is to overstate the impact of the programs, taxpayers would be better served by a more careful assessment of the data.

The purpose of this paper is to suggest that through the use of statistical controls, such an assessment is feasible and possible and does not necessarily reflect negatively on carpool programs. A number of straight-forward carpool designs are described, which are based on experimental principles that have been found to be effective in assisting in these assessments.

PRINCIPLES OF STATISTICAL DESIGNS

Statistical designs evolved from the tradition of scientific experiments and are intended to isolate and quantify the causal linkages in analytical relations. The designs usually contain the following elements:

1. A test group (or individuals) selected to receive the service or treatment;
2. A control group that does not receive treatment but is monitored over time;
3. Before-and-after observations of behavior, attitude, status, and so on, of members of the test and control groups; and
4. Internal observations (records) that permit reporting and evaluation of the direct effects of the treatment.

In classic experiments, identical units are obtained, but only one is treated. In the social sciences we cannot obtain identical individuals, so units are randomly selected (or randomly assigned). Randomly selected (or assigned) individuals or groups are then treated with services or policies, with background factors allowed to vary; the resulting causal linkage is inferred from the differences in responses from differently treated groups. Basic statistical designs involve the use of a test service or treatment (X) and a series of observations (O) of the behavior of the tested (or other) entities. Basic common designs in the transportation literature are

1.	$X\ O$	One-shot case study;
2.	$O_1\ X\ O_2$	One group pretest and posttest;
3.	$\begin{array}{l} R\ O_1\ X\ R\ O_2 \\ \hline R\ O_3 \quad R\ O_4 \end{array}$	Pretest and posttest with control groups and random assignment (r) of observation;
4.	$\begin{array}{l} R \vert O_1\ X\ O_2 \\ \hline R \vert O_3 \quad O_4 \end{array}$	Nonequivalent control group; entire group rather than individual groups is assigned (randomly) to test or control; and
5.	$\begin{array}{l} O_1\ X\ O_2 \\ \hline O_3 \quad O_4 \end{array}$	Predetermined nonequivalent control group

Because designs 4 and 5 are often conducted in real-world settings rather than in laboratories, and the nature of the control is inexact, they are often called quasi-experiments.

The extent of the causal inferences that can be drawn depends on the nature of the design and the strengths of the controls. Campbell and Stanley (2) review the designs most often used and describe their limitations. They describe two kinds of validity of the study: (a) internal validity, which refers to conclusions drawn about the experiment itself, and (b) external validity, which refers to conclusions drawn (from the experiment) about a larger population. In each case, many factors can mask the design and threaten validity. The primary concerns that jeopardize internal validity are

1. History--events occur between the first and second measurements;

Table 1. Properties of some common experimental designs.

No.	Design	Name	Internal							
			History	Maturation	Testing	Instrumentation	Statistical Regression	Differential Selection	Mortality	Selection and Maturation
1	$X\ O$	Case study	–	–				–	–	
2	$O_1\ X\ O_2$	Pretest and posttest	–	–	–	–	?	+	+	–
3	$\begin{matrix} R\ O_1\ X\ R\ O_2 \\ R\ O_3 \quad R\ O_4 \end{matrix}$	Random pretest and posttest with control	+	+	+	+	+	+	+	+
4	$\begin{matrix} R \mid O_1\ X\ O_2 \\ R \mid O_3 \quad O_4 \end{matrix}$	Nonequivalent control group (random group)	+	+	+	+	?	+	+	–
5	$\begin{matrix} O_1\ X\ O_2 \\ O_3 \quad O_4 \end{matrix}$	Predetermined nonequivalent control group[a]	+	+	+	+	+	+	+	–

Note: – = weakness, + = factor is controlled, and ? = possible problem.

[a]Assumes equivalent response by test and control groups.

Table 2. Effect of statistical designs on carpool program evaluation.

Problem	Design				
	1	2	3	4	5
Changes in background that encourage carpooling			X	X	X
Carpool impact in a flat background		X	X	X	X
Magnitude of uncovered versus created carpools			X	X	X
Changes in questionnaire format in before versus after surveys			X	X	X
Carpool breakups		–[a]	X	X	X
Differential impact of program by user group		–[a]	X		
Differential impact of program by site			X	X	
Changes in background that decrease carpooling			X	X	X

Note: X = design accounts for these problems.

[a]From internal records.

2. Maturation--subjects age or otherwise change naturally, thus changing behavior or sensitivity to the experiment;
3. Testing--test takers better understand or become more familiar with the questions;
4. Instrumentation--changes in test procedure, questions, and observers;
5. Statistical regression--tendency for extreme points to drift toward the mean on repeat observations;
6. Differential selection--differences of respondents or subjects for test and control groups;
7. Mortality--subjects die, resign, or cannot be recontacted differentially between test and control groups; and
8. Selection and maturation interaction--subjects in certain behavioral groups change or age more rapidly.

The primary threats to external validity are

1. Reactive effect of testing--questionnaire itself causes a change in behavior or inclination in subjects;
2. Selection and experiment interaction--subjects self-choose to participate from interest;
3. Reactive effects of experiment--service or test itself causes changes in behavior; and
4. Multiple treatment--effects of multiple testing or treatments on subjects cannot be erased.

The above designs only partly control for basic internal threats and some external threats to validity. The data in Table 1 (2) summarize the capabilities of each design. The data in Table 2 indicate how each design handles typical problems concerning carpool program evaluation. It is clear from these tables that the designs currently in most common use (case study and pretest and posttest) do not adequately address most validation problems because no control group is available for isolation of most effects. But even the more complex designs do not remove threats to external validity.

Transportation policy studies rarely permit random assignment of individuals to receive treatment (e.g., a new service or lower fare), so designs 3 and 4, which involve random assignment, are not often conducted in real-world settings, although they have been conducted in laboratory or classroom settings.

A particularly useful feature of designs is that the external impact of the test can be separated from its internal impact. For example, in the random pretest and posttest design (number 3 in Table 1), O represents observations of behavior, attitude, and so on; these are usually determined from a sample drawn from a larger population, and means ($\bar{O}$) are calculated to estimate average values.

As an example, from the population there will be a random assignment sample, which can be set up as follows:

$$\begin{matrix} \bar{O}_1\ X\ \bar{O}_2 \text{ (test)} \\ \bar{O}_3 \quad \bar{O}_4 \text{ (control)} \end{matrix}$$

where (a) internal effects are effects caused by the program (X), which consist of direct effects (i.e., effects caused directly by the program) and indirect effects (i.e., effects caused indirectly by the existence of the program); and (b) external effects, which are effects caused by changes in the background. Total program effects are isolated by comparing the differences [i.e., total program effects = internal effects - external effects, or $TOT_X = (\bar{O}_2 - \bar{O}_1) - (\bar{O}_3 - \bar{O}_4)$].

The internal effect consists of two parts: the direct impact of the program ($Dir._X$), which can be determined directly from the internal records of the study (e.g., number of new carpoolers attracted, new transit riders), and the indirect (additional halo) effects ($Ind._X$), i.e., $TOT_X = Ind._X + Dir._X$.

The null hypothesis is that, if the program has no effect, there should be no difference in the changes observed in the test versus control group statistics; that is $(\bar{O}_2 - \bar{O}_1) - (\bar{O}_4 - \bar{O}_3) = 0$. Standard statistical procedures for the significance of these differences are readily available.

Interpretation of results from such studies depend generally on the strength and direction of

External			
Reactive Testing	Selection and Experiment	Reactive Experiment	Multiple Treatment
	–		
–	–	?	
–	?	?	
–	?	?	
–	?	?	

changes observed in the test and control groups. Nine possible results are shown in Figure 1. The results can be most confidently interpreted when test and control groups diverge in changes in behavior (Δtest +, Δcontrol –; or Δtest –, Δcontrol +). However, most studies do not yield such clear results. Particular care should be taken in situations in which the test appears to have little or no effect but, when compared with the control, it is seen to slow a declining process (e.g., Δtest 0, Δcontrol –; Δtest –, Δcontrol –). An example from the transportation field would be transit fare-saver programs that halt or slow declines in transit ridership. Without a control group, it is difficult to estimate what the ridership would be if the fare had not been saved.

APPLICATIONS

Although the applications of these principles are widespread in the literature (education, psychology, and sociology), the use of these principles in transportation studies is limited. Dunbar (3) describes the errors in model coefficients that occur from using cross-sectional data and calls for the integrated use of before-and-after data and cross-sectional data in model building. Although literally thousands of examples of the use of before-and-after data sets to infer internal validity exist in transportation, most do not have controls or the context structured so that the effect of the policy can be isolated. Louviere and others (4) describe a number of experiments (using college students) that deal with the rating of shopping sites in the Laramie, Wyoming, area, but generalization to the behavior of nonstudents shows marked differences in the laboratory and real-world models.

Tischer and Phillips (5) describe the use of a similar technique--the cross-lagged panel--which involves repeat observations of behavior and attitudes of a group of commuters over time, during which the treatment (in this case, a carpool lane) is introduced. In a later report Tischer (6) used the same data set to test whether structural models of modal use changed as a result of the introduction of the carpool lane service (the conclusion was negative). Finally, McClelland and others (7) describe the pitfalls of relying solely on aggregate changes in behavior over time without having detailed positive and negative switching behavior.

In addition to the above studies, several applications to ridesharing, conducted by the New York State Department of Transportation (NYSDOT), are discussed below. These examples demonstrate how the concepts described above have been used to evaluate carpooling programs. The cases are drawn from recent NYSDOT studies of carpooling services in employer and community-based settings.

These two demonstrations took place within economic and energy settings that were radically different from each other. The employer-based ridesharing demonstration took place in a year of

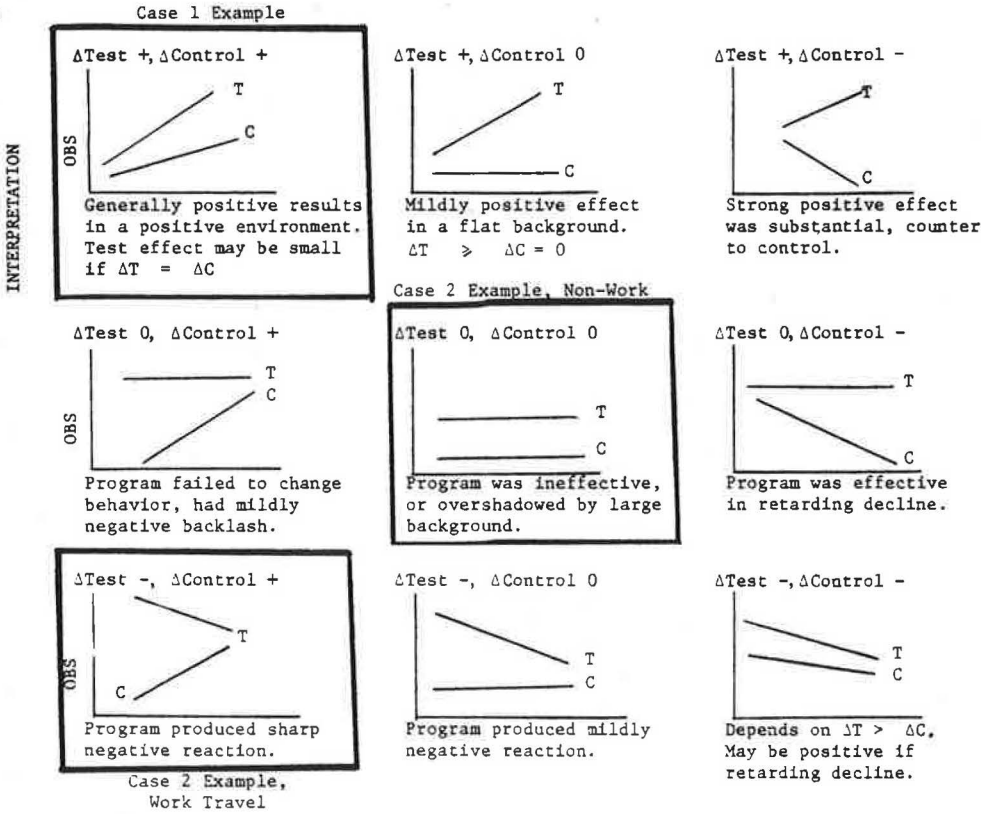


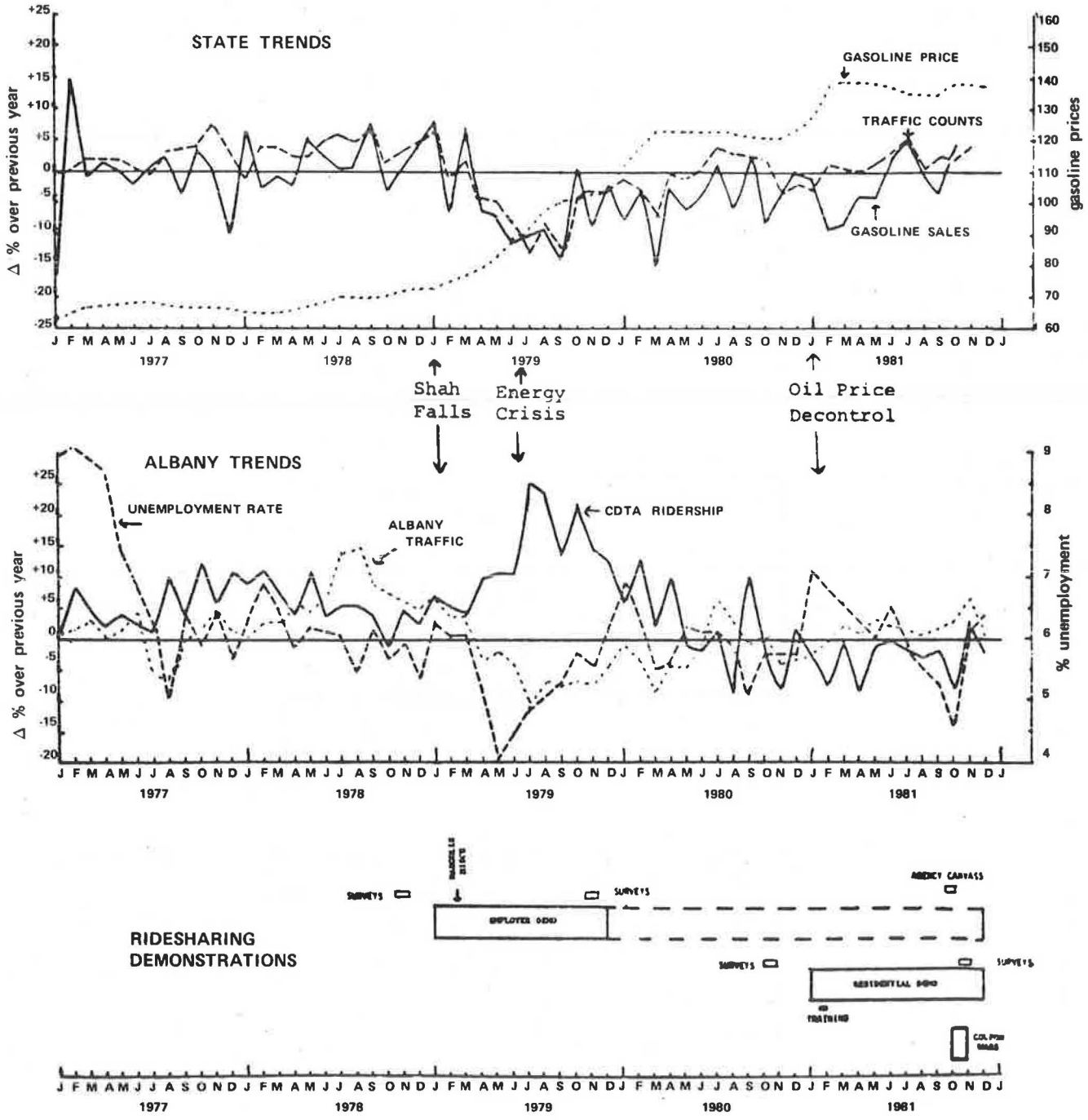
Figure 1. Interpretation of results from statistical designs.

uncertainty and adversity that generally favored carpooling, whereas the neighborhood ridesharing demonstration took place in a year of general optimism and economic growth--trends that likely retarded increases in ridesharing. Further, the sharpest part of the decline in 1979 was much greater than the greatest rise of optimism in 1981; therefore, it was expected that more moderate changes in travel behavior would occur during the 1981 demonstration relative to the 1979 demonstration.

The chronology of national and local events associated with each of these demonstrations is shown in Figure 2. The employer-based demonstration was coincidentally initiated at the time of the fall of the Shah of Iran in January 1979 and spanned the difficult period of the 1979 energy crisis. During that period, gasoline prices rose sharply, gasoline supplies dropped by a maximum of 13 percent, and traffic declined substantially compared with previous years. Unemployment, which had been quite low in the early months of 1979, rose sharply, as did transit ridership. These events encouraged ridesharing by workers and precipitated a major increase in ridesharing within the state agencies surveyed.

On the other hand, the circumstances surrounding the neighborhood ridesharing demonstration, which began in January 1981, were substantially different. This was a period of moderate stability in gasoline prices after an initial rise following oil

Figure 2. Events associated with NYSDOT ridesharing demonstration.



price decontrol. Traffic, which had been down in 1979 and 1980, rose steadily through this period, as did gasoline sales. Conversely, transit ridership dropped and unemployment declined (until the end of the period when it began to rise as a result of the 1981 recession). These trends indicated increased flexibility on the part of drivers and a generally rising economy; there was also a predictable rise in traffic and gasoline sales and a decline in transit use. All of these trends favor declining or stable ridesharing behavior.

Case 1: Employer-Based Ridesharing Coordination Program During an Energy Crisis

The employer-based ridesharing demonstration formally began in January 1979. Originally funded by the New York State Energy Office, the demonstration evaluated the effectiveness of coordinators in work sites over a 1-year period. Six New York State agencies participated: three as test and three as control agencies.

In order to measure the effectiveness of the program in forming and maintaining carpools, a before-and-after study with control and test groups was planned. This study was undertaken on both the uptown (Campus) and downtown (Nelson A. Rockefeller Plaza) sites of the New York State government in Albany. These areas represent two extremes in their respective accessibilities and parking situations. The Campus area has generally ample parking and is easily accessible through several major routes. The downtown area, however, has severe parking restrictions and suffers from the congestion of the Albany central business district (CBD).

The test designers were concerned that the incidence of carpooling might also be affected by other events, including another oil embargo or changing transportation service to downtown Albany.

To ensure a strong test, New York State agencies at both the Campus and downtown Albany locations were surveyed before and after the demonstration program. These included nonparticipating (control) agencies, against which change in carpooling--independent of the carpool coordinator project--could be measured. Other agencies (test agencies) were provided with carpool coordinators.

The design used for this experiment (8,9) was a version of design 5 (predetermined, nonequivalent control group). Agencies were assigned to test or control status primarily on the basis of willingness to participate and general demographic similarity. As with all such designs, the choice must be a compromise between statistical appropriateness and administrative and institutional concerns. The resulting design attempts to control for background effects as well as agency location (see Table 3).

A random sample of approximately 150 employees from each agency was surveyed at the beginning of the demonstration, and a separate random sample was surveyed again at the end of the demonstration project. Comparison of the before (O_a) and after (O_b) data on both the test (X) and control agencies would uncover any significant changes in carpool formation, method of travel to work, and attitudes toward carpooling. The effect of various demographic characteristics (e.g., age, sex, income, family size, and automobile ownership) on carpool formation and continuance were also investigated. The initial survey was distributed in November 1978, and the project was initiated in early December 1978. The follow-up survey was undertaken again for each agency in October 1979.

Agency changes in mode to work are given in Table 4. The results indicated that in test agencies the carpool coordinators increased ridesharing substantially (10 percentage points), whereas ridesharing among control agencies rose 3.5 percentage points

Table 3. Evaluation design for employer-based demonstration.

			External Data		
Site	Agency	Status	Before (November 1978)	Carpool Coordinator Demonstration[a]	After (September 1979)
State Campus	Transportation	Test	O_a	X	O_b
	Labor	Control	O_a		O_b
Rockefeller Plaza	Motor Vehicle	Test	O_a	X	O_b
	General Services	Test	O_a	X	O_b
	Health	Control	O_a		O_b
	Public Service	Control	O_a		O_b

Note: O's represent observations of carpooling (i.e., an employee survey) and X's represent carpool coordinator activities.

[a]Internal records.

Table 4. Changes in mode to work for employer-based coordinator program.

	Changes in Mode to Work (%)																	
	Drive Alone			Drive with Another Employee			Drive with Family Member			Transit			Walk			Other		
Item	1978	1979	Δ	1978	1979	Δ	1978	1979	Δ	1978	1979	Δ	1978	1979	Δ	1978	1979	Δ
Agency																		
Transportation[a]	54	42	-12	27	39	12	11	16	5	5	2	-3	3	0	-3	1	1	0
Labor	50	45	-5	25	32	7	18	18	0	6	4	-2	0	0	0	2	2	0
Motor Vehicles[a]	43	33	-10	27	41	14	13	8	-3	12	11	-1	3	4	1	3	4	1
General Services[a]	43	40	-3	28	32	4	14	11	-5	9	11	2	6	4	-2	0	2	-1
Health	41	37	6	26	23	-3	16	16	0	11	18	7	5	4	-1	1	3	2
Public Service	42	39	-3	34	35	1	10	5	-5	10	15	5	5	3	0	2	2	0
Overall total	46	40	-6	27	33	5	14	13	-1	9	10	1	3	2	-1	1	2	1
Avg test			-8			10			-1			-2			-2			0
Avg control			-3			3.5			-2			3			0			1

[a]Test group.

over the same period of time. Thus the coordinator project was able to effect an increase of 6.5 percentage points because of its activities. Approximately 195,000 gal of gasoline was conserved by new carpoolers in all six agencies--an average of 283 gal of gasoline per year per carpooler. Of this, 101,000 gal was attributable to the carpool coordinator program.

Comparison of internal records (data reports by the coordinators themselves on new carpoolers) isolates the direct effect of the coordinator program from the indirect (halo) effect of the program and the effect of background changes. Halo program effect refers to the inducement of additional positive behavior by individuals not actually registered in the program but merely encouraged by it. The data in the table below indicate that, of the 530 new carpoolers in the test agencies, 150 came directly from the program, 233 from the halo effects of the program, and 147 from the energy crisis (external effect):

	Agencies	
Item	Test	Control
Agency population	4,207	4,365
Change in carpool (%)	+10	+3.5
Effects		
External (nonprogram)	147	162
Internal (program)		
Direct (from program records)	150	-
Indirect (halo)	233	-
Total	383	-
Total	530	162

[Note that 147 (external effect) was derived by multiplying 4,207 x 0.035; 150 (direct internal effect) includes dropouts; and 233 (indirect internal effect) is the total of program and energy crisis carpoolers.] The 233 employees were encouraged to carpool by the spirit of the program in these agencies, but would not have done so solely because of the energy crisis. [Note that the estimate of the 147 carpoolers from the energy crisis is determined by applying the percentage change in the control group (+3.5) to the test population (4,207).]

Thus, although the energy crisis itself clearly accounted for an increase in carpooling, the carpool coordinator program in the test agencies was capable of taking advantage of that event by directly assisting some employees and indirectly encouraging others to participate on their own. Furthermore, the use of the test and control design with internal and external observations allowed the quantification of these effects. Without this design (relying on program data records only), the program would have registered only 150 new carpoolers and missed entirely the 233 indirect carpoolers. Thus the strong design, instead of hurting the program, actually strengthened it.

These results are an example of the Δ test +, Δ control + results in Figure 1. The positive interpretation stems from the fact that ΔT is much greater than ΔC and both are positive.

Case 2: Neighborhood-Based Program During a Stable Period

The neighborhood-based demonstration began in January 1981 and ended in December 1981. As shown in Figure 2, the period was generally one of economic and travel stability, and therefore a surge in carpooling would not be expected. The goal of this study was to determine the effectiveness of home-end carpooling success. The study featured the use of ridesharing coordinators operating within neighborhood sites (community based), a quasi-experimental design in which the effects of coordinator services are compared with the behavior of control sites, the use of before-and-after surveys, and careful periodic monitoring. Comparison of results was made on the basis of changes in travel behavior, carpool formation and retention, vehicle miles of travel (VMT), energy savings, and the effect of marketing materials.

The evaluation design may be represented as follows (note that the internal effect includes $T_1, T_2, \ldots$):

	Overall Effect				
Site	Before Survey (T_B)	T_1	T_2	...	After Survey (T_A)
Cohoes	O_B				O_A
Clifton Park	O_B	M_1 O_1	M_2	...	O_A
Glenville	O_B				O_A
Albany-South Side	O_B				O_A
Control area	O_B				O_A

Four sites from the Albany standard metropolitan statistical area (SMSA) were selected and provided with community-based coordinators for a 1-year period. The control site was the remainder of the Albany SMSA. Sites varied in density and accessibility to the urban cores and in location of the coordinators' offices:

Type of Setting	Location of Office	
	Town Hall	Home
Suburb	Clifton Park	Glenville
City	Cohoes	Albany-South Side

The general hypothesis tested (10) is that if the marketing and coordinators' services are effective, the change in behavior in the test sites should be different (significantly) from the change in behavior in the control site. Similarly, tests between specific sites, or groups of sites, can be arranged to evaluate the effectiveness of suburban versus city programs, town hall versus home offices, and each site's program relative to the others.

The before-and-after surveys consisted of random sample telephone surveys of residents in each site and in the control area. Each household contacted was given a brief questionnaire on travel patterns, work and nonwork ridesharing, reasons for ridesharing (before survey only), and program awareness (after survey only). Persons selected in the before survey were recontacted in the after survey, thus constituting a panel of observations. The use of the panel approach allowed a determination of changes in travel over time within each site. Tests for the significance of changes in travel over time were conducted by using paired observations for nonwork travel and modal-shift behavior of work travel. Tests for significance between sites were conducted by using standard tests for the difference in mean change.

Direct effects were measured through a review of records kept by each carpool coordinator. Basic information included

1. Number of applications attracted;
2. Number of ridesharers attracted;
3. Number of new carpoolers per coordinator hour of effort; and
4. VMT reductions associated with the number of new carpoolers, the number of coordinator hours, and the number of applications received.

During the program weekly records were kept of the hours and type of coordinator effort, number of applications received, number of applications attributed to each marketing strategy, and number of carpools formed. The results of this effort were summarized on a quarterly basis. Each marketing strategy was evaluated by the number of applications generated, the cost, and the resulting VMT savings.

Analysis of the external data is given in Table 5. Work-based carpooling activity declined in the test sites and increased in the control sites, although the changes were small. Further analysis suggested that these results were caused by inordinately large drops in the number of reported workers per household, which suggested reporting problems in the panel data that were possibly caused by carpool dropouts in the not-working group rather than the drive-alone group.

Nonwork carpooling--already high in these sites--was found not to have changed in the 1-year period. The data in Table 6 indicate that, although some increases in nonwork travel did occur, these appear to be related to shopping travel increases in Clifton Park and Glenville and are probably the result of widescale supermarket coupon wars in those towns (see Figure 2). Carpool nonwork travel, however, showed no changes (11), which implies that the coordinator services had no significant effect on overall community travel.

Surprisingly, the internal records indicated that the community-based service was equally as effective as the employer-based service described above. In the four sites, 176 new carpoolers were formed from 396 applications for a savings of 18,000 VMT/week. When reduced to the same time period as the employer demonstration, the results are almost identical (Table 7). Taking into account that these results did not have the benefit of an energy crisis, the study concluded that the neighborhood approach has considerable potential.

However, in contrast to the employer demonstration, the overall effect of the program on community travel was small. The data in Table 8 indicate that the program saved less than about 0.3 percent of community VMT, and this saving was concentrated in the suburban sites of Clifton Park and Glenville.

Table 5. Changes in work travel (1981-1982) for neighborhood ridesharing demonstration project.

	Drive Alone		Rideshare		Transit		Other[a]		Total		
Area	Percent	Avg Distance (miles)	Percent	Avg Distance (miles)	Percent	Avg Distance (miles)	Percent	Avg Distance (miles)	Percent	Avg NST	Private Vehicle Avg Distance (miles)
Cohoes											
1981	62	8.0	26	8.5	4	5.5	7.9	1.6	100	7.5	8.1
1980	56	9.0	32	9.2	4	5.5	8.0	1.5	100	8.3	9.0
Δ	+6	-1.0	-6	-0.7	0	0	0.1	0.1		-0.8	-0.9
Clifton Park											
1981	70	14.9	29	14.6	0.5	22.0	0.5	1.0	100	14.8	14.8
1980	69	14.3	30	14.4	0.5	22.0	0.5	1.0	100	14.3	14.3
Δ	+1	+0.6	-1	+0.2	0	0	0	0		+0.5	+0.5
Glenville											
1981	76	9.2	17	8.9	3	11.5	4	3.0	100	8.9	9.2
1980	76	10.1	16	8.8	4	8.4	4	3.0	100	9.5	9.9
Δ	0	-0.9	+1	+0.1	-1	3.1	0	0		-0.6	-0.7
Albany-South Side											
1981	57	6.6	15	6.9	16	4.1	12	1.8	100	5.7	6.7
1980	58	8.2	15	7.5	17	4.4	10	1.8	100	7.2	8.1
Δ	-1	-1.6	0	+0.6	-1	-0.3	+2	0		-1.5	-1.4
Total test areas											
1981	67	10.3	22	10.8	5	5.3	6	1.6	100	9.7	10.4
1980	65	10.8	24	10.7	6	5.6	5	1.6	100	10.1	10.8
Δ	+2[b]	-0.5	-2[b]	+0.1	-1	-0.3	1	0		-0.4	-0.4
Capital District control											
1981	68	10.7	18	9.0	8	4.6	6	3.0	100	9.5	10.3
1980	71	10.7	17	8.8	6	4.4	6	3.0	100	9.5	10.3
Δ	-3[b]	0	+1[b]	+0.2	+2	+0.2	0	0		0	0

[a] Includes walk and bicycle. [b] Statistically significant.

Table 6. Summary of tests for significance of differences in changes in nonwork travel between sites (neighborhood ridesharing demonstration).

	Summary of Tests (t-statistics)				
Significance of Δ VMT for	Shop, Grocery	Shop, Nonwork	School	Church and Civic	Visit and Social
Test as a whole	2.1	2.3			4.5
Cohoes				2.1	2.5
Clifton Park	3.6	2.8			4.9
Glenville	2.1	2.1			3.8
Albany-South Side					2.9
City versus control					3.2
Suburban versus control	3.3	2.8			5.0
Town hall versus control	2.3				4.3
Home and office versus control		2.3			3.9
Suburb versus city	3.2				2.0
Town hall versus home and office					

Notes: There were no significant changes in the t-statistics for Δ carpool VMT or Δ carpool person miles of travel (PMT). $x = t \geq 2.0$; $n = 821$ (reduced panel: used only female respondents in second year of survey).

Table 7. Comparative summary of direct effects for employer versus neighborhood ridesharing demonstrations.

Phase	Item	Demonstration	
		Neighborhood	Employer[a]
Target	When	January-November 1982	January-October 1979
	Target population	101,723	4,207
Effort (input).	No. of coordinators	4	4
	No. of hours	3,755	2,230
Results (output)	Applications received	346	624
	New carpoolers attracted	154	150
	Total VMT saved per week	16,447	16,335
	Total gallons of gasoline saved per week	1,097	1,126

[a]Initial period.

Table 8. Direct program effects as a percentage of community VMT.

Item	Cohoes	Clifton Park	Glenville	Albany-South Side
Work				
Community VMT per week[a]	639,000	1,067,000	974,000	974,000
VMT saved per week	1,282	2,454	1,739	401
Percentage saved	0.20	0.29	0.18	0.04
School and recreation				
Community VMT per week[a]	16,000	58,000	44,000	34,000
VMT saved per week	536	7,876	2,956	1,533
Percentage saved	3.35	13.58	6.72	4.51
Total				
Community VMT per week[a]	1,085,000	1,501,000	1,662,000	1,516,000
VMT saved per week	1,818	10,330	4,695	1,954
Percentage saved	0.19	0.67	0.28	0.13

[a]Estimated from external survey data.

Therefore the use of a strong design in this case had the effect of placing the generally positive results into perspective to remind the researcher that the apparent positive news from the internal records should not be presumed to have generated large benefits to the community as a whole.

The test results in this study fall into two interpretation groups of Figure 1. The work travel results are Δtest −, Δcontrol +, which suggests a negative backlash on the program or (in this case) methodological problems with the data. On the other hand, the nonwork results are best interpreted as Δtest 0, Δcontrol 0, which suggests an ineffectual program in a large stable background.

CONCLUSIONS

It has been demonstrated that the use of statistical designs can be helpful, and not necessarily negative, in evaluating carpooling programs. Among the benefits of such designs are the following:

1. Isolation of background changes: In the face of major background changes, the test and control design prevents inappropriate attribution of results entirely to the program. It also permits quantification of the direct and indirect effects of the program as part of its positive impact. This would not be possible without before-and-after data.
2. Perspective setting: In both studies the design permits the results to be placed into a broader perspective. In cases where the community is large and the program small, this naturally means a dampening of apparent positive results. Although ridesharing agencies might therefore be reluctant to include such findings, it is believed that the people (as taxpayers) are better served by them.
3. Insurance: No one knows, of course, when rapid changes in background might occur. Given the relatively long lead time necessary to plan and implement transportation services, the prudent researcher should include the possibility that such an analytical disaster might occur during the study.

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Impact of Flexitime Work Schedules on an Employer-Based Ridesharing Program

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The impact on commuting behavior of employees when flexitime is superimposed on a large employer-based ridesharing program is discussed. The case study uses the Tennessee Valley Authority (TVA) program in downtown Knoxville, Tennessee. Based on the first 6 months of experience with TVA's Knoxville flexitime program, it is shown that giving employees greater choice in working hours can serve to upset an established ridesharing program. It must be noted that the TVA ridesharing program is unique in that it provides a high level of consumer-oriented services. Buses operate equivalent to a subscription program and, along with vans, arrive just before the work day starts and leave immediately at the end of the work day. The element of choice then adds complexity to the operations. With shifting demands for different starting and leaving times, it becomes difficult to balance the services with the demand. Also, it is difficult for 35 to 40 people who use the same vehicle to reach a mutually agreed on schedule. Van operations are easier to adapt to flexitime because the decisions involve a smaller number of individuals and decisions can be made at the decentralized level of the van. However, when individuals are accustomed to receiving a high level of commuter service, and events take place to spread that demand over a longer time period, readjustments in travel behavior and accompanying services will be required. These adjustments will require the provision of additional commuter services. As TVA's experience indicates, without service adjustments, people will make use of the flexitime opportunities by carpooling or by driving alone. Both ridesharing and flexitime are important concepts for energy conservation. However, when flexitime is added to a large customized ridesharing program, the net energy savings will not equal the sum of both energy conservation actions taken singularly.

Two critical issues that confront transportation planners are increased concern over the cost and availability of energy and the ability of the government to undertake large-scale capital investment programs to increase the capacity of transportation facilities. Increasingly, it is becoming apparent that many transportation problems are related to the peaking of trips. Work trips tend to cluster during about 4 hr of the day, which necessitates the sizing of transportation facilities to accommodate the travel demand concentrated in these hours. Peaking problems create travel delays and cause inconvenience to users of the transportation systems; these delays are also costly in terms of excess pollution and energy use.

Rather than building excess transportation capacity that is only used for a few hours per week, a philosophy of peak-period demand management is evolving as a transportation system management (TSM) strategy. Attempts are being made to reduce peak-hour demands through such concepts as staggered work hours, flexitime, or the 4-day work week.

Flexitime, in particular, is receiving increased attention as a peak-period demand management technique. Flexitime differs from staggered work hours in that it does not formally assign work arrival and departure times to groups of employees. For example, in a firm in which all employees worked from 8:00 a.m. to 4:30 p.m., the work force could be divided into three groups by initiating staggered work hours. The first group might work from 7:30 a.m. to 4:00 p.m., the second from 8:00 a.m. to 4:30 p.m., and the last from 8:30 a.m. to 5:00 p.m. Some employees will benefit from improved transportation because of less congestion, but each employee's arrival and departure time remains fixed.

Flexitime is different. One popular variation is to designate certain hours as flexible or core hours within the span of a work week. An employee must work a set number of hours, but there is more latitude in choosing working hours within an established range. Typically, all employees must be available for a core time (e.g., 9:00 a.m. to 3:00 p.m.); within a certain number of flexible hours employees may choose their own arrival and departure times. In some programs, lunch breaks may also be defined as flexible time (1).

Flexitime is a relatively new idea that is receiving increased attention in the United States. Historically, flexitime is generally attributed to a program initiated in 1967 by the Messerschmidt-Boelkow-Blohm aerospace firm in West Germany. Since that date, flexitime has spread rapidly through Europe; but, until recently, it has received only limited attention in the United States (2). It is estimated that more than 3,000 West German companies have extended the flexitime concept to more than 50 percent of the labor force (3). Similar acceptance rates have been achieved in other European countries. Projections made from a 1977 survey conducted by the American Management Association estimated the use of flexitime in the United States as follows (4):

1. Almost 13 percent of all nongovernment organizations with 50 or more employees use flexitime,
2. More than 5 percent of all employees are on flexitime, and
3. Between 2.5 and 3.5 million employees are on flexitime, not counting self-employed persons and many professionals, managers, and sales people who

have long set their own hours without calling their schedule flexitime.

Experimentation with flexitime is continuing, with many private and public organizations actively exploring the concept. The question to be addressed is: What are the benefits to be derived from flexitime?

Flexitime appears to provide substantial benefits to employees and management (1):

1. For employees--improved working climate, an opportunity to exercise self-reliance, easier accommodation of family responsibilities, increased usable leisure time, reduced morning stress associated with occasional late arrivals, and reduced traffic congestion and possible reduction of automobile gasoline consumption; and
2. For management--reduced tardiness, reduced short-term sick leave and annual leave, less interruptions during the early morning and late afternoon, increased productivity, and increased recruiting advantage.

However, concern has also been raised that flexitime might create some ridesharing problems. Besides the obvious problems of potential workers' abuse, increased recordkeeping requirements, additional overhead costs from longer hours, and the fact that supervisors are not available for the entire work day, flexitime also has uncertain implications on ridesharing.

There are two distinct schools of thought concerning the consequences of changing work schedules on commuter travel behavior. One is that greater flexibility in work-trip scheduling will permit employees to avoid peak crushes and will make it more attractive for commuters to drive their personal automobiles. In this sense, adoption of a flexitime schedule will be counterproductive to energy conservation plans that rely on the encouragement of carpooling and transit riding.

However, contrary data have been provided that suggest that additional flexibility in scheduling work trips will in fact enhance ridesharing efforts. This will be achieved by allowing individuals to enter carpools that were previously inconvenient due to scheduling differences or permit riding transit at other than peak crush, thereby reducing inconvenience, travel time, and wait time.

Interestingly, survey evidence has been developed by Blakely that supports the contention that flexitime will enhance ridesharing (1). Unfortunately, flexitime is still a relatively new concept and does not have the benefit of extensive demonstration or testing. It is not clear what impact flexitime will have on ridesharing, either as a counterproductive force or as a mutually supporting element.

