

pool formation in companies that had shown an interest in vanpooling but had not implemented a company-operated program. Caravan also succeeded in establishing multicompartment vanpools.

This analysis provides benefit and cost data for determining the role of vanpooling in a comprehensive transportation policy. The benefits of the third-party program, as measured by user cost savings, far outweigh the portion of the program costs that is publicly funded. The program is relatively cost effective for achieving reductions in fuel consumption and vehicle emissions, compared with other transportation measures. However, because of natural market limits to potential vanpool growth, the total contribution toward achieving areawide energy and air quality goals is small (though, again, comparable to many other measures).

Third-party vanpooling is a relatively inexpensive program for government to support. Based on the findings of this analysis, policymakers could follow two different paths in deciding future government funding and involvement.

One line of reasoning is that, since the financial benefits of the program accrue to the users, government should discontinue subsidy after the program is nurtured to maturity. Since the anticipated subsidy is low (6 percent), its removal might not significantly decrease van ridership (depending on the demand sensitivity to price).

The second line of reasoning is that government should continue or increase its subsidy to the program so as to increase the potential for vanpools (again, depending on the demand sensitivity to price) and hence maximize the societal benefits. In this case, the interrelation of such a policy with transit policy should be analyzed carefully.

The policy determination should consider the full range of impacts of vanpooling and the cost-effectiveness, compared with other programs, toward achieving a wider range of areawide and corridor-specific goals. In either case, other actions could be taken that increase the potential for vanpooling. Government could implement automobile manage-

ment actions that would make vanpooling more desirable. The program can continue to pursue cost-reduction strategies, stress other factors in promotional activities in addition to cost savings, and market through a variety of channels (e.g., office parks, communities, and the general public, in addition to large employers).

#### ACKNOWLEDGMENT

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#### Abridgment

## Can Employer-Based Carpool Coordinators Increase Ridesharing?

JOANNA M. BRUNSO AND DAVID T. HARTGEN

The carpool coordinator is a company employee who forms carpools among employees by using personal, manual techniques. He or she is available to resolve ridesharing problems as well as to promote carpooling. This paper evaluates the carpool coordinator demonstration project undertaken by the New York State Department of Transportation in 1979 under contract to the New York State Energy Office. Six state agencies in the Albany, New York, area were used to set up a quasi-experimental design to test the effectiveness of the concept and to control for carpool formation that would normally occur because of rising gasoline prices and restrictions of supply. Before and after surveys in the six agencies were conducted in October 1978 and again in October 1979. The results show that in test agencies the carpool coordinators increased ridesharing substantially (10 percentage points), but ridesharing among control agencies rose only 3.5 percentage points during 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 were conserved by new carpoolers in all six agencies, an average of 283 gal of gasoline per year per carpooler. Of this, 101 000 gal is attributable to the carpool coordinator program. The direct cost of the project in the

three agencies was \$26 000. This produces an overall benefit/cost ratio of 3.9; however, the benefit/cost ratio for employees who commute long distances was 9.0.

The 1973-1974 and 1979 oil crises provided the impetus for carpool demonstration programs across most of the country. These programs consisted primarily of computer-matching procedures and a wide range of publicity measures. These programs did not result in a great increase in carpooling (less than one percentage point) and, once the restriction on the gasoline supply was lifted, many of these new carpools fell apart and many programs were abandoned (1,2). Some projects, however, continued to expand in scope and enlisted the support of major employers in their area. Most programs were unable to evalu-

ate their effectiveness in terms of new carpoolers induced to rideshare by the program itself. In the fall of 1978, estimates were that these programs had increased ridesharing to the extent of 1.1 percent of the areawide population (1).

Simultaneously, research into the motivations and attitudes of commuters toward carpooling (2-5) showed that carpooling is not basically an economic phenomenon but rather a complex social and psychological one. Most carpools are formed among acquaintances and friends, both at home and in the work place. Most people are not easily motivated to contact nonacquaintances provided by computer-matching lists and may shy away from doing so because of perceived difficulty in easily resolving problems that can arise in ridesharing situations. This research suggests that carpool coordinators who work within employer sites and use manual and personalized techniques to match employees and resolve ridesharing problems can have a more positive influence on the incidence of ridesharing than will conventional computer-matching techniques.

In recognition of the energy-saving potential in ridesharing, the New York State Energy Office (SEO) contracted with the New York State Department of Transportation (DOT) in mid-1978 to test the concept of the employment-site-based carpool coordinator. This demonstration was intended to be promoted by SEO and DOT throughout New York State as one of many actions to reduce the state's dependence on foreign energy resources. This paper describes the results of that study.

#### STUDY DESIGN

The purpose of the carpool coordinator demonstration project was two-fold:

1. By using state agencies as a test, evaluate the impact of carpool coordinators on the incidence and stability of carpooling in a white-collar working environment.
2. Evaluate the amount of energy that can be saved by this approach.

Approximately 36 000 state workers are employed at two major sites in the Albany area. One is the state campus on the Albany city outskirts, which is characterized by good access to urban expressways and arterials, infrequent transit service, and unlimited parking. The other is the downtown Albany Rockefeller Plaza, where transit is good, traffic more congested, and parking severely restricted. Within each site numerous state agencies operate, each as a separate entity that has a separate management structure. Thus the demonstration could be confined within specific agencies at each location. The participating state agencies were the DOT, Department of Labor (DOL), Department of Motor Vehicles (DMV), Office of General Services (OGS), Department of Health (DH), and the Department of Public Service (DPS). A quasi-experimental design that uses test and control agencies was developed. The test agencies appointed carpool coordinators; the control agencies did not. The design may be represented as follows, with the before and after observations taken from an employer survey.