OBJECTIVES

The impact of flexitime on the commuting behavior of Tennessee Valley Authority (TVA) employees who work in downtown Knoxville is discussed in this paper. The significance of this experimental group is that TVA maintains an extensive employer-based ridesharing program that involves 92 vanpools and 27 express buses. This provides an interesting example of superimposing flexitime on a mature ridesharing program, where 84 percent of the 4,200 work force was already coming to work by means other than driving alone. Almost half of those who participate in ridesharing commute in vanpools and buses.

TVA RIDESHARING PROGRAM

The commuter ridesharing program in Knoxville evolved gradually over the past 9 years. Before the inception of express buses and vanpools, TVA employees participated in ridesharing primarily in the form of carpooling and, to a lesser extent, through the use of regular bus service. The first proposal for an express bus was brought up at a citizens' meeting in west Knoxville with city traffic engineers and planners. The citizens were concerned with the traffic congestion on I-40 and the sole reliance being placed on the automobile to meet all current and future needs in the corridor. The citizens' group represented an area that has a large concentration of TVA employees, and the group seriously pursued the proposal for an express bus.

A commuter express bus was initiated in Knoxville on December 3, 1973, and was highly successful. Joint efforts between the city administration and TVA employees proved effective in promoting ridesharing, and by the end of 1974 there were 10 express buses and 6 vanpools, all of which were serving primarily TVA employees.

A major change in the ridesharing program occurred in January 1975 with the initiation of TVA's incentive program, which was called the Commuter Pooling Demonstration Program. This incentive plan called for

1. A one-third discount on commuter bus tickets,
2. Issuance of a $5 monthly municipal parking ticket to each bona fide carpool (a carpool for this purpose was defined as a group of three or more riders with at least two being TVA employees),
3. Credit to vanpool accounts of $3/month for each TVA employee participating in vanpooling, and
4. Reimbursement to handicapped employees for the direct cost of parking in a commercial lot convenient to their place of work.

The impact of the incentive program was significant. There was an immediate reduction of 12 percent in the number of TVA employees driving alone to work while the number of express bus and vanpool riders continued to increase. Two private bus operators had to be used in addition to Knoxville Transit Corporation (K-Trans) to meet the increased need for express bus service during peak hours. By January 1977, there were 23 express buses (13 public and 10 private) and 18 vanpools serving TVA employees. Finally, by 1979 there were 29 express buses and 69 vans. Table 1 gives the modal-use pattern of TVA employees.

TVA FLEXITIME PROGRAM

In June 1979, a flexitime demonstration was adopted for a major portion (82 percent) of TVA office em-

Table 1. Modal-use patterns of TVA employees.

Item	Modal-Use Pattern of Work Force Over Time				
	11/73	12/74	1/75	1/77	1/79
Mode of transportation (%)					
Drive alone	65.0	42.0	30.0	18.0	17.0
Regular bus	3.5	3.0	5.0	3.0	3.0
Express bus		11.0	18.0	28.0	22.0
Carpool	30.0	40.0	42.0	41.0	40.0
Vanpool		1.7	3.0	7.0	16.0
Bike, walk, etc.	1.5		2.0	3.0	2.0
Total work force	2,950	3,000	3,100	3,400	4,200
No. of express buses		10	12	23	29
No. of vans		6	6	18	69

ployees in downtown Knoxville. The four flexitime plans available are noted in the table below:

Scehdule	Start Time (a.m.)	End Time (p.m.)
A	7:00	3:45
B	7:30	4:15
C	8:00	4:45
D	8:30	5:15
E	9:00	5:45

(Note that employees may select schedule A, B, C, or D. The core time is from 9:00 a.m. to 3:45 p.m., excluding 45-min lunch periods beginning 11:30 a.m. and ending 12:45 p.m. Employees may use schedule E only on an infrequent basis for individual circumstances or emergencies. When schedule E is used, employees inform their supervisors as soon as possible after determining that this option is to be exercised.)

A core time of 6 hr, excluding lunch, is defined. All employees are required to work an 8-hr day, and the 45-min lunch period cannot be flexed. Each employee uses a sign-in and sign-out sheet to record arrival and departure times. Also, all employees are required to declare their anticipated schedules on a biweekly basis. The impact of adopting flexitime on the TVA ridesharing program will be discussed based on its two major elements: vanpools and buspools.

A survey of 10 percent of TVA personnel who work in downtown Knoxville was conducted in fall 1980. The survey was initiated to determine current TVA employees' commuter travel modes and the impact of flexitime on commuting schedules. Of the 424 TVA employees surveyed, slightly more than 50 percent continued to select the 8:00 a.m. to 4:45 p.m. work schedule:

	Modal Choice (%) by Flexitime Schedule				
Mode	A	B	C	D	Other
Bus	21.3	9.8	68.9	-	-
Van	25.3	36.0	38.7	-	-
Drive alone	37.9	11.1	41.7	6.5	2.8
Carpool with family	27.3	18.2	47.3	7.2	-
Carpool	24.4	19.5	56.1	-	-
Other	35.7	28.6	28.6	7.1	-
Total	28.0	17.6	50.8	2.9	0.7

The 7:00 a.m. to 3:45 p.m. flexitime period was the second most desirable work schedule with 28 percent of the work force selecting this work period. Note that the work schedule is not totally flexible, as 20 percent of the survey respondents who work from 8:00 a.m. to 4:45 p.m. were employed in sections not eligible for flexitime. As expected, modal choice was influenced by flexitime work schedule.

Bus ridership, partly reflecting seating capacity, is highly oriented to the 8:00 a.m. to 4:45 p.m. time period, with more than 68 percent of the bus riders selecting this time. The drive-alone mode indicates a heavy concentration in the 7:00 a.m. to 3:45 p.m. and 8:00 a.m. to 4:45 p.m. time periods, but limited participation in the 7:30 a.m. to 4:15 p.m. flexitime period. Vanpools provide a relatively equal participation in the three flexitime periods. Carpooling is oriented to the 8:00 a.m. to 4:45 p.m. period, although not as extensively as bus riders.

Approximately 10 percent of the respondents indicated an intention to change their flexitime period in the fall and winter. Sixteen percent of the individuals in the 7:00 a.m. to 3:45 p.m. time period indicated a desire to change working hours, with 89 percent desiring a later starting time. Changes by other time periods were minor, except for tne 8:30 a.m. to 5:15 p.m. time period, where 25 percent indicated a desire to start earlier. The greatest number of changes were planned by the drive-alone mode, which of course has the greatest flexibility in selecting working hours.

VANPOOLS

An important element of the TVA ridesharing effort was the 69 vanpools operated by the TVA Employees Credit Union. Before flexitime, all vans arrived at TVA's starting work time of 8:00 a.m. and then departed immediately after work at 4:45 p.m. Vanpools were able to respond to flexitime in most instances by having vanpool riders and drivers work out their own arrangement without intervention by the Commuter Pooling Operations Section that administers the ridesharing program.

Nine months after flexitime was initiated, a telephone survey was conducted of all 75 Knoxville van drivers to determine their experience and reaction to flexitime. The survey revealed that 20 percent of the vanpools had shifted to a 7:00 a.m. arrival time, 30 percent to 7:30 a.m., and 50 percent remained at the original time of 8:00 a.m. Where sufficient demand and interest existed for a revised work schedule and an existing vanpool did not or could not change arrival times, new vanpools were established. For example, of the six new vanpools established after flexitime was initiated, four arrived at 7:00 a.m. and two arrived at 7:30 a.m.

Most decisions with respect to flexitime were decentralized and made by the members of each vanpool. For 54 percent of the vanpools, the decision was reached by strict majority vote, whereas for 20 percent, the decision was by a general consensus. There were only a few cases in which the vans did not change schedules either because the driver would not or could not change or because of special concern for hardships imposed on a few riders. Only one vanpool experimented with different flexitimes and eventually decided to revert back to the original 8:00 a.m. arrival time.

A critical question concerning the implementation of flexitime is the impact of altering vanpool arrival and departure times on the travel behavior of vanpool riders. Of the 34 vanpools that selected a new starting time, 38 percent lost riders because of the schedule change. Of the 35 vanpools that did not alter the arrival time, only 26 percent reported losing riders. Fifty percent of the vanpools that altered arrival times reported being able to attract new riders because of the new arrival times.

Table 2 provides a summary of the modal shift in ridership due to flexitime. In total, there was a net loss of 18 riders to vanpools out of the total ridership base of 1,012 individuals. The largest shift occurred between vanpools because individuals already vanpooling selected vanpools that operated closer to their preferred work hours. Because the express buses operating at this time all retained the original 8:00 a.m. to 4:45 p.m. schedule, it became attractive for employees desiring to start work before 8:00 a.m. to switch to vanpools and, also, for riders in vanpools that had changed arrival times to switch to buses if they desired to retain the original work hours. Flexitime, then, had only a minor effect on vanpool ridership. A few additional riders were diverted from the buses, carpools, and drive-alone modes to the vanpools, but this accounted for less than 1 percent of the total ridesharing population.

In general, vanpools were able to adjust to the flexitime schedules with minimum difficulties. In

Table 2. Modal shift to and from vanpools due to flexitime.

Item	Modal Shifts to and from Vanpools by Operating Times		
	7:00 a.m.-3:45 p.m.	7:30 a.m.-4:15 p.m.	8:00 a.m.-4:45 p.m.
No. of vans	14	20	35
No. of vans adding riders due to time shift	5	10	4
No. of vans losing riders due to time shift	6	7	9
Riders joined vans from			
Bus	2	2	0
Van	7	3	4
Carpool	1	2	0
Drive alone	2	3	1
Unknown	0	1	0
Total	12	11	5
Riders left van to use			
Bus	2	6	2
Another van	11	8	12
Carpool	1	3	0
Drive alone	2	10	1
Unknown	1	0	4
Total	17	27	19
Net change in van ridership (persons) going to or from modes other than vans	-1	-11	-6

cases where selection of flexitime posed some difficulty, it was possible to add new vanpools to the fleet to accommodate those seeking an earlier starting and departing time. Interestingly, 92 percent of the vanpool drivers stated they had no plans to shift hours during the summer or fall. This indicates a high degree of stability and satisfaction with the chosen schedules. The vanpools were then able to adjust to flexitime, reach a stable condition, and retain their former ridership.

BUSPOOLS

At the time of adoption of flexitime, all of the express buses were operating to accommodate the 8:00 a.m. to 4:45 p.m. work schedule. After the vanpools adopted a flex schedule, pressure mounted for the buses to alter schedules. Because buses carry 26 percent of the work force, retaining the buses on the 8:00 a.m. to 4:45 p.m. work schedule was a major obstacle to implementing flexitime on an agencywide basis.

In comparison to the vanpools, the adjustment to a flexitime schedule had a major impact on the bus program. After numerous suggestions, the decision was made to develop a new bus schedule and begin the schedule on the first Monday in February 1980. Altering the bus arrival and departure times required developing a new schedule and communicating the revisions to the riders. In order to ascertain schedule preference, a survey was conducted of 1,174 employees by zip codes in areas where express bus service was available. As noted in the table below, the desired starting times were varied, which made it difficult for the transportation coordinator to work out a compromise:

Desired Time to Start Work (a.m.)	Responses	
	No.	Percent
7:00	469	40.0
7:30	210	17.9
8:00	456	38.8
8:30	39	3.3

Unlike the vanpools, only the schedules of eight buses were changed, with seven arriving at 7:00 a.m. and one at 7:30 a.m. Although a majority rule was attempted, an unhappy and vocal minority was always dissatisfied with the decision. In hopes of converting to bus commuting individuals who were previously lost due to the rigid bus schedule, additional bus service was provided on the first day. The net result was expanding the bus fleet by two buses--one added by the public operator (K-Trans) and one by a private bus operator (B&C Bus Lines). The number of buses increased, but average occupancy dropped.

A major concern was the impact of flexitime on bus ridership. With the institution of a flexitime bus schedule, it was hoped that many riders who had changed from bus to other modes of transportation in order to get to work earlier would start using the buses again.

In order to compare preflexitime and postflexitime ridership trends, K-Trans ridership statistics were used because K-Trans provides the largest amount of bus service (17 out of 29 buses) and had provided continuous service for at least 3 years before flexitime with the same routes, equipment, and fares. The base year of 1978 was used because it best reflects historical trends. As noted in Figure 1, once flexitime schedules were adopted on June 17, 1979, bus ridership started to decline when compared with ridership during the first 5 months of the year. By using January through May 1979 as the preflexitime control period, monthly bus ridership dropped an average of 5,000 riders, or a daily average of 121 persons during the July to December 1979 time period. All of these figures were corrected for seasonal variations in ridership by using 1978 as the historical base. The resulting 21 percent decline in bus ridership during this time can be largely attributed to the inability of the bus system to serve the needs of those individuals desiring to participate in the flexitime program.

As noted in Figure 2, in each of the 5 months before flexitime schedules were instituted, the bus ridership was higher than the preceding year. However, once the flexitime program was initiated in June 1979, there was a lower ridership in each of the following months of 1979 than in the preceding year. The decision by K-Trans to put the buses on a flexitime schedule was an attempt to recapture these lost riders.

The data in Figure 2 show that the concept worked well, with bus ridership increasing 2.5 percent over the preflexitime ridership of 1979 and 24 percent over the seasonally corrected ridership during the last months of 1979. The only direct monthly com-

Figure 1. Comparison of preflexitime and postflexitime (1979): express bus ridership versus control period (1978).

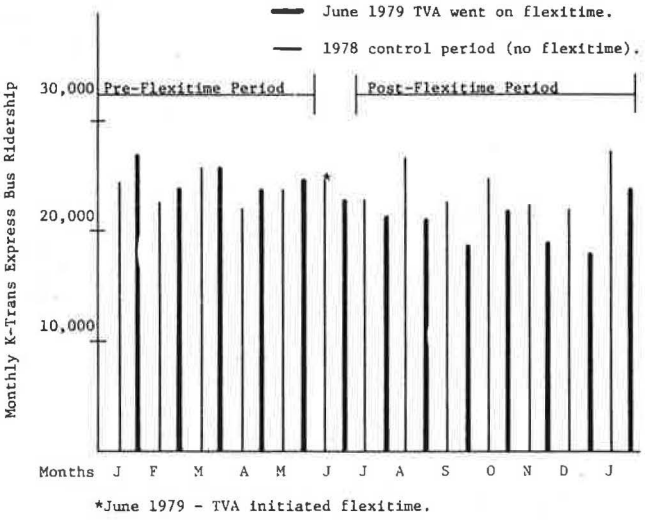
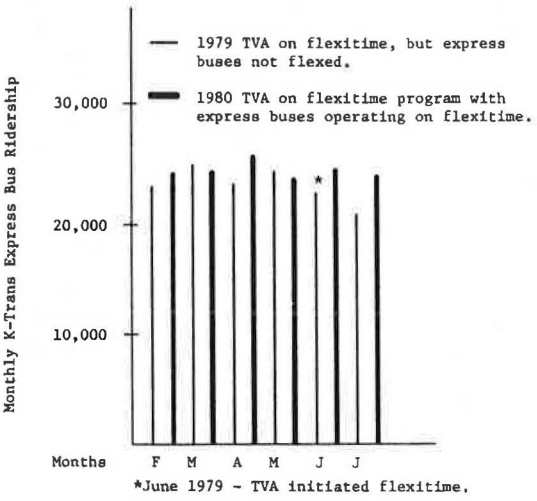


Figure 2. Comparison of express bus ridership with (1980) and without (1979) buses operating on flexitime schedules.



parison with both the flexitime program active and the buses operating on a flexitime schedule was July 1979 with July 1980. The July 1980 period had a bus ridership of 24 percent over 1979. This increased bus ridership was accomplished with only 7 percent additional vehicle miles of bus service. As a countertrend, the express bus fare was raised from $0.60 to $0.75/ride effective July 1, 1980, but during this same time period, automobile driving costs increased markedly, which made bus service more attractive. Also during this 1-year time interval, TVA substantially increased the number of vans to a fleet size of 86 vehicles.

Currently, the transportation coordinator is closely monitoring ridership to detect any seasonal changes in desired starting times and thus the need to alter bus schedules. After a difficult adjustment period, ridership appears to have stabilized. One of the buses lightly used in the flexitime schedule will be eliminated and another rerouted to accommodate riders left without service.

The public bus company (K-Trans), has been able to integrate the express runs with the regular work schedule; two drivers make both the 7:00 and 8:00 a.m. runs, while other drivers are used mainly for regular service runs or school runs after the express peak. The bus manager believes that opportunities exist for multiple runs, but with Knoxville's extensive freeway reconstruction program and unpredictable traffic tie-ups, the risks are too great for providing reliable service. If more peak-hour work could be found for the drivers, this might give the transit manager greater flexibility in cutting runs.

CONCLUSIONS

Where peak loads can be spread to reduce vehicle concentrations and congestion and the transportation services are readily available, flexitime work schedules have a definite advantage. However, if ridesharing services are provided at fixed intervals (e.g., TVA's vans and buses that arrive just before 8:00 a.m. and leave at 4:30 p.m.), the introduction of travel choice adds complexity and requires incremented additions to the services already being provided. Flexitime as an energy conservation concept then requires careful planning and tailoring to the local situation.

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Measuring the Effectiveness of Personalized Ridesharing Assistance

WILLIAM R. HERSHEY AND ALEXANDER J. HEKIMIAN

Cumbersome data-collection techniques hinder evaluations of many ridesharing programs. Fundamental performance measures have eluded researchers, who often depend on infrequent surveys of ridesharing program participants for their data. The Share-A-Ride program in Silver Spring, Maryland, however, has developed a reliable evaluation process that does not depend on special surveys. Share-A-Ride uses an ongoing data-collection effort based on follow-up telephone calls to program participants. The resulting information helps make the program responsive to its clients and serves as a basis for detailed evaluation. Share-A-Ride has raised pool formation rates beyond those typically produced by traditional ridesharing programs. Approximately 54 percent of Share-A-Ride's participants who were active at the 2-year mark of program operations had formed new ridesharing arrangements. Attrition claimed a significant number of participants, which emphasizes the importance of rematching participants and maintaining data base integrity. The average participant received three follow-up calls from Share-A-Ride staff. More than half of the new ridesharers did not start pooling until after their first follow-up call. Nearly three-quarters of the participants who were sent matches for pooling ultimately contacted others on their lists. The evaluation also measured staffing requirements for implementing the personalized approach. The Share-A-Ride experience shows that labor can be reduced after the initial 2 years of program operations. Although the labor-intensiveness of personalized ridesharing assistance makes it somewhat more expensive than traditional approaches, the resulting benefits are significant.

Hundreds of ridesharing programs exist around the country, yet little is known about how well they place people into carpools, vanpools, or public transit. Even less is known about which assistance techniques are most effective. The main problem is that cumbersome and expensive data-collection techniques hinder evaluations of ridesharing programs. Most evaluations rely on infrequent surveys. Consequently, the typical evaluation provides only a snapshot of a highly dynamic situation. To make matters worse, if the survey is of the mail-back variety, it is likely to be biased.

Previous research underscores the problem. Wagner's review of major U.S. ridesharing programs in 1978 conveyed the frustration of trying to collect enough data to report on even the most fundamental performance measures (1). Glazer and Webb have recommended reporting standards for ridesharing programs, but their suggested improvements in evaluation procedures have been slow in reaching the local level. [Note: J. Glazer and P. Webb's work, Evaluation Kit No. 1: Procedures for Carpool Program Evaluation, was prepared as a supplement to NCHRP Report 241, Guidelines for Using Vanpools and Carpools as a TSM Technique, in November 1981.] At the time of this writing, FHWA has work under way to develop standards for ridesharing program evaluations. All of the latest evaluation guidelines, however, are limited by their reliance on survey data.

The unfortunate result of the evaluation dilemma is that ridesharing agencies have little feedback on how responsive they are to their clients and how they can improve their programs. Wagner estimated that, on average, 16 percent of the people who applied to the ridesharing programs in his sample entered new pools or expanded existing pools (1). However, recent evidence suggests that much higher success rates are achievable, particularly for employer-based programs. Shearin's research in 1981 (2) indicates that personalized assistance is having a profound effect in increasing success rates in several programs around the country. An important side benefit of personalization is the ongoing collection of data, which serves as a continual source of feedback and a basis for evaluation.

The evaluation of Share-A-Ride, a personalized ridesharing program in Silver Spring, Maryland (3), is described in this paper in order to show in detail how effective a personalized rideshare assistance program has been after 2 years of operation. Also, an unconventional but easy and thorough way to perform an evaluation, based almost entirely on data collected as a normal part of implementing the personalized approach, is described.

BACKGROUND ON SHARE-A-RIDE

The Maryland-National Capital Park and Planning Commission created the Share-A-Ride program to test the potential of personalizing the marketing, matching, and follow-up processes. Share-A-Ride's personalized approach involves direct marketing with the largest employers in the market area. The program staff make ongoing, personal contacts with employer coordinators who help promote the program to their employees. Meanwhile, people who work for small employers receive information on the program by way of brochures, posters, and leaflets in building lobbies, banks, parking garages, and other public areas.

The staff process program applicants (called participants in this paper) through a hybrid manual and computer technique that produces high-quality matches. The matching process relies on staff judgments that are based on information in the program's data base and on a large map of the region. Share-A-Ride participants receive match information not only when they first enter the program, but each time their names appear in match lists of later participants.

Soon after sending the initial match information, the staff make follow-up calls to record what actions the new participants have taken and to offer advice if necessary. As needed, the staff continue to make periodic calls to update the status of participants and urge them to form new ridesharing arrangements.

Since 1979, Share-A-Ride has applied the personalized approach in the Silver Spring business district, a suburban employment center just north of Washington, D.C. The program supplements a region-wide computerized ridesharing service for the rest of the Washington area operated by the Metropolitan Washington Council of Governments.

The Silver Spring business district has a work force of nearly 18,000 people. Approximately 58 percent of the employees work for small businesses that have fewer than 100 employees. Moreover, approximately 70 percent of the employees are in office-related land uses, the remainder being primarily in retail-oriented uses. In recent years, the average modal shares of Silver Spring employees have been 70 percent automobile drivers, 12 percent automobile passengers, 12 percent transit passengers, and 6 percent walk and other (4). People commute to work in Silver Spring from all parts of the Washington-Baltimore region. The peak overall demand for long-term spaces at public parking facilities in Silver Spring is 83 percent of existing ca-

pacity. Several lots and garages regularly operate at 100 percent of capacity (5).

Two previous papers have reported various aspects of the Share-A-Ride program. In the first paper (6), the philosophy of the personalized approach and its practical applications were discussed. In the second paper (7), the hybrid manual and computer system used to process applicants was described.

The focus in this paper is primarily on the level of effort and measures of performance associated with Share-A-Ride's personalized approach. It offers a basis of comparison for other ridesharing professionals who wish to evaluate their own programs. It also points the way toward improved data-collection methods for ridesharing programs.

RESEARCH METHODS

This research used two sources of data: logs of staff activities and the program's data base. The logs of staff activities provided information on the level of effort required for Share-A-Ride's personalized assistance. During a 1-year period, the staff recorded on one log the time spent on matching, follow-up calls, marketing, and other activities. Another, more detailed log--kept over a 4-week period--showed the amount of time required to complete each personalized match list, rematch list, and follow-up call.

Share-A-Ride's data base provided information on the program's participants. The data base contains all of the information from the original application forms as well as transactions on matches, rematches, and follow-up calls for all participants. Because Share-A-Ride's data base management system permits easy retrieval of a variety of performance measures, special surveys of participants were practically unnecessary. The follow-up calls that are so essential to the personalized approach serve double-duty as a continual telephone survey of Share-A-Ride's participants. Unlike conventional rideshare program surveys, the follow-up calls are not restricted to one sampling point. And, unlike mail-back surveys, the follow-up calls do not bias the data toward those who would choose to respond.

Each record in the Share-A-Ride data base contains more than 600 characters of information in 126 fields. Comments recorded during each follow-up call are placed in additional records that are linked to the participant's main record from a separate part of the data base. Fifteen sets of fields are available to store the identities and dates of matches. Nine sets of fields store a history of follow-up status codes and dates for up to nine follow-up calls. In addition, five sets of fields contain the history of pools formed. Other fields contain information about the type of assistance requested, date of the application, previous mode, assistance provided, and standard information such as name, address, telephone numbers, map grid locations, and work hours.

The Share-A-Ride computer programs allow staff to store the data and generate a variety of reports as a part of day-to-day operations. The programs consist of two sets of routines, each with a different purpose. Both, however, depend on a data base management package supplied by the computer manufacturer. The first set of routines is a collection of custom-written programs that generate match letters and other special reports and make the necessary changes to the data base. The second set is a flexible user-oriented information retrieval package that allows the Share-A-Ride staff extract information from the data base. The retrieval routines were used to conduct this evaluation.

For evaluation purposes, the data base is not only an efficient and flexible source of information, but it is reliable as well. A key advantage of the Share-A-Ride data base is that it does not rely on infrequent surveys and the memories of participants for the dates on which they applied to the program, received their first match lists, received each set of rematches, and formed their pools. With this and other information now available in the Share-A-Ride data base, questions can be asked about ridesharing that have not been asked previously.

SHARE-A-RIDE'S PERFORMANCE

Initial Assistance

When Share-A-Ride participants first apply to the program, they indicate preferences for various combinations of carpool, vanpool, and transit assistance. The staff then responds accordingly to provide either matches for pools or transit route and schedule information. Figure 1 groups the types of requests for assistance and Share-A-Ride's responsiveness to these requests. The grouping of categories of assistance makes it easier to visualize how well the program has met the needs of its participants. The staff were able to fill requests completely 78 percent of the time. For 13 percent of the participants, the program partly filled their requests by providing either match or transit information when the person requested both. The program could not provide assistance for only 8 percent of the participants.

The mailing of no-help letters does not typically terminate contact with those participants who are difficult to serve. The record of follow-up calls to these people indicates significant efforts to help them until they ultimately receive useful information or drop out of the program.

Many ridesharing agencies have focused on shortening the time between the receipt of an application and the mailing of a match list to the participant. To measure the possible effects of response time, the difference in days between the application date (when the application was received) and the letter date (when the match list was mailed) was calculated for each participant. Share-A-Ride's median response time was 7 days. The distribution of response times was analyzed for people who ultimately started pooling with someone on their match lists versus the distribution for people who did not pool. No significant difference between the two distributions was found, which indicates that response time does not appear to be an important determinant of propensity to pool. The impact of instant matching (while the applicant is still on the telephone) was not tested but is a worthy issue for future research.

Attrition

Based on the record of follow-up calls, 58 percent of Share-A-Ride participants remained active after 2 years of program operations. The high attrition rate illustrates the importance of keeping the data base current. Of the people who dropped out, 66 percent moved and 34 percent lost interest.

Figure 2 shows the cumulative application and attrition rates over the program's first 2 years. Figure 3 shows similar curves for the participants who ultimately entered new ridesharing arrangements. The attrition rate of ridesharers is much less than for participants as a whole. Approximately 82 percent of this group of participants were still in the program at the 2-year mark. The vast majority of the attrition among these people was due to moves rather than loss of interest.

Figure 1. Initial assistance to participants.

ASSISTANCE REQUESTED				ASSISTANCE PROVIDED				
	Car Pool	Van Pool	C&V Pools	Total	Matches	Transit Info	Both	No Help
Matches	452	40	480	972	877			95
Transit Info				100		93		7
Both	164	22	426	612	181	45	346	40
	616	62	906	1,684	1,058	138	346	142
						226	1316	
				All Requests	Partially Filled		Filled Requests	Did Not Fill
				100%	13%		78%	8%

Figure 2. Applications and attrition for all Share-A-Ride participants.

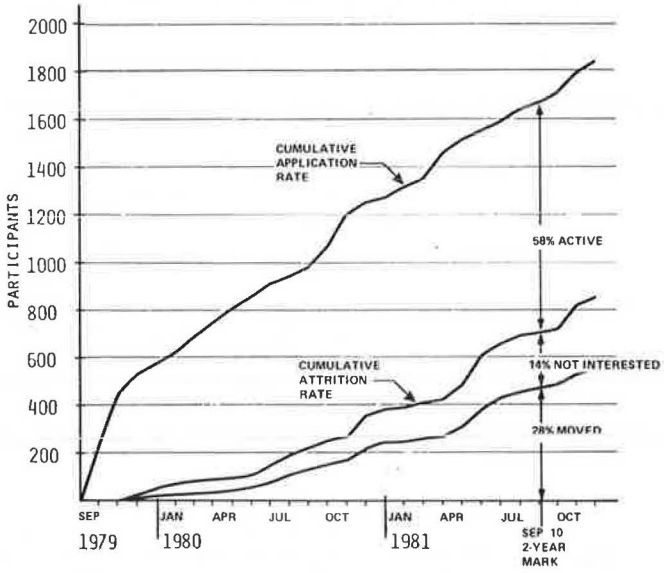
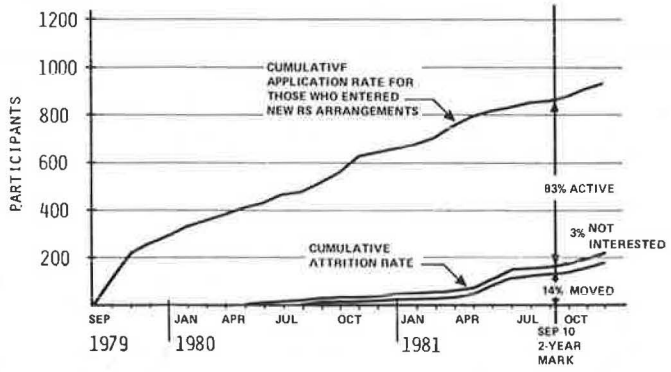


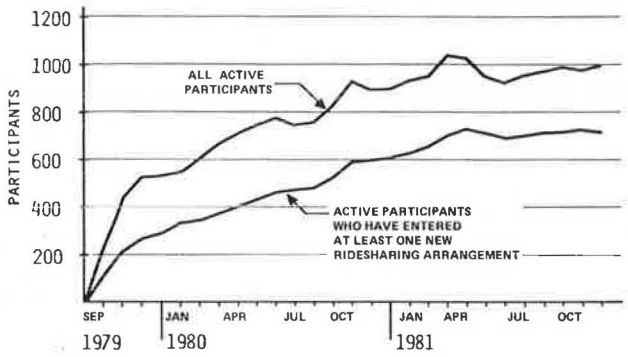
Figure 3. Applications and attrition for Share-A-Ride participants who entered at least one new ridesharing arrangement.



Active Participants

At any given time, the difference between the cumulative application and attrition curves is the number of active participants who have entered new ridesharing arrangements, who are still interested in being matched, or who are receiving further service from the Share-A-Ride program. Figure 4 shows

Figure 4. Active Share-A-Ride participants.



total active participants on the top curve and those who have entered new ridesharing arrangements on the lower curve. Because the attrition rate for ridesharers is so much lower than for participants as a whole, at a given time ridesharers and former ridesharers make up most of the active participants. For example, by December 1, 1981, 73 percent of the active participants had entered new ridesharing arrangements since joining the program. Because some of these people subsequently dropped out of pools or transit and were looking for new arrangements, a net total of 54 percent of all active participants were still ridesharing at that time.

Mode Switching

Table 1 shows the effectiveness of Share-A-Ride in getting participants to switch modes of transportation. The first two columns of the table represent all Share-A-Ride participants and those active as of November 1981 subdivided by their previous commuting modes. Note that 304 participants were in pools before joining the program. It can be assumed that most of these people joined Share-A-Ride to expand their existing pools.

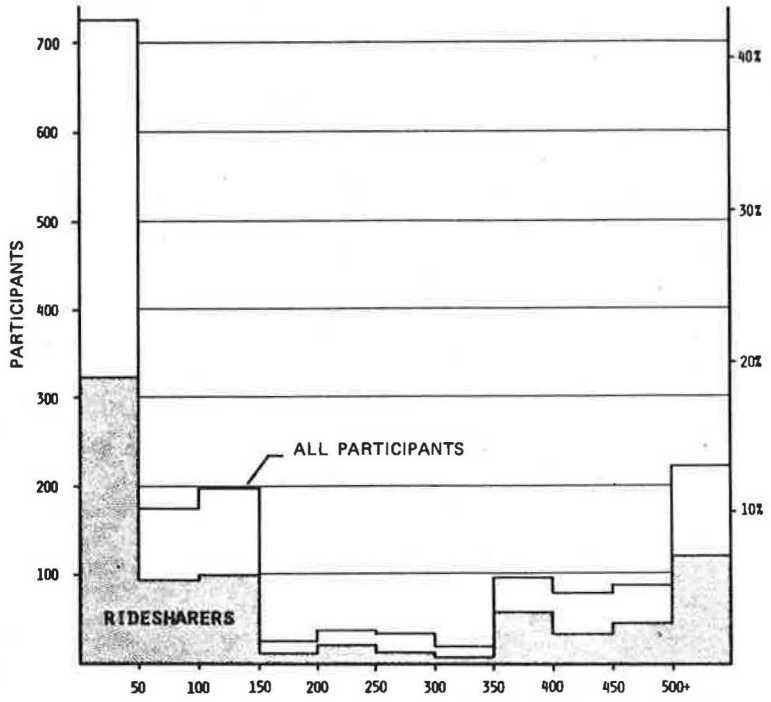
The third column in Table 1 shows that a total of 529 of the active participants (54 percent) entered new ridesharing arrangements after joining the program and were still ridesharing. Another 183 people--not shown in the table--entered new ridesharing arrangements, later dropped out, but were still interested in receiving more assistance. The right portion of the table splits the ridesharers into carpoolers, vanpoolers, and transit users and further subdivides the carpoolers into categories that reveal some effects of the matching process. Counting only the participants who were pooling with

Table 1. Mode switching by participants.

Mode	Previous Mode: Total Participants	Previous Mode: Active Participants as of November 1981	Total Current Ridesharers as of November 1981	Current Mode: Carpoolers: With Participants Only	Current Mode: Carpoolers: With Nonparticipants Only	Current Mode: Carpoolers: With Both	Current Mode: Vanpoolers	Current Mode: Transit Riders
Drive alone	1,050	598	325	81	114	65	15	50
Pool	304	226	134	29	33	53	13	6
Transit	288	129	60	19	21	17	3	
Other	42	22	10	2	3	3	1	1
Total	1,684	975	529	131	171	138	32	57

Note: There is a total of 440 carpoolers.

Figure 5. Distribution of participants according to employer size.



other Share-A-Ride participants or riding transit, up to 37 percent of the active participants could be claimed to be in new ridesharing arrangements as a direct result of the match lists of transit information provided by Share-A-Ride. Another 17 percent of tne active participants were pooling solely with nonparticipants. Although the program played no direct role in inducing this last group to pool, the program's marketing efforts may have had some indirect influences.

Pool Composition and Size

Figure 5 illustrates the predominance of participants from small employers in Share-A-Ride's market area, which implies the necessity of matching people between different employers. Such matches have apparently been successful. Among Share-A-Ride pools, 78 percent have participants from more than one employer, whereas the other 22 percent comprise participants from the same employer.

Because the Share-A-Ride data base keeps a record of the sizes of pools, the number of nonparticipants who were indirectly affected by the program through their association with Share-A-Ride participants can be calculated. The 472 active poolers are in 291 different pools comprising 910 total members. The average pool size, therefore, is 3.1, and the number of nonparticipants indirectly affected is 438. Figure 6 shows the distribution of the 472 poolers according to pool size.

New Pools for Dropouts

The data on Share-A-Ride pools indicate the importance of rematching people as they drop out of pools. The table below gives the distribution of a total of 838 participants according to the number of ridesharing arrangements they have had:

No. of Ridesharing Arrangements	No. of Participants	Percent
1	719	86
2	95	11
3	20	2
4	4	1

Approximately 14 percent of the new ridesharers have been in more than one ridesharing arrangement over the initial 2-year period.

Findings from Follow-Up Calls

The follow-up status codes in each participant's data record help the staff serve Share-A-Ride participants by keeping track of who needs what kind of help. The data base also provides a historical record of the service provided to each participant and the action taken. This information has been extremely valuable in evaluating the Share-A-Ride program.

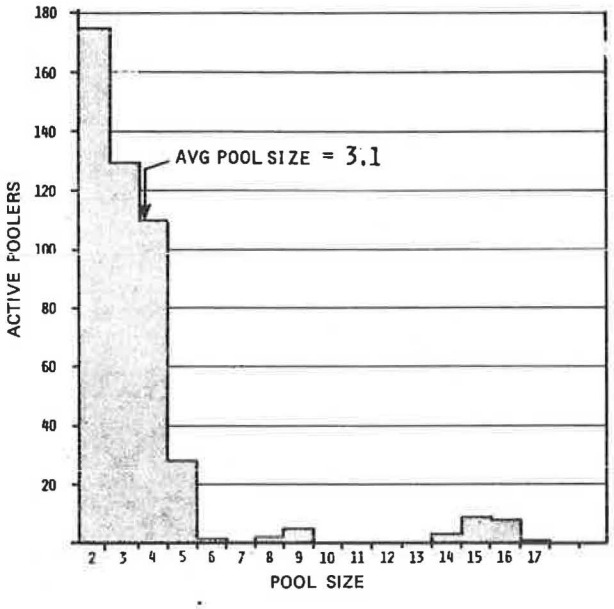
Figure 7 shows the current status at the end of November 1981 for all Share-A-Ride participants who had applied to the program by September 10, 1981. The bars in Figure 7 show the numbers of participants who were in ridesharing arrangements as of late November 1981. The bars indicate separate counts for carpoolers, vanpoolers, and transit riders, as well as the degree of staff involvement before the pools were created or expanded. Participants who started ridesharing before the first follow-up call are shown separately from the ones who started after the first follow-up call and from the ones who started after receiving matches.

Figure 8 shows the status of participants who were not ridesharing in late November 1981. The bulk of people in this group dropped out of the program because of moves or loss of interest.

Based on information obtained in the early phase of the program, 72 percent of participants who were sent matches for pooling contacted others on their lists. If this percentage is applied to all participants over the 2-year period, the total number of people who contacted others on their match lists is approximately 1,110. By combining this estimate with the record of actions of participants as determined from follow-up calls, we can derive a picture of the participants who were motivated enough to contact others about ridesharing. Table 2 classifies the 1,110 participants who are estimated to have contacted others according to ridesharers and nonridesharers and three levels of action. The table suggests that 52 percent of the new ridesharers did not start pooling until after their first follow-up call from Share-A-Ride staff.

Figure 9 presents the distributions of ridesharers and all participants according to numbers of follow-up calls received from Share-A-Ride staff. As might be expected, the participants who entered new ridesharing arrangements received more follow-up calls than participants as a whole. Part of the reason is that ridesharers typically stay in the program longer than other participants. Over the initial 2 years of the program, ridesharers received an average of 4.2 calls each, whereas participants as a whole received an average of 3.1 calls each.

Figure 6. Distribution of active poolers according to pool size.



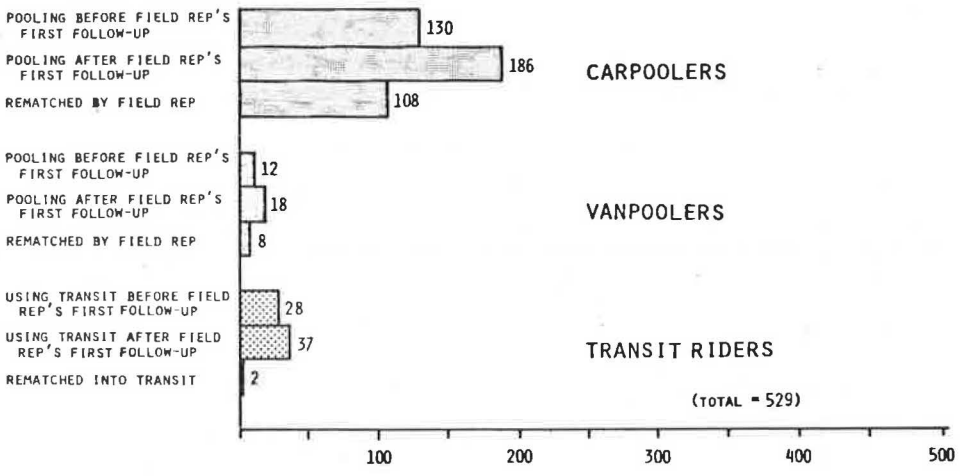
SHARE-A-RIDE'S LEVEL OF EFFORT

During the initial years of the program, Share-A-Ride has operated with a full-time staff of two field representatives and a secretary. The field representatives have been responsible for matching, follow-ups, marketing, and some administrative duties; the secretary has been responsible for entering and maintaining the information in Share-A-Ride's data base and performing support functions.

Based on the experience in Silver Spring, a good estimate can be made concerning the size of the market area and volume of applications that the personalized approach can reasonably handle. Interacting with the data base and producing letters, postcards, and other computer-generated documents have been easy and quick and therefore are not the limiting factors in implementing the personalized approach. The time devoted by the field representatives to the matching follow-up and marketing functions, however, is the key consideration.

According to the logs kept by Share-A-Ride's field representatives, it takes an average of 18 min

Figure 7. Latest status of active ridesharers.



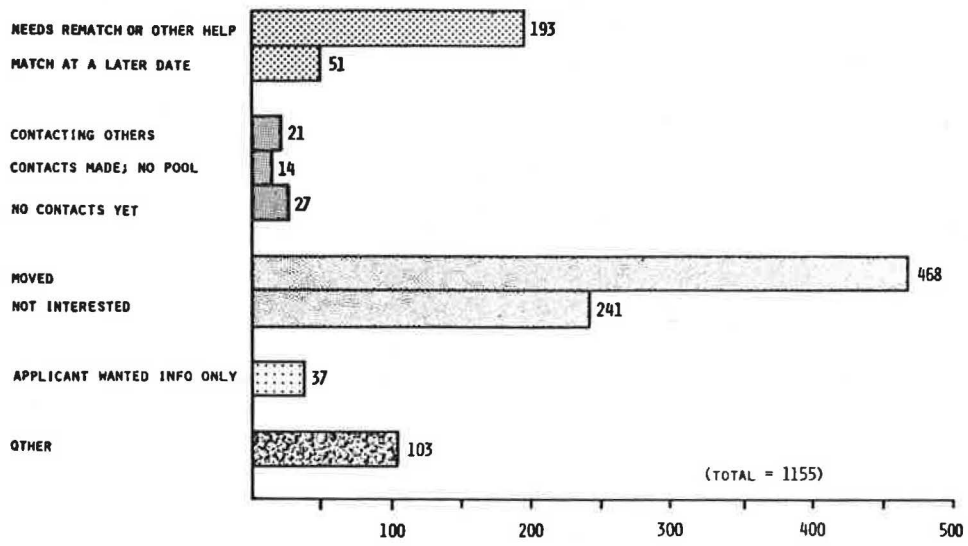


Figure 8. Latest status of active and inactive nonridesharers.

Table 2. Actions taken by all participants who contacted others.

Action	Entered New Ridesharing Arrangement During 2-Year Period	Did Not Start Ridesharing During 2-Year Period	Total
Contacted others and started ridesharing before follow-up calls	403		403
Contacted others but did not start ridesharing before follow-up calls	168	177	345
Did not contact others before follow-up calls	267	95	362
Total	838	272	1,110

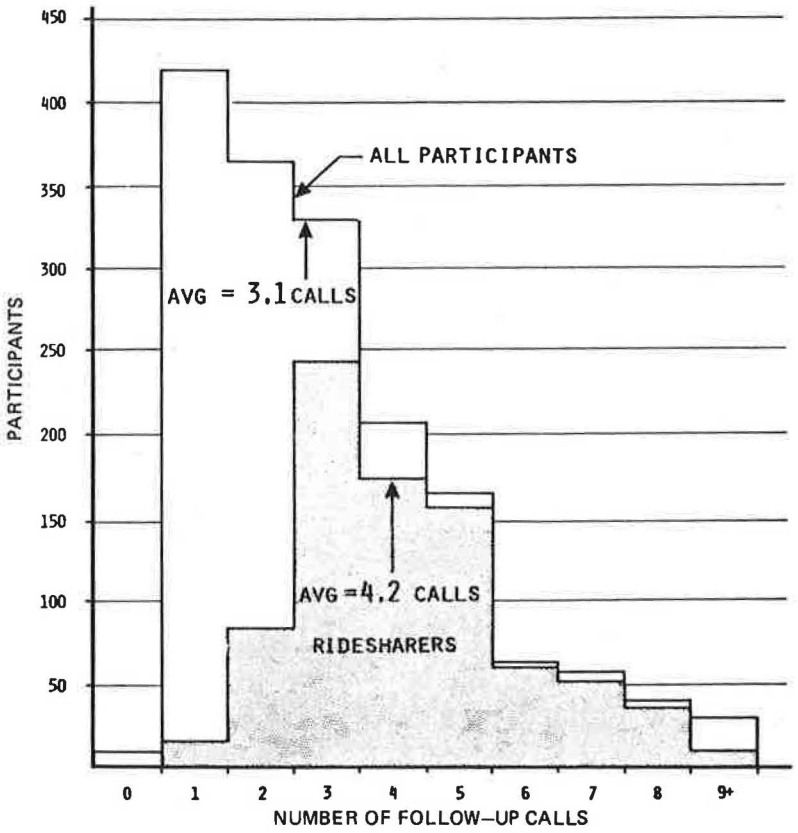


Figure 9. Distribution of participants according to number of follow-up calls received from Share-A-Ride.

to process the initial match list for each participant. This time includes use of the hybrid manual and computer matching techniques and preparing the mail-out to the participant. It takes approximately 6 min to rematch a participant--less time than the initial match--because the field representative knows the participant's specific needs as conveyed in follow-up calls. The field representatives send out, on average, two rematch lists for every three initial match lists. The follow-up calls take an average of 9 min each, which includes the time required for repeated attempts to reach an individual.

Although personalized matching, rematching, and follow-up require some time, marketing and administrative duties take up most of the field representative's average day. Approximately 82 percent of the field representative's time was spent on marketing and administrative tasks, whereas only 8 percent was spent on matching and rematching and 10 percent on follow-ups. By the end of the second year of operation, each field representative was responsible, on average, for marketing a work force of 9,000 employees and processing 500 active participants on an ongoing basis.

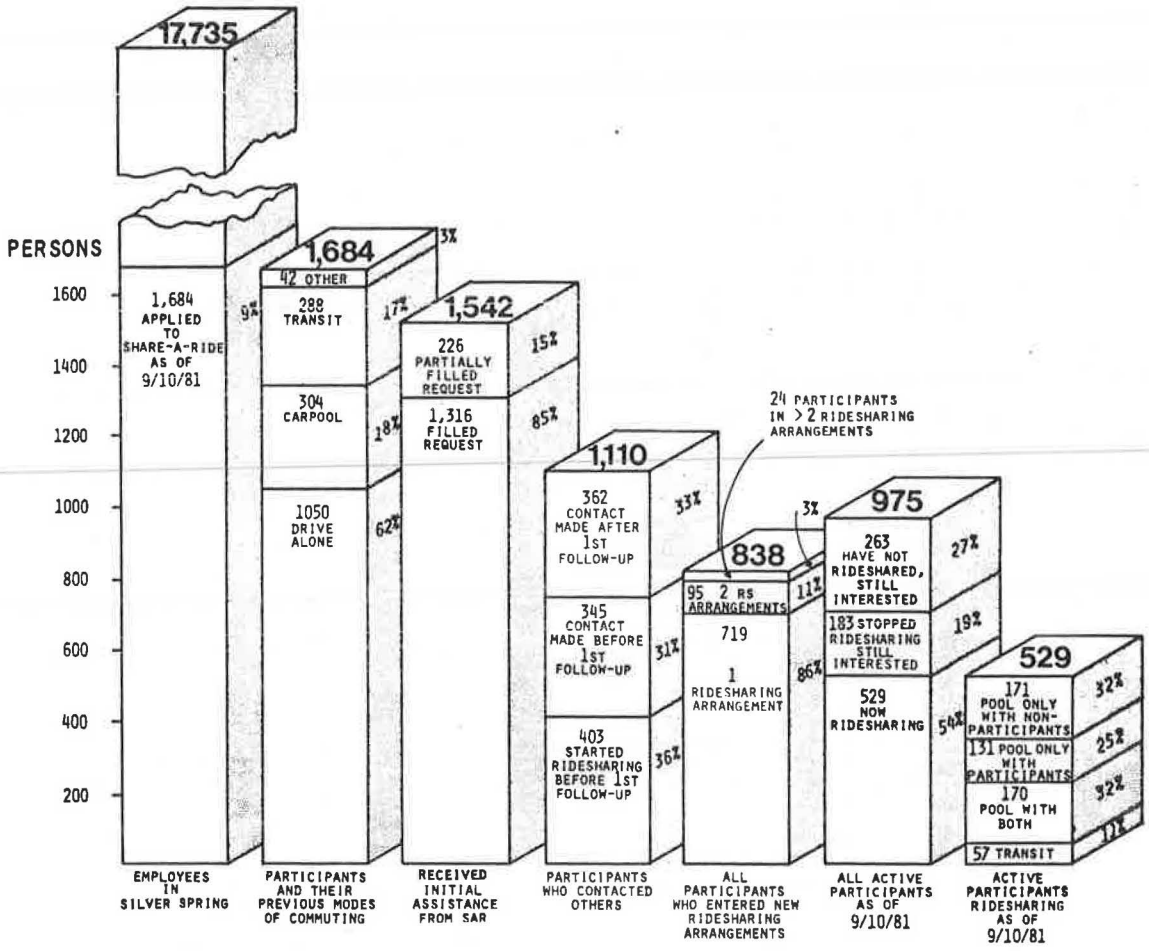
The initial years at Share-A-Ride required considerable marketing to make a strong impact in the market area. The staff also devoted a significant amount of time assisting in the evolution of the program's new techniques. Now that the program is well established, less time is needed for marketing and administrative duties; it is now at the point where one less field representative is needed for continuing the program in the existing market area. Moreover, the logs show that a single field representative could handle even more than the 18,000 employees in Silver Spring. A major reason is that employer coordinators and volunteers are taking on a larger share of the promotional activities.

Extrapolating from the Share-A-Ride experience, a similar suburban business district that has a work force of approximately 25,000 could expect to generate a daily volume of 4 to 5 initial matches, 2 to 3 rematches, and 12 to 16 follow-up calls. That work load would require a single field representative to spend approximately 25 percent of the time on matching and rematching, 30 percent on follow-ups, and the remaining 45 percent on marketing and administrative duties. A secretary would also be necessary to provide support services. Another field representative and possibly another secretary would be needed to serve each additional increment of 25,000 employees.

Not surprisingly, it does cost a ridesharing program more to implement the labor-intensive personalized approach rather than the traditional automated approach. Based on the experience at Share-A-Ride, the cost of personalizing a program could range between $100 to $150/person placed in a new ridesharing arrangement. Mature programs and those with a significant proportion of large employers can expect to be at the low end of this range or perhaps even below it.

The extra cost of personalizing the assistance process is reasonable when compared with the costs

Figure 10. Performance measures for Share-A-Ride.



of the alternatives. Constructing a public parking space, for instance, is many times more expensive than helping a person carpool under the personalized approach. Extending transit service into low-density areas is also much more costly.

SUMMARY AND CONCLUSIONS

A summary of Share-A-Ride's major performance measures is shown in bar chart form in Figure 10. The detail provided here and in the supporting discussion has been extremely useful to project management in fine-tuning Share-A-Ride's operations.

Although it is not yet possible to determine quantitative cause-and-effect relations for the individual factors that affect Share-A-Ride's effectiveness, the evaluation reveals several features of the personalized approach that have produced high success rates:

1. Sending rematch information automatically to the people who appear in each new match list,
2. Making follow-up calls to urge people to take action on their ridesharing arrangements and assist people who need help,
3. Rematching participants who drop out of pools or want to change their ridesharing arrangements, and
4. Keeping the data base up-to-date via follow-up calls so that information is reliable and usable.

Although follow-up calls are extremely important in achieving high pool formation rates, they should be preceded by high-quality matches. Furthermore, the person who makes the follow-up calls should have knowledge of the rationale behind the specific matches that were sent to participants.

A regular program of follow-up calls, which is supported by a data base as comprehensive as Share-A-Ride's, can also provide significant benefits in the management of a ridesharing program. Such an approach integrates evaluation into the daily operations of a ridesharing agency. The results, moreover, are more reliable than those for occasional telephone or mail-back surveys, which are expensive and cumbersome ways to measure performance. Ridesharing programs need continuous monitoring of performance through a personalized data base to provide quick, accurate feedback.

The evaluation of Share-A-Ride shows that ridesharing professionals can produce results, by way of pools formed, for far more people than they typically help today. Low pool formation rates need not be the norm. Perpetuation of low success rates can only hurt a ridesharing agency's credibility by generating negative word-of-mouth against the agency as well as ridesharing in general.

Ridesharing agencies, through their marketing, raise people's expectations. By personalizing their programs and incorporating ongoing evaluation efforts, they can better meet the expectations of the people who come to them for assistance. Personalized programs do cost more than traditional approaches, but the absolute public benefits from the additional ridesharing still far outweigh the costs.

ACKNOWLEDGMENT

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Market for Vanpooling in the Baltimore Region

JOHN M. BAILEY

A market-estimation procedure is proposed that is based on computer-simulated work trips that occur in the Baltimore region. It identifies clusters (larger than 60) of long (greater than 10 miles one way) work trips between all 94 planning districts in the region. The number of trips selected is reduced by factors that depend on the percentage of workers at the destination who are employed at establishments that have more than 200 and 100 employees. The number of qualifying trips is increased if they originate in residential districts that have a significant percentage of dwelling units in clusters larger than 200. From the population of trips so selected, a subset of trips for which vanpooling is cheaper than carpooling or driving alone is identified. Trip costs are estimated by using a model that recognizes time as well as travel costs. Vanpooling is less costly, and thus more attractive, for commuting distances longer than an equal-cost distance. Under 1980 conditions, that distance is large enough so that the achievable market is limited to 200 vanpools. However, as perceived driving costs, the price of fuel, or parking costs increase, the equal-cost distance decreases and an estimated market of more than 2,000 vanpools could be achieved.

In the past decade, vanpooling has become a much-discussed mode for commuting to work. A vanpool is defined as a group of 7 to 15 people who ride to work in one vehicle and pay fares to meet driving expenses. In Maryland, where more than 300 vanpools were registered statewide in June 1981, the average number of passengers (plus the driver) is approximately 14 (1).

Because vanpools remove a number of vehicles from the road (5.9 in Maryland), vanpooling constitutes a significant measure for saving fuel, reducing vehicular emissions, and relieving congestion. Vanpools can result in savings not only to the participants but also to employers because they reduce the demand for parking facilities.

Two previous vanpool studies have been conducted in the Baltimore region and yielded market estimates of 2,300 (2) and 3,100 (3) vanpools. The purpose of this study is to reexamine the potential for vanpooling in the Baltimore region by using information from surveys conducted during the intervening years as well as several years' experience with ridesharing programs in Maryland.

Responses to the 1980 Maryland Mass Transit Administration (MTA) vanpool survey (1) showed an average one-way commuting distance of 29 miles for all pools: 19.7 miles for those picking up passengers near their front doors and 30.9 miles for those collecting passengers from a few central points. Round-trip van distance was greater than twice the direct one-way commuting distance because of the need to pick up and distribute passengers. The average daily round-trip distance traveled by vans in the survey was 67.6 miles. Approximately 144 vanpools originated or had destinations in the Baltimore region in 1980.

The market-estimation procedure used here divides the region into 94 districts and identifies clusters of long work trips between the districts. The clusters are then factored by the percentage of employees who work at large establishments in the work district and by the percentage of residences in the residential district in clusters of more than 200. [The Baltimore region is projected to have a population of 2,226,000 and employment of 1,046,000 by 1985 (4).] Trips that do not meet a minimum cluster-size criterion of 60 are rejected. From the population of trips so selected, a subset of trips for which vanpooling is cheaper than carpooling or driving alone is identified. Trip costs are estimated by using a model that recognizes time as well as travel costs (5). In general, vanpooling is less costly, and thus more attractive, beyond an equal-cost distance. The models show this distance to be sensitive to the price of fuel, perceived cost of operating an automobile, financial incentives for the purchase of vans, parking costs, and other factors. If changes in factors combine to reduce the equal-cost distance, then the market for vanpooling enlarges. Because the results are based on Baltimore costs and Maryland vanpool characteristics, it is the relative sensitivity of the market to various cost changes that is of most interest.

VANPOOL MARKET ESTIMATE

Potential Market

A 1985 work-trip table, simulated at the level of 94 regional planning districts (RPDs), was examined to find all residence-to-work trip combinations for which (a) the network travel distance was 10 miles or greater and (b) the number of trips was 60 or greater. The number 60 is based on Maryland experience and indicates the number of commuters that must be found with common residence and work locations in order to find 15 who have similar work hours and are able to pool. This corresponds to a potential 25 percent capture rate, but only for work trips longer than 10 miles. According to the district-level simulation, 52 percent of the work trips in the Baltimore region meet that criterion. The 10-mile minimum avoids conflict with regular bus service and agrees with current vanpool experience. Less than 2 percent of the vanpoolers responding to the MTA survey lived less than 10 miles from work. Furthermore, the models used indicate that, as commuting distance is reduced below 10 miles, the passenger pickup and delivery time can exceed 50 percent of total trip time. It is shown later than vanpooling is attractive for distances less than 20 to 30 miles one way, but only under certain conditions.

The trips that meet the two criteria above were further reduced by factors determined by the percentage of workers in the work district employed at establishments that have more than 100, 200, or 500 employees. For example, if a particular district had 75 percent of its employees working at establishments with more than 100 employees, 50 percent working at establishments with more than 200 employees, and 40 percent working at establishments with more than 500 employees, then all work trips that end in that district were multiplied by 0.75, 0.50, or 0.40 to estimate the number of trips destined for establishments larger than 100, 200, or 500 employees.

Residential concentration was recognized by multiplying the surviving trip clusters by $(1 + X)$, where X is the percentage of dwelling units in the residential district located in clusters of 200 or more. This arbitrary factor was used to reflect greater opportunities in areas of dense development.

To obtain the number of potential vanpools, the factored trips remaining were divided by 60. Fractional numbers ending in 0.9 were rounded up to the next whole number; numbers less than 0.9 (54 trips) were rejected. The results are given in the table

below and are arranged so as to show the vanpool market potential within 5-mile intervals:

One-Way Commuting Distance (miles)	Potential Market for Establishments Employing More Than 500	200	100
>35	6	9	9
30-35	38	56	69
25-30	161	231	277
20-25	303	445	532
15-20	481	676	897
10-15	731	1,043	1,306
Total	1,720	2,460	3,090

This table is also arranged to show the market as a function of the size of establishments cooperating in the program. If all of the more than 1,200 establishments in the Baltimore region that employ more than 100 workers were to cooperate, and the market for all commuting trips longer than 10 miles were exploited, then the potential market could be 3,090 vanpools.

The numbers shown in the previous table are an average of potential vans to, as well as from, all RPDs in the region and include vans that would originate or have destinations external to the region. They also recognize residential concentrations and assume that the ridesharing outreach program includes housing complexes as well as employment centers. Recognition of residential concentrations larger than 200 dwelling units contributes approximately 11 percent to the numbers in the previous in-text table.

The potential market has also been subdivided to indicate districts within the region where vanpooling potential exists. The central business district (CBD) in Baltimore is the largest potential attractor of vans, drawing 13 percent of the regional market. This result agrees with an estimate of 14 percent obtained for the Pittsburgh CBD (6).

Reasonably Achievable Market

The potential vanpool market figures presented in the in-text table are based on simulated trip length, clustering, and employment and residential concentration only. They do not recognize any of the other factors that limit the formation of vanpools. In the following section, calculations of a reasonably achievable vanpool market are made, which are based on the premise that vanpooling will occur only for those work trips for which it is less costly than carpooling or driving alone. A model is applied that indicates, for various sets of conditions, an equal-cost distance beyond which vanpooling is the least costly mode of transportation (5). Costs include time as well as driving costs. By applying this distance to the numbers given in the in-text table for the potential vanpool market, an achievable market of vanpool trips can be separated from the potential market. The size of the achievable market is found to be sensitive to various cost and incentive factors.

In calculating the markets, several initial assumptions or criteria were used:

1. Twenty percent of the vanpools will provide front-door service and 80 percent will pick up passengers at a few central places along the route. [These were the conditions found in 1980 vanpool survey (1).]
2. If vanpooling is less expensive than both driving alone and carpooling, the full vanpool market can be achieved for that trip length.
3. If vanpooling is less expensive than driving alone but more costly than carpooling, one-third of the market potential can be achieved. [This assumes that the demand for carpooling is double that for vanpooling, so that carpooling gets two-thirds of the market. Surveys of several ridesharing programs indicate that overall carpool demand may exceed vanpool demand by 3 or 5 to 1 (7). However, for the longer work trips and large clusters of work trips considered here, a ratio of 2 to 1 appears justified, particularly if vanpooling is fully promoted.]

1980 Base Case

The first reasonably achievable market calculation is based on cost factors that are assumed or derived from 1980 surveys in the region. It assumes that the van is leased (rather than company- or driver-owned), that fuel costs $1.25/gal, and that the perceived value of time of the commuter is $6/hr. From the surveys, the number of passengers per vanpool is taken to be 13.2, and the number of persons per carpool is 2.5. From Maryland vanpool data, 1980 average van leasing costs were $416/month and operating costs were $0.19/mile. In most cases, the vanpool service provided was basic rather than luxurious. Data obtained in the 1980 vanpool survey (1) showed that 20 percent of the vanpool passengers was picked up near their front doors and 80 percent drove an average of 3.6 miles to a pickup point where they joined the pool. The two types of vanpools had considerably different theoretical costs and real operating characteristics (time spent picking up passengers, line-haul times, route diversions), so they are addressed separately in the market calculation.

The tables below present estimates of the vanpool market for the cost conditions described above. The first table gives the achievable vanpool market in the Baltimore region (1980 base case):

Establishments Employing More Than	Estimated Vanpool Market	Actual Vanpools in Region, 1980
200	200	144
100	235	

The second table gives the equal-cost commuting distances (1980 base case):

Service	Calculated One-Way Commuting Distance (miles)
Front-door van versus	
Drive alone	18.8
2.5-person carpool	18.3
Central-pickup van versus	
Drive alone	30.2
2.5-person carpool	29.5

By using the costs given above, the model indicates that a front-door-service vanpool is less costly than driving alone or riding in a 2.5-person carpool for one-way commuting trips longer than 18.3 to 18.8 miles. The small difference between driving alone and carpooling results from the assumption that the solo driver goes directly to work whereas the carpooler goes to a central pickup place, as does the central-pickup vanpooler. Central-pickup vanpools are less costly for trips longer than 29.5 to 30.2 miles. These calculated distances agree with existing commuting distances for the two types of vanpools in Maryland: 19.7 and 30.9 miles.

The market shown in the tables above is calculated on the basis of the two levels of ridesharing promotional effort. One assumes that all

workers at establishments in the region that have more than 200 employees are exposed to the program, but that no effort is extended toward residential complexes. The other calculated level of effort would reach all workers at establishments that have more than 100 employees, as well as all residential complexes that have more than 200 dwelling units. The inclusion of establishments with as few as 100 employees would expand the market from 200 to 235. These are both conservative estimates, which are based on perceived low automobile operating costs. They do not reflect some of the ridesharing incentives (priority parking for pool vehicles and employer subsidy of van expense) that were already occurring in 1980. Nevertheless, the actual level of vanpooling in the Baltimore region in 1980--about 144 registered vans for a promotional effort reaching 45 percent of the employees at large establishments in the region--provides a validity check on the models and the assumptions used in applying them. The vanpool market estimate just made is based on perceived driving costs calculated from responses to a local commuting survey: $0.093/mile for persons driving alone and $0.066/mile/person for members of carpools. The latter figure translates into $0.165/vehicle-mile for a 2.5-person carpool and could reflect an increased awareness of driving costs on the part of carpoolers.

Although the data on perceived driving costs are sketchy, it is reasonable to expect that, with an increased emphasis on fuel-efficient automobiles and increasing insurance and maintenance costs, the average motorist will become more aware of the real costs of driving. With this change, vanpooling might become competitive with carpooling and driving alone over commuting distances that are not as great.

What might be the result if an educational campaign succeeded in changing driving costs as perceived by commuters to higher, more realistic levels? Two cost levels will be considered (5): (a) $0.13/mile (fuel, tires, oil, maintenance, and mileage-dependent insurance), and (b) $0.20/mile (the above plus mileage-dependent depreciation). The depreciation or wear term is based on an initial cost minus salvage value of $7,000 spread over 100,000 miles. Other ownership costs could be included, but it is assumed that the car left at home by the vanpoolers is not sold and is used for other types of trips.

Vanpool costs, which are real and must be paid for with fares, will be assumed to remain at the 1980 level of $0.19/mile. For vanpools, wear is covered by the monthly leasing cost of $416.

Table 1 gives the marked expansion of the vanpool market (from 200-235 to 1,200-1,650) that could result if the average commuter were to perceive realistic automobile operating costs, compare them with vanpooling costs, and behave economically. Because carpoolers already perceive automobile operating costs to be $0.165/mile, the carpooling share of the market is unchanged for a perceived cost of $0.13/mile. However, at $0.20/mile, vanpooling gains on carpooling because it costs less for one-way trips longer than 17 or 20.5 miles, depending on the type of vanpool service. The vanpool market is expanded accordingly.

Changes in Price of Fuel

Consider now a market in which a commuter's cost perceptions remain at the 1980 base level, but the price of fuel in 1980 dollars per gallon increases. For fuel that costs $1.25/gal (as in 1980) and an average automobile that gets 17 miles/gal, fuel costs are $0.073/mile. Thus, the solo driver's perceived cost of $0.093/mile would correspond to the cost of fuel plus $0.02/mile. By the same reasoning, the carpooler's $0.165/vehicle-mile corresponds to the cost of fuel plus $0.092/mile. For a 10-mile/gal van, the 1980 real van operating cost of $0.19/mile corresponds to the cost of fuel plus $0.065/mile. With these numbers, new costs that correspond to more expensive fuel can be calculated.

Fixed costs for both automobiles and vans will be held at 1980 levels. If the price of fuel were to increase to $2 (in 1980 dollars), the perceived drive-alone, perceived carpool, and real vanpool operating costs per mile would increase to $0.138, $0.21, and $0.265, respectively. With fuel at $3/gal, the three costs become $0.196, $0.268, and $0.365/mile. As indicated in Table 1, $2 for fuel could expand the reasonably available vanpool market to 1,075 to 1,490. If the price of fuel were to increase to $3 and all other cost conditions remained as in 1980, the vanpool market could expand to 1,680 to 2,330, depending on the size of employers cooperating.

The market estimates are based on competition between vans with 10 miles/gal efficiency and cars with 17 miles/gal efficiency. If the efficiency of the car is doubled to 35 miles/gal, the vanpool market estimate drops by 27 to 29 percent.

Financial Incentives for Vanpooling

Two barriers that have limited the growth of vanpooling are the fact that the pool must be self-supporting in real cash terms and that a capital expenditure must be made for a vehicle whose use is largely limited to commuting. In view of all of the overall fuel savings and vehicular emissions reductions that result from vanpooling, it is reasonable to consider several subsidy measures that would reduce the cost of vanpooling relative to other commuting modes (8).

The first to be considered is company ownership of the vans. Vanpool experience indicates that passengers in company-sponsored vans pay less fare. (In

Table 1. 1985 reasonably achievable vanpool market in Baltimore region for various real or perceived costs.

Item	Equal-Cost Commuting Distance (miles, one-way)				Market, Including All Establishments Employing More than	
	Front-Door Vanpool versus		Central-Pickup Vanpool versus			
	Drive Alone	Carpool	Drive Alone	Carpool	200	100
1980 base case	18.8	18.3	30.2	29.5	200	235
Perceived automobile operating costs						
$0.13/mile	13.6	18.3	13	29.5	675	960
$0.20/mile	<10	17	<10	20.5	1,200	1,650
Price of fuel						
$2/gal	13.4	16.3	11	21.2	1,075	1,490
$3/gal	10.5	14.2	<10	15.2	1,680	2,330

Table 2. 1985 reasonably achievable vanpool market in Baltimore region for effect of incentives and disincentives.

Item	Equal-Cost Commuting Distance (miles)				Market, Including All Establishments Employing More than	
	Front-Door Van versus		Central-Pickup Van versus			
	Drive Alone	Carpool	Drive Alone	Carpool	100	200
1980 base case	18.8	18.3	30.2	29.5	200	235
22 percent company subsidy	16	16	21	21	680	920
15 percent federal income tax rebate	16.3	16.3	19	21	720	970
Interest-free van loans	15.2	15.2	18	17.4	1,010	1,375
Priority parking	16.4	18.3	25	29.5	290	380
$2 parking fee for commuting vehicles	<10	15.3	<10	15.9	1,520	2,080

1980, 19 perecent of the vanpools in Maryland were company-sponsored, with the passengers paying 22 percent less fare, on average.) The subsidy that is involved can be the result of lower insurance rates for fleet vehicles, preferred interest rates on loans, or a simple picking up of expenses that would have to be paid by passengers in a leased van.

If company sponsorship of vans, accompanied by a 22 percent reduction in van operating and capital costs, were to cover the region, the vanpool market could more than triple [from 220-235 to 680-920 (see Table 2)].

Two measures that could ease the purchase of vans for pooling are federal income tax relief [as proposed by Senator David Durenberger (IR-Minnesota) in Bill S239 (Congressional Record, January 22, 1981)] and low-interest loans. For purposes of illustration, a tax rebate (amounting to 15 percent of the purchase price to individuals who purchase vans) and interest-free van loans are considered. These two measures could reduce monthly fixed costs (5), and with them equal-cost commuting distances, so as to increase the vanpool market to 720-970 and 1,010-1,375 vans in the region (Table 2). According to the cost model used, the effect of these subsidies on the estimated market is less than increasing the price of fuel (Table 1).

Parking Management

Control of the parking space available for commuting vehicles can be a potent factor in the encouragement of ridesharing (9). In this section, the impact of two parking measures on the vanpool market are considered. The first, already in common use in the Baltimore region, is the reserving of preferred parking spaces for pool vehicles. Assuming that all commuters who drive alone must walk an extra 2.5 min from their parking places to the work entrance, a daily time penalty of $0.50 is being imposed (5 min/day at $6/hr). The effect of even this small time penalty could increase the vanpool market by half (from 200-235 to 290-380).

A more severe measure, which is still not feasible in most areas, would be to eliminate all free commuter parking and charge each vehicle a $2/day parking fee. Seventy-five percent of the commuters in the Baltimore region currently park free (10). The effect of a $2 fee would be to encourage vanpooling at the expense of both carpooling and driving alone. Table 2 indicates that imposition of such a parking charge (in all employment areas, not just in the CBD) could expand the vanpool market by a factor of eight. The impact could be similar to that of $3 fuel (Table 1).

Three Levels of Vanpool Marketing Effort

The preceding sections have estimated the market impact of a number of cost changes taken one at a time. If, instead, several strategies are applied simultaneously, the results could be as given in the table below, which describes three levels of vanpool promotional effort:

Level of Effort	Description	Vanpool Market
A	All employers larger than 200 employees and priority for pool vehicles	290
B	A plus all residential complexes larger than 200 dwelling units, 15 percent federal tax rebate, or interest-free van loans	780
C	B plus all employers larger than 100 employees, $2 parking fee for all commuting vehicles, or education to perceive automobile operating cost as $0.20/mile	2,100-2,575

Level A continues the current effort in the Baltimore region. Level B features outreach to residential clusters and some financial incentives, and level C is an all-out or contingency effort that involves a combination of the single measures discussed previously.

CONCLUSIONS

Under 1980 conditions, the cost of vanpooling, including time costs associated with pickup and delivery of passengers, was such that vanpooling was attractive only for long commuting trips. However, as various real or perceived driving costs are altered, the length of trip for which vanpooling is cost competitive will decrease markedly, and the estimated achievable vanpool market could increase to an even greater extent.

It should be understood, however, that this market can be reached only if every possible means of assisting the formation of vanpools and finding drivers is applied. These could include

1. Provision of computerized match lists that contain 50 to 75 names to persons interested in vanpooling;
2. Provision of more incentives for vanpool drivers than are currently available, such as free use of the van during weekends and, for leased vans, assistance in getting the vehicle to and from the garage for maintenance;
3. Preferred insurance rates for pool vans;
4. Exemption from portions of license fees or sales tax for pool vans;
5. Zero down-payment loans for purchase of pool vans;

6. Priority treatment of pool vehicles at toll booths;
7. Provision of safe, convenient, and well-signed park-and-ride lots;
8. Changes in zoning ordinances to discourage the use of large areas for employee parking;
9. Tax credits for employers, as well as employees, who participate in carpooling;
10. Priority access to fuel for pool vehicles in time of fuel scarcity;
11. Encouragement of alternative work schedules to permit pooling by employees who previously could not pool because of differences in work hours;
12. Provision of ideas to employers on use of vans during work hours as well as for commuting;
13. Provision of information on employee travel allowances to employers; and
14. Promotional efforts with employee labor unions or credit unions.

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Community-Based Ridesharing: An Overlooked Option

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The neighborhood ridesharing demonstration, which took place in four residential communities in the Albany, New York, area, is described. The project tested whether personalized coordinator techniques could be used at the home end because residential areas offer homogeneous neighborhoods with established social networks. Careful test design and internal recording allowed for a rigorous evaluation and comparison with other approaches. The neighborhood ridesharing coordinator program was shown to be a viable concept. Coordinators were successful in organizing ridesharing from the home end. The advertising methods found to be most successful were word-of-mouth, newspaper articles about the program, and community group meetings. In comparison with employer-based coordinators, neighborhood coordinators were equally effective in the number of placements and in cost-effectiveness measures. Given that employer ridesharing programs gradually rise to a saturation point, a neighborhood program, which has a larger population base and continuous changeover in residents, has possibilities for cost-effective expansion.

Government-sponsored carpooling programs began during the 1973-1974 energy crisis and focused largely on computerized matching services. The main thrust of these early programs was the savings in gasoline and money to be achieved (1,2). Interest fell off sharply as the crisis abated, and two-thirds of the programs initiated were discontinued. For those programs that were continued, promotional campaigns were expanded and the focus was on economic savings. Interest again increased sharply during the 1979 fuel crisis but then subsided as the crisis abated. Review and evaluation of these programs has been difficult. Rarely have such programs accounted for more than 1 percent of areawide work vehicle miles of travel (VMT). Clearly these programs are not having the effect intended by their promoters.

Additional evidence also suggests that the problem of increasing carpooling is far more difficult than first surmised. First, carpooling already involves 19 to 23 percent of work travel in many metropolitan areas (3) and has been stable at that level since at least 1970; these levels are confirmed in the 1980 census (4). Second, research into carpooling behavior (5-8) has disclosed that long-term ridesharing is often a social phenomenon rather than an economic one. Most people are reluctant to contact nonacquaintances to initiate carpools except in the face of a major crisis. Economically oriented carpools are a much smaller group and more transitory than the first group. The emerging picture is that carpooling is a social phenomenon that is largely impervious to government pressure.

One suggested approach to dealing with the reluctance of people to carpool is the use of a carpool coordinator. The coordinator works out of an employment or neighborhood site by using personalized methods to promote ridesharing, match participants, perform introductions, and resolve ridesharing problems. In this way many carpooling difficulties can (in theory) be overcome.

Since mid-1978 the New York State Department of Transportation (NYSDOT) has designed, implemented, and evaluated two ridesharing coordinator demonstration programs: an employer-based program at three New York State agency sites and a residential-based program at four selected sites in the greater Albany area. The former, funded by the New York State Energy Office and carried out in 1979, has been well documented (9,10) and is summarized later in this paper. Careful monitoring and evaluation revealed that, during a period of political and economic pressure on the supply and price of gasoline, the carpool coordinator program was 3 times more effective in carpool formation than the programs in state agencies that did not have a coordinator. The success of this program led to a follow-up project, funded by FHWA, in which a similar concept was tested at the neighborhood level. The findings of this study are summarized here; other reports (11,12) provide more detail.

NEIGHBORHOOD RIDESHARING COORDINATOR DEMONSTRATION

Design

The neighborhood ridesharing demonstration project is organized around the belief that the successful techniques of the employer-based carpool coordinator project can also be used at the home end. Residential areas offer several advantages for ridesharing formation. Neighborhoods are for the most part homogeneous and have established social networks that can be used to gather information about potential ridesharing matches. Moreover, ridesharing coordinators can promote and create ridesharing arrangements for nonwork purposes as well as for commuting to work. The NYSDOT study reported here is one of a number of demonstrations currently under way in Kansas City, Los Angeles, and the Maryland suburbs around Washington, D.C.

The design of the neighborhood ridesharing demonstration was laid out with careful postevaluation in mind (12,13). The goal of this study was to test the concept of the ridesharing coordinators who work from a residential base. Considerations were also given to the type of communities or neighborhoods, the appropriate setting for an office, and the effectiveness of various marketing techniques. Careful internal records were kept to permit comparison with the employer-based carpool coordinator project.

It is well known that national economic and political forces can also affect potential applicants' desire to share rides. To measure these effects, a before-and-after panel survey of residents' mode to work and ridesharing habits was conducted in each of the sites selected as well as in the region as a whole (6). Analysis of these data revealed that, with stable gasoline supply and price, there were no significant differences in carpool formation between the demonstration sites and the region as a whole.

Because future neighborhood ridesharing programs would be more easily sustained if funded by jurisdictions with the power to tax, the town or city appeared to be the logical basis for a ridesharing site. Two types of office sites were tested: home-based offices and town hall-based offices. Other important criteria included (a) distance from major employment sites, schools, and shopping areas; (b) development stage of the neighborhood, including the age of the housing stock, the residential street plan, and the degree of resident turnover; (c) socioeconomic mix of the residents; and (d) availability of transit.

Four communities were selected for the demonstration (Figure 1). The data in Table 1 summarize the

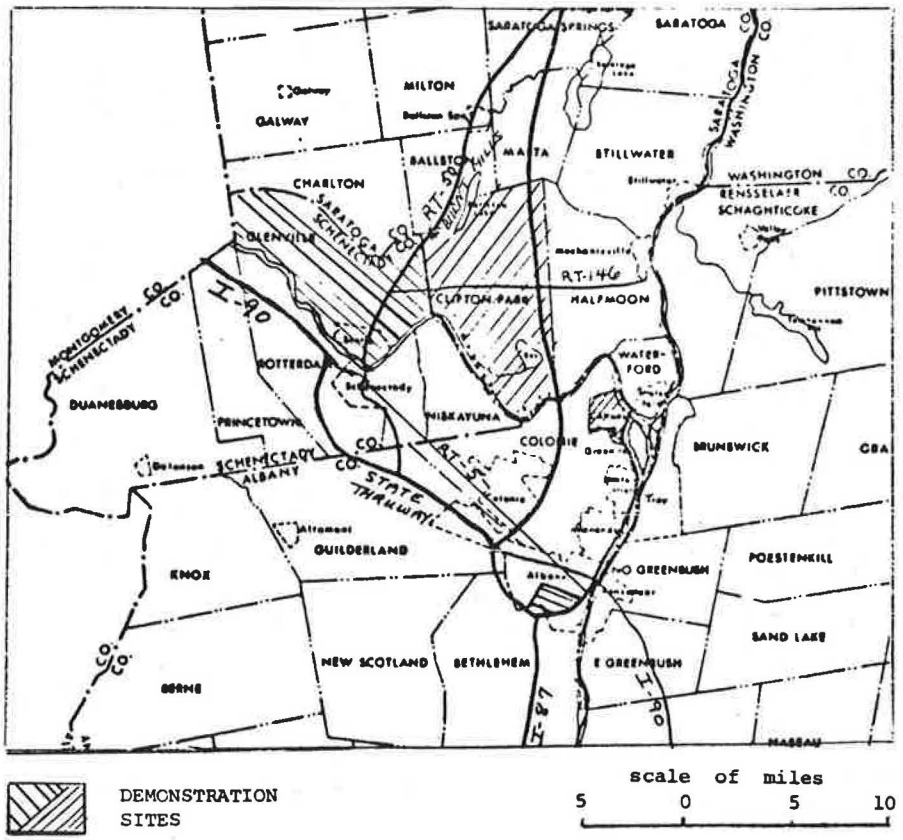

Figure 1. Capital District study area.

Table 1. Characteristics of sites for neighborhood ridesharing demonstration study.

Characteristics	Suburbs		Cities		
	Clifton Park[a]	Glenville[b]	Cohoes[c]	Albany-South Side[d]	Albany SMSA
Population					
1980	23,989	28,519	18,144	31,071	741,480
1970	14,867	28,636	18,653	30,001	721,910
Difference	+9,122	-117	-509	+1,070	+19,570
Δ (%)	+62	-4	-3	+4	+3
1980 households	7,464	9,840	7,106	15,898	267,428
Median value of owner-occupied housing ($)	65,500	40,100	36,500	37,700[e]	39,900
Transit available	None	Peak hour only	Good	Good	Urban areas, weekdays

Note: SMSA = standard metropolitan statistical area.

[a] Series of developments built entirely since 1960. Two-thirds commute to Albany and one-third commute to Schenectady.
[b] Generally middle and upper-middle class. Most work for General Electric (GE) and Schenectady-based businesses.
[c] Some new development.
[d] Homes of all types.
[e] Median housing value for neighborhood not available. Value indicated is for entire city of Albany.

characteristics of these communities. The table below is a quick reference guide to the study sites:

Type of Setting	Location of Office	
	Town Hall	Home
Suburb	Clifton Park	Glenville
City	Cohoes	Albany-South Side

Coordinators

The heart of the neighborhood ridesharing study is the coordinator who promotes ridesharing through a variety of specific strategies. Selection of coordinators was undertaken jointly by NYSDOT and the four communities.

The program was initiated in January 1981. Although the newspapers in the Capital District reported the demonstration with enthusiasm, the towns viewed the idea with some skepticism. Part of the problem was that the officials of each site perceived their own locality to have either a major or minor transit problem and believed that the demonstration funding could be better used in addressing these problems. Community auspices were granted after some initial discussion. Once hired, the coordinators were trained for operating the demonstration. These activities included

1. Presentations and discussions of the personalized ridesharing matching approach;
2. Familiarization with the operation of the NYSDOT employer-based demonstration;
3. Presentation of the energy situation in New York State;
4. Presentation by transit authority staff of routes, schedules, capacity, and limitation of currently available service;
5. Schedule and discussion of marketing approach;
6. Instruction and practice in informal presentations; and
7. Equipment, office supplies, and procedures for running an office.

Marketing Strategies and Promotional Literature

As part of the marketing strategy, messages were designed to influence various groups (market segments) to consider ridesharing and the usefulness of the neighborhood ridesharing coordinator. This work was undertaken by NYSDOT by using the results of the before survey, the literature on ridesharing behavior, and the findings for the Albany area (14). The resulting material was developed around the Sweet Car-o-line logo, which featured a clairvoyant fortune-teller who predicts (and helps make happen) a happy ridesharing future. The literature focused on the nonthreatening aspects of ridesharing and emphasized the fun and convenience and the personalized matching of the coordinator.

Applications consisted of a single tear-off card attached to the Sweet Car-o-line flyer. Information obtained from the application included

1. Home and work addresses,
2. Work start and leave times, and
3. Ridesharing request (work, school, shopping, other).

The source of each application (e.g., newspaper, radio, telephone, poster) was also recorded.

The marketing strategies involved five basic kinds of activity:

1. General announcements, newspaper articles, posters, stuff boxes, and so on;
2. Door-to-door and telephone promotion;
3. Group presentations;
4. Promotion through matching activities; and
5. Other (word-of-mouth, friend).

The effect of each activity was evaluated by reviewing the number of applications generated versus the effort and funds involved, and the resulting impact on carpooling and VMT reduction.

Literature marketing strategies were also used, including:

1. Posters (and applications) at community stores,
2. Door-to-door delivery of applications,
3. Literature made available at group meetings, and
4. Newspaper articles, radio spots, and newspaper advertisements.

To the extent possible, without violating individual privacy, the coordinators also recorded data on demographic characteristics.

Progress and Results

Applications and New Carpoolers Attracted

The increase in applications occurred in differing patterns in each of the test sites. The greatest activity was in the Clifton Park area, a community completely dependent on the automobile, where flyer delivery and news articles generated nearly 70 applications at the end of 10 weeks, but then applications grew at the rate similar to the other sites.

The number of applications and new carpoolers in Cohoes appears higher than it actually was because many of the coordinators' friends who were already carpooling registered as applicants. Because it is easier to find matches among a large group of willing ridesharers, these applications were included, although the number of new carpoolers is actually 23 rather than 45. The Glenville coordinator received a slow, steady trickle of applications for work carpooling, primarily from the Glenville area to the Albany area, and from students attending community colleges in the area.

Most applications in Albany came through recreational sports leagues. This is reflected in the climb in applications in the spring and late summer. The two commuter carpools from the Albany area to Schenectady resulted from participation by Schenectady Community College.

Travel Saved

By and large the applicants fell into three categories: new job holders who did not own a car, solo drivers who were looking for riders to share commuting costs, and people from multiple-car households.

The data on work carpools and on school carpools (this includes community college, school, and recreational sports carpooling) were analyzed separately (see Table 2). The latter group cannot be observed on a regular basis throughout the year and this should be observed over a prolonged period of time to determine continued behavior. The weekly VMT saved was twice as high in the suburbs as the urban areas. The application rate in the suburban areas was higher than in the urban areas, but the rate of new carpoolers placed was lower in the suburban areas. However, if the community college bus riders are included, the suburban placement rate is higher. It may be argued here that suburban sites are the preferred targets for neighborhood ridesharing programs. Whereas it is possible to increase ridesharing in urban areas, the existence of transit and taxi services over relatively short distances can serve as alternatives to solo-occupant automobile driving.

Carpool occupancy averaged 2.8 for work trips and 3.6 for school and recreation trips. An automobile occupancy of 2.8 for commuter ridesharing is consistent with 1978 and 1979 New York State agency surveys.

The data in Table 3 summarize the direct program effects of 176 new carpoolers who were attracted as a result of internal efforts; 18,797 VMT/week were saved. Carpools for nonwork purposes (school, recreational, and HVCC bus) involved about 111 new individuals who saved an average of 116 miles/week; work carpools involved 65 persons who saved an average of 90 miles/week. These numbers are comparable to the internal results of the employer demonstration during its first year.

Effect of Marketing Strategies

Analysis of returned applications (Table 4) revealed that most (50 percent) were generated from newspaper articles, and fewer by flyer distribution (21 per-

Table 2. VMT saved per carpooler by purpose and site.

Area	Persons	Carpools	Avg Automobile Occupancy	Total Miles per Week	Area VMT per Carpool per Week	VMT Saved per Week per Ridesharer[a]
Work Carpools						
Clifton Park	23	9	2.5	1,600	177.8	106.7
Glenville	27	9	3.0	1,235	137.2	91.5
Albany	10	3	3.3	191	64	44.6
Cohoes	14	5	2.8	715	143	91.9
Total test	74[b]	26	2.8	3,741	143.9	92.5
School, Community College, and Recreational Carpools						
Clifton Park	2	1	2.0	100	100	50.0
Glenville	17	7	2.4	1,055	151	88.1
Albany	45	8	5.6	337	42	34.5
Cohoes	9	4	2.2	436	109	59.5
Total test	73[b]	20	3.6	1,928	96.4	69.6
HVCC bus[c]	38	1	38	250	250	243

[a] Average weekly VMT saved per ridesharer = [(average automobile occupancy − 1.0)/average automobile occupancy] x (average weekly VMT/carpool).
[b] Includes existing carpoolers who were absorbed with new carpoolers.
[c] HVCC bus = Hudson Valley Community College bus system.

Table 3. Direct program effect.

Item	Cohoes	Clifton Park	Glenville	Albany-South Side	Total
No. of applications received	75	189	80	52	396
Work		115	43		
Community college		74	37		
New applicants					
Work carpoolers	14	23	19	9	65
School and recreation carpoolers	9	2	17	45[a]	73
HVCC bus riders	—	32	6	—	38
Total	23	57	42	54	176
Weekly VMT saved					
Work	1,282	2,454	1,739	401	5,876
School and recreation	536	100	1,498	1,553	3,687
HVCC	—	7,776	1,458	—	9,234
Total	1,818	10,330	4,695	1,954	18,797
No. of hours of effort	1,188	1,174	1,076	854	4,292

[a] Includes 33 persons in recreational sports league.

cent), group meetings (15 percent), and friends (14 percent).

Of considerable surprise was the small number of applications that originated from the neighborhood meetings. Several explanations are possible from the above results, but the most likely, in our view, is that group meetings already have matched people of a common interest and carpooling is already at optimum levels. We therefore would not expect strong results, particularly because most of the applications received were for work travel.

In spite of low response, program awareness was high. The data in Table 5 indicate that between 31 and 52 percent of respondents in a survey conducted in October 1981 had heard about the program. Most respondents remembered news articles or conversations with friends. The flyers and posters generated disappointing results. Considering that there was only one radio interview, the results indicate that radio is indeed an effective marketing device. When compared with the program use rate, results show that lack of program awareness was not a major factor.

COMPARISON OF APPROACHES

Employer-Based Program

The employer-based carpool coordinator program began in fall 1978 in a climate of concern over the adequacy of the energy supply and rising gasoline prices. Three New York State agencies participated; one agency instituted a hard-sell approach and an aggressive personalized matching campaign, whereas the other agencies used less-active approaches. Cutbacks and hiring freezes subsequently reduced the effective time available for coordinator activities assumed by agency personnel, and the program was left in a passive state in December 1979.

With the start of the neighborhood ridesharing demonstration program, the three agencies were asked and agreed to maintain their same level of commitment. Nevertheless, personnel changeovers and increased work loads of the coordinators resulted in changes in the matching approaches among the agencies. One agency [Department of Motor Vehicles (DMV)] developed the most active program by targeting (on a weekly basis) a group of employees who were asked to visit the coordinator's office and review the list of employees' names and addresses for possible carpool matching. This approach was effective enough to totally eliminate the carpool notices on DMV bulletin boards, and it is now used heavily by new employees. The program is being continued by the DMV; less than 10 percent of the coordinator's time is spent on ridesharing activities.

NYSDOT canvassed all of the applicants in their files in November 1981; the results are given in the table below:

Item	Value
Total no. of new carpoolers	106
Total no. of uncovered carpoolers	274
Total no. of carpoolers	380
Total no. of carpools	113
Avg automobile occupancy	3.4
Avg one-way trip distance (miles)	22.0
VMT reduction (%)	
Attributed to circuity (%)	7
Attributed to car left home (%)	5
Weekly VMT saved by each carpooler	135.5

[Note that VMT saved = distance x car left home x circuity x frequency = (22.0 miles) x (1 - 0.05) x (1.0 - 0.07) x (3.4 - 1.0/3.4) x (10 days) = 135.5.] The average trip length of these carpoolers was 22 miles, which is more than 5 miles longer than the average trip [illegible]ted in the fall 1979 sur-

Table 4. Impacts of marketing materials.

Month	Application Source				Marketing Activities			
	Newspaper	Flyer Distribution	Friend	Group Meeting	Articles	Flyers	Meetings	No. Attending Meeting
January	18	0	4	0	14	0	0	0
February	30	20	11	0	4	4,000	1	25
March	21	16	11	5	5	2,000	18	395
April	7	4	5	5	1	1,000	19	236
May	7	0	4	2	1	1,000	12	182
June	8	2	4	5	6	0	6	255
July	4	1	5	4	2	0	4	148
August	0	0	4	4	6	0	6	107
September	3	0	1	1	0	0	5	68
October	4	0	5	3	0	0	3	342
November	1	0	1	1	0	0	0	0
December	0	0	0	0	0	0	0	0
Total	103	43	55	30	39	8,000	74	1,758

Table 5. Awareness of program.

Item	Albany-South Side	Cohoes	Clifton Park	Glenville	Capital District	Total
Overall (%)						
Heard about program	31	32	52	32	18	
Received help	0	0	1.3	0.8	0	
How heard about program (%)						
Newspaper	21.1	15.2	36.3	16.8	13.3	20.4
Radio	2.0	4.6	3.4	4.9	3.5	3.7
Flyer delivered to home	0	1.3	3.0	0.8	0	1.2
Flyer picked up at public building	0.8	2.1	3.4	1.2	0.4	1.6
Speaker at group meeting	0.4	0.4	0.9	2.6	0.7	1.0
Telephone call from coordinators	0.9	2.5	1.3	2.0	1.2	1.6
Friend	7.5	10.1	6.0	6.1	4.3	6.8

vey. The average automobile occupancy of 3.4 is also higher than the 2.75 noted in the previous agencywide survey. [For additional discussions of the results of the employer-based carpool coordinator program, see other reports (9,10).]

Cost Comparison

Table 6 gives the costs of both the neighborhood ridesharing demonstration and the continuation of the employer carpool coordinator project chargeable to the former project. The total cost of the neighborhood ridesharing demonstration program was $96,980, a considerable portion of which was evaluation oriented and would not necessarily be repeated. Note that the $34,710 spent by the four ridesharing coordinators represents the total hours the coordinators were allowed to work, at $4.40/hr plus fringe and leave benefits at 59.08 percent, regardless of whether they were actively seeking applicants or passively waiting by the telephone. On the other hand, the amount charged by the employer-based coordinators represents the part-time costs (including fringe and leave) of the coordinator, whose major responsibility was other departmental work. Aside from the number of hours worked, the difference in these coordinators costs are attributed to differences in salary.

Measures of Effectivensss

The results of the employer-based carpool coordinator program and the neighborhood ridesharing coordinator program were strikingly similar (Table 7), even though the neighborhood program ran for a slightly longer period of time, served a much larger population, and required more input hours. When the program length of the neighborhood program is adjusted to correspond with the employer program, the estimated new ridesharers attracted to the neighborhood program is 154 versus 150 for the employer demonstration. The neighborhood program saved slightly more VMT, mainly due to the community college buspool; but when these savings are adjusted for similar program lengths, the savings and differences even out.

The employer program was more effective in attracting applicants. However, the placement rate was higher in the neighborhood demonstration, which indicates a less difficult matching effort. But it must be remembered that the efforts of the neighborhood coordinators include some passive time, i.e., traveling and waiting for the applications to reach a matchable level. The employer-based coordinators worked only part-time on this demonstration and they were occupied with other tasks when not involved in coordinator activities. Thus, although the application rate is higher in the employer demonstration, the carpool attraction rate is more similar than it might otherwise appear.

The employer demonstration took place during gasoline supply shortages and rapidly rising gasoline costs, whereas a stable economic situation existed in the initial stage of the neighborhood demonstration. It is probable that the employer program would not have succeeded in attracting as many carpoolers in a stable environment; this further reduces the difference in the results. There is no continuation period in which to compare the two demonstrations, but the relatively high effectiveness demonstrated in the employer continuation period suggests that, after initial start-up, this neighborhood program may be more successful. Indeed, the amount of applications received did not

Table 6. Program costs.

Item	Cost ($)		
	Employer-Based Carpool Coordinator Demonstration		
	January 1979-December 1979	January 1980-December 1980	Neighborhood Ridesharing Coordinator Demonstration: January 1981-December 1981
Implementation			
Personnel services			
Administrative salaries	8,369	680	7,580
Support staff	1,426		180
Ridesharing coordinators			
NYSDOT		3,008	34,710
Office of General Services[a]	6,381	21,078	
DVM[a]	125	3,744	
CETA[a]	5,926		
Total	22,227	28,510	42,470
Nonpersonnel services			
Telephone	400		1,120
Printing	3,099		3,507
Supplies	104		865
Computer tabulation	262		
Total	3,865		5,492
Total direct costs	26,092	28,510	47,962
Total charged to neighborhood demonstration		3,688	47,962
Development			
Administration			23,161
Technical support			
Clerical			3,064
Total			26,225
Evaluation			
Administrative and technical support			17,123
Clerical			1,982
Total			19,105
Total NYSDOT cost[b]			96,980

[a]Donated. [b]Period from May 1, 1980 to February 1, 1982.

Table 7. Comparative survey of direct results of employer versus neighborhood ridesharing demonstrations.

Item	Neighborhood		Employer	
	Entire Period	Adjusted to 42 Weeks	Initial Period	Continuation Period
Target				
Time period (weeks)	48	42	42	109
When	January-November 1981		January-October 1979	October 1979-November 1981
Population	101,723	101,723	4,207	4,200
Effort (input)				
Coordinators	4	4	4	3
Hours	4,292	3,755	2,230	1,150
Cost ($)	47,962	41,967	26,092	28,510
Cost per week ($)	999	999	621	262
Cost per hour ($)	11.17	11.17	11.70	24.79
Results (output)				
Applications received	396	346	624	1,264
New carpoolers attracted	176	154	150	163
Avg trip length (miles)		14.4/11.8[a]	18	22
Avg carpool occupancy		2.8/3.6[a]	3.2	3.4
Avg miles per week saved	106.8	106.8	108.9	135.5
Avg gasoline per week saved (gal)	7.1	7.1	7.5	9.0
Total VMT saved per week	18,797	16,447	16,335	22,087
Total gasoline per week saved (gal)	1,253	1,097	1,126	1,472
Gasoline price per gallon ($)	1.38	1.38 | 1.00	1.00	1.25
Savings per week($)	1,729	1,514 | 1,097	1,126	1,840
Effectiveness				
Applications per hour	0.09	0.09 | 0.09	0.28	1.10
Placements per application	0.44	0.44 | 0.44	0.24	0.13
New carpoolers per hour	0.04	0.04 | 0.04	0.06	0.14
Cost per new carpooler ($)	272	272 | 272	174	175
Benefit/cost ratio	1.73	1.52 | 1.10	1.81	7.02

[a]Work/nonwork trip length.

indicate any leveling off when the demonstration ended.

These comparisons are clouded by different cost rates, gasoline prices, backgrounds, and input hours, but it was concluded that neither the neighborhood nor the employer demonstration is clearly superior to the other. In parallel circumstances, both programs are likely to be equally cost effective.

Ease of Implementation

Each of the programs lasted approximately 4 months from the time the sites were chosen until the beginning of the implementation phase. Although help was being provided free to the communities, the officials needed time to assess the possible implications of the program for their constituents. The agencies were asked to cooperate in a new concept that might help their employees at a time of gasoline scarcity; however, each department had to agree to donate the services of an existing employee.

Now that each of these approaches has measurable demonstrated effects, the implementation potential becomes less hypothetical. Ridesharing programs have been shown to be effective wherever top management provides real support for the programs. In these instances, personnel and funds for marketing and parking management have been made available to the program. Management can generally gain by implementation of a ride sharing program (e.g., reduction of parking space, attraction for employees, less need for relocation facilities, easing of labor disputes). When these benefits are not present, employers are reluctant to enter into ridesharing programs. Even when concerns for patriotism or energy conservation have motivated employers, labor contracts may prevent changes in benefits such as parking. Establishing programs in an employer site is difficult unless the employer perceives a real gain.

Implementation in the community may be somewhat easier. Programs may be as flexible as the funding and imagination of officials and program management allow. Labor problems may be fewer; however, establishing programs at this level requires that funds must either be raised through taxes or by diverting funds from other programs. Because elected officials must answer to their constituencies, such a program must be perceived as necessary and effective.

Awareness of Program

Awareness of the program is easier to generate at the employer level because information channels are often well established. Problems may arise with employee perception of the effectiveness of the program; thus the long-term support of weak programs may result in noneffective programs. However, this is directly under the control of management.

Awareness at the community level is somewhat more difficult to develop. Results indicated that flyers delivered door-to-door tend not to be effective. Repeated newspaper articles have more effect, as do presentations at group meetings, but these are not generally under the control of officials or program managers. Eventually, information is no longer newsworthy, and group programs are no longer open to repeated messages about ridesharing. Thus expensive marketing campaigns may have to be added to the ridesharing program budget.

Potential for Expansion

The potential for expansion of the program is greater at the community level than at the employer level. Company programs can and will attract employees who want to reduce commuting expenses and also some who are just entering the work force. However these programs will face a saturation point. That carpooling to work has remained stable over the past several years confirms this finding. Applications may continue to grow, but turnover and dropout rates will reduce gains and ultimately produce a stable total.

Because of the larger base of residents within communities, there is greater possibility for expansion. The communities contain many commuters who may commute to jobs at firms that are too small to have ridesharing programs. These residents may only lack awareness of other community residents who are traveling to close-by locations. The experience of the ridesharing coordinators and the findings of the panel survey indicate that at least half of the new ridesharers are just entering the work force and use this service until they can afford to own and operate their own automobiles. In this respect, ridesharing enables persons to get to jobs they might otherwise be unable to take or keep without difficulty.

Although nonwork ridesharing was difficult to organize, the limited success in organizing ridesharing to schools, recreation programs, and community colleges indicates that ridesharing programs can be successful in either reducing VMT or providing transportation to those who otherwise would not have that option. The limits of such specific programs were not even approached by the coordinators. It is believed that great expansion potential exists within many communities.

In summary, with positive and negative aspects of the program inherent in each approach, it cannot be said that one approach is more effective than the other. The continuation phase of the employer demonstration indicates that sustained effort produces more results for less effort and cost. The neighborhood approach deserves a continuation phase and is worthy of attempts in other types of communities throughout the country.

CONCLUSIONS

In conclusion, it appears that the neighborhood-based ridesharing coordinator program is a viable concept. With the solid support of the communities, ridesharing coordinators can influence ridesharing formation for the residents of those communities. The coordinators were most successful in forming carpools to work and to regularly scheduled activities such as community colleges. In this study, the coordinator was the catalyst for a buspool to a local community college. Ridesharing arrangements for nonwork purposes other than school were found to be informal, socially based, and not a productive target of the coordinators' efforts.

Public awareness of the program was high. The most effective marketing technique appears to be word-of-mouth generated by newspaper articles about the program and brief announcements and flyer distribution at large group meetings. Most nonwork groups were not open to involved discussion about the benefits of ridesharing.

In comparison with the employer-based carpool coordinators, who ran a proven program in a time of rising gasoline prices and fuel supply shortage, the neighborhood ridesharing coordinators were equally effective in the number of placements per hour and in cost-effectiveness measures. Given that employer ridesharing programs gradually rise to a saturation point, a neighborhood program that has a large population base and a continuous changeover in residents has great possibilities for cost-effective expansion. Therefore, additional demonstration programs are recommended.

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Transit Agency Use of Private-Sector Strategies for Commuter Transportation

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Demand for public transit services in most urban areas is concentrated in the peak period. However, peak-period service is significantly more expensive to the transit agency than its other services and usually produces larger deficits. Faced with pressures to maintain or increase commuter services, yet also control rapidly escalating deficits, transit agencies are in need of strategies that improve the cost-effectiveness of commuter transportation. Several innovative service strategies, which make use of the private sector (service contracting, service turnovers, vanpooling), have considerable potential to achieve this objective and are alternatives to traditional transit agency approaches to problem solving. Transit agency use of innovative private-sector strategies is examined based on a study of eight transit agencies in eight diverse metropolitan areas, all with some significant private-sector activity in commuter transportation. The reasons these agencies have or have not adopted these strategies are identified, and the major barriers to their more widespread use are specified. The initial incentive to consider nontraditional approaches comes from fiscal and service pressures that require some change in the status quo, but whether private-sector strategies are actually used depend largely on four factors: (a) management interest in nontraditional approaches, (b) analyses that demonstrate the utility of innovative approaches, (c) discretionary rather than dedicated local subsidies, and (d) the ability of local government officials to influence the transit agency's service and budget decisions. The main barriers to innovation are traditional management orientation, labor constraints posed by federal legislation or local union contracts, and subsidy and decision-making arrangements that give the agency no strong incentive to improve the cost-effectiveness of its different types of services.

The provision of peak-period transportation services has historically been a major focus of U.S. urban transit operators. Over the past two decades, as the transit market share has declined, the peak-period orientation of urban transit has increased. Choice riders have all but abandoned transit for off-peak travel and, consequently, peak service has become the most important source of ridership for most urban transit systems.

In addition to the relatively high use of peak-period transit services, changing conditions in many urban areas throughout the country (particularly the West and South) have generated more demand for all collective forms of commuter services. The inability of street and highway capacity to keep pace with increasing traffic has resulted in rising levels of congestion on major commuter routes, particularly in areas of rapid growth. Rapidly increasing energy costs (which affect the purchase price of automobiles as well as gasoline prices) have made the private automobile an increasingly expensive means of commuting to work. Moreover, the growth of employment in many central city areas has created parking shortages as well as local congestion problems. Because of these conditions, public demand for additional commuter services is being expressed to many public institutions, particularly public transit agencies.

Unfortunately, peak-period transportation poses as much of a problem for public transit providers as it does for commuters. Although the peak period is the key source of transit ridership, it is also the greatest source of transit deficits. Thus, as the peak orientation of public transit has increased, so has the need for subsidies. The nature of the peak problem has been described elsewhere (1,2), and thus is only briefly reviewed here.

Basically, the peak-period problem results from two factors. First, the size of the transit organization is determined by maximum service requirements. As the peak-to-base ratio increases, a relatively higher percentage of labor and vehicle stock is underused for most of the service day. Although administrative staff, maintenance and garage facilities, vehicles, and drivers are determined by the volume of peak service provided, the revenue-generating potential of these inputs exists for only a few hours per day. Thus the peak orientation leads to a low level of productivity in public transit service.

The second problem is that existing transit union work rules add to the expense of providing peak service through spread time limitations, overtime provisions, and minimum pay time requirements. These work rules result in drivers being paid for many more hours than actually worked in peak service. Thus the labor cost per unit of service is higher in the peak than in the off-peak period.

These two factors are further complicated by the more general cost and efficiency problems of the urban transit industry. The monopolistic structure of transit providers and the lack of efficiency incentives generated by formula-based subsidy mechanisms have allowed a rapid escalation in transit service costs. At the same time, fare revenues have not kept pace with these costs. Consequently, transit deficits have reached a critical magnitude. Available subsidies are no longer sufficient to cover the deficit for many transit operators; as federal operating subsidies are reduced, this problem will become both more serious and widespread.

The transit industry is faced with a difficult challenge because of the conflicting pressures of supply and demand. On the one hand, peak-period transit in its current form is inefficient and too costly. On the other hand, the demand for peak services is increasing, particularly in high-growth areas. If this demand is to be met in a cost-effective fashion, alternatives to traditional peak transit services must be developed.

The primary focus of this paper is on innovative peak-period service delivery strategies that use the private sector in some way. These innovative alternatives are examined in terms of the conditions necessary for their success, the motivations for promoting them, and the obstacles that may prevent their implementation.

Research results presented here are based on case studies of eight public transit agencies located in eight metropolitan areas around the country. The research took place in spring and summer 1982 as part of an UMTA-sponsored project on the evaluation of private-sector-provided services. The eight areas were selected on the basis of the extent and variety of private-sector activity in commuter service.

STRATEGIES FOR REDUCING THE PEAK SERVICE PROBLEM FOR TRANSIT PROVIDERS

There are several alternative strategies available to transit providers that can reduce the peak service problem. Of primary interest are service contracts with private bus companies, turnovers of commuter service on an unsubsidized basis, transit agency actions that facilitate the provision of unsubsidized private commuter bus services, and

transit agency vanpooling programs. Each of these strategies requires the transit agency to adopt a nontraditional approach to peak-period service organization and provision, and some entail substantial institutional changes in the service delivery system. Transit agencies also can respond to the peak-period problem by using more traditional strategies that, although typically easier to implement, also have less potential to provide a viable long-term solution to the problem, because they cannot simultaneously improve service and increase cost-effectiveness.

Traditional Strategies

Traditional solutions consist of strategies that reduce the deficit of peak services but do not change the institutional structure of service provision. This means that the public transit provider remains the sole provider of peak services within its service area and reduces the deficit either by decreasing service costs or increasing fare revenues.

One method of achieving reductions in service costs is through more efficient use of labor in the peak period; e.g., by using a higher proportion of part-time drivers or by negotiating work rule changes. The potential cost savings of work rule changes and the use of part-time labor are sensitive to the peak-to-base ratio and length of time between the morning and evening peak periods (3). On average, such strategies can reduce labor cost up to 8 percent, provided that changes in work rules are not compensated with higher wage rates.

A less-traditional strategy is that of load shedding, or simply reducing the volume of peak service. Resulting cost savings can be significant, particularly if the most costly peak services--those runs for which drivers are paid the largest spread time or overtime penalties--are eliminated. Because of the public support of peak services, however, such service cutbacks are frequently a political impossibility.

Another relatively novel strategy, ableit still within the traditional framework, is to target fare increases at peak-period users. Such fare increases are appropriate for equity as well as efficiency reasons, because recent studies indicate that long-distance peak users are subsidized by short distance central city off-peak users (4). However this approach fails to address the problem of escalating service costs. Relying on fare increases over the long term would require repeated fare hikes in order to keep pace with rising service costs. Moreover, the range of fares over which demand is inelastic is unknown. Large fare increases could lead to revenue losses if demand becomes elastic at higher fare levels.

Innovative Strategies

The use of part-time drivers, peak-period service reductions, and selective fare increases all hold some potential for alleviating the peak-period problem. However, they do not attack the root cause of the problem, namely, that most transit agencies have excessively high cost structures for peak service, which even the use of part-time drivers will not completely overcome. In the current economic climate, it is difficult to expand commuter services even when demand is present.

Contracting with Private Providers

Perhaps the most radical innovative strategy is for the transit agency to contract with a private provider for fixed-route or subscription bus service. The motivation for doing so is to take advantage of the lower costs of privately provided service. The practice of contracting is well established in the public transit field. Demand-responsive services are provided by private contractors in many areas of the country, and many transit agencies have maintenance or management contracts with the private sector as well. Private operators have lower labor costs than public operators: wage rates are lower and work rule restrictions such as spread time penalties are minimal. Moreover, private operators are frequently able to interline commuter service with their charter business, thereby using labor and vehicles throughout the day and reducing the unit cost of service. A study done in southern California indicated that current subsidies for 22 peak-period-only bus routes could be reduced by 90 percent by contracting the services to private bus companies (5).

The most problematic issue associated with private contracting is that of labor protection. Any attempt to turn existing transit agency service over to a private contractor will involve Section 13(c) of the Urban Mass Transportation Act of 1964, as amended, if federal subsidies are involved. If a transit agency contracts a route to a private provider, it would not be able to eliminate employees as a direct result of this change because Section 13(c) protects public transit workers from such eventualities unless they receive compensation.

A much less problematic strategy is to use private providers for subsidized service expansions, although fiscal constraints severely limit service increases for most transit operators. In this case, Section 13(c) labor-protection provisions do not apply because service increases would not adversely affect existing transit employees. However, some transit union contracts have limitations on the amount of contracting permitted.

Turning Service Over to Private Providers

A second strategy transit agencies can use for involving private bus companies in commuter transportation is to turn over some commuter routes to the private sector that would be operated without subsidy. In a number of metropolitan areas private bus operators are still active in the commuter field, which suggests that there is an interest in providing this type of service. However, despite the lower costs of private operators, there often would be a need for fare increases to ensure profitability, and the fare elasticities of commuters are uncertain. Only certain routes would be suitable for this strategy, most likely the long-distance express routes that already have a relatively stable revenue return. The Section 13(c) issue would be less relevant for this strategy because no subsidies are involved, but some union contracts have clauses mandating that the size of the bargaining unit cannot be decreased. In this case, the strategy becomes somewhat less attractive, as labor inputs removed from peak-period operations must be deployed during the off peak, thereby reducing the subsidy savings.

Facilitating Private-Sector Services

The transit agency can also strengthen the private sector so that it is then capable of meeting demands for peak service expansion or demands for new kinds of services. For example, the transit agency can act as a broker and pass along requests for work-site service to a private bus company that is willing to provide subscription service. The emphasis

is on meeting the needs of particular market segments rather than maintaining transit agency control.

A major impediment to private-sector expansion is a lack of equipment. Low profit margins make equipment purchasing a risky proposition when entering a new market. The transit agency can alleviate this problem by leasing new or extra equipment to private companies. Leasing can also help support existing services because private operators often lack the capital to update deteriorating bus fleets.

The transit agency can also support private-sector activities within the context of their own programs. Private services can be actively marketed in conjunction with public services. Park-and-ride lots can be built for or opened up to passengers on privately operated express routes.

Although none of these actions has direct cost savings, they increase the peak services available. They are also supportive of some of the other strategies that require a strong private-sector bus industry.

Ridesharing Services

Another strategy that transit agencies can use to increase the total supply of commuter services is to support or sponsor a ridesharing program. This can involve providing a matching service for prospective carpools and vanpools, organizing vanpools through third-party providers, or providing vehicles for vanpools and administering a vanpool program. One significant incentive for providing ridesharing programs is that they can be largely financed from non-transit funding sources. The transit agency thus has the opportunity to expand services without taking subsidy support away from existing services.

Vanpooling is a more cost-effective form of commuter transportation than regular transit service. A vanpool is not initiated until the persons required to fill the van (between 10 and 15) have been brought together. Because vanpool fares are usually set so that all costs (except administrative overhead) are covered, the subsidies involved in vanpooling are small. Vanpooling also provides a means for targeting service to specific markets, and because the only large capital investment (the van) is easily transferred, vanpools can be dissolved or reorganized as members change jobs or move.

Sponsoring a vanpool program can make it possible for transit agencies to provide commuter service in suburban areas where residences and employment centers are spatially dispersed and at the same time avoid the large operating deficits that regular fixed-route service would generate. Vanpooling programs can also provide a means for increasing the overall cost-effectiveness of the transit agency if high deficit express bus services are replaced by vanpools. Again, as with private-provider contracting, transit service replacements may generate Section 13(c) problems if federal subsidies are involved.

Although vanpooling and other ridesharing support services have distinct economic advantages, they can present problems for the transit agency. There is a potential conflict with regular transit service if vanpools are used instead of transit services. As a result, some transit agencies avoid providing ridesharing services to commuters who can be served by transit. In this way service competition is avoided. However, under such conditions, the effectiveness of the ridesharing program may be adversely affected. This also raises the question of whether an institution with a vested interest in one form of commuter service can effectively market other services.

TRANSIT AGENCIES AND THEIR ENVIRONMENT

Environmental Influences on Peak-Period Strategies

The transit agencies' perceptions of the peak-period problem and their response to it must be analyzed in the context of their operating environment. Four environmental factors may be important.

First, the potential demand for peak-period public transportation services is affected by the overall transportation environment. Highway congestion, land use patterns prevailing in the region, and current use of public transit are indicators of whether transit is now, or is likely to be in the future, a central element in commuter transportation.

Second, the characteristics of the transit agency itself affect its response to peak-period problems. These include the peak/base ratio, size of the agency, length of time in the public sector, and extent of institutional autonomy.

A third important factor is the economic environment within which the agency operates. Transit agencies differ widely in their source of funds, the amount of deficits, the availability of funding, and the degree to which they are accountable to funding sources.

Finally, the private-sector service environment determines the potential nontraditional options available to the transit agency. The extent of private bus operations and vanpooling programs, the number of park-and-ride lots available for commuter services, and the involvement of private employers in organizing ridesharing and transit services all influence the ability of the transit agency to be innovative in commuter transportation.

The data in Table 1 and the following section summarize these four factors for the eight transit agencies in the study.

Transportation Environments

The eight transit agencies are located in eight urban areas with distinctive transportation environments. The three largest regions--Los Angeles, Boston, and Houston--all have congestion problems, particularly in the core areas. In the San Francisco Bay area, Golden Gate Transit faces the bottleneck of the Golden Gate Bridge, whereas Santa Clara's congestion problems result from insufficient capacity to serve the rapidly expanding northern industrial areas. In contrast, Pentran and Tidewater Transit serve adjacent areas in Newport News and Norfolk, Virginia, which have few traffic problems. In the Hartford area, only the CBD is a source of congestion.

The relative importance of transit in providing commuter services is indicated by modal split. Golden Gate, MBTA, and ConnDOT all carry a sizable share of work trips in their areas. The remaining transit agencies carry a much smaller share, ranging between 3 and 7 percent.

The peak/base ratio measures the extent of peak service orientation by the agency. Both Golden Gate and Pentran have a strong peak orientation. The other agencies have more moderate peak/base ratios, but only Santa Clara and Tidewater have a ratio less than 2.0.

In terms of organizational growth and longevity, these transit agencies are quite diverse. MBTA is by far the oldest operation, and it has not undergone any significant expansion for several years. SCRTD is a relatively stable system and has been in operation for about 25 years. Boston and Los Angeles both have recently faced fiscal crises as available subsidies were no longer sufficient to cover rapidly increasing deficits. In Boston, the

Table 1. Transit agency characteristics.

Item	Connecticut Department of Transportation (ConnDOT)	Peninsula Transportation District (Pentran)	Tidewater Transportation District	Golden Gate Bridge, Highway, and Transportation District	Massachusetts Bay Transportation Authority (MBTA)	Metropolitan Transit Authority (MTA)	Southern California Rapid Transit District (SCRTD)	Santa Clara County Transportation Agency
Urban environment								
Major city	Hartford	Newport News	Norfolk	Northern San Francisco Bay area	Boston	Houston	Los Angeles	San Jose
Population (000,000s)	0.73	0.27	0.80	0.61	2.8	2.5	7.2	1.3
Congestion	Low	Low	Low	High	High	High	High	High
Geographic bottlenecks	No	No	Yes	Yes	Yes	No	No	No
Modal split for work trips (%)								
Transit	31[a]	5.2	5	28[b]	19	3	7	3
Rideshare	21[a]	94.8	95+	34[b]	20	97	17	22
Automobile alone	48[a]			38[b]	61		76	75
Transit agency characteristics								
Date public subsidy began	1972	Mid-1970s	Mid-1970s	1973	1918	1979[c]	1958	1972
No. of buses	234	100	175	230	1,137	400	2,821	346
No. of passengers per year (000,000s)	18.1	NA	14.2	10.1	118.3[d]	39.0	257.0	35
Peak/base ratio	2.4	4.5	2.0	5.3	2.38	2.45	2.0	1.5
Express as percentage of total service	13 percent of passengers	12 percent of miles	5 percent of miles	40 percent of passengers	8 percent of routes	20 percent of passengers	25 percent of miles	14 percent of miles
Economic environment								
Source of revenue (%)								
Fares	46	35	45	50	22[e]	18	39[f]	9
Local	0	30	21	28	28[e]	51	0[f]	55
State	27	3	5	16	41[e]	8	45[f]	30
Federal	27	32	29	5	9[e]	23	16[f]	6
Local funding arrangement	State general funds	General funds	General funds	General and dedicated bridge tolls	Dedicated property tax	Dedicated sales tax as of 7/82	Dedicated sales tax	Dedicated sales tax
Private-sector peak service environment								
Private bus companies								
No. of subsidized operations	6 routes	0	0	27 club buses	0	13 routes	1 route	0
No. of unsubsidized operations	1 route	54 buses	90-100 buses	0	200 buses	0	100 buses	0
Vanpools in metropolitan area	274	200	400	218	225	1,983	733	27

Note: NA = not available.

[a]Central business district (CBD) only. [b]Golden Gate Bridge. [c]Regional. [d]Bus only. [e]All modes. [f]Before sales tax approved.

crisis resulted in fare increases and service cutbacks. In Los Angeles, planned fare and service changes were avoided when a local sales tax was validated by the courts and provided greatly increased subsidy resources.

The remaining agencies are relatively young, and all are characterized by service changes of one sort or another. Those systems that have experienced financial problems (Hartford, Norfolk, Newport News, and Golden Gate) have either stopped expanding or have turned to more cost-effective services. Houston and Santa Clara both receive plentiful local sales tax monies and continue to expand transit services.

These eight transit agencies represent a diversity of funding arrangements and a wide range of economic environments. In Boston, the towns and cities in the transit district provide a major portion of the subsidy money (30 percent), but their share is legislated by the state and entails no direct control over service provision. In Los Angeles, transit funding is channeled through the Los Angeles County Transportation Commission. Although the Commission has little discretionary power over state funding, it has influence on the sales tax subsidies. State transit assistance is Golden Gate's major subsidy source. These funds are channeled through a planning organization, but the transit agency is primarily responsible to its own board of directors. As a state agency, the Hartford division of ConnDOT is accountable to the state legislature for all aspects of its operations. Although this control is not regularly exercised, some funding carries mandated service requirements. Newport News and Norfolk receive a substantial portion of their funding from the towns and cities in their districts, but the contribution is not mandated by law. As a result, the transit agencies are directly accountable to the local entities that receive the service, and thus there is strong local pressure to be efficient and keep costs down.

Although local funding is also a major subsidy source for Santa Clara and Houston (and now Los Angeles), in these cases the funding comes from a dedicated sales tax with few restrictions and little accountability to other government agencies. The large local contributions do create an implicit emphasis on keeping fares low, as reflected in the amount of revenue that comes from fares--10 percent in Santa Clara and less than 20 percent in Houston. Across-the-board fare reductions were required by the sales tax measure in Los Angeles. In addition, all three systems are planning major capital expansion programs.

Innovative Agencies and the Peak Period

The first step toward accepting the innovative approach to problem solving is the recognition that the peak period is a major source of deficits. Having acknowledged this, the agency may then undertake the task of developing innovative alternatives, including tailoring service to particular markets, ending the transit agency monopoly over service provision within its district, and coordinating with the private sector.

Table 2. Peak-period services and plans.

Item	Hartford	Newport News	Norfolk	Northern Bay Area	Boston	Houston	Los Angeles	San Jose
Transit agency	ConnDOT	Pentran	Tidewater	Golden Gate	MBTA	MTA	SCRTD	Santa Clara
Perceives peak problem	Yes	Yes	Yes	Yes	No	No	No	No
Cost allocation study	Yes	IP	Yes	Yes	Partial	No	Partial	IP
Vanpool program	Yes	Yes	Yes	Yes	No	Yes	No	No[a]
Contract with private sector	Yes	Yes	Yes[b]	Yes	Yes[b]	Yes	No	No
Facilitate private bus	Yes	Yes	Yes	No	No[c]	No	No	No
Turn routes over to private sector without subsidy	IP	Yes	No	No	—[d]	No	No	No
Plans for peak service	Cut peak; eliminate express	Contract services; turn over services to private sector	Maintain low peak/base ratio	Reduce or eliminate club bus subsides	General service cuts; part-time labor; fare increases; union restrictions	Expand peak and express lines; end contracting; rail system	Rail system; part-time labor	Expand peak service; highway construction; light rail

Note: IP = in planning stages or in progress.

[a]Participates in area's vanpool program but does not use it to increase peak-period supply of transit services.
[b]Not for commuter services but others.
[c]State DOT leases buses to private carriers.
[d]One route.

The eight transit agencies divide into two groups on the basis of whether the transit agency recognized the peak-period problem or not. Although the use of innovative strategies by the transit agency does not always directly correspond to peak-period perceptions, the overall approach to transit management does. The data in Table 2 summarize each agency's perception of the peak problem and the types of innovative services it provides or otherwise encourages.

Hartford, Norfolk, Newport News, and Golden Gate all perceive the peak period as a major source of deficits. A crucial feature of this perception has been detailed studies of costs allocated to time periods (peak and nonpeak), routes, and different types of service. Such studies can provide evidence that can sway fiscally conservative managers who may otherwise be reluctant to support nontraditional approaches to service delivery.

The most common innovative addition to the transit agency's service has been ridesharing (particularly vanpools). All of the innovative agencies sponsor vanpools, although not all sponsor carpools. These agencies do not fear ridesharing as competition, but see it as a supplement to current service.

Innovative agencies are willing to coordinate with the private sector. In their ridesharing programs they organize or promote employer-sponsored vanpools. Hartford and Golden Gate contract with private bus companies, recognizing that these companies can more efficiently provide certain services, such as express service. In Hartford six different companies are paid guaranteed hourly rates for their express service. ConnDOT has also built park-and-ride lots for these routes. Golden Gate Transit began subsidizing a club bus (subscription bus service) program in the early 1970s, and currently contracts with four bus companies for 27 bus runs daily. Innovative agencies also facilitate the involvement of private bus companies in commuter transportation even when the agency does not retain control over service decisions, as it does when contracting. For example, ConnDOT has built park-and-ride lots for nonsubsidized commuter routes, and Tidewater and Pentran lease buses to private bus operators.

All four agencies anticipate that additional services can be turned over to the private sector without subsidies. Pentran was encouraged by the willingness of a private provider to pick up a service to a neighboring county that the transit agency decided to terminate. ConnDOT anticipates that where express routes are terminated, unsubsidized vanpools and private bus operations will step in to serve the market. Golden Gate Transit wants to eliminate subsidies altogether from the club bus program and reconstitute it as an owner-operator service (with the clubs owning the buses), which would be similar to vanpooling.

Traditional Agencies and the Peak Period

The four traditional transit agencies--Boston, Houston, Los Angeles, and Santa Clara--do not perceive the peak period as a major economic problem. In Boston there is some recognition that the peak period probably costs more, but the spiraling costs are blamed more on labor problems than on service organization factors. During its recent fiscal crisis, SCRTD proposed higher fares for peak service but resisted efforts to turn over certain peak-period-only routes to private operators. Both Houston and Santa Clara plan to increase peak services. None of these transit agencies has conducted a full cost study (to date) by route and time period. At Santa Clara and Houston MTA, costs have not been an important issue because of the ample availability of local subsidies. In Los Angeles and Boston it is recognized that reducing certain peak services may reduce the overall deficit, but there is a reluctance to cut back services that serve many riders and are politically visible.

Only Houston has a ridesharing program, but it is small; it currently consists of 19 vans. There are no plans for vanpools to become a major service offered by the Houston MTA; the program was initiated only because of political pressures from areas that do not currently receive MTA bus service. Houston is also the only one of the traditional transit agencies to contract with private carriers for commuter service. But rather than being a strategy for ameliorating peak costs, contracting is a limited-term measure for expanding peak service until MTA can increase its own stock of equipment.

The issue of turning over some routes to private carriers without subsidies has been discussed in both Los Angeles and Boston. Within the transit agencies there is considerable resistance to the

concept. Although it is conceded that there would be some cost savings, there is a general belief that express routes produce relatively more revenue than other services. It is believed that giving viable routes to private carriers would cause a deterioration in overall performance. In both cities the idea was given serious consideration during times of fiscal crisis. However, the idea was dropped by SCRTD as soon as the transit sales tax was validated by the courts; and in Boston the outcome of the most recent crisis was general service cutbacks and increased local subsidies from the towns and cities in the service district, despite discussion regarding service turnovers.

WHAT ACCOUNTS FOR TRANSIT AGENCY RESPONSES?

Five of the eight transit agencies--Tidewater, Golden Gate, Pentran, ConnDOT, and Houston MTA--have made at least a moderate commitment to innovative responses to the commuter transportation situation. Although the use of innovative strategies does not necessarily imply an innovative orientation on the part of these transit agencies (Houston MTA being the prime example), it does distinguish them from the transit agencies in Boston, Los Angeles, and Santa Clara, which have not demonstrated any serious interest in the use of nontraditional strategies.

What accounts for these different degrees of willingness and ability to use innovative strategies for providing commuter transportation? Although many factors affect the use of innovative strategies by transit agencies, five factors appear to be most influential:

1. Political pressures to expand commuter services or to constrain overall transit costs,
2. Constraints on the use of traditional strategies,
3. Nontraditional management orientation,
4. Nondedicated subsidy arrangements, and
5. Fiscal control by local elected officials.

Fiscal and service pressures are invariably the prerequisites to innovative approaches to problem solving, although it must be emphasized that they do not guarantee a nontraditional response. Rather, pressures to expand peak service or, more typically, to reduce projected deficits (and hence the needed subsidy) require an agency to consider how it will achieve these objectives. Without such pressures, the organization will almost inevitably maintain the status quo for its service delivery system. When such pressures are present, however, an opportunity is created to examine alternatives to traditional problem-solving responses. Whether this opportunity will in fact lead to an innovative approach that uses the private sector appears to be a function of the other four factors.

Top management of a transit agency need not be particularly innovative in orientation for an innovative response to occur, but it must be open to nontraditional modes of problem solving. Tidewater Transit is virtually unique among U.S. transit agencies in its unhesitant embrace of innovative problem-solving approaches. On the other hand, Pentran, ConnDOT, and Golden Gate have more traditional top management; yet management at Pentran and Golden Gate was willing to experiment with innovative strategies developed by their ridesharing divisions, whereas at ConnDOT internal cost studies demonstrated the necessity for more cost-effective service alternatives.

Subsidy and decision-making arrangements have a crucial effect on whether transit policymakers will be motivated to investigate and support nontraditional approaches to commuter transportation services. In particular, when nonfederal subsidy sources are discretionary (i.e., are not dedicated exclusively to transit) and when policymakers are members of government units with a direct financial stake in the agency's cost and service performance, the prospects for policy-level support (and even advocacy) of innovative strategies are much greater than when these factors are not present. Under such circumstances, policymakers and their constituents have a direct interest in the most cost-effective forms of service delivery possible because subsidy savings can be diverted to other government services or to lower taxes. Tidewater, Pentran, Golden Gate, and ConnDOT all use discretionary sources of subsidy, and in each case the agency's policymakers must account to their constituents as to how the funds are spent. Therefore, policymakers, and through them management, have a compelling interest in maximizing the cost-effectiveness of the services for which the agency is responsible.

In addition, note that the politics of transit are in part the politics of service delivery. If satisfactory service is good politics, then strategies that reduce service costs and thereby allow additional services to be produced, or at least the current level of service to be maintained, are also politically desirable. Thus the policymakers for Tidewater and Pentran have not had difficulty accepting proposals to provide commuter services, as well as other transit services, through mechanisms other than the transit agency's own vehicles and drivers. With respect to Pentran, the policymakers were the initial advocates of such thinking. It must be emphasized that direct control of local subsidies is the key to the development of such attitudes on the part of policymakers.

In contrast, MBTA and SCRTD have both faced severe fiscal crises, but in neither case did it lead to agency support of nontraditional strategies. Both organizationally and politically, MBTA and SCRTD are shielded against change. Management believes that it should control and provide all transit services in its sphere of influence. Politically, the two agencies derive much of their influence from their contribution to commuter transportation because the peak period is the only time of day when a significant portion of the ridership is composed of middle-class citizens. With dedicated funding sources and a decision-making system in which local policymakers lack the authority to connect service decisions with subsidy allocations, there is little incentive or ability for policymakers to intervene in the agency's internal decision-making process.

Neither Houston MTA nor Santa Clara County Transit is experiencing fiscal pressures. Although Santa Clara's policymakers (the County Board of Supervisors) are in a position to control subsidies by influencing service decisions, the dedicated transit funding gives them no incentive to do so. In fact, current Board policy is aimed at constructing light rail lines and generally expanding transit service, which will result in more transit subsidies in future years.

The policymakers in Houston are equally committed to spending far more money on transit than is now the case, again primarily through the creation of a rail transit system. In the short run, however, the Houston transit agency has been forced to use nontraditional means of providing additional peak services, notably contracting and vanpooling. Nevertheless, the agency adopted these two strategies because it is under intense pressure to increase the amount of peak-period service in order to help cope with Houston's serious traffic congestion problem.

Moreover, the vanpool program is small, and the contracting arrangements are viewed as an interim strategy that will be eliminated as soon as the transit agency can build up its own fleet to take over the service. Thus, with a dedicated and ample funding source, the Houston MTA long-range plan is to reimpose traditional strategies for peak-period transportation.

WHAT ARE THE BARRIERS TO INNOVATION?

Considering the fiscal problems that are besetting more and more transit agencies, even as demands for peak services continue to increase, it is pertinent to ask why so few agencies have chosen to adopt the commuter transportation innovations that are the focus of this study. What are the primary barriers to more widespread use of these strategies?

Perhaps the most important barrier is that many transit agencies lack the incentive or motivation to adopt nontraditional responses to peak-period problems. Although private-sector strategies are one way of dealing with the fiscal problems they confront, transit agencies can also cope through more traditional responses. Service cutbacks (usually concentrated in off-peak periods), fare increases, and the use of part-time drivers are all means of addressing fiscal problems that are compatible with the traditional transit agency orientation. An agency with traditional management will usually look first to such strategies; if such strategies promise to solve the immediate problem, management will look no more until the next crisis occurs.

This response leaves largely intact the structural conditions that underlie the peak-period problem because it does little or nothing to enable the agency to better match supply and demand characteristics. Nonetheless, it has some major advantages from the standpoint of a traditionally oriented management. Why go through the organizational and political trauma, however mild (and it may not be mild), of altering the institutional structure for service delivery in order to solve a problem when a response that is thoroughly compatible with existing institutional mechanisms is available? Moreover, it is by no means proven that an innovative strategy will result in major subsidy savings when compared to traditional responses, at least in the short run, and the short run is usually the relevant decision frame. Unless there is simply no other feasible option (as in the case of Houston MTA) or the costs of conventional strategies are so high as to be unacceptable (as in the case of Golden Gate Transit), a traditionally oriented transit agency can usually find a conventional response to deal with the immediate problem.

Even when a transit agency is motivated to use an innovative commuter transportation strategy, there often remain significant barriers to its implementation. Labor issues are one major constraint. Some labor contracts prohibit or severely restrict subcontracting of services; unless the transit union can be persuaded or compelled to eliminate these provisions, an important option is unavailable. For example, SCRTD is prohibited from service contracting. Transit unions may also attempt to use the leverage given them by Section 13(c) to forestall innovative options if they require the use of federal funds. Golden Gate Transit's union delayed the implementation of the vanpool program for a year by not signing a Section 13(c) agreement needed to purchase the vans. The union relented only when the agency agreed not to reduce the size of the bargaining unit as the result of the vanpool program. Similarly, Tidewater Transit had to agree to have all van maintenance done by transit workers.

One of the cornerstones of the innovative approach to commuter transportation problem solving is the matching of supply (e.g., types and costs of services) to demand characteristics. This assumes, however, that the appropriate types of supply services can be created. Of greatest concern is whether the commuter market can support profitable unsubsidized private bus service. If it cannot, then the service turnover strategy is infeasible, as are attempts to facilitate new private commuter bus services. Private operators in Houston, San Francisco, and Hartford all believe that subsidies are essential for additional commuter services. Hartford area bus operators are apparently uninterested in taking over routes the transit operator may decide to abandon; Boston area operators, although interested in MBTA routes, are somewhat skeptical about their profitability based on the one experience to date. On the other hand, a planning study has indicated that 13 of 17 SCRTD express routes could be turned over to the private commuter bus companies in Los Angeles on a profit-making basis (at current or slightly higher fares).

Another supply constraint is that private bus companies may lack the equipment to handle a major expansion of their commuter services, such as would have been required in Los Angeles if a proposal to turn over nearly 100 bus runs/day to the private sector had been adopted. The needed equipment could be purchased by the transit agency, but the use of Section 3 funds (of the Urban Mass Transportation Act of 1964, as amended) would probably create serious Section 13(c) problems. Both Houston MTA and Golden Gate Transit require their bus contractors to provide all of the equipment used in the service. If the company does not already own the vehicles, this can represent a large initial capital outlay. New buses cost as much as $150,000, and although used buses are less expensive, they are increasingly difficult to locate. One consequence is that several companies must be involved in the Houston and Golden Gate programs, as none owns enough equipment to provide all of the services or can afford to acquire an additional bus for only two commuter runs a day.

Transit agency leasing of the needed equipment, as is done by Tidewater Transit and Pentran, can minimize the capital outlay. However, if the equipment is expensive, the bus operator is still faced with high leasing costs, which push up the necessary fares or contract price. It is significant that the private-sector supply has been forthcoming in all five areas where contracting or service turnovers have occurred, but the potential problem remains.

POLICY IMPLICATIONS: CAN COMMUTER TRANSPORTATION INNOVATION BY TRANSIT AGENCIES BE ENCOURAGED?

The rationale for encouraging transit agencies to adopt private-sector commuter transportation strategies is that such strategies provide a way out of the current fiscal and service dilemmas. Their key advantage, when compared with traditional responses to fiscal problems and service pressures, is that they reduce the level of public transportation costs while allowing service levels to be maintained or increased. Traditional strategies such as fare increases or service reductions either require users to pay more or decrease service availability, yet they do not attack the underlying problem of escalating production costs. The use of part-time drivers can reduce production costs, but as such drivers are typically compensated at approximately the same wage rate as regular drivers, the savings accrue from improved labor use. Private bus companies pay their drivers $2 to $5/hr less than transit agencies

and thus have significantly lower labor costs. Vanpool services have virtually no driver costs. It is apparent that private-sector innovations are potentially powerful tools for improving the cost-effectiveness of transit agency operation.

It is equally clear that major cost savings from innovative strategies may also require large institutional changes. The commuter bus study conducted in southern California found that SCRTD could save about $4.6 million annually by contracting or turning over all of its peak-period-only express bus services to the private sector. But this represents only 10 percent of the unfunded deficit the agency recently faced, which it proposed to address with a policy of fare increases and service reductions. To achieve savings comparable with those associated with the proposed SCRTD service reductions (about $20 million), the agency would have had to contract out a significant amount of all of its peak service (not just express service) in excess of base requirements. This would be a radical move, one that is infeasible with the current labor constraints confronting the agency. It should be emphasized that private-sector innovations alone are probably not sufficient to resolve major fiscal problems. Of course, both traditional and nontraditional strategies can be used simultaneously, such as contracting out express routes and raising peak-period fares.

Transit agencies have used innovative private-sector strategies for peak-period transportation service provision when three conditions have been present. First, the agency has been under pressure to reduce subsidies or to improve service. Second, the agency's top management has been persuaded, whether by internal studies and staff advocacy or simply its own orientation to problem solving, that traditional responses are inferior to an innovative approach. Third, the agency's policymakers are local government officials who have fiscal responsibility for decisions by the transit agency.

In identifying these factors, it becomes apparent why private-sector innovations are difficult to encourage with available federal and state policy instruments. Fiscal and service pressures are largely situation specific. Innovative management is in critically short supply within the transit industry. Funding and decision-making arrangements reflect local and, to a lesser extent, state political actions that have already been taken and are difficult to alter. It should be emphasized that the last two factors are especially critical, yet they are the most difficult to influence.

The two policies most likely to encourage transit agency interest in private-sector innovations are cutbacks in federal operating subsidies and a loosening of Section 13(c) constraints. If federal operating assistance is severely reduced or eliminated, many transit agencies will face fiscal pressures, and local subsidies (including state funds) will become much more important. As local governments bear a significantly larger burden of the transit deficit, local officials will become motivated to advocate cost-effective innovations unless dedicated funding sources exist. However, when transit agencies receive funds with no strings attached, they are prone to continue in the traditional service delivery framework, and local governments typically lack the desire or ability to influence the service and subsidy connection. Thus, although one of the transit industry's major objectives is to obtain dedicated formula-based funding sources, it is obvious that this will only perpetuate the traditional orientation by insulating transit agencies from the cost-effectiveness concerns that invariably accompany discretionary funding and control of both subsidy and service decisions by fiscally responsible local officials.

With respect to the labor issue, any administrative or legislative changes in Section 13(c), which clearly indicate that transit workers do not have veto power over service changes that do not lead to the direct elimination or worsening of conditions of current workers' jobs, would probably embolden some transit managers to experiment with new initiatives.

Even if all of the barriers to private-sector innovations were removed, some obstacles to actually implementing the innovations, most notably labor constraints, would remain. The experiences examined in this study suggest, nevertheless, that even the labor barrier is not impossible to overcome if there is a will to use the strategies. Tidewater Transit, ConnDOT, and Houston MTA have each contracted with the private sector; Golden Gate has created a successful vanpool program that has offset additional demand for its own express service (and thereby the need for additional transit workers); and Pentran has turned over transit services to private bus companies, all without making any significant concessions to labor. It is the will to use such strategies that is usually the missing ingredient. Unless that will develops locally, it is unlikely that state and federal policies can create it.

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Evolving Institutional Arrangements for Employer Involvement in Transportation: The Case of Employer Associations

ERIC SCHREFFLER AND MICHAEL D. MEYER

Many professionals are involved in the urban transportation planning process. The characteristics of a relatively new participant in urban transportation issues—the employer association—are examined. Five California employer associations, and their role in transportation, are described. The analysis emphasizes the factors that influenced the creation of these associations and the characteristics of their operation. Although still in their infancy, these associations have shown some impact on their respective urban areas. The roles played by these associations have ranged from facilitating the resolution of transportation controversies to conducting planning studies of critical problems facing employer sites. It is concluded that employer associations could play an important role in transportation in many urban areas. Some key problems in the creation and maintenance of such associations include obtaining and keeping corporate commitment to the association, establishing the legal status of the group, creating a useful funding mechanism, and establishing effective relations with public-sector agencies. Finally, some of the potential implications of employer associations, with respect to other participants in urban transportation, are postulated.

Experience in the United States with private employer involvement in the employee work trip spans two decades. Before the 1960s, the employee work trip was primarily considered the sole responsibility of the employee, with little effort exerted by the employer to provide incentives to use specific modes or services. Beginning in the late 1960s, however, several major employers became interested in transportation actions that could reduce automobile congestion on or near their work sites, and also actions that would increase employee reliability and productivity. Other employers were required by public-policy mandates (e.g., air quality directives) to reduce automobile use at congested sites. Still other employers, worried about employee mobility during the fuel shortages of 1973 to 1974 and 1979, undertook initiatives to assure employee access to work sites. In almost every instance, this private-sector employer involvement was undertaken by individual employers for the benefit of their own employees.

The purpose of this paper is to examine an alternative institutional arrangement for employer involvement in transportation--the employer association. Instead of employers working independently to address company-specific problems, in this new organizational relation, employers join and support an association that has responsibility for transportation and other issues that confront a major employment center or section of an urban area. Several examples of such associations from California, both successes and failures, are presented. Although the characteristics of these efforts are influenced by the specific situation for each case, the examples do exhibit some of the important factors that might be relevant for the implementation of such associations elsewhere.

CONTEXT

Before discussing employer associations, it is important to first set the general environmental context in which they have been undertaken. With cutbacks in federal, state, and local finances, many public agencies have found themselves incapable of providing and maintaining as many transportation services as they once did. Increasingly, these agencies have turned to those who most directly benefit from these services, seeking some form of support in planning and constructing transportation improvements. These beneficiaries have included private developers whose development sites require some form of transportation access, private employers who need good employee accessibility to work sites, and downtown business people and retailers who need good transportation access for employees and customers.

From recent experience, there appear to be several ways in which these groups could provide important support in transportation planning and service provision (1-3).

One way is to provide aid or services to employees, as follows:

1. Development of a self-generated, single employer ridesharing program, which is completely organized, administered, and operated by in-house staff; program may be organized to perform carpool matching only, or also to become involved in vehicle (van) acquisition through lease or purchase arrangements;
2. Formation of nonprofit corporations that (among other functions) develop regional carpool or vanpool programs for companies that are either too small or ill-equipped to start their own ridesharing programs;
3. Cooperation, coordination, and assistance to publicly formed third-party ridesharing matching organizations;
4. Employer promotion or subsidization of public mass transit service in the work force;
5. Contracting of commuter or conventional transit bus service, either operated by private bus companies or with employer-owned and employer-operated vehicles, as a replacement or complement to existing public transit services;
6. Lease-back arrangements whereby private corporations buy transit equipment and lease it back to transit authorities to take advantage of tax laws;
7. Provision of local share of project cost; and
8. Provision of highway facilities.

Another way to provide aid is the formation of advocacy or advisory groups whose purpose is to influence the urban transportation policymaking process. Existing business associations (e.g., chambers of commerce) are becoming increasingly involved in urban transportation policymaking and investment decisions. Also, businesses are forming regional associations to improve employee transportation or for other specific purposes (e.g., a specific capital-intensive project).

Still another way is private sponsorship or funding of specific urban transportation-related studies on topics that are important to an area's business community. Study topics can vary from optimal forms of land use in downtown areas to the location and design of transportation facilities. Private inter-

ests can provide funding, personnel, facilities, or any combination of these resources to perform the studies.

Finally, there can be management assistance to public-sector transportation organizations. Such assistance is not given with the idea that private managerial experience and assistance will lead to a direct improvement in transportation service provision. It can, however, improve organizational functions that exist in both the private and public sectors.

As can be seen, the private-sector role in urban transportation can be wide-ranging and diverse. It should be noted that the creation of employer associations is one of the few actions that involves more than one employer in an organized manner. Although such joint effort could provide a more effective means of solving the transportation problems of an employment center, it could also create some important institutional issues relating to coordination, funding, organizational interaction, and management control. The following examples illustrate how some employer groups have handled these issues.

The five examples of employer associations in California are summarized from more detailed studies (4-6). As summaries, they do not represent the detailed case study description necessary to provide all of the evidence for the conclusions made later. The intent is to illustrate some of the characteristics of such associations and the factors important in their creation.

EL SEGUNDO EMPLOYERS' ASSOCIATION

The El Segundo Employers' Association (ESEA) is one of the first nonprofit employer associations in the United States that deal solely with employee transportation issues. ESEA first became involved in such issues when officials from the city of El Segundo requested employer participation in the area's transportation planning process. The business community responded by recommending the development of a transportation system management (TSM) plan and implementation scheme. The TSM plan was to be a short-range plan that outlined the low-cost, service-oriented actions that the city and ESEA might jointly adopt to improve transportation system performance.

The city's involvement of the business community in local issues was not surprising, in that it reflected long-standing city policy and attitudes toward local business. For many years, city officials had been attracting new business to El Segundo by promising minimal government interference in business activities. This laissez-faire attitude toward business development, although successful in attracting new business, also resulted in unguided growth and concomitant traffic congestion. The TSM effort was thus a logical mechanism for local business participation in charting future actions to alleviate congestion problems. Prominent corporations in the area established the El Segundo TSM Group as a forum in which to foster discussion on the role of the private sector in the area's transportation problems.

This early TSM group sponsored special meetings among local employers on such topics as a new freeway design and ridesharing strategies for the El Segundo Employment Center. By February 1981, this working group had evolved into a nonprofit corporation--the El Segundo Employers' Association. In less than 2 years, ESEA has grown to 19 members, including 4 developers active in and around the Employment Center. With membership representing close to 75,000 employees (nearly three-quarters of the area's work force), ESEA has become a significant participant in the transportation planning process in El Segundo.

Funding for ESEA is based on a per-employee fee annually assessed to member firms. The current fee is $1.25/employee, and developers are levied the same fee per 200-ft² interior floor space. The 1981 (July-February 1982) ESEA budget of $50,000, and an estimated budget for fiscal year 1982-1983 of approximately $100,000, also provided the Association with substantial resources to undertake planning efforts (7).

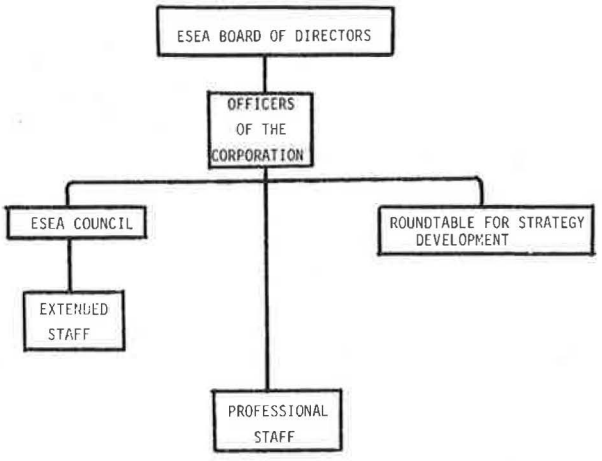
ESEA consists of six district organizational levels (see Figure 1). The first level, the board of directors, consists of 12 principal officers elected from member companies who serve staggered 3-year terms. The board sets policy and ratifies the corporate work plan.

The second organizational level is the ESEA council, which consists of midlevel managers designated by each member firm. The council meets monthly to discuss the issues targeted by the board. Several public agencies also participate as nonvoting associate members. These agencies include the city of El Segundo, the city of Hermosa Beach, Commuter Computer, the El Segundo Chamber of Commerce, Southern California Rapid Transit District (SCRTD), and individual participation by the Los Angeles City councilwoman who represents the El Segundo area.

A third, more informal level is the roundtable for strategy development. This group meets on an ad hoc basis to discuss the possible strategies ESEA might follow to implement the corporate work plan. The roundtable membership consists of those individuals within the Association with higher levels of transportation expertise.

The fourth level within the organization is related to its corporate structure as a nonprofit entity. One officer of the Association is an executive director, whose time is donated by a member

Figure 1. ESEA organizational structure.



ORGANIZATIONAL LEVEL	TASKS
BOARD OF DIRECTORS	● POLICY DEVELOPMENT ● CORPORATE WORK PROGRAM
OFFICERS	● OFFICERS OF NON-PROFIT CORPORATION
COUNCIL	● INFORMATION DISSEMINATION FROM OTHER LEVELS
ROUNDTABLE	● STRATEGIC PLANNING
PROFESSIONAL STAFF	● DAY-TO-DAY RESPONSIBILITES OF ASSOCIATION
"EXTENDED" STAFF	● COORDINATE EFFORTS OF EACH MEMBER FIRM

firm. Other officers include a deputy executive director, a chief financial officer, a secretary, and an office counsel. A fifth organizational level is the professional staff, which consists of the executive director, a transportation planner, a ridesharing planner, a community relations and publications specialist, and an office manager.

The final organizational level is the informal network of company employee transportation coordinators, or the extended staff. Those individuals are responsible for the ridesharing and alternative commuting programs of member firms. They are instructed as to policy and program specifics by their company's representative on the ESEA council.

The corporate work program of ESEA outlines the following goals and objectives for the Association (8):

1. Develop a transportation master plan for the El Segundo Employment Center,
2. Act as a contracting agent for transportation improvement projects,
3. Represent interests of the Employment Center to outside agencies in the area of transportation,
4. Establish a ridesharing coordinator council,
5. Develop an ongoing coordinator training program,
6. Monitor and forecast traffic congestion and needs,
7. Act as a local center for information exchange,
8. Provide technical assistance for members to improve in-house transportation programs,
9. Set up and coordinate either a large or small employer assistance program,
10. Develop model company transportation policies and practices, and
11. Develop special programs to involve new employers in ridesharing.

As directed by the board of directors and the council, ESEA's planner is involved in numerous planning and coordinating undertakings. Although most employer associations are so new that the impact of their actions is not yet clear, ESEA has already established a record of accomplishment. Some of these accomplishments are described below.

Bus Express Employee Program

One of the first actions taken by ESEA was an attempt to save the bus express employee program (BEEP) operated by SCRTD. The BEEP system, a commuter bus service serving moderate-distance trips into Los Angeles employment centers, was not attracting a large ridership. Some SCRTD officials believed that, given this low patronage, BEEP was a cost-ineffective transportation service and a likely candidate for service cutbacks.

After conducting a study of the BEEP system, the ESEA planner concluded that the ridership was even less than that estimated by SCRTD. ESEA, realizing the service was surely doomed if the Association did not actively assure its retention, created a system of bus monitors to support the service at their places of employment. At the same time, this program was intended to show SCRTD how committed ESEA was to retaining the BEEP service.

ESEA has also recommended modifications to the service to improve its quality and to increase ridership. These service changes were the result of an effort of the ESEA staff as well as support provided by a member corporation. In case SCRTD decides to discontinue the BEEP service, ESEA has been considering alternative funding schemes to assure the continued provision of some service similar to BEEP.

Manhattan Beach Light Rail Study

The city of Manhattan Beach contracted with ESEA to study the feasibility of light rail transit to the area. The new line would serve Manhattan, Redondo, and Hermosa Beaches, as well as El Segundo. One of the major reasons for ESEA involvement in this study is that these cities have a history of conflict during the past 25 years. Officials from these cities decided that, given the possible tensions between the cities, some outside organization was needed to conduct the light rail study. Thus, ESEA, a nongovernment entity, is playing a middleman's role.

Bike Paths

One of the interesting facts that emerged out of the original El Segundo TSM study was that 25 percent of all employees live within 4 miles of their place of employment. ESEA thought that bike paths might well serve the travel needs of these nearby workers. The Association hired the president of a national bike riders' association to identify candidate bike routes in the El Segundo area. One particularly attractive route was chosen by ESEA officials, and ESEA is currently negotiating with the owner of the land to acquire an easement. ESEA is also applying (through the city) to the California Department of Transportation (Caltrans) for state funds to support the bike path.

Situational Analysis

The ESEA staff will soon begin conducting a situational analysis of the El Segundo Employment Center. This study will (a) describe the transportation infrastructure that serves the area, (b) review transportation activities taken by individual firms, and (c) identify personnel and agencies involved in transportation planning and implementation. This analysis will help inventory the needs of member firms as well as identify the means to involve new members.

Corporate Support

ESEA has also spent much time promoting its actions, and the concept of nonprofit employer associations, to other employer groups in California. The executive director of ESEA (and head of the transportation department for a local corporation) has argued that the key factor to a successful association is corporate top management commitment to employee transportation programs (9). Such commitment is especially evident in the El Segundo case, in that the area does not suffer from the severe parking problems that characterize employer ridesharing programs elsewhere. The need for an efficient transportation system, and the importance of such a system to employer operations, appears to be the major motivating factor for the ESEA efforts.

ESEA sees the next year as the possible turning point for the organization. It is believed that public sentiment will go for or against their efforts. ESEA realizes that it could push the cities and other agencies too far, and, also realizing that the agencies it must deal with do have the official implementation powers, ESEA officials do not want to push too hard. Yet it is this very pushing and action-oriented stance that has allowed ESEA to become a key participant in the transportation issues and problems of the area.

SANTA CLARA COUNTY MANUFACTURING GROUP

Santa Clara County, often referred to as Silicon Valley, has experienced periods of rapid growth since the early 1950s when aircraft and automobile companies began to locate in the region. More recently, high-technology firms have found Santa Clara County to be an ideal location for their activities. As housing became more expensive and the county's public infrastructure became inadequate for handling this rapid growth, major employers became concerned about how these factors would affect their operations. Indeed, employers were already beginning to experience problems in recruiting and retaining good employees as housing costs skyrocketed and congestion became more severe.

Concern over the growing transportation problems resulted in the formation of the Santa Clara County Manufacturing Group (SCCMG). At the outset, SCCMG identified three critical problems in the region: (a) limited land use options, (b) competition among localities leading to fragmented decision making, and (c) regional industry not being involved in the above issues. To address these constraints, and fearing limited economic viability of the region, the Manufacturing Group based its organization on several principles. These principles include a countywide organization to be involved in a broad set of issues, a limited constituency of the largest corporations, and policymaking representation by corporate chief executive officers. Finally, the region's problems should be viewed as the joint responsibility of the public and private sectors.

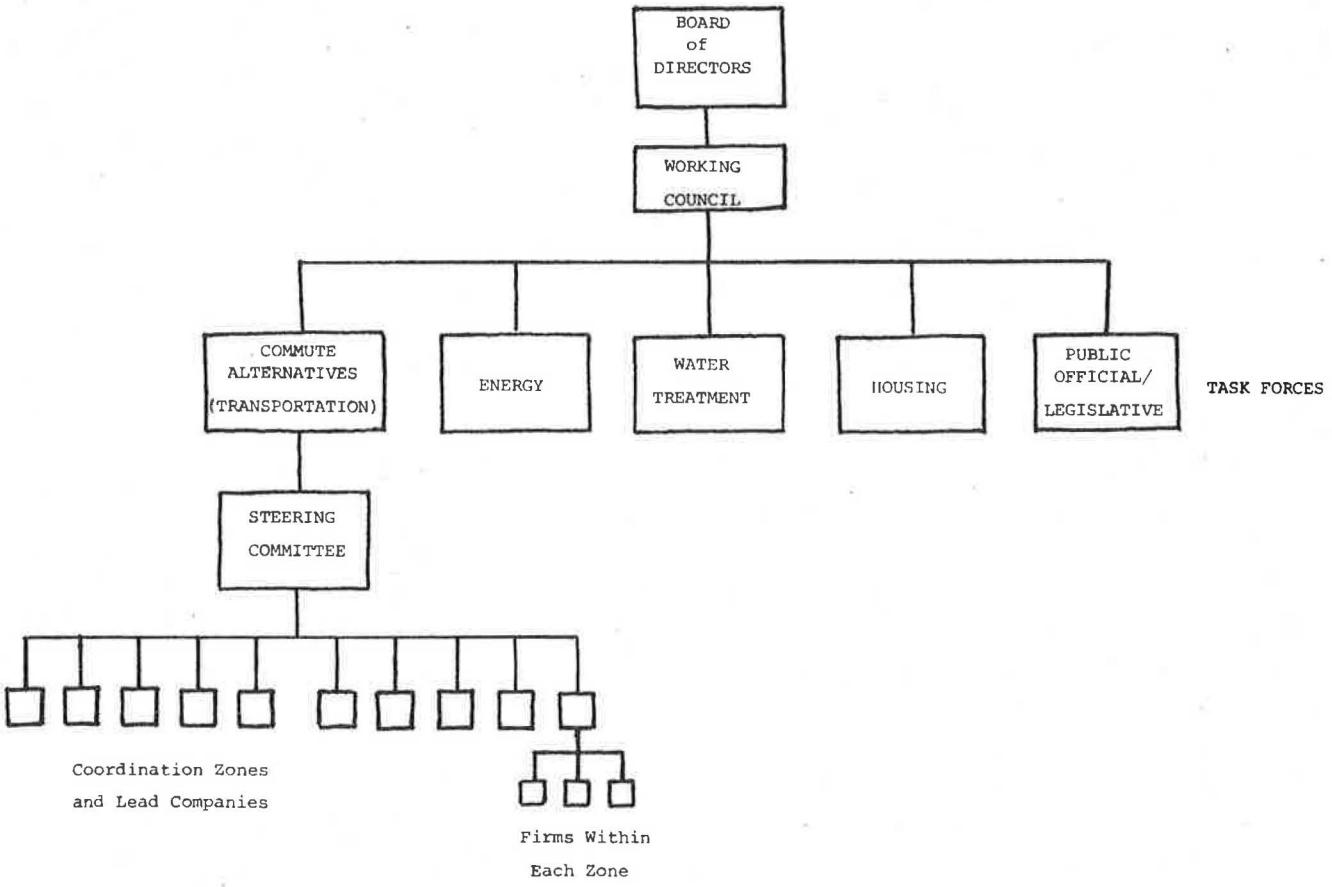
SCCMG, which now has 75 members, was formed "to enable local industries to work cooperatively in helping local government respond effectively to the challenges of growth affecting the county's economic health and quality of life" (10). The Group now represents more than 180,000 employees--more than half of the county's manufacturing work force.

Unlike ESEA, SCCMG is also concerned with housing, energy, and private and public relations. However, similar to ESEA, SCCMG levies dues on member firms on a per-employee basis. A board of directors provides policy guidance to a small staff, and most of the coordination and policy discussion occurs in various steering committees and ad hoc groups (see Figure 2).

To assess transportation issues, the Group has formed a transportation task force that consists of member firms, association staff, the regional transit agency (County Transit), and RIDES for Bay Area Commuters, Inc. The task force membership is based on a zone structure whereby individual companies in an area will develop a coordinated transportation program with supporting services provided by County Transit and RIDES. Transportation coordinators for individual firms meet by zone and discuss the needs of their respective firms and the area as a whole. Some recent activities of the task force have included

1. Establishing coordinators at 50 companies,
2. Holding training classes and workshops,
3. Producing a training videotape,
4. Developing material to supplement the MTC manual,
5. Organizing 10 zones that have a lead company in each,
6. Obtaining employee survey and planning information,

Figure 2. SCCMG organizational structure.



7. Developing personalized ridesharing marketing techniques,
8. Fostering a promotional "Commuter Saluter" contest, and
9. Participating in transportation-related legislative advocacy.

SCCMG sees its role as a transportation facilitator, whereby it promotes and coordinates the efforts of groups that want to improve the commuting trip for the region's employees. This facilitator role brings developers and public agencies together to mitigate traffic impacts and introduces employers to ridesharing and transit services. One tool SCCMG uses to foster this discussion of conflicting factions is the briefing. Briefings bring involved persons together to resolve differences that serve as barriers to project or program implementation. In this role of facilitator, SCCMG assures that decisions made by often disparate groups, agencies, and localities are at least known to each other, and, it is hoped, beneficial for the entire region as well as individual employers and businesses.

The representative of County Transit on the task force believes that the success of this facilitator status is due to the political clout the Group has enjoyed, which is stronger than that of the chamber of commerce enables the Manufacturing Group to get people to talk to each other.

SOUTH PLACER COUNTY MANUFACTURING ASSOCIATION

When high-technology industries began moving out of the over-crowded Santa Clara valley and into the Roseville area of Placer County near Sacramento, major development began to occur along several state highways in the region. Given this new development, Caltrans began planning for a highway that would carry traffic around Roseville. This project was included in the state transportation improvement program, which was approved by the California Transportation Commission (CTC). However, CTC approval was contingent on the consideration of other actions that could address the problems of housing, air quality, and transportation caused by the development.

In August 1980, CTC signed an agreement with local jurisdictions to establish a coordination group, the Placer County Policy Committee, which consisted of one councilman each from the cities of Roseville, Lincoln, and Rocklin, and a supervisor from Placer County. Ex officio members included representatives from two surrounding cities and three counties. Currently, this group is considering the creation of a ridesharing ordinance for the development area, assigning the costs of transportation improvements to developers, possibly creating a transportation assessment district, and requiring that development site plans include a transportation management plan (11). Caltrans has suggested to this group that new development should be contingent on several actions, including

1. Partial funding of the new highway by the developer,
2. Easy pedestrian access,
3. Bike storage facilities,
4. Bus turnouts and other transit projects,
5. Automobile-restricted zones,
6. Employer transportation coordinators, and
7. Ridesharing and transit promotion.

In part due to this substantial government interest in development-induced problems, local corporate officials organized the Placer County Manufacturing Association. The Association's goals are to:

1. Promote transportation coordinators in each firm,
2. Encourage liaison activity by coordinators,
3. Establish a clearinghouse for transportation information,
4. Form agreements with public entities, and
5. Advocate public and private expenditure in transportation.

Although in its infancy, the Association has begun to address some of the important issues in the area of development. The initial cooperative effort of the Association and the policy committee is reaching a consensus on the form and content of a ridesharing ordinance to set a legal imperative on the commutation-related responsibilities of developers and tenants of the industrial area. According to some Association members, the effectiveness of this group will depend on how it interacts with public-sector personnel in identifying a strategic development plan for the area.

NEWPORT CENTER ASSOCIATION

The Newport Center Association was created for corporate and business interests located in Newport Center, a new and expanding commercial development in the heart of one of Newport Beach's most congested areas. There were approximately 10,000 employees in the Center area at the time of the Association's inception.

The owner of the Newport Center, the Irvine Company, wished to enlarge the development by 20 percent with new commercial and office space. With the city of Newport Beach, Orange County, and the California Coastal Commission opposed to development and the probable traffic problems, the goal of the Irvine Company became one of increasing the floor space of the Center and the number of employees by 20 percent while maintaining the traffic congestion level at its current amount. The Irvine Company hired a management services company to study traffic management options. Although density and commuter matching studies were being completed, the Association pursued a campaign to encourage Center employers to participate in the Centeride program, which was designed to introduce the employers to "the concepts of carpooling, vanpooling, public transportation, flextime, and other innovative approaches combined for a comprehensive solution to (employer) transportation needs" (12).

The Newport Center Association was also sending to perspective members of the Centeride program a brochure that outlined employer and employee benefits of alternative transportation programs. The intent of the Association was to establish in-house transportation coordination abilities, disseminate information, and assist with TSM plan formulation. The Association planned to implement a shared coordinator program to allow smaller employers to purchase time for an employee transportation coordinator.

As for funding the Association, the Irvine Company planned to solicit donations for the Center's tenants once the program's success was established. The program also received input from many sources through the formation of a transportation management program advisory committee comprised of individuals from Newport Center employers, the city of Newport Beach, the Newport Harbor Area Chamber of Commerce, the Fashion Island Merchants Association, and the Newport Center Association.

After nearly 1 year of frustrating attempts to

solicit employers to deal with the traffic mitigation issues, and to satisfy the city and the Coastal Commission, the Irvine Company decided to forego its expansion plans for Newport Center. A major factor in this decision was the conclusions of the traffic study, which pointed out the overwhelming difficulties of maintaining traffic levels and expanding the number of employees. In addition, vocal opposition was being encountered by a growing number of organized citizen groups.

The demise of the Newport Center Association can be attributed to the lack of top-level commitment on the part of the Center's chief executives. The Association was established by the developer, who assumed that commitment and membership would follow. The impetus for the formation of the Association was again the conditions placed on a developer by a public regulatory agency. A public-private partnership did not ensue; rather a more forced, artificial relation was fostered among the employers, the developer, and the involved public agencies.

ORANGE COUNTY TRANSPORTATION COALITION

The Orange County Transportation Coalition is a group of private businesses that lobbies for transportation improvements in Orange County. The Coalition, formed in 1979 by 6 of the county's leading business executives, currently has 52 member companies that represent more than 95,000 employees. Membership in the Coalition requires a commitment of $5,000/founding member and a minimum of $1,000/member/year, with those most affected by transportation problems urged to contribute more.

There are several stated purposes of the Coalition:

1. Monitor and support critical Orange County transportation interests at state and county levels,
2. Maintain a healthy economy and business climate,
3. Protect mobility (i.e., person and goods movement),
4. Secure investment for projects needed to complete highways and transit system (i.e., those projects that will accommodate vehicular traffic, provide responsive transit services, and use TSM actions),
5. Work closely with the Orange County Transit District and the Orange County Transportation Commission, and
6. Support legislation favorable to transportation interests.

The Coalition's aim is to seek transportation improvements independent of any public agency activity. The Coalition strongly believes that its involvement should stay separate from the public sector in order to maintain its role as the private-sector voice in transportation. Supported by two hired consultants, some of the activities of the Coalition have been to

1. Lobby and support efforts that led to the passage of a bill that increased the state gasoline tax by $0.02/gal, thereby increasing state highway revenues;
2. Support the creation of Caltrans District 12, which would help distribute funds back into Orange County; and
3. Support successful efforts to secure a $9.4 million freeway project approval by CTC.

EMPLOYER ASSOCIATIONS: LESSONS FROM THE CALIFORNIA EXPERIENCE

Although many of the employer associations discussed in this paper are still in the initial stages of development, their experiences (and failures) to date provide some useful insights into the role that such groups could play in urban transportation and the characteristics of successful association operation. Several characteristics merit special attention. First, the commitment and ongoing involvement of top-level executives and chief executive officers are essential to the success of such efforts. It is these individuals who are able to use a variety of incentives for employee involvement within their firms. An important aspect of this involvement is the decision of top management to use corporate employees as liaison personnel. A network of employer transportation coordinators assures the success of employer associations and activities as mid-level managers keep information flowing to their superiors, their employees, the community, and especially to each other.

Second, the perceived lack of an active posture on the part of government appears to have influenced the desire of business people to organize and commit resources to solving the problems they see as critical to the economic future of the community. This is not to suggest that public agencies are unable to carry out their job. Rather, the existence of an employer's association can focus public attention on the key issues facing an employment center. Joint public and private action is extremely important for most of the employer associations described above.

Third, one of the most significant barriers facing the creation of an employer association is its legal status. Such an association may file for either charitable corporate status or recognition as a business league, one with a mutually beneficial purpose. Although both types of status are tax exempt, only the charitable status allows deductible donations as income from nonmembers. The league status confines the acquisition of capital to membership fees. The ability of employer associations to acquire charitable status may be a crucial factor in the future role of these entities.

Funding is an obvious and crucial issue facing employer associations. Flexibility in funding mechanisms and options will contribute to the strength and viability of these organizations. Several funding schemes are currently used by employer associations to assess fees to member firms: per-employee assessment, square-foot interior floor space assessment, annual flat dues, one-time fee, substitution of in-kind services for fees, and a combination of these mechanisms.

Another issue related to nonprofit status is the restriction of lobbying efforts. An objective of many associations is to support public-sector spending on transportation improvements. The inability to lobby, a requirement of charitable status, often restricts this activity. A related issue is the ability of the association to invest funds in transportation improvements and services. A myriad of bureaucratic hurdles must often be overcome before an association is able to provide a shuttle bus service or fund the signalization of a congested intersection near an industrial park. As a nonprofit organization, the association would not qualify for investment tax credits (being tax exempt) if it were to purchase vehicles or other transportation improvements.

A final factor that affects the ability of the association to solve the transportation needs of the employment center is the participation rate of corporate members. Effectiveness increases as member-

ship in the association grows. This ability to strengthen membership (and therefore resources) may be linked to the ability of member corporate officials to exert some friendly peer pressure on other corporate officials. Another form of peer pressure may come from employees. Employees of a nonmember firm may perceive their benefit package to be less comprehensive than that of the member firm that offers transportation-related services. This may also affect the ability of the nonmember firm to recruit new employees.

An important point to remember is that these associations are not a panacea for all transportation ills. Employer associations often deal with specific, localized conditions that are perceived to have a direct bearing on member firms. Keeping this in mind, and given true cooperation between the associations and the appropriate public agencies, employer associations might still become a viable institutional mechanism to solve employee commutation problems. As issues of turf and political barriers are alleviated, and as misconceptions about roles and responsibilities dissolve, such associations may be able to play an active part in dealing with future transportation problems.

CONCLUSIONS

Urban transportation planning has long been a process influenced by many groups in an urban area. In some areas of the United States, employer associations are the latest entities to claim a role in this process. As discussed above, many of these associations are in the initial stages of formation, and hence their impact on urban transportation planning has yet to be determined. Several roles have begun to emerge, however, and their potential implications could be far-reaching. The following conclusions suggest what role employer associations could play in local transportation issues, not what role they should or will assume.

The first such role, for example, involves other employers and developers in the specific region. Employer associations often serve to convince the entire business community of the importance of a viable urban transportation system, and the value of such a system to the economic health of the entire region. Constricted mobility can seriously place limitations on the labor pool available to employers. Severe congestion can hamper an employer's productivity as tardiness becomes widespread. A weak transportation system can have additional effects on the employer's ability to recruit and retain competent employees. This may also affect a developer's ability to lease or occupy new or expanded development.

As the region's business community becomes more aware of these issues and witnesses the commitment on the part of member employers, cooperation with public-sector transportation agencies could potentially be fostered. It should be remembered, however, that these associations are currently being formed in regions that exhibit healthy economic growth, and that it is usually the largest firms in an area (often corporate headquarters) that are becoming involved. The transferability of the employer association concept to other, less economically healthy areas is unclear. These firms often cannot dedicate resources to something as innovative as employee transportation services. The issue of the economic health and the success of such associations will only be solved over time, and by the degree of adaptability of the employer association concept.

Another role being assumed by employer associations relates to their advocacy efforts and the legislative lobbying activity discussed in the previous cases. These associations are becoming a new, powerful lobby in state and regional-level transportation issues. These issues include increased public spending for transportation infrastructure and services, regulatory reform concerning commutation issues, and even specific transportation projects, programs, and demonstration monies. Employer organizations are often able to use the political influence of key members to forward these concerns and desires. The implications of these advocacy and lobbying efforts have serious ramifications for state and regional decision makers. The ability of these decision makers to trade off the interests of such associations against the wide range of demands placed on them will be crucial to the equitable allocation of transportation resources.

A final role that employer associations are undertaking concerns their relative influence within transportation planning and policymaking. Some associations are currently assuming de facto responsibility for many of the service, planning, and coordination functions previously undertaken by public-sector agencies. Thus, although statutory responsibility may rest with third-party ridesharing organizations, metropolitan planning organizations (MPOs), public transit operators, and municipal traffic engineering departments, many functions are actually being performed by the employer association.

Thus, cooperation then becomes a means to action-oriented ends. With regard to the El Segundo association, this de facto responsibility has taken the form of several planning efforts related to transit service improvements, ridesharing coordination, and even the proposed implementation of a light rail line. In the Santa Clara County case, rather than taking on the role of doer, SCCMG is becoming a key coordinator or facilitator of transportation activity in the region. Although this role is primarily the responsibility of the MPO, the political clout enjoyed by the Manufacturing Group is strengthening its influence and even control over many of the transportation issues facing the county.

This powerful role, being assumed by many of the associations identified here, potentially could result in the increased effectiveness of the entire urban transportation system. The fear of such influence lies in the possible circumvention or disruption of traditional institutional arrangements. These traditional arrangements may be well-entrenched and exhibit a strong sense of territorialism. As revealed by ESEA, a fear exists of pushing certain agencies too hard or tampering too much with well-established institutional allegiances. This role of active intervention and responsibility could thus backfire and lead to the eventual failure of an employer association due to alienation from other organizations, thereby excluding the possibility of meaningful collaboration.

In sum, related employer associations may be assuming roles and de facto responsibilities that may supersede their intended purpose and have significant implications for the entire urban transportation planning and policymaking process. This is not to say that these roles and responsibilities are necessarily counterproductive to the overall objectives and programs as set by public agencies and transportation-related organizations. The key to assuring the coordination necessary to foster common goals and objectives is the need for interactive cooperation between the two sectors, not reactive mistrust and misinterpretation.

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Paratransit at a Transit Agency: The Experience in Norfolk, Virginia

A. JEFF BECKER AND JAMES C. ECHOLS

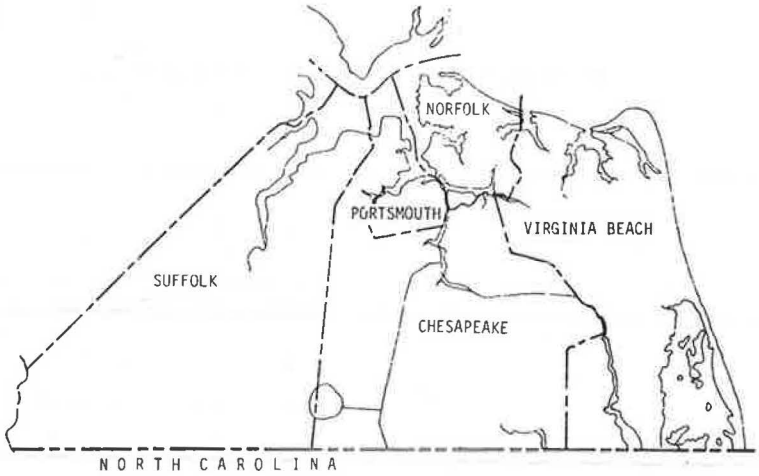
The objective of this project was to test the feasibility of a transit agency's development and provision of alternative, lower-cost transportation services. Demand-responsive and fixed-route paratransit services were substituted for unsatisfactory bus services in low- to medium-density areas and introduced in unserved suburban and rural areas. Services were extensively monitored, and the results are reported. The new services failed in new service areas due to lack of riders. Where bus service was severely reduced or eliminated, substitute services were largely successful in continuing to attract a substantial ridership at lower cost (deficit) to the transit agency. Major problems, including opposition by the transit union and some private service providers, and also some operational problems are discussed.

The Tidewater Transportation District Commission (TTDC) is a government agency chartered in Virginia to plan, operate, and regulate public transportation services. Five cities--Chesapeake, Norfolk, Portsmouth, Suffolk, and Virginia Beach--are members of the Commission. About one-third of the 1,092 miles^2 encompassed by TTDC is urbanized (see Figure 1). Norfolk and Portsmouth are completely urbanized, as is the northern third of Virginia Beach and small portions of Chesapeake and Suffolk. The table below gives the population and population density for each city and the entire area:

Area	1980 Population	Population Density (persons/mile^2)
Chesapeake	114,486	335
Norfolk	266,979	5,037
Portsmouth	104,577	3.606
Suffolk	47,621	116
Virginia Beach	262,199	1,012
TTDC	795,862	729

TTDC provides public transportation services to each city under an agreement that stipulates that each city will pay for the service it requests. Costs are allocated according to vehicle hours of service, and revenues are allocated according to passenger fares. There are no other sources of local operating funding. The prevailing funding restrictions of the member cities, along with the high costs (including fare increases and service reductions) of doing business as usual, are the principal reasons why TTDC undertook state and national demonstration projects to test alternative, lower-cost ways of providing public transportation.

Figure 1. TTDC operating area.



In 1976 TTDC management reviewed its financing and service delivery program and found a situation where (a) the costs of its fixed-route bus services were high and were increasing; (b) fare revenues were low and were decreasing; and (c) subsidy amounts were too high to be financed by the local cities and were increasing each year. TTDC concluded that it was beyond its power in the near future to substantially reduce the costs of fixed-route bus services (due to the increasing wage and fuel costs) or to substantially increase ridership (due to continued dispersal of jobs and homes). Thus subsidies would continue to increase significantly each year if the existing bus service program was to continue. With the constraint of subsidy money available from the cities, the options before TTDC were to plan on an extended period of reduction in its service of fixed-route buses or develop a lower-cost way of providing public transportation services. TTDC chose to develop lower-cost services, and some results of that strategy are presented in this paper.

SCOPE OF PROJECT

The objective of this project was to provide an alternative mode of public transportation--at less cost to the rider (than driving alone) and the transit operator--in low- and medium-density areas where regular bus transportation was not economically feasible. Shared-ride taxi services were designed and operated for the work, shopping, personal business, school, and social-recreation trips to major activity centers and low-density areas. TTDC proposed to experiment with shared-ride taxi service as a new mode of public transportation. This type of service was less costly than bus service, used private providers of transportation, and was suitable for public transportation in low-density areas. TTDC was awarded a national ridesharing demonstration program project, sponsored by FHWA and UMTA, for the development of shared-ride taxi services in selected areas. An experimental state-aid project enabled TTDC to expand the shared-ride taxi concept to test a full range of alternatives.

Shared-ride taxi services can be used (a) as a substitute for regular route bus service where it is lightly patronized; (b) to institute new services in low-density neighborhoods; or (c) as jitneys, which are similar to small fixed-route buses in certain transportation corridors. The federal demonstration project concentrated on the initiation of Maxi-Taxi service to low-density neighborhoods that were not served by public transportation. The state-aid project was to be carried out in conjunction with a comprehensive program of shared-ride services; it concentrated on the substitution of Maxi-Taxi services for lightly patronized bus service.

It was also proposed to substitute fixed-route Maxi-Taxi service for evening and weekend bus service. Ridership on some bus services operating after 7:00 p.m. drops significantly on TTDC routes. TTDC analyzed evening and weekend ridership statistics and selected several routes that warranted substitute, lower capacity, and lower-cost service. Also, because evening bus service was terminated in Portsmouth several years ago, it was proposed to reinstitute public transportation service in one or two corridors.

TTDC was to determine potential markets; remove institutional and legal barriers; market the service; develop the appropriate service arrangement, including coordinated dispatching; underwrite the startup and development cost of the service during the trial period; monitor the services; and report on the results.

It was anticipated that TTDC would institute contracts with local taxicab operators for the provision of Maxi-Taxi services. TTDC would plan the service, develop specifications, and solicit bids from qualified service providers. TTDC would then monitor the service contract and conduct appropriate data collection to evaluate the effectiveness of the service.

Promotion of these services was believed to be essential. Because the program would primarily serve specific neighborhoods, local advertising would be used, particularly direct mail, door-to-door, and newspaper. Also, personal selling by TTDC's transportation service representatives would be employed to inform neighborhood groups, businesses, and other interested parties. Brochures, posters, and other materials would be produced to support promotion activities.

BACKGROUND

Conceptual development of shared-ride taxi service at TTDC goes back to 1977. Dial-a-ride (DAR) transportation was then under active development and demonstration in a number of communities throughout the country. TTDC, in cooperation with the city of Virginia Beach and the Southeastern Virginia Planning District Commission [the region's metropolitan planning organization (MPO)], was considering ways to respond to the travel needs of suburban locations in Virginia Beach that did not have public transporta-

tion services. Some form of demand-responsive transportation was needed.

TTDC's first effort to understand travel demand was to survey potential users of the new service. Five suburban activity centers were selected, including a shopping mall, hospital, community college, and office park. At each activity center people were asked 11 questions, including origin and destination, mode, trip purpose, and demographics. It was concluded from the survey results that there existed only a small potential ridership group for shared-ride taxi, even under the best service conditions.

Although the results were discouraging, conceptual development was pursued. In early 1978 a request for proposal (RFP) was drafted to solicit the interest of taxi companies in providing shared-ride taxi service at a regional shopping center. The objectives included meeting the transportation needs of those people not served by other forms of public transportation and strengthening the taxi market. The RFP requested information on fare structure, service area, requests for service, level of service, and coordination among taxi operators. The fare was to be set so that the service was self-supporting and profitable for the taxi company.

TTDC received expressions of interest from two taxi companies in the city of Norfolk. Initially they thought the RFP concerned elderly and handicapped services, which they were interested in at the time. They appeared interested in the shared-ride taxi concept; but, as Norfolk-based companies, they would have difficulty operating exclusively in Virginia Beach. No Virginia Beach company had expressed interest.

Although no service was ever implemented at the shopping center, these early efforts did lay the groundwork for several arrangements with taxi companies in 1979. One was the contracting with three taxi companies to provide elderly and handicapped services. This arrangement lasted until mid-1980, when the cost of the monthly single-passenger, metropolitanwide trips became prohibitive and TTDC terminated the program in favor of its own limited, advance-reservation, demand-responsive service.

In May 1979 TTDC submitted a letter of interest for a national ridesharing demonstration program project. Although a contract was not signed until November 1980, TTDC proceeded in its development efforts. An opportunity arose as a result of complaints about congestion at Tidewater's largest shopping mall, Military Circle. Both the owners of the mall and city officials were concerned about improving traffic access. TTDC suggested that a shared-ride taxi service might help.

With the cooperation of the mall's management and merchants' association, an operational plan for service was developed and implemented. However, the final plan provided for services from the mall to an adjacent subdivision, Kempsville, which is located in Virginia Beach. This provided benefits to two cities and allowed a Norfolk taxi company to operate the service. The service was to be an experiment during the 1979 Christmas season. It began on November 15, 1979, with two taxis dedicated to the service Monday through Saturday, 9:30 a.m. to 10:30 p.m. The fare was $1.00 each way. Because of inadequate ridership, one taxi was eliminated on December 4. Ridership never exceeded about 15 persons/day, and service was terminated on January 1, 1980. The taxi company charged $8.00/vehicle-hr.

The Deep Creek area of Chesapeake is a low-density rural area adjacent to the city of Portsmouth that had several established and rapidly developing subdivisions in 1975 when the private bus system serving it was acquired by TTDC. It had two bus routes that extended from Portsmouth that ran on approximately 60-min headways. One route was immediately terminated because of high deficits. Service on the other was later reduced to 2-hr headways and longer as declining ridership and increasing costs produced steadily worsening values of TTDC's principal performance indicator--deficit per passenger. After much public comment, an additional route was extended to the area to improve service in fall 1978. However, the deficit per passenger continued to increase and Chesapeake city officials asked TTDC for service alternatives to continuing bus service or terminating the service altogether.

TTDC and Chesapeake city officials had several discussions in early 1979 concerning ways to provide a basic level of public transportation in areas of Chesapeake where fixed-route bus service was not appropriate. TTDC suggested a shared-ride taxi service to replace the bus route. A presentation to the city council indicated that such service would be better because it could pick up people at their homes, and subsidy costs would be lower as a result of both lower costs of operation and a higher fare for the user. The city council did not agree that such a travel arrangement should be supported by city funds ("we are not going to pay for cabs") and decided to terminate the bus service and not replace it with an alternative.

After an interval of 6 months public requests to reinstitute the bus service built to the point where the city council agreed to restore fixed-route bus service over the old route. The performance on this bus route was worse than the previous one because costs were now higher and riders were fewer; thus the deficit per passenger was higher than the previously unacceptable high level. Faced with the dilemma of citizen demands for service and an unacceptable cost of continuing the current bus service, the city council agreed to try a new way of providing basic public transportation service in the area.

The major change was to terminate the current fixed-route bus service and operate a flexible service tailored to carry residents of the area to either a regular bus route in Portsmouth or to an activity center such as Tower Mall. The flexible service would (a) use a taxi or van-type vehicle, (b) be available on an on-call basis, (c) pick up at the home, and (d) cost the rider $1/trip (twice the regular bus fare).

An analysis of alternative services--fixed-route bus and shared-ride taxi--indicated that the taxi service would be less expensive, as illustrated in the table below (note that this table is an alternatives analysis for Deep Creek for July 1979):

Item	Bus	Estimated for Shared-Ride Taxi
Vehicle hours	239	338
Cost ($)	4,660	2,704
Passengers	1,170	650
Revenues ($)	526	650
Deficit ($)	4,134	2,054
Deficit per passenger ($)	3.53	3.16

Based on the above analysis, shared-ride taxi was selected for implementation in September 1979, which resulted in a substantial cost savings to Chesapeake.

PLANNING

From the winter through the fall of 1980, TTDC finalized development of the Maxi-Taxi services to be implemented, which included

1. Selection of areas to be served;
2. Detailed analyses of potential ridership,

hours of service, boundary lines, schedules, and costs for service areas;

3. Review and revision of detailed proposals with city officials;

4. Public hearings and formal TTDC approval; and

5. Development of RFP and contracts for private service providers.

This is the normal way of processing proposed changes to the TTDC public transportation system. The Maxi-Taxi proposals were combined with the transit service proposals for the annual processing of the transportation services program. The data in Table 1 describe the Maxi-Taxi services that were finally approved by TTDC in September 1980 for implementation on November 23, 1980. Many changes were introduced during the extensive review process. A map of each area is shown in Figure 2. The data in Table 1 also describe the service concept demonstrated and also characteristics of the service area.

CONTRACTING FOR SERVICES

Taxicab companies were solicited to bid on the provision of the various Maxi-Taxi services. There are two major cab companies and six smaller firms in the area. The two dominant firms were approached by TTDC for comments and expressions of interest in shared-ride services. These firms were doing substantial Medicaid business and desired to do more business for the elderly and the handicapped, including contracting with TTDC to do all its special services for the handicapped at standard meter rates. However, both major firms perceived general shared-ride services provided on a contractual rate basis as a threat to their market and declined to bid on the services.

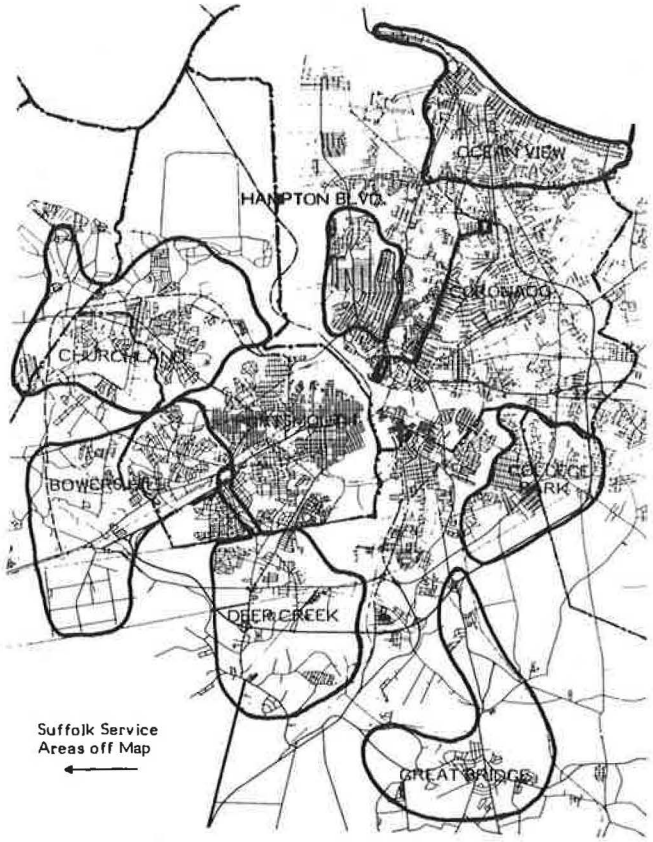
In meetings of a taxi study committee formed by TTDC, which was composed of taxi and city staff representatives, the major firms were represented by an attorney who repeatedly expressed concern over issues such as regional control, fare levels, and increased competition. The two major firms also retained a consultant to develop their position and present a report to the committee. The companies subsequently withdrew from participation on the taxi committee and ended all discussion of participation in shared-ride services.

Two smaller companies responded to the proposals and both were engaged to provide service. Yellow Cab of Chesapeake was contracted to provide all Maxi-Taxi services (except College Park) at $14/vehicle-hr. Airport Limousine Company was contracted

Table 1. TTDC paratransit services.

Service Area	Area Characteristics	Service Concept
Suffolk		Three small, rural satellite communities without public transportation to the Suffolk central business district (CBD); DAR service on a rotating basis 2 days/week from each area to Suffolk CBD from 9:00 to 11:00 a.m. and 12:00 to 2:00 p.m. for a total of 6 days/week; fare = $2.00; service every 60 min; 1 vehicle
Holland		
Population	1,400	
Area (mile^2)	5.60	
Population density (persons/mile^2)	250	
Whaleyville		
Population	700	
Area (mile^2)	6.40	
Population density (persons/mile^2)	109	
Chuckatuck		
Population	3,650	
Area	15.00	
Population density (persons/mile^2)	243	
Deep Creek		Suburban and rural community of Chesapeake adjacent to Portsmouth; replace low-patronage, long-headway bus service with DAR feeder service to major shopping center with bus connections; service from 6:00 a.m. to 7:00 p.m., Monday through Friday, about every 60 min; fare = $1.00, with free transfer to bus (see section on Backround); 1 vehicle
Population	19,222	
Area (mile^2)	19.06	
Population density (persons/mile^2)	1,001	
Churchland		Same as Deep Creek, except 2 vehicles
Population	25,272	
Area (mile^2)	26.89	
Population density (persons/mile^2)	940	
Bowers Hill		Same as Deep Creek
Population	16,427	
Area (mile^2)	21.45	
Population density (persons/mile^2)	766	
Great Bridge		Same as Deep Creek, except no bus service was replaced; attempt to increase ridership by expanding service area with new DAR service; service from 8:00 a.m. through 5:30 p.m. with 2 vehicles
Population	31,441	
Area (mile^2)	37.62	
Population density (persons/mile^2)	836	
College Park		Suburban and rural community in Chesapeake adjacent to Norfolk without public transportation; DAR service to community shopping center with low-frequency bus connections; attempt to service new community from 6:00 a.m. to 10:00 p.m., Monday through Saturday; same as Deep Creek otherwise
Population	25,560	
Area (mile^2)	6.55	
Population density (persons/mile^2)	3,905	
Hampton Boulevard corridor		Urban community in Norfolk serviced by four bus routes; two parallel routes performed poorly at night and were replaced with DAR from 7:00 p.m. to 12:00 a.m. daily; many-to-many as well as distributor for replaced service; 2 vehicles; fare = same as bus fares: $0.60 base, $0.25 zone, and $0.05 transfer
Population	33,428	
Area (mile^2)	5.52	
Population density (persons/mile^2)	6,053	
Coronado route		Bus route in Norfolk with poor performance at night; route was replaced with fixed-route jitney from 9:00 p.m. to 12:00 a.m. daily; fare = same as bus fare
Population	30,520	
Area (mile^2)	6.00	
Population density (persons/mile^2)	5,087	
Portsmouth night service		With the exception of one route, all evening bus service in Portsmouth terminated in 1975 due to poor ridership and high costs; Portsmouth and TTDC officials felt that the national ridesharing program provided the opportunity to reintroduce some kind of public transportation service to test the market; DAR service from 7:00 to 11:30 p.m., Monday through Saturday, with 4 vehicles; fare = regular bus fare
Population	60,272	
Area (mile^2)	14.61	
Population density (persons/mile^2)	4,126	
Ocean View		Urban community in Norfolk with a low-frequency, highly circuitous bus route with poor performance for years; replace route with DAR service, many-to-many, and to several community shopping and activity centers from 8:00 a.m. to 6:00 p.m. daily; 1 vehicle; fare = regular bus fare
Population	47,031	
Area (mile^2)	7.88	
Population density (persons/mile^2)	5,968	

Figure 2. Service areas.



to provide the College Park service (the only one it bid on) at $13/vehicle-hr. TTDC leased 12-passenger vans to the Yellow Cab Company at its standard rates from its inventory of vehicles used for vanpooling and other uses.

The RFP was easily written. The services were described as in Table 1 and a minimum of specifications were developed (1.5 pages). The proposals were solicited on the basis of low bid per vehicle hour. The contract contained provisions for insurance, facilities and equipment, supervision, fare collection, and so on.

MARKETING

Operating procedures for each service were finalized and incorporated into brochures. These brochures described the service area, fares, and pickup procedures, and contained a map of the service area.

A total of 116,000 brochures describing and promoting Tidewater Regional Transit (TRT) Maxi-Taxis were produced and distributed. Of this total, 80,000 were distributed door-to-door in the Maxi-Taxi service areas. The remaining 36,000 were distributed by TRT service representatives to merchants and civic groups also within the service areas. Individual merchants were also solicited to promote Maxi-Taxi to their customers.

In addition to these service-specific promotions, a general Maxi-Taxi ad was produced and placed in several editions of local newspapers. This ad extolled the general benefits of using Maxi-Taxi and encouraged readers to contact TTDC for further information.

MONITORING SERVICES

Maxi-Taxi services began operation on November 23, 1980. Operations were monitored extensively in several ways. The principal monitoring device was the monthly evaluation report.

Each month operational information, including in-service hours, cost, ridership, revenue, cost per hour, and average fare, was obtained and reported for each Maxi-Taxi service area. The performance indicators deficit and deficit per passenger--the principal measures of effectiveness used by TTDC--were derived and reported. This information was used to make decisions to add, delete, or modify services. Monthly evaluation reports for Deep Creek, Ocean View, and Coronado are given in Tables 2-4.

TRT service representatives monitored the operation of Maxi-Taxi services. Service representatives rode each Maxi-Taxi and interviewed both operators and passengers. The service representatives also compiled information gained from complaints that they received about the services. This information was used to help plan service changes and improve marketing efforts. Service representatives continued extensive marketing efforts with local merchants, civic groups, and major activity centers in the Maxi-Taxi service areas based on their analyses.

Ridership was extensively analyzed in several ways. Maxi-Taxi trip manifests were analyzed to determine origin-destination information, average trip length, and passengers per vehicle hour. Tables 5 and 6 and the table below give information on trip length and passengers per vehicle hour (note that the total excludes Coronado because it has jitney service):

Service Area	Passenger Trips	Avg Trip Length (min)
Churchland	167	15
Deep Creek	376	29
Bowers Hill	128	18
Ocean View	156	19
Hampton Boulevard	117	14
Portsmouth	245	28
Total	1,189	21
Coronado	33	28

These analyses provide useful insights concerning travel patterns, major activity centers, travel time, vehicle productivity, and vehicle scheduling.

Riders were also surveyed by TTDC staff who rode the vehicles and administered questionnaires. The survey obtained information on trip purpose, origin and destination, rider demographics, rider satisfaction with the service, and how the rider learned about Maxi-Taxi. These analyses are valuable in planning marketing strategies and in obtaining the rider's perspective on service operations.

In short, the survey found that most Maxi-Taxi passengers were frequent users of the system, were females between the ages of 21 and 30, and were not disabled. The majority of riders were transit dependent and used Maxi-Taxi to go shopping or to work. Almost half of the riders were employed full time, but a large proportion were from households that earned less than $5,000 annually. The ridership data can also be analyzed in other ways to discover specific information, such as transferring between Maxi-Taxi and bus service and also fare collection.

Another type of monitoring is an operations analysis. TTDC conducts a covert check of Maxi-Taxi operations by using staff or a contractor who pose as riders. This information is invaluable in spotting operational problems such as theft of fares, driver

Table 2. Deep Creek: 1981 monthly evaluations.

Month	In-Service Hours	Cost ($)	No. of Passengers	Revenue ($)	Deficit ($)	Deficit per Passenger ($)
January	426	5,964	1,672	1,672	4,292	2.57
February	588	8,342	2,274	2,274	6,068	2.67
March	522	7,681	2,356	2,356	5,325	2.26
April	462	6,736	2,171	2,171	4,565	2.10
May	463	6,732	2,090	2,090	4,642	2.22
June	428	6,224	1,689	1,689	4,535	2.69
July[a]	439	6,355	1,364	1,773	4,582	3.36
August[a]	486	7,059	1,331	1,863	5,196	3.90
September[a]	462	6,464	1,281	1,793	4,671	3.65
October[a,b]	435	6,090	1,316	1,382	4,708	3.58
November[a,b]	380	5,323	1,199	1,259	4,064	3.39
December[a,b]	399	5,584	1,245	1,307	4,277	3.44

[a] Fare increased from $1.00 to $1.50 on July 5, 1981.
[b] Revenue from bus transfer riders allocated to bus route of origin. Therefore, the average fare was reduced.

Table 3. Ocean View Maxi-Taxi: 1981 monthly evaluations.

Item	In-Service Hours	Cost ($)	No. of Passengers	Revenue ($)	Deficit ($)	Deficit per Passenger ($)
Bus route No. 14 Maxi-Taxi 1980	300	8,940	1,680	570	8,370	4.98
November 23-December 31, 1980	370	5,698	1,556	653	5,045	3.24
January 1981	300	4,200	1,242	522	3,678	2.96
February	280	4,312	1,085	434	3,878	3.57
March	310	4,991	1,223	428	4,563	3.73
April	300	4,830	1,461	511	4,319	2.96
May	310	4,991	1,460	511	4,480	3.07
June	300	4,830	1,617	566	4,264	2.64
July[a]	310	4,991	1,323	1,323	3,668	2.77
August[a]	310	4,991	1,361	1,361	3,630	2.67
September[a,b]						
Maxi-Ride	531	7,433	2,246	2,246	5,188	2.31
Jitney-Ride	94	1,315	1,207	604	712	0.59
Total	625	8,748	3,453	2,850	5,900	1.71
October[a,b,c]						
Maxi-Ride	613	8,588	2,698	2,050	6,538	2.42
Jitney-Ride	121	1,694	1,540	462	1,232	0.80
Total	734	10,282	4,238	2,512	7,770	1.83
November[a,b,c]						
Maxi-Ride	562	7,864	2,471	1,878	5,986	2.42
Jitney-Ride	109	1,523	1,397	419	1,104	0.79
Total	671	9,387	3,868	2,297	7,090	1.83
December[a,b,c]						
Maxi-Ride	589	8,245	2,588	1,967	6,278	2.43
Jitney-Ride	121	1,694	1,453	436	1,258	0.87
Total	710	9,939	4,041	2,403	7,536	1.86

[a] Fare increased from $0.50 to $1.00 on July 5, 1981.
[b] Service area expanded to cover Willoughby, vans increased from 1 to 2, hours extended in morning and evening, and Jitney-Ride available in peak periods.
[c] Revenue from bus transfer riders allocated to bus route of origin. Therefore, the average fare was reduced.

Table 4. Coronado jitney: 1981 monthly evaluations.

Item	In-Service Hours	Cost ($)	No. of Passengers	Revenue ($)	Deficit ($)	Deficit per Passenger ($)
Bus Route No. 16 Maxi-Taxi	112	3,024	1,858	651	2,373	1.28
November 23-December 31, 1980	185	2,590	714	300	2,290	3.21
January 1981	155	2,170	714	300	1,870	2.62
February	112	1,946	738	310	1,638	2.22
March	124	2,163	822	288	1,875	2.28
April	120	2,100	844	295	1,805	2.14
May	124	2,170	1,024	358	1,812	1.77
June	120	2,079	929	325	1,754	1.89
July[a]	124	2,170	924	416	1,754	1.90
August[a]	124	2,170	606	273	1,897	3.13
September[a]	104	1,456	609	274	1,182	1.94
October[a,b]	124	1,736	614	356	1,380	2.25
November[a,b]	116	1,624	546	317	1,307	2.39
December[a,b]	120	1,680	600	348	1,332	2.22

[a] Fare increased from $0.50 to $0.60 on July 1, 1981.
[b] Revenue from bus transfer riders was allocated to bus route of origin.

Table 5. Passenger trips per vehicle hour for daytime routes.

Time Period	Passenger Trips				
	Churchland	Ocean View	Deep Creek	Bowers Hill	Avg
6:00-7:00 a.m.	–	–	6.2	1.6	4.1
7:00-8:00 a.m.	4.2	–	3.6	1.6	3.1
8:00-9:00 a.m.	5.6	2.6	5.2	3.8	4.1
9:00-10:00 a.m.	3.6	3.5	3.3	3.4	3.5
10:00-11:00 a.m.	2.3	5.6	4.2	1.6	3.6
11:00 a.m.-12:00 p.m.	3.0	5.3	3.5	3.2	3.9
12:00-1:00 p.m.	4.3	4.3	4.5	1.6	3.7
1:00-2:00 p.m.	5.3	5.2	3.2	2.8	3.9
2:00-3:00 p.m.	2.8	4.0	4.2	2.4	3.4
3:00-4:00 p.m.	6.3	5.6	5.2	1.8	4.7
4:00-5:00 p.m.	0.8	5.0	5.8	2.4	3.8
5:00-6:00 p.m.	2.5	1.8	5.3	3.8	3.5
6:00-7:00 p.m.	–	–	4.0	2.6	3.4

Table 6. Passenger trips per vehicle hour for nighttime routes.

Time Period	Passenger Trips			
	Hampton Boulevard	Portsmouth (night)	Coronado	Avg[a]
6:00-7:00 p.m.	–	1.9	–	1.9
7:00-8:00 p.m.	2.3	2.7	–	2.6
8:00-9:00 p.m.	4.2	2.9	–	3.2
9:00-10:00 p.m.	3.8	3.9	9.8	3.9
10:00-11:00 p.m.	6.3	3.1	11.8	3.9
11:00 p.m.-12:00 a.m.	3.3	0.2	6.5	1.0
12:00-1:00 a.m.	–	–	3.8	–

[a]Does not include Coronado because it has jitney service.

discourtesy, inadequate dispatcher and driver coordination, inefficient routing and scheduling, improper vehicle speeds and layovers, and physical problems with vehicles and at stops.

Many operational problems were spotted. Drivers took fares from passengers and did not deposit them in the fare box. Fare boxes were broken and pilfered. Drivers carried friends and their family members free. Riders had difficulty identifying Maxi-Taxi vans, especially at night. Dispatcher and driver coordination was often lax and riders sometimes waited hours for pickups. Vehicles were not always clean, and drivers went out of the service area or took unexcused breaks.

A number of actions have been taken to remedy these problems. TTDC increased its supervision and assigned an individual to manage paratransit and other contract and special services. Closer monitoring has been implemented, and some drivers have been dismissed. Specifications for more appropriate vehicles have been developed, and other contractors have been solicited to provide additional services.

SERVICE CHANGES

It became evident that, based on the monthly evaluations and budget contraints, changes in service level were required. The following statements summarize the analysis and changes.

1. As part of a bus service reduction, it was decided to expand the service area of the Bowers Hill Maxi-Taxi to include an adjacent neighborhood in Portsmouth. Bus service was terminated by truncating a route at the shopping center. The new Bowers Hill-Simonsdale service area, which provided transfers to bus service at the shopping center, was implemented in September 1981.

2. The College Park service was terminated March 1, 1981, due to inadequate ridership, which never reached more than 80 riders/month.

3. The Great Bridge service showed promise in developing ridership; however, only one van was required according to ridership (721 riders/month) during the first 60 days of service. Therefore, one van was eliminated March 1, 1981. This service was again evaluated after several more months. At that time service was terminated because of the high deficit per passenger ($4.33) and because of funding limitations from the demonstration project and the city of Chesapeake.

4. The Hampton Boulevard Maxi-Taxi serves riders who formerly used TTDC buses. Two vans served this area, but ridership (885 riders/month) warranted only one van. One van was eliminated March 1, 1981.

5. Ridership in the Ocean View service area was satisfactory, and the potential market is large. It was proposed to add one van in combination with expanding the service area. The service area was expanded to cover a neighboring community where bus service was terminated. A fixed-route jitney service was provided during the morning and evening peak periods, with demand-responsive service in between. This service expansion became effective September 6, 1981.

6. Ridership on the Suffolk rural Maxi-Taxi was extremely light--never more than 6 riders/day--and significant market potential was not detected. This service was terminated March 1, 1981.

7. Ridership on Portsmouth night service was sufficient, as was the market potential. However, after the first 60 days of service, the data indicated that four vans were not required to serve this area, which had a ridership at 1,375 riders/month. Therefore, one van was terminated on March 1, 1981. But because of funding constraints from of this project and the city of Portsmouth, and because of the continued high deficit per passenger ($7.64), this service was terminated November 1, 1981.

8. Churchland Maxi-Taxi was assessed after 60 days of service and it was determined that neither ridership (994 riders/month) nor market potential warranted two vans. One van was eliminated March 1, 1981. After almost a year of service, the data indicated that only a few people rode the Maxi-Taxi before 7:00 a.m. and after 6:00 p.m. Service was reduced to 7:00 a.m. through 6:00 p.m. on November 1, 1981.

9. TTDC held five public hearings throughout the Tidewater area during spring 1981 concerning service and fare changes for the entire TTDC transit system. At this time the name of the service was changed from Maxi-Taxi to Maxi-Ride as a result of objections by some private taxicab operators. New fares for Maxi-Ride became effective July 5, 1981, as follows:

Service Area	Old Fare ($) Flat	Old Fare ($) Zone	New Fare ($) Flat	New Fare ($) Zone
Churchland	1.00		1.50	
Bowers Hill	1.00		1.50	
Deep Creek	1.00		1.50	
Portsmouth night service	0.50	0.20	1.50	
Hampton Boulevard	0.50	0.20	1.00	
Ocean View	0.50	0.20	1.00	
Coronado	0.50	0.20	0.60	0.25

The new fares have had a substantial effect on ridership, which was reflected in the monthly evaluations for Deep Creek, Ocean View, and Coronado.

UNION LABOR AND INSTITUTIONAL ISSUES

The initiation of paratransit services generated concern by a variety of groups that provide transportation in the Tidewater area. Actions taken to implement a new service are generally met with at least an equal reaction by those who will be affected by the service. This reaction process then produces a final implementation program that has been tempered by competing or opposing interests. Reflecting this process, paratransit services were accepted into TTDC's regular service delivery program for public transportation.

One implementation issue was the impact on bus operator jobs. The regular transit bus operators and mechanics of TTDC are represented by a collective bargaining agent, Local Division 1177 of the Amalgamated Transit Union, AFL-CIO. During the public hearing on the proposed paratransit services, an attorney for the union presented a prepared statement in opposition to the new services and in favor of continuing regular bus services. The union also wrote to the state funding agency to protest funding of the new services.

During the term of the project, union officers observed the new operations closely and reported any difficulties, such as appearance of drivers, off-route trips, cleanliness of vehicles, or possible mishandling of fares. In addition, union officers talked steadily about widespread concern among the employees about the loss of jobs if the new services were successful. Although no employees were furloughed as a result of the new services, or were any employees furloughed for any reason during the term of the project, job security was presented by the union as a major fear of the employees.

Another implementation issue was the impact of the new services on existing providers of similar services; i.e., the private taxicab companies. During the early stages of project planning, TTDC staff assumed that the taxicab companies would welcome the type of services to be provided by the project, as they would represent a new market and possible expansion of their business. During the public hearing before beginning the services, a representative of a cab company spoke against the new services on the grounds that they would result in a loss of jobs for cab drivers because the project services would attract riders who were currently using cabs and thus result in less cab business. This concern was presented even though it was widely advertised that the new services would be provided through contracts with private taxicab companies. Further, the owner of a large taxi company wrote the state to protest funding of the project as a subsidized intrusion against private enterprise.

The major taxicab companies in the area declined to bid for the services to be provided by the project. During the course of the project the major taxicab companies sought and obtained through the Virginia General Assembly approval of a bill that clarified the enabling legislation for transportation district commissions to ensure that taxicab services shall not be regulated by the district commissions. In response to this concern, TTDC changed the name of project services from Maxi-Taxi to Maxi-Ride as a way to distinguish the group of shared-ride services included in the project from the regular, exclusive-ride services provided by private taxicab companies.

It is curious to note that both the bus and cab operators perceived the new services to be a threat to their job security, even though one group would clearly receive more jobs.

At the conclusion of this project, only one taxi operator was providing all the Maxi-Ride services. Subsequent to the conclusion of the project, TTDC expanded substitute services in other service areas. The union objected, saying that the Section 13(c) agreement of the Urban Mass Transportation Act of 1964, as amended, does not permit contracting for these services. As of this writing, the union is attempting to have the federal district court order arbitration of contracting out services.

OBSERVATIONS AND CONCLUSIONS

Continuation of current transit services and patterns can be carried on without generating new concerns by users or providers of the services. Developing new services can generate many impediments that need to be overcome. Some of TTDC's experiences in implementing alternative services are presented in this section.

The provision of new and innovative services represents a change in the status quo and therefore generates reaction from existing providers of transportation services. As a specific example, several large taxi companies viewed the neighborhood bus substitution services as an infringement on their market and resisted expansion of these services. They declined to bid on operating the services under contract and sought changes in TTDC's enabling legislation to restrict the scope of services.

New services are outside the experience of the transit unions and are resisted because the results are unknown and they are perceived to threaten job security. For example, substituting low-capacity neighborhood services for regular bus services meant that the transit system needed fewer bus drivers, and the union reacted strongly (including lawsuits) to a decrease in the size of the bargaining unit, even when no employees were laid off as a result of the service changes. Drivers perceived new services as an eventual threat, even though they may not be furloughed, because the new services may affect wage and benefit levels in the long run by permitting the operation of services at lower wage costs.

Developing new services requires a great deal of policy board and management insight and initiative because most new services are starting for the first time. New services will need substantial revision between the time something is proposed and when it is implemented. Developing a dependable, useful, and timely monitoring system has been a significant, difficult, and important task of this project. The purchase of public transportation services, as well as the Maxi-Ride concept, is new to TTDC, and this has presented organizational problems. These problems include control of fare revenues, supervision of non-TRT-operated services, coordination of rider complaints, acceptance by union officials and TTDC planning and operating staffs, and development of working relations with service providers. It is anticipated that additional refinements will be made to the monitoring system.

The major accomplishments of this project are

1. Introduction of a low-cost alternative to bus service in low-bus-ridership areas,
2. Purchase of service from private providers,
3. Acceptance by public officials, and
4. Heightened awareness of changes by the transit union and the public.

The major problems encountered are

1. Challenges by the transit union;
2. Opposition by some private service providers;
3. Public resistance to change; and
4. Lack of experience in planning, marketing, monitoring, and evaluating the service.

The major impacts of this project with respect to the service provided to Tidewater citizens are that

1. Bus service would have been discontinued without alternative service, thereby leaving riders without any public transportation, and
2. Maxi-Ride failed in new service areas due to the lack of riders.

One can understand that change comes hard. Changing the traditional fixed-route public transit system into a variety of services tailored to people's travel needs is definitely hard. However, with the outlook for restricted and even reduced public funding for transit, transit operators must change their ways of doing business if they are to continue to provide services.

TTDC's service delivery program incorporates the belief that there is a high potential for payoff in less-costly and more useful services through offering a wide range of public transportation services. The effort required to change will be repaid many times over if TTDC can continue to provide services that would otherwise be discontinued because they are too expensive to fund. In the example of substituting neighborhood van-type services for bus routes, both taxi company and transit system employees have been noted as resisting the change. However, if transit is to continue in many neighborhoods for the benefit of all citizens, new ways must be found to provide at least a basic public transportation service. As the agency responsible for the public transportation in Tidewater, TTDC must balance the needs of the people for transportation with the difficulties involved in providing the appropriate service.

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Urban Bus Transport in Buenos Aires: The Colectivos

JOHN HIBBS

The urban bus system in Buenos Aires, which carries more than 50 percent of all trips and is provided by profitable medium-sized companies, is discussed. The developments of urban transport in the city, and the nature and organization of the component companies that have evolved there, are reviewed. Particular attention is drawn to the combination of medium-sized buses and high frequencies that is characteristic of Buenos Aires, and information is given about one particular company. It is concluded that the Buenos Aires experience has relevance for urban bus operation in Europe and North America. Conventional wisdom, which assumes that large business units and large vehicles are the optimum solution to the problems of urban transport, is questioned.

Conventional wisdom, at least in Europe, holds that urban passenger transport in public transport modes can only be provided through a subsidy out of public funds. In the course of research into the licensing and control of public road passenger transport in various countries, reference was found to the colectivos of Buenos Aires, and that city was visited in order to examine this bus system. It must be stressed, however, that this paper represents only a brief examination of the system.

It may come as a surprise that urban bus services can be operated at a profit, especially in a city as established and sophisticated as Buenos Aires. Because the city is more similar to cities in Europe and North America than to those of Third World countries, examination of the transport pattern of Buenos Aires makes for a relevant critique of the conventional wisdom--more so than many Oriental cities, whose paratransit systems might not transfer well to western countries.

Buenos Aires has rail commuter services, a metro, and a large number of taxis, but, as seen in the table below, the colectivos provide the majority of trips by all modes (note that this table gives the 1970 modal split):

Mode	No. of Trips (000s)	Percentage
Bus	9,458.0	54.3
Rail	1,216.4	7.0
Private car	2,680.5	15.4
Taxi	1,177.0	6.7
Metro	948.1	5.4
Walk	1,410.0	8.1
Other	537.6	3.1

The routes lie close together, and the services run on headways often between 1 and 3 min, with bus stops about 275 m apart. There is no prohibition on getting on or off the bus between stops when speeds permit. People do not have to stand in line. The buses seat about 25, and there is room for at least 30 more passengers. Most buses are built locally by Mercedes (with locally built bodies) and are painted in bright colors. Route numbers, destinations, and route details are painted on the exteriors. The services are shared among 142 firms that run 172 routes; and the average fleet size is about 55. Al-

though fares are fixed by the authorities, routes coincide over long distances, and competition is keen.

Traffic congestion is severe in the city center, which is characterized by a grid pattern of narrow streets, and where only wider avenues provide access. Transport policy is designed to discourage private car traffic, partly by imposing high parking fees in certain areas and partly by physical limits. Access by private car to certain streets within a 7x9-block downtown area is prohibited during the day. In addition, 3.8 km of streets in the central business district (CBD) are restricted to use by colectivos and taxis, and a further 1.4 km are restricted to colectivos alone.

BACKGROUND

Buses first appeared in Buenos Aires in 1920. These early buses appear to have been similar to early buses in the United States: saloon cars with extended chassis to take a larger body; they might be called limousines. (In Britain there was a similar period between 1896 and 1906.) The colectivo started as a 7 to 11 seater, growing first to 14 to 16 seats and then to the current average of 23 to 25 seats. From the beginning, there was a tendency for individual proprietors to form cooperatives, which resembled the associations that dominated the London horse-bus trade in the 19th century (1).

The colectivos soon became serious competitors of the trams and metro. After the fall of President Irigoyen in 1930, there followed a series of conservative administrations, one of which in 1936 established the Transport Corporation of Buenos Aires, which was supervised by a Control Commission that had a monopoly on urban public transport, except for railway services. The parallel with British experience is interesting (2), but already there were differences: firms that had been licensed in 1934 received grandfather rights and, although the Corporation had powers of compulsory acquisition, it also had powers to license other operators for services that it did not wish to provide.

Acquisition began in 1938, but not without resistance. It was not yet completed when in 1942 the government stopped the process and left many of the original firms in operation. The Corporation, however, started to introduce larger buses and to distinguish between omnibuses and micro-omnibuses. By 1951 the Corporation was in financial difficulties, and the government took control. Urban public transport thus came to be split between the remaining private firms, which ran the colectivos, and the state-owned Transportes de Buenos Aires, which ran the buses, trams, trolley-buses, and metro.

After this, according to the official history (3), "the public transport system, in the hands of the state, continued to deteriorate." By 1959 its deficit amounted to $120,000/day (U.S. dollars). In 1962 Transportes de Buenos Aires was itself defunct, and the buses and services were handed over to private enterprise. (The tramways were abandoned in the same year, except in the neighboring city of La Plata, where they lingered on until 1965; trolley-buses ceased operation in 1966.) The colectivo operators thus returned to the forefront in a form of privatization.

COLECTIVOS OF BUENOS AIRES

The early cooperatives consisted of owners (usually possessing one bus each) who kept their own revenue and met their own expenses, although they permitted the association to regulate routes and timetables. This led to the formation of firms called component companies, in which each partner has an internal work contract with the company as a whole. The company then contracted with the drivers, although they may have been chosen by the partners, or may even have been partners themselves.

Currently, operating schedules are produced by the company. Each partner is responsible for the expenses of the vehicle(s) but, although in some companies the partners keep their own revenue, in others it is pooled and then shared in proportion to the mileage run by each partner's vehicles. The company charges each partner on a proportional basis in respect to its overhead and management costs, and also charges an allowance against depreciation for each vehicle.

The partners control the company on the basis of a one-bus, one-vote system. There is, on average, one partner per vehicle, and although some partners may own more than 1 vehicle (as many as 10 in some cases), in other cases a vehicle may be owned by several partners. The typical colectivo thus has a large number of members, where about half work as drivers of their own vehicles. Members benefit from successful trading through the increase in the value of their investment, but the shares cannot be sold on the open market.

The component companies appear to be an unusual form of enterprise, although the cooperatives on the west coast of Scotland may be similar. There are records of similar cooperatives in the English Midlands in the 1920s, but these did not survive the introduction of licensing in 1931. The advantage of the component company lies in the direct responsibility of each partner for his own vehicles and in his contribution to the management of the company, usually with limited financial reward. The disadvantage is financial weakness due to lack of central financial reserves.

Not all of the colectivos are run by component companies, but none of the firms is large by British standards, and there is no overlapping of ownership. In 1970, of the 310 routes in central Buenos Aires, about a third were shared between two or more firms, and a few among as many as nine. The state sets the fares and also defines the routes, although it is not difficult for the firms to make route alterations; permission is often given verbally. The number of vehicles and the frequency on each route are subject to little control, but safety is the responsibility of a government inspectorate, and the mechanical condition of the vehicles appears to be satisfactory.

Tickets are issued on a modified zonal basis. The fare enables a passenger to travel up to a maximum distance, which is about twice the length of the average transit trip. Fares are relatively low. The maximum distance at the lowest fare is 25 km, and at this fare the ratio of distance traveled to distance paid for is about 0.65 in the central area to as much as 0.85 on routes running to and from the outer suburbs.

Frequencies are often high by British standards, so there are often no fixed timetables, but rather a set number of trips per day. On only about 5 percent of the routes are frequencies hourly or less. The basic (peak) frequency on the majority of routes is from 5 to 25 trips/hr (with duplication), and 9 percent is more frequent than that. (The peaks are from 6:00 to 8:00 a.m. and from 5:30 to 7:30 p.m., with a less-pronounced peak from 12:00 to 2:00 p.m.) For the entire system, 8 percent of the routes are covered for 24 hr/day, 80 percent for 20 hr/day, and only 6 percent run for less than 18 hr/day. Seasonal peaks are not significant. The yearly average load is about 90 percent of the average for the busiest month.

The company that was visited, Nuevos Rumbos, operates one route. It starts at a suburban terminus, goes into and through the city center, and ends at the railway station. The company was something of a showpiece, but its vehicles were not exceptional.

The firm owns 62 buses, and employs 150 drivers, 25 administrative staff, 4 inspectors, and 6 mechanics. There are 20 shareholders, some of whom work in the business, even though this is not a component company. With roughly 2.5 drivers/vehicle, each tends to stay with the same bus. The route has three main traffic points. One point is at the university, which gives it a different peak structure--7:00 to 9:00 a.m. and 4:00 to 8:00 p.m. The buses run until 2:00 a.m. and recommence at 4:00 a.m.; the frequency of every 2 min is doubled between 6:00 and 8:00 p.m. Mondays through Fridays and then is reduced to 3 min after 3:00 p.m. on Saturdays and Sundays. The round trip is 29 km.

Drivers work an 8-hr day, 24 days/month. Maintenance facilities are adequate, but it appears that major docking is contracted out. The oldest vehicles in the fleet date from 1968, whereas the newest consist of a class of air-conditioned buses. The driving position, with a posture seat, is equipped with automatic ticket-issue and change-giving equipment. (With so many on-and-off passengers, rapid ticket issue is vital, and fare dodging is a problem.)

Drivers' pay is considered low by British standards; wage costs amount to only 50 percent of total costs. The table below gives the numbers of staff per bus in Britain and Argentina for comparison purposes:

Undertakings	Persons Employed per Vehicle
Great Britain	
London Transport	5.63
Provincial Passenger Transport Executives	4.19
Smaller provincial cities	3.31
State-owned companies	3.28
Private firms	1.23
Argentina: Nuevos Rumbos	2.98

The severe restrictions imposed on the trade unions might account for the wages, but it is said that pay is adequate. (The constant inflation makes it difficult to make valid comparisons.) Because of the computerized accounting system, administrative control is impressive.

CONCLUSIONS

There appear to be two main lessons to be drawn from the Buenos Aires experience, and both concern aspects of scale. It can be argued that there is too great a difference between Argentina and the United Kingdom for comparisons to be drawn, but that is not the purpose of this paper. Rather, it is suggested that the organization of public transport in Buenos Aires should make transport administrators rethink much of the conventional wisdom. The comparison of the level of car ownership in the two countries may offer an argument that will appear sufficient to some to reject the lessons that may be drawn. It appears, however, that the Buenos Aires system (and comparable systems in other South American cities) concentrates on high efficiency at low cost, which is a worthwhile goal.

The first significant aspect to examine is the size of the firm. Because public transport functions under constant returns to scale, there is no economic argument for the large European undertaking; the South American firms are probably nearer to the optimum fleet size for the industry. This may be determined by behavioral factors, such as span of control. In seeking to harness the profit motive, the Argentine approach encourages effective profit centers, and not the bureaucracy that places a cost burden on large-scale enterprises. Clearly, then, there is no need for urban bus operators to be large in order to be efficient.

In transport, there are significant economies to be gained from the increased use of the fixed plant, and many railway mergers have been justified by the subsequent rationalization that has achieved this end. It is a false analogy to extend this to the road transport industry, where the investment threshold is much lower. The British have pursued largeness almost for its own sake, and this has meant ever-larger and more expensive vehicles; therefore, the investment threshold is currently unnecessarily high. This leads to the second significant aspect--unit of output.

Operators in the United Kingdom are generally regarded as being eccentric because of their preference for the double-deck bus, but European and U.S. operators concur in the pursuit of high labor productivity by using ever-larger buses. (Perhaps the significant difference is the poor quality of ride that is inherent in double-deckers, especially when they have power-assisted steering.) The smaller buses of Buenos Aires, with their high frequencies and the ability of passengers to hop on a bus, demonstrate the fallacy inherent in the pursuit of labor productivity, irrespective of elasticity of demand.

In simple terms, by doubling the size of the buses on a given route, there will be a need to halve the frequency in order to obtain the full benefit of labor productivity. What this equation ignores, and what has been consistently ignored in Britain, is that the quality of the service worsens because passengers value frequency--and there is good reason to assume that they greatly value frequency. In simple economic terms, the cost to passengers is increased because they are being charged the same price for a less-desirable product. The volume of demand then falls because of elasticity (and this price and quality elasticity is probably high), and so the service carries less traffic overall and fares have to be raised. The cycle that is thus initiated has undermined urban public transport in Britain, but it has been avoided in Buenos Aires (4). What is more, labor productivity is actually higher in Buenos Aires than in British cities (see the previous in-text table on staff and vehicles).

It is probably not too late to apply the lessons of the Buenos Aires experience elsewhere. There are various methods of doing this: autonomous work groups as cost centers within existing overall structures; the encouragement of cooperatives of various kinds, including outright coownership; or small entrepreneurial businesses such as Nuevos Rumbos. The bu- reaucracies of local and central governments may not approve of these methods, and the manufacturers may have to be pushed into building buses as satisfac- tory as those in South America, but transport man- agers should attempt to have open minds concerning the lessons to be learned from the Buenos Aires ex- perience.

ACKNOWLEDGMENT

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Conducting Transportation System Management Studies of Taxicabs: Lessons from the Milwaukee Experience

BRIAN F. O'CONNELL

From 1978 through 1980, the city of Milwaukee conducted a transportation systems management type study of taxicab service and regulation. In order to provide guidance for other cities considering undertaking similar studies, an evaluation of the Milwaukee study was made. The Milwaukee study was compared against 13 evaluation criteria suggested in the transportation planning literature. The findings of the evaluation were that future taxicab studies could incorporate the strengths of the Milwaukee study and avoid its weaknesses by following 11 guidelines: develop measurable objectives, limit data collection to data needed for problem identification and problem analysis, do field work, maximize use of existing data, emphasize problem identification, set priorities for problems, involve other agencies, involve affected parties, develop alternate solutions, develop strategies for implementation of the recommendations, and require recommendations to be compatible to the maximum extent feasible, but allow early implementation of solutions to serious problems.

In September 1977 and January 1978, the Milwaukee Common Council held hearings on problems affecting the city's taxicab service and on national developments in taxicab service and regulation. The participants in these meetings agreed that a thorough review of the city's taxicab regulations and cab operators' problems was needed.

As these meetings were being held, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) was completing its 1978 transportation system management (TSM) plan (1). The SEWRPC recognized that taxicabs, as providers of an estimated 3.3 million person-trips annually in the Milwaukee area, are a significant part of the urban transportation system.

The SEWRPC was aware of the meetings that had been held in Milwaukee and the attendees' consensus that the cab regulations needed revision. The SEWRPC planners believed that revision of taxicab regulations in Milwaukee would be an appropriate TSM action because reform of the city's regulations could foster improved efficiency and productivity in a part of the transportation system.

The SEWRPC included a recommendation in its 1978 TSM plan that the city undertake a TSM study of the city's taxicab fare and regulatory policies, including the evaluation of policies for encouraging innovative services such as shared-ride taxis. The Department of City Development (DCD), which is Milwaukee's planning department, was designated as the lead agency for the study.

The SEWRPC included in its TSM plan the statement that "similar (taxicab) studies for the remainder of the region will be recommended when the city study is completed as a model." In the interest of providing a useful model for future taxicab studies, a critical evaluation of the Milwaukee study was undertaken (2). The findings of that evaluation are reported, and the caveats and desiderata that should be followed in future taxi studies are emphasized.

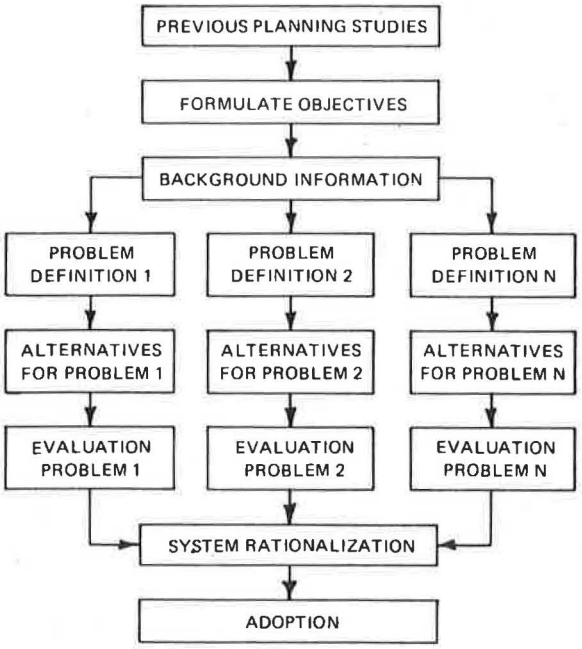
DESIGNING THE MILWAUKEE TAXI STUDY

Work on the taxicab study began with the drafting of a study design. Ten criteria guided the study design preparation:

1. The taxi study should be compatible with the TSM planning process and its results relevant to subsequent TSM planning.
2. The ultimate and essential product of the study would be revised taxicab regulations.
3. Because the taxicab ordinance is a written reflection of public policy, the study must be relevant to policy decisions.
4. The study design must allow for consideration of a range of problems and issues, some interrelated and some independent.
5. The study must produce recommendations that are mutually compatible.
6. The study should seek short-range, low-cost solutions to problems.
7. In anticipation of the study, the Milwaukee Common Council created the advisory committee to guide the study. The study design had to give meaningful responsibilities to this committee.
8. The study design should use the expertise of all agencies involved in taxicab regulation.
9. The principal focus of the study should be on taxicabs as providers of public transportation.
10. The study recommendations should produce an efficient and effective transportation service that has a maximum of positive and a minimum of negative impacts.

Examples of taxicab studies meeting these criteria were sought, but none was found. The lack of an existing taxi study that could readily be used as a model for the Milwaukee study prompted the study staff to adapt the SEWRPC's overall short-range planning process (3) to the needs of the study. This planning process is shown in Figure 1 (1).

Figure 1. Overall short-range transportation planning process.



As finally developed, the study design called for the study to have eight steps.

Step 1 consisted of a review of relevant previous studies (e.g., Milwaukee area and Wisconsin taxicab studies, urban renewal plans that affected cab stands, and local mass transit plans).

Step 2 was the development of measurable objectives for taxicab service and regulation.

Step 3 was the collection of background information. Four types of information were to be collected. In-person interviews with cab owners were to yield information on cab operations; information on current city, county, and suburban taxicab regulations was to be collected through interviews and from local records; taxicab passenger data were to be collected by an in-cab survey; and mail-back surveys and interviews were to yield information on taxicab insurance experience.

Step 4 was the identification of problems. This was to be accomplished through analysis of the background information and through public hearings held by the advisory committee.

Step 5 was the development of alternative solutions for the problems identified. The staff person assigned the problem was required to develop at least two alternative solutions and describe the advantages and disadvantages of each in a brief report to the advisory committee.

Step 6 involved review of the alternative solutions by the advisory committee and selection of the alternative that produced the greatest benefits with the least negative effects. After selection of the recommended alternative, an implementation strategy was to be prepared by the staff that specified the actions required for implementation and identified the agency responsible for implementation.

Step 7--system rationalization--involved the comparison of the study recommendations to eliminate conflicts and inconsistencies.

Step 8--adoption--involved preparing a study report incorporating the recommendations and pertinent background information. On formal adoption of the recommendations by the Common Council, copies of the report would be sent to the implementing agencies identified in the report with a request that they pursue implementation of the recommendations addressed to them.

EVALUATION

Work on the taxi study began in July 1978. The study advisory committee adopted its last recommendation in December 1980 and the study final report was published in June 1982. The study analyzed 21 problems, and 48 actions were recommended as solutions to the problems. To date, 42 recommendations have been fully implemented, 1 partly implemented, and 5 are awaiting action. No recommendations have been rejected.

Through the implementation of so many recommendations, a comprehensive revision of Milwaukee's taxicab regulations was accomplished and the taxi study fulfilled its purpose. In that sense, it can be judged a successful study. But how a purpose is achieved is often as important a consideration as whether it is achieved. To assess how well the taxi study met other important criteria for transportation studies, the study was evaluated against 13 criteria gleaned from the transportation planning and general planning literature. The criteria are listed below. An effective taxicab study

1. Does not deal with irrelevant issues and does not conduct unnecessary analyses;
2. Does not promise results beyond its staff or financial capabilities;
3. Does not take too long relative to its purpose;
4. Considers impacts from multiple viewpoints, e.g., users, operators, regulators;
5. Encourages creativity in problem analysis and solution development;
6. Examines a wide range of options and alternatives;
7. Explicitly identifies trade-offs among alternatives;
8. Has explicit purposes;
9. Includes a comprehensive assessment of problems and deficiencies;
10. Is open to and seeks public involvement;
11. Produces feasible, implementable recommendations;
12. Provides information directly related to decision making and is policy oriented; and
13. Recognizes uncertainty and has a planning period appropriate to the amount of uncertainty.

These criteria are concerned with varying aspects of transportation studies, from the efficiency with which the study is conducted to the thoroughness of the study. The criteria are mutually compatible; it should be possible to design a study that meets all 13 criteria. It is possible to use other criteria that have been suggested for valid transportation studies, but the 13 listed above are particularly appropriate for the type of study considered here.

Evaluation of the taxi study against the criteria revealed some serious weaknesses, but it also revealed some significant strengths. These findings are discussed below.

Irrelevant Issues

In the Milwaukee study, all of the 21 problems addressed were treated as though they were equally important. Yet some problems were more serious than others, and treating the problems equally diverted resources from more important to less important analyses.

Similarly, the ambitious data-collection effort produced a considerable amount of information that went unused in the analysis steps. For example, almost none of the information collected by the taxicab passenger survey was used in the problem analyses. The survey results were interesting in a general way, but the collection of unnecessary data can only be judged a waste of limited resources.

Overpromising

A major concern of the city's cab owners was the high cost of motor vehicle insurance. The study staff had no expertise in insurance matters, and it appeared likely that the city could do little about the cab industry's insurance problem. However, rather than explain this situation to the committee and drop the insurance problem from the study, the staff expended considerable effort preparing a report that merely stated facts already known. This was a clear case of overpromising.

Timeliness

Early in the study process, the advisory committee decided that every problem brought to its attention should be researched and that problems could be suggested for consideration at any time during the study. The decision had three effects. First, it made the study comprehensive, with a large number of different problems being considered. Second, it necessitated extending the study schedule because problems that were suggested late in the study could not be analyzed within the proposed schedule. Third, it created inefficiency. Problems that emerged late in the study often were related to problems investigated earlier. Had all problems been identified at the same time, data collection for and analysis of similar problems could have been combined and staff time and money could have been saved.

It took 2.5 years to accomplish steps 1-6 of the study process and another 1.5 years to complete steps 7 and 8. This delay was problematic. Even acknowledging the implementation of almost all of the study's recommendations, the published final report could have provided guidance to decision makers in the 1.5 years between completion of the study and submission of the final report. In addition, it is inconsistent for a study with a 5-year planning perspective to take 4 years to complete the final report.

Multiple Viewpoints

The chief mechanism used in the taxi study to ensure that differing viewpoints were considered was the study advisory committee. The committee took an active role in the study. It was common for a subcommittee of interested staff and advisory committee members to review the draft report on a problem, critique it, and suggest changes. This procedure was used with every complex problem and with every problem on which the advisory committee was divided. This process ensured consideration of differing viewpoints.

Creativity

Mandating that alternative solutions be considered, and the use of the review subcommittees and informal staff brainstorming sessions, encouraged creativity.

Many Alternatives

As previously noted, the study design required consideration of multiple alternatives. Only one problem--antiquated cab regulations--was found to be so clear-cut that the development of a range of alternatives was not warranted. In that case, the only feasible recommendations were the repeal of the completely obsolete regulations and the revision of regulations that were applicable to current conditions, but included antiquated language.

Trade-Offs

Trade-offs among alternatives and among recommendations were explicitly analyzed in steps 6 and 7 of the study. Interestingly, when step 7 (system rationalization) was undertaken, it was found that almost none of the recommendations was mutually incompatible or inconsistent. The high compatibility resulted from two factors. First, the study staff was small and the staff members were aware of each other's research and thinking. Second, the advisory committee was actively involved in the evaluation of alternatives and thus played an integrating function. These influences prevented antagonistic recommendations from being adopted.

Explicit Purposes

The Milwaukee taxicab regulation and operation study proposed to be a comprehensive review of the taxi industry's operational and service characteristics and the impact of public action on taxicab operation and service. In particular, the study proposed to recommend revisions to the city's regulations, as needed, to achieve a strengthened industry and to improve public service. These purposes proved to be sufficiently specific to adequately guide the study.

Comprehensive Assessment of Problems

A systematic assessment of problems and deficiencies as intended by the study design did not occur. It was originally intended that the background information collected in step 3 of the study would be evaluated against the objectives for taxicab service and regulation developed in step 2, and problems would thereby be identified. Instead, because of the misapplication of a consensus-building technique, the advisory committee adopted objectives that were not measurable and could not be used to identify problems.

However, this weakness in the study process was largely offset by the study's almost total openness to problems identified in other ways, such as staff and advisory committee judgments based on background data and consumer, cab owner, and cab driver complaints voiced at advisory committee hearings.

Public Involvement

The study's openness is important. As noted, the committee held numerous hearings at which anyone could comment on the work currently under review or suggest additional problems for study. However, the committee did not actively advertise these hearings, and many times they were attended only by cab drivers and owners.

Almost no comment was obtained from cab users at the public hearings. The taxi passenger survey did ask patrons to rate the service and supplied room for written comments. The responses to that question and the written comments were reported to the committee, as were complaints received by the city during the study.

In retrospect, although more could have been done to obtain the general public's input for the study,

the study appears to have had adequate, albeit not overwhelming, public involvement.

Feasible Recommendations

The explicitly required implementation strategies, and review of them by the advisory committee, appears to have ensured that the recommendations made were feasible.

Appropriate Information

The study was particularly sensitive to the need for information relevant to policy decisions. During the evaluation of alternative solutions, care was taken to describe the policy implications of the different alternatives when their advantages and disadvantages were being described.

Uncertainty

The taxi industry is currently in a state of flux (4). However, the industry has relatively low capital needs (a cab, radio, and meter can be bought for $7,300 or less) and is relatively unconstrained by labor agreements. As a result, it can respond to change quicker than other modes of public transportation. In light of the changing conditions in the taxi business, and the industry's own efforts to accommodate change, the 5-year planning perspective chosen for the study appears appropriate.

RECOMMENDATIONS

The Milwaukee study design had both considerable strengths and weaknesses. Its weaknesses were that it wasted study resources by collecting data before a need was clearly established, by attempting analyses beyond the capabilities of the staff, by failing to set priorities for problems and drop or defer low-priority problems, and by failing to more actively seek the input of cab users and the general public. Study strengths included producing feasible, implementable results and providing information needed for intelligent decision making. These strengths derived from the use of an appropriate short-range planning perspective, from the consideration of multiple viewpoints in problem analysis, from the requirements that two or more alternative solutions be considered for each problem and that the advantages and disadvantages of each alternative be fully described, and from the creativity engendered by subcommittee review of proposals and informal staff brainstorming.

Based on this evaluation of the Milwaukee study, some suggested guidelines are discussed below for avoiding the pitfalls of the Milwaukee study and for incorporating the Milwaukee study's best features into other taxicab studies.

Develop Measurable Objectives

As part of the after-the-fact evaluation given the Milwaukee study, the study was compared with similar studies prepared in other cities. One surprising finding was that none of the studies used measurable objectives of the type widely recommended for transportation studies.

In light of this finding, it is appropriate for planners to recognize that goal setting for taxicab service and regulation is an innovation. Their aim should be to get started, gain experience, prove the value of the exercise, and develop a basis for further evaluation of service and regulation.

It is recommended that the planners begin with objectives for which pertinent data are easily obtained. For example, a goal to improve taxicab safety could have as its measurable objective the minimization of the proportion of taxicabs failing inspection for hazardous defects. The data needed to assess achievement of this objective should be available from reports on the periodic taxicab vehicle inspections held in most cities.

Such setting of objectives would show the value of being able to assess the status of service and regulation and should encourage taxi regulators to collect additional data regarding the quality of service and the effects of regulation.

Limit Data Collection to Data Needed for Problem Identification and Analyses

There is a tendency to overcompensate for the lack of useful historical data on cab regulation and service by collecting copious amounts on current conditions. Often, much of this information proves irrelevant to the study.

This happened in Milwaukee. The data collected in an expensive and time-consuming taxicab passenger survey was not germane to any of the problems subsequently investigated. The small amount of survey data that was used could have been acquired from other sources at less cost.

Data collection should occur in two phases. The first phase should be the acquisition of the minimum amount of data needed to provide a general overview of taxicab operation and regulation in an area. Included in this phase is the compilation of the data available for use in comparing the existing service and regulations with the adopted objectives.

The second phase is the collection of data needed for the individual problem analyses. At this point, detailed information should be collected on the specific aspects of cab operation or regulation relevant to a particular problem. Care should be taken to ensure that sufficient information is collected to allow development of alternative solutions and that information on related problems is collected only once.

In both phases, a conscious effort should be made not to collect data unless a convincing reason for doing so is apparent. The experience in Milwaukee was that a taxi study is more likely to err by overcollecting than by undercollecting data.

Do Field Work

Taxi studies are not armchair exercises. This was discovered on two occasions during the Milwaukee study. First, a review of the city's taxicab inspection ordinance suggested that the ordinance was sufficient to ensure that roadworthy taxis were in use. But a study staff person attending one of the twice-yearly inspections saw grossly defective taxis being allowed to return to service. The police, who were conducting the inspection, pointed out that the ordinance did not authorize them to suspend the permits of defective cabs. They believed suspensions were the responsibility of the Utilities and Licenses Committee of the Common Council. The Utilities and Licenses Committee, in turn, thought that the police had been prosecuting owners of unsafe cabs under a different, but related, ordinance. If the staff person had not gone to the inspection, this serious problem would have been overlooked.

On the second occasion, field work revealed a problem to be different than it was originally described. Cab drivers claimed that many problems at the airport occurred because cabs licensed by suburbs were allowed to provide service between the airport and suburban destinations. A field check found that suburban cabs accounted for only 5 per-

cent of the departures from the airport and that Milwaukee permit holders were responsible for the reported problems.

Maximize Use of Existing Data

In many cases data have already been collected that can be used in taxi studies. For example, concern about the condition of Milwaukee taxis prompted questions about the average age of cabs. The information was found to be available in the Utilities and Licenses Committee's records, although it had not been tabulated previously. The need for a more costly survey of cab owners was thereby avoided.

Taxi firms themselves are sources of data that should not be overlooked. The dispatching records and trip sheets maintained by Milwaukee cab companies were more accurate sources of information on origin-destination and time-of-day travel patterns than were the passenger survey conducted by the study. In many cities, cab firms are required to make such records available to city officers.

Emphasize Problem Identification

Problem identification is perhaps the most important step in the taxi study process. A study that does not address perceived problems will be judged irrelevant. The type and number of problems identified will dictate the type and amount of data needed. An early and thorough problem-identification stage will allow the study to be conducted expeditiously and at minimum cost.

Many ways exist for discovering people's concerns about cab service and regulation. The collection of background information will identify some. The comparison of background information with the service and regulation objectives will point out others. Public hearings can be held. Displays that describe the study and ask for comments can be set up at food stores, airports, and shopping centers. Advertisements can be run in the newspapers. Brief, prepaid, preaddressed questionnaires can be distributed to homes and work places and in hotel rooms and taxicabs.

These methods can be used in combination, and there are other methods not mentioned here. The important considerations are that these efforts be intensive and made early in the study. One weakness of the Milwaukee study was that problems were suggested throughout the study process. It became impossible to combine data collection and analysis for similar problems, and many opportunities for more efficient use of staff time were lost.

It is neither possible nor desirable to insulate the study from all changes that possibly require study effort. (In Milwaukee, the largest cab firm closed midway through the study, requiring reexamination of several issues and collection of additional data.) But an early and thorough problem-identification step will minimize the number of surprise problems emerging late in the study and allow the most efficient use of study staff and budget.

Set Priorities for Problems

Once a list of problems is compiled, priorities should be set, ranked from most important to least. The list of priorities should then be used to determine how many problems can be examined with the resources available to the study. Issues that rank below the cutoff point determined by available funding and staffing should either be permanently dropped from consideration or deferred until another opportunity to study them arises. This setting of priorities ensures that the most serious problems are considered and that analysis of less-important problems does not drain resources from more important analyses.

Planners should also be wary of problems that are likely to require disproportionate amounts of study resources. Such problems may be too difficult to be considered in a multifocus study and may require a separate study.

Involve Other Agencies

In most cities, several agencies share responsibility for taxicab regulation: a committee or commission may grant licenses, the police may have responsibility for enforcement of regulations, and the department of public works may designate taxi stands. In many cities, as in Milwaukee, the transportation planning function may be separate from any of the previously mentioned agencies. In such cases, a pooling of expertise is essential.

One strength of the Milwaukee study was that a technical team, which included representatives of the agencies most involved in cab regulation, evolved during the study. This technical team provided peer review of analyses, alternative solutions, and implementation strategies; in turn, the peer review produced convincing analyses, creative solutions, and feasible recommendations. It is strongly recommended that other studies use a technical team approach.

Involve Affected Parties

Cab owners, drivers, patrons, and regulators all have an interest in the way cabs operate. The interests of these parties often differ; sometimes they are directly opposed. A taxi service and regulation study should recognize these tensions and use them to develop acceptable recommendations. To ignore these tensions is to risk having study recommendations rejected by implementing agencies because of the strong and previously unconsidered opposition of an affected party.

The Milwaukee study was fortunate to have an advisory committee that included representatives of the potentially affected parties. The staff was forced to develop analyses and solutions acceptable to the members of the committee; therefore, acceptance of the study's recommendations was more likely.

An additional advantage of having the advisory committee was that the first-hand experience of the members was made available to the study, an asset that produced sounder analyses and more realistic solutions. Also, committee members often became supporters of the study and, in turn, obtained their constituencies' support for study recommendations. Most notably, the committee chairman, an alderman, was an effective advocate of study recommendations with city agencies and the Common Council. An advisory committee should be used in other taxi studies.

Develop Alternative Solutions

Partly because of the differing interests of the parties involved with taxicabs and partly because the circumstances that create taxicab problems can be surprisingly complex, it is essential that alternative solutions be developed for these problems. It is likely that the obvious solutions to taxi problems will either fail to be implemented or be ineffective.

For example, Milwaukee had a problem with drivers refusing service for short trips to and from the airport. The airport is in an area of suburban to

rural development, a typical place for an airport but not the best source of cab business. Cab drivers were reluctant to take low-fare trips to the area around the airport and thereby miss out on longer, higher-fare trips to downtown.

Three alternative solutions were suggested for the problem: (a) stricter enforcement of city and county ordinances prohibiting refusal of service, (b) use of a taxi starter who would see that cabs that had previously received short trips would later get long ones, and (c) a $4.00 minimum fare from the airport. Initially, the minimum fare was the alternative least preferred by the staff and a significant number of advisory committee members. Not surprisingly, cab drivers favored it. As the characteristics of airport tripmaking were considered, and the disadvantages of the other options were described, it became apparent that the minimum fare was the superior alternative. It was put into effect and has nearly eliminated the service-refusal problem.

Develop Implementation Strategies

Transportation planners are rarely taxi regulators, and taxi regulators are rarely transportation planners. For this reason, it is necessary that planners prescribe the actions needed to implement the study's recommendations. The parties involved in cab regulation often have few resources for additional study of how a recommendation should be put into effect. It was the experience of the study staff that Milwaukee's cab regulators welcomed explicit implementation instructions and that explicit instructions helped ensure that recommendations were actually implemented.

Require Rationalization of Recommendations

System rationalization is a means of ensuring that all the effects of the study's recommendations have been considered and of minimizing the recommendations' conflicts with each other. System-rationalization ensures that the study produces the greatest possible overall benefit with the minimum amount of negative effects.

In Milwaukee, for example, the system-rationalization step pointed out that the minimum fare recommended for trips from the airport was in conflict with a study objective that flexibility in fare rates be allowed. It was decided that this conflict would be allowed to stand because it could not be reduced without reducing the recommendation's effectiveness in meeting another, higher-priority study goal: elimination of service refusals.

The system-rationalization step reduces the chance that the study will be accused of making inconsistent recommendations. However, it opened the Milwaukee study to a different charge--that the study was allowing serious problems to continue after feasible solutions had been recommended solely for methodological convenience and purity. The study staff and advisory committee considered this charge and decided that recommendations concerning serious problems should be forwarded for implementation as soon as they were adopted, without waiting for system rationalization. System rationalization was still done and, had any serious conflicts been discovered, suggestions designed to reduce conflicts would have been included in the study's final report along with the recommendations for less-serious problems.

The compromise allowed the study to achieve immediacy and relevance and at the same time remain systematic and comprehensive in its approach. The compromise allowed the study to build a track record of implemented, effective recommendations that facilitated acceptance of later recommendations. The approach should be used by other cities undertaking taxicab studies.

APPLICABILITY

In closing it should be noted that the Milwaukee study has certain characteristics that will limit the applicability of its study design and the recommendations offered in this paper. First, the Milwaukee study design is most appropriately used in urban areas. The key characteristics of the Milwaukee situation are municipal regulation of taxicabs, an institutional framework in which different agencies are responsible for different aspects of taxicab regulation, and a situation in which taxicab regulation and transportation planning are not formally integrated. Depending on how these characteristics vary from place to place, the Milwaukee model will have to be modified or rejected in favor of one that is more appropriate to local conditions.

However, after talks with cab regulators and planners in other areas and examination of other studies of taxicab regulation, it was found that Milwaukee's regulatory structure is typical of the structure found in many other areas, and it may even be the most common type nationally. Thus the Milwaukee experience should be applicable to many other areas.

The second point worth noting is that the Milwaukee study is only one of several types of studies involving taxicabs. It is a short-range study that is chiefly concerned with improving taxicab service and regulation, and it would be inappropriate to use it as a model for the taxicab element of a multimodal long-range plan. Similarly, the Milwaukee study would be an inappropriate model for a study concerned with designing a new taxi-based transit service.

This type of service and regulation study does fulfill a common need, however. As Kirby (5) has observed, there are a number of changes and innovations in taxicab regulation and operation that deserve consideration by regulators and planners in U.S. cities. It appears likely that the need for TSM and taxi studies of the Milwaukee type will increase in the future in response to these innovations and changes.

ACKNOWLEDGMENT

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Comparison of User-Side Subsidy and Dial-A-Ride Services Operated in Los Angeles

DAVID B. TALCOTT

This study is a comparative analysis of the dial-a-ride and user-side subsidy community transit service operations provided in Los Angeles. The study concentrates on two project areas, Venice and West Central, in which dial-a-ride services operated in 1980 were replaced with user-side subsidy operations in 1981. The dial-a-ride service, as operated in Los Angeles, requires a contractor to provide a specific number of vehicle hours of service per month; the contractor is compensated on that basis. The user pays a fixed fare regardless of the length of trip. The trip must be arranged at least 24 hr in advance and is provided between the hours of 9:00 a.m. and 5:00 p.m. on weekdays. The user-side subsidy program requires the user to purchase coupons that are good for 24-hr service from any participating taxicab company of the user's choosing. The broker subcontracts with the taxicab operators to reimburse them for the coupons they receive. The user is allowed to use up to $5.00 in coupons for each one-way trip and must pay in cash any amount over the coupon limit. Three measures of comparison were used in the analysis: patronage, cost to the user, and cost per passenger. Under equal funding levels, more trips were provided by the user-side subsidy program. The user-side subsidy patronage exceeded the dial-a-ride patronage by 75 percent in Venice and 40 percent in West Central. Dial-a-ride fares were fixed at $0.15/trip in 1980, but a new state law adopted for 1981 financing would have required the city to raise the dial-a-ride fares to an average of $1.40/trip. The user-side subsidy service costs the user an average of $0.92/trip. Over two quarters of operation, the user-side subsidy patronage grew considerably, reducing the cost to an average of $5.63/passenger, approximately 60 percent of the dial-a-ride cost per passenger. The comparisons made in this study indicate that user-side subsidy service is superior to dial-a-ride service for Los Angeles.

The purpose of this paper is to provide a comparative analysis of the dial-a-ride and user-side subsidy methods of providing community transit service in Los Angeles. Both types of service have been and are being operated for elderly and handicapped residents of the city. The operating procedures used may be peculiar to Los Angeles; therefore, the paper contains a brief history and description of the services. Comparisons are made between the dial-a-ride services operated in 1980 and the user-side subsidy services operated in 1981 in the West Central Los Angeles and Venice community transit service areas.

Los Angeles has been operating community transit services since 1973 with the implementation of dial-a-ride projects in two service areas under the federally sponsored Model Cities Program. The city implemented four additional dial-a-ride projects in 1975.

The California State Legislature established a new funding source for community transit service in 1976. The Transportation Development Act (TDA) was amended by Article 4.5 to allow the county transportation planning agency to reserve up to 5 percent of the county's TDA funds for community transit services. Funding for the program came from state sales tax revenue.

The first user-side subsidy service began operating in the Harbor service area in August 1978. A second user-side subsidy demonstration project was initiated in the Echo Park-Silverlake service area under Article 4.5 financing. The early success of this program led to the decision to convert some of the existing dial-a-ride services to user-side subsidy programs.

In fiscal year (FY) 1980-1981, dial-a-ride services were replaced with transportation coupon (user-side subsidy) programs in the West Central Los Angeles and Venice community transit service areas.

DIAL-A-RIDE

As Viewed by the Consumer

Dial-a-ride is a curb-to-curb service that requires route diversion and group loading. The user pays a fixed fare ($0.15/trip during 1980), regardless of the length of trip. The trip must be arranged at least 24 hr in advance and is provided between 9:00 a.m. and 5:00 p.m. on weekdays. The user must understand that the service is not exclusive and that travel times may be long due to route diversions. Trip destinations are limited to 1.5 miles outside of the service area boundary.

Contractor Relations

Dial-a-ride-service is an operator-side subsidy, demand-responsive service that uses either profit or nonprofit companies as providers. The contractor is required to provide a specific number of vehicle hours of service by using vehicles dedicated to dial-a-ride service. The contractor is paid monthly, based on the number of vehicle hours operated. The contracts for West Central and Venice were with Golden State Transit Corporation doing business as Yellow Cab Company. The vehicle-hour rate was $13.58 for West Central and $10.28 for Venice.

The contractor is required to have two-way radio communication between the dispatcher and the vehicles, and the dispatcher is required to load, route, and unload the vehicle to obtain the maximum efficiency. (In practice, this was rarely accomplished.)

Accessible Vehicle Service

The dial-a-ride contract requires the contractor to provide at least one lift-equipped vehicle for each service area for people in wheelchairs who cannot transfer to a standard passenger vehicle. These vehicles are dedicated to dial-a-ride service and are operated in the same manner as the other dial-a-ride vehicles.

For the West Central contract, which included four small service areas, four lift-equipped vehicles were provided. In the Venice service area, one lift-equipped vehicle was provided. There were not many backup vehicles, so at times the lift-equipped vehicle service was limited.

USER-SIDE SUBSIDY SERVICE

As Viewed by the Consumer

The user-side subsidy or transportation coupon program requires users to purchase coupons before they can obtain transportation service. Transportation coupons are sold in books with a predetermined dollar value for 20 percent of that value. The bearer uses the coupons to purchase taxicab service from any of the companies listed on the coupon book. The amount of coupons that can be used on any one trip is limited. The user may take longer trips, but any amount over the dollar limit must be paid by the user of the coupon book. Because of a high demand for this type of service, the number of coupon books a person can buy is limited to one or two books per month, which is equivalent to approximately 5 to 7 trips/month.

Both the West Central and Venice programs sold coupon books with a $10 value for $2. The amount of coupons that could be used on any one-way trip was limited to $5.

Contractor Relations

The user-side subsidy programs developed by the city involve two distinct functions. There is a broker function and a service-provider function. The broker is the primary administrator of the program and performs three distinct functions: (a) arranges for the printing of coupon books, (b) develops a marketing plan for the distribution of coupon books and promotion of the program, and (c) reimburses the taxicab companies for the coupons they collect for service rendered. All funds for the program are dispursed by the city through the broker or prime contractor. The contract specifies the administrative personnel, equipment and supplies, and funds available for coupon reimbursement. The broker is also responsible for subcontracting with the taxicab operators for the provision of taxicab service. The subcontract also specifies the procedures for reimbursement.

Occasionally the broker and the taxicab service provider are one and the same entity, in which case there is no need for a subcontract arrangement. When such is the case, users do not have the opportunity to choose the taxicab company they prefer. However, the broker then has more control over the quality of service provided.

The West Central program is the prototype of the first example given, and the Venice program is an example of a taxicab company contracting to perform both the broker and service-provider functions.

Accessible Vehicle Service

Accessible vehicle service for people in wheelchairs who cannot transfer to taxicabs is provided in a different manner in the two user-side subsidy programs.

In the Venice program, the contractor is required to provide a lift-equipped van dedicated to a dial-a-ride type of service. The lift-equipped vehicle is prescheduled, which requires the users to arrange appointments 24 hr in advance. Special coupons are printed for this service, and users pay the fare in coupons equivalent to the taxicab rate established for the company. The same dollar limit per trip is applied to this service as for the taxicab coupon service.

In West Central, a completely different design for providing accessible vehicle service is used. The broker subcontracts with companies that operate nonambulatory medical vehicle transportation. Such companies are established to cater to the needs of outpatients on Medical.

Originally, the West Central broker selected a single company through a competitive bid process to provide dedicated vehicles for accessible service as in Venice. However, the cost of having vehicles on call was too expensive (more than $30/trip). Therefore, the subcontract was renegotiated so as to be similar to taxicab coupon service.

Currently, the broker subcontracts with any interested company established as a nonambulatory vehicle operator. Special voucher coupon books are sold for $20. The books contain 10 vouchers, each of which is valid for one 5-mile trip. Each trip costs the city $17.50, which is the 1980 Medical-approved transportation rate. If users wish to travel beyond the 5-mile limit, they must pay the city-established nonambulatory service rate of $0.85/mile. If and when Medical or nonambulatory vehicle rates are increased, the companies that participate in the program will have the opportunity to negotiate amendments to their subcontracts.

Both of these options have the restriction that the trips must have either the origin or destination located within the service area in order to prevent the vehicles from traveling long distances, which would result in too many deadhead miles.

ANALYSIS OF DIAL-A-RIDE VERSUS USER-SIDE SUBSIDY SERVICE

The services analyzed and compared in this report pertain to the Venice, Mar Vista, West Los Angeles, and West Central Los Angeles community transit service areas. Comparisons are made between the dial-a-ride services operated during the third and fourth quarters of FY 1979-1980 and the user-side subsidy services operated during the third and fourth quarters of FY 1980-1981. The first and second quarters of FY 1980-1981 were conversion periods for the replacement of the dial-a-ride service with user-side subsidy service. A summary of the fourth-quarter operational data for the two services is given in Table 1.

Patronage

The monthly ridership figures for the Venice and West Central services for all of 1980 and 6 months of 1981 are shown in Figure 1, and a summary of the patronage data for the third and fourth quarters for each type of service is given in the table below (note that dial-a-ride service is for FY 1979-1980 and user-side service is for FY 1980-1981):

	Patronage	
Service Area	Third Quarter	Fourth Quarter
Venice		
Dial-a-ride	2,873	2,489
User-side subsidy	2,018	4,346
West Central		
Dial-a-ride	9,271	9,614
User-side subsidy	3,457	13,242

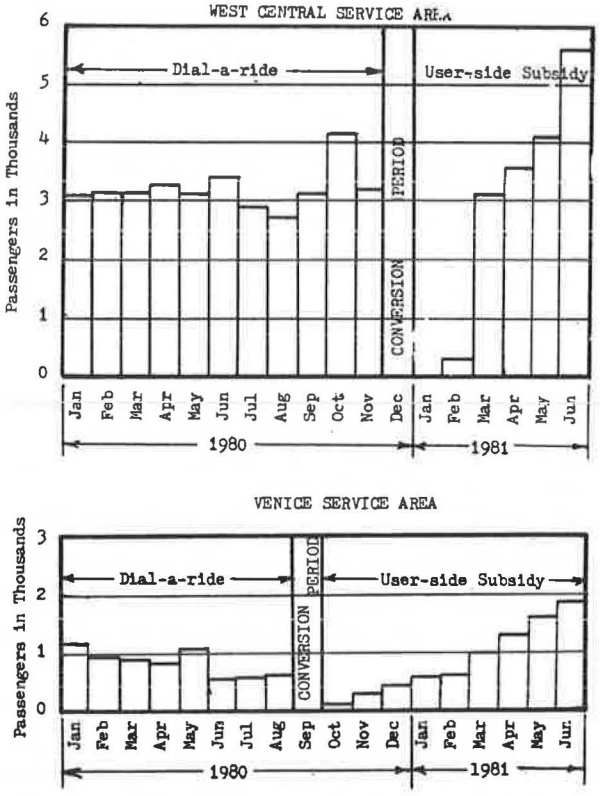
(Note: The dial-a-ride service was a well-established service, whereas the user-side subsidy system was in an initial growth period.)

Table 1. Operational data: dial-a-ride versus user-side subsidy.

Item	Venice Area		West Central Area	
	User-Side Subsidy[a]	Dial-a-Ride[b]	User-Side Subsidy[a]	Dial-a-Ride[b]
Trips per quarter	4,336	2,489	13,242	9,614
Vehicle hours per quarter	2,677	2,049	8,403	5,438
Miles per quarter	14,657	25,863	38,964	67,501
Cost per quarter ($)	26,644	24,960	67,942	73,841
Cost per vehicle hour ($)	9.95	12.45	8.09	13.58
Cost per mile ($)	1.82	1.02	1.74	1.09
Cost per passenger ($)	6.13	10.03	5.13	7.68
Passengers per hour	1.62	1.23	1.58	1.77
Farebox revenue ($)	4,006	374	16,700	1,543
Farebox recovery ratio (%)	15.04	1.6	24.58	2.1

[a] Fourth quarter, 1981.
[b] Fourth quarter, 1980.

Figure 1. Patronage comparison: dial-a-ride versus user-side subsidy.



The figures in the table above show that, for the third quarter of FY 1980-1981, the user-side subsidy patronage was below the dial-a-ride service a year earlier. However, after the start-up period, the fourth quarter patronage for the user-side subsidy program was 75 percent greater in Venice and 40 percent greater in West Central than the comparable dial-a-ride service.

Cost to User

A comparison of the cost to the user of the two types of service is given in the table below (note that dial-a-ride service is for FY 1979 and user-side service is for FY 1980):

Service Area	Cost per Trip for User ($)	
	Six-Month Average	Required to Comply with State Law
Venice		
Dial-a-ride	0.15	1.65
User-side subsidy	0.98	0.98
West Central		
Dial-a-ride	0.15	1.13
User-side subsidy	0.86	0.86

The dial-a-ride service, as operated in 1980, was considerably less expensive to the user than the user-side subsidy service, but compliance with state law would have required an increase in dial-a-ride fare beyond the cost for user-side subsidy service, as discussed below.

Dial-A-Ride

The fare for dial-a-ride service was $0.15/trip, which allowed the patron to travel anywhere within the service area and to major destinations within 1.5 miles outside of the service area boundary.

State law currently requires that transportation programs that use state funds must recover 10 percent of the total cost of operation from farebox revenue; this is termed the farebox recovery ratio (FRR). For this reason, dial-a-ride rates in Los Angeles have been increased to $0.65/trip for any service that is financed with state funds, such as TDA Article 4.5.

The FRR was approximately 2 percent for both service areas under the old $0.15 dial-a-ride fare. The FRR would have been between 7 and 8 percent if the new $0.65 fare was used, based on cost and patronage data for dial-a-ride operations. Because the cost of dial-a-ride service in recent bids has increased approximately 50 percent from the previous service, it appears likely that the dial-a-ride fare would have to be approximately $1.40/trip or added matching funds would be required to comply with the state law.

User-Side Subsidy

The cost per trip to the user of the transportation coupon service varies, depending on the length of the trip. Initially, the user pays $2 for $10 worth of coupons; however, only $5 worth of coupons can be used on any one-way trip. The operational data for the Venice and West Central transportation coupon services indicate that the average trip length is 3.3 miles, which would cost approximately $4.50 at the established taxicab rate. Therefore, coupons could be used to pay the entire fare, and the cost of the trip to the user would be $0.90. A trip that costs more than the $5 limit would cost the user the initial $1 cost for the coupon plus the additional fare shown on the taxi meter in excess of $5.

The FRR attained by the Venice and West Central transportation coupon programs during the comparison period was 16.3 and 27.8 percent. The FRR is high because these programs were in a growth period, and revenue obtained from coupon sales in the first months of the contract will balance against the reimbursement costs near the end of the contract. There is also a built-in safety margin to prevent the necessity of the city being required to make up any shortfall in the FRR from the city's general fund.

Total Cost of Service

The total cost of either service is based on the funds available. Nearly equal amounts of money were available for each type of service in the two service areas. However, because the user-side subsidy services were in a growth period, less funds were expended over the 6-month period. In West Central, $145,600 was expended on the dial-a-ride service and $100,000 on the user-side subsidy service. For the Venice service area, $48,100 was expended on dial-a-ride and $42,800 on user-side subsidy. Unlike dial-a-ride with dedicated vehicles, funds are expended on user-side subsidy only when the service is actually used; there are no payments for deadhead hours or miles of service. A better method of comparison is to use a common unit of measure, such as cost per passenger.

A comparison of the cost per passenger of the two services is given in the table below (note that dial-a-ride service is for FY 1979 and user-side service is for FY 1980):

	Cost per Passenger ($)	
Service Area	Third Quarter	Fourth Quarter
Venice		
Dial-a-ride	8.47	10.03
User-side subsidy	8.03	6.13
West Central		
Dial-a-ride	7.75	7.69
User-side subsidy	9.28	5.13

Third-quarter comparisons show that the average cost to the city for user-side subsidy service was $8.66 as compared to the average dial-a-ride cost of $8.11. The higher cost for user-side subsidy service was the result of start-up costs and low patronage. By the fourth quarter, the user-side subsidy patronage had grown considerably, resulting in an average cost of $5.63/passenger--approximately 60 percent of the average dial-a-ride cost.

There are some complexities about the two types of service that relate to the cost per passenger and its usefulness in comparing the services. Dial-a-ride service, as contracted by Los Angeles, is provided at a fixed cost per vehicle hour. Fluctuations in the number of passengers do not affect the total cost of the service but do directly affect the cost per passenger.

User-side subsidy service has a fixed administrative cost but a variable service cost associated with it. The cost per passenger for a user-side subsidy program does not drop as directly as the dial-a-ride program, because as the number of passengers increases the cost for coupon reimbursement also increases. However, at current costs, there are sufficient funds in the program to provide services to approximately 6,100 riders/month in West Central and 2,730 riders/month in Venice. This patronage is approximately twice the level of service provided by the previous dial-a-ride operations in those areas.

Service Aspects

Length of Trip

Dial-a-ride passengers are allowed to travel anywhere within, and up to 1.5 miles outside of, the service area boundaries. Little data are available on the average trip length of community transit service. An origin and destination study conducted by the Los Angeles Department of Transportation of the Venice dial-a-ride service determined an average trip length of 2 miles for that service area. Dial-a-ride service offers greater travel distances at a lower cost to the passenger (even at the increased dial-a-ride rates); however, there are boundary limitations. The miles per passenger data in Table 1 include deadhead mileage on dial-a-ride vehicles and therefore do not provide an accurate measure of actual trip length.

User-side subsidy service allows the rider to use coupons for up to a $5 fare, which is approximately 3.6 miles; however, there was no limit on the destination except that the passenger must pay cash for the fare in excess of $5. The user-side subsidy service allows the riders to travel greater distances at their option. The Department's records of the user-side subsidy services indicate an average trip length of 3.3 miles.

Response Time and Travel Time

Dial-a-ride service is a shared-ride type of system with a limited number of vehicles. It requires the vehicles to follow a circuitous route to load and discharge passengers. Therefore, passengers must be willing to accept a longer travel time than would be necessary for a vehicle going directly from point of origin to point of destination. The circuitous routing oftentimes results in delays in response time.

User-side subsidy service makes use of the existing taxicab fleet authorized to operate in the service area. In most areas of the city, several franchised companies and the two independent associations are available for telephone orders. In the West Central and Venice communities, five taxicab firms are authorized to serve passengers. Standard taxicab service usually provides a response time of 15 min, and service is direct from origin to destination, therefore requiring less travel time per rider.

Patron Satisfaction

Dial-A-Ride

A city monitoring report dated September 23, 1980, indicated that there was a considerable degree of dissatisfaction with the dial-a-ride service in the West Central service area. Some of the problems were related to operational efficiency and the ability of the system to meet demand, whereas others related to program design.

The most common complaint received from dial-a-ride users was failure to be picked up, either at the scheduled time or at all. Other problems included complaints that the telephone was busy or not answered and that orders were denied because the system was booked to capacity. The reason given by Yellow Cab Company was that service capacity was not adequate to meet the demand. From experience gained from the subsequent user-side subsidy service, it was apparent that the dial-a-ride service was underfinanced. The demand for good, efficient service was great in the West Central service area.

Other complaints were related to system design. Users complained often of not being able to travel to destinations outside the service area. Funding limitations prevented the expansion of the service area to alleviate this problem. Another problem was the difficulty users had arranging for the return trip from medical appointments. It was difficult to determine the correct pickup time in advance.

Regardless of the complaints, when the dial-a-ride service was replaced by the user-side subsidy program, the Department received many calls indicating how important the dial-a-ride service was to

many people and that it should not be stopped. Once the user-side subsidy service was implemented, however, the Department received few calls requesting reinstatement of the dial-a-ride service.

User-Side Subsidy

The Department received considerable favorable response about the user-side subsidy program. The major complaints were related to the inability of the program to cope with the large demands of the elderly and the handicapped community. Other complaints were related to the nature of the service provided by the taxicab companies.

Beginning with the first month of implementation of the user-side subsidy program in the West Central area, it became apparent that the community transit service for this area was underfinanced. An elaborate system of sites and subsites had been developed for the distribution of coupons. This system was dropped when the demand for coupons resulted in a complete sellout in the first week of the coupons allocated for the first month. This condition improved to the point that in the sixth month the coupons lasted until the third week of the month. The purchases of each patron had to be limited to one or two books per month.

The Venice service area did not have the same experience. The program had to maintain a constant publicity program to encourage sales and use of the coupons, and there were practically no limits on the number of books a person could purchase.

Other complaints involved incidents of uncooperative taxicab drivers. Some drivers were unpleasant, refused to accept the coupons, overcharged, complained about lack of tips, or made the users feel like second-class citizens. This type of complaint is handled by the Department's Regulation and Enforcement Division. Investigations are conducted and disciplinary action taken as appropriate.

In spite of the coupon limitations, the Department received considerable positive response about the program. The coupons sold in the West Central service area carried an August 31, 1981, expiration date. As the date approached, many users called to support continuation of the program. Many people said they used the coupons regularly, while others said they only used them occasionally. The only complaint was that they could not get enough coupons, but coupon shortage was not a reason for changing or dropping the program.

Program Monitoring

There are several aspects of the community transit programs that must be monitored for compliance with the program designs, contracts, and grant funding requirements. Monitoring involves verifying eligibility of users, quality of service delivered, dispatching records and vehicle use coupons submitted for reimbursement, coupon sales, and promotion of service.

Eligibility of Users

The predominant source of funds (Article 4.5) for community transit limits the service to elderly and handicapped residents of the service area. The verification of user eligibility for dial-a-ride service should be the function of the order taker. However, the dial-a-ride program design in Los Angeles does not provide for screening for eligibility. Therefore, verification of the users' eligibility fell to the drivers of the vehicles. There are no records to indicate whether anyone was turned down because of ineligibility. The only way to monitor the eligibility of users of this service was through spot-check observations.

Verification of eligibility for the user-side subsidy service is determined at the time the coupons are sold. Coupons are sold by various nonprofit agencies that deal with elderly and handicapped persons. In effect, the process of selling coupons does provide screening for eligibility before the provision of service.

Dial-A-Ride

Dial-a-ride services are designed to provide a specific number of vehicle hours of service. The number of vehicles operating each day must be verified. This can be done by verifying the driver log sheets (waybills), field checks, and dispatching records.

Dial-a-ride service is much harder to monitor. Much field work is necessary to adequately verify eligibility, vehicle use, and vehicle hours of service provided, and also to investigate complaints.

User-Side Subsidy

Venicle service is provided by existing taxicab and nonambulatory vehicle operating companies. Service is provided as requested, and the used coupons provide the means for verifying vehicle use. However, vehicles are not required to be dedicated or set aside specifically for this service. Payment is made only when service is actually provided and is based on the standard rate established for taxicab or nonambulatory vehicle service.

The Department has found that there are several checks built into the user-side subsidy program to prevent misuse and fraud. Lists of eligible users are maintained. Taxicab companies verify coupon use, as does the operating agency. Payments are made only when service has been used. The Regulation and Enforcement Division is used to investigate user complaints.

Under the user-side subsidy program, taxicab and lift-equipped van drivers are prohibited from questioning the eligibility of persons requesting service. However, they are requested to notify the administrator of the program of the Department of Transportation of any flagrant violations of eligibility; to date, none has been reported.

It is the opinion of the Department of Transportation that the transportation coupon program provides a greater degree of verification of eligibility than the dial-a-ride program.

CONCLUSIONS

The comparisons made in this paper would indicate that user-side subsidy service is far superior to dial-a-ride service. However, this is only true of the experience and service designs that have been used in Los Angeles. Both the dial-a-ride and user-side subsidy service designs have limitations.

The greatest shortcoming of the user-side subsidy approach is that it subsidizes exlusive taxicab-type service. Users are encouraged to ride together (group loading) in order to use their coupons more economically. However, no data have been collected to indicate that shared riding is occurring. On the other hand, dial-a-ride service is designed to achieve economies through prescheduling and group loading.

Dial-a-ride service in the Venice and West Central areas was operated by a taxicab company. The Department's experience indicates that taxicab com-

panies that use standard taxicab dispatching and scheduling techniques cannot achieve the type of efficiency that will result in a cost per passenger that is competitive with user-side subsidy programs.

Currently, even with limited funding, the user-side subsidy services operated in the Venice and West Central service areas are providing more than 2.5 times the number of trips at nearly one-half the cost per passenger as the previous dial-a-ride services.

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