Location	Agency	Carpool Coordinator Demonstration		
		Oct. 1978	Oct. 1979	Oct. 1979
State campus	DOT	X	X	X
	DOL	X		X
Rockefeller Plaza	DMV	X	X	X
	OGS	X	X	X
	DH	X		X
	DPS	X		X

A random sample of 200 employees was selected from each agency in the fall of 1978 and again in 1979. The observations at each agency serve to uncover significant changes in carpool formation or mode shift. Changes that occurred in the control agencies allow measurement of the effects of changes in the energy supply or price, political changes, or changes in the work environment (e.g., flex time) that have occurred in the period October 1978-October 1979.

#### PROGRAM DEVELOPMENT

Initially the concept of a carpool coordinator was that of an agency employee who works within each agency who would publicize and promote carpooling, hold small group meetings, relate on a personal level to those who desire help with carpool matchings, perform introductions, and resolve ridesharing problems. Within each test agency a current employee who has some other duties as well as appointed as carpool coordinator.

In February 1979, two employees hired with funds from the Comprehensive Employment and Training Act (CETA) of 1973 joined the project in DOT. The coordinating activities, under close supervision, were largely turned over to them. They engaged in a canvass of all DOT employees, beginning with a well-defined neighborhood approximately 15 miles from work. Their job was to promote carpooling, determine interest in carpools, match individuals, distribute lists of employees interested in carpooling, arrange introductions, and resolve problems. The most effective techniques in forming carpools were personal introductions and matching based on routes to work. All new carpoolers were called on a monthly basis to encourage communication with the program to offer assistance in problem solving and to keep records current.

#### SURVEY RESULTS

The results of the 1978 and 1979 surveys of the employees of the six agencies are presented in Table 1. Carpooling (the percentage of employees who drive with other employees) clearly increased during the past year, with the exception of the DH; however, the percentage of family members who ride to work together decreased or rose less significantly (DOT). The much greater increase in ridesharing in the test agencies (10 percent) as opposed to the control agencies (3.5 percent) shows the positive impact of the carpool coordinators and the existence of ridesharing promotional programs.

The percentage of employees who drive alone was greater on the state office campus, where parking is virtually unlimited. The higher incidence of transit use in the downtown agencies seems to suggest that, in the case of limited parking and energy constraints, transit will be used when it is available.

#### Energy Savings

Analysis of the survey results indicates that, over the course of the demonstration project, there have been no significant changes in the length of the one-way commuting trip, the one-way door-to-door commuting time, or the carpool automobile occupancy (6). If the one-way commuting distances and increases in carpoolers associated with each agency are combined, the result is an implied savings of 196 000 gal of gasoline or about 283 gal of gasoline for each new carpooler per year.

#### Effect of the Energy Crisis on Carpooling

The energy events of 1979 had a definite negative impact on the percentage of solo drivers among

Table 1. Mode to work.

Agency	Drive Alone (%)			Drive with Another Employee (%)			Drive with Family Member (%)			Transit (%)			Walk (%)			Other (%)		
	1978	1979	Δ	1978	1979	Δ	1978	1979	Δ	1978	1979	Δ	1978	1979	Δ	1978	1979	Δ
Campus																		
DOT <sup>a</sup>	54	42	-12	27	39	12	11	16	5	5	2	-3	3	0	-3	1	1	0
DOL	50	45	-5	25	32	7	18	18	0	6	4	-2	0	0	0	2	2	0
Plaza																		
DMV <sup>a</sup>	43	33	-10	27	41	14	13	8	-3	12	11	-1	3	4	1	3	4	1
OGS <sup>a</sup>	43	40	-3	28	32	4	14	11	-5	9	11	2	6	4	-2	0	2	-1
DH	41	37	-4	26	23	-3	16	16	0	11	18	7	5	4	-1	1	3	2
DPS	42	39	-3	34	35	1	10	5	-5	10	15	5	5	3	0	2	2	0
Percentage of entire survey	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

<sup>a</sup> Test site.

agency employees (the one exception is the DH; here, the inclusion of an additional group, formerly located in an area where parking was less restricted and transit less available, is shown to have increased both the percentage of solo drivers and the percentage of transit users).

The increase that occurs in the control agencies represents the increase that would have occurred due to the energy crisis had no carpool program been in effect. The table below indicates the effect of the energy crisis on the incidence of carpooling:

Agency	Change in Driving with Another Employee (%)		
	Campus	Plaza	Overall
Test	12	9	10
Control	7	-2	3.5
Increase attributable to carpool coordinator project	5	11	6.5

The difference between the incidence of carpooling in the test agencies and the control agencies, as shown in the table, represents the true effect that the carpool coordinators were able to realize--an increase of 5 percent on the campus and 6.5 percent overall. In view of the initial high incidence of ridesharing, this is a substantial effect.

MARKET SEGMENT ANALYSIS

In an attempt to determine which factors influence ridesharing, a computerized data analysis scheme known as AID (7,8) was used on the 1978 survey data. This analysis showed that, in general, demographic data are poor predictors of ridesharing. Nevertheless, four market segments based on distance and travel time to work were identified. The incidence of ridesharing was greatest among those who travel over long distances (>10 miles) and slower routes (>40 min) ("far slow"), and decreased among those who travel greater than 10 miles but take less than 40 min ("far fast"), those who travel between 3 and 10 miles ("medium"), and was least among those who commute 3 miles or less to work ("near"). This segmentation is useful in targeting the activities of the carpool coordinators as well as in interpreting the results of the attitudinal and cost/benefit analyses.

ATTITUDINAL ANALYSIS

In order to understand the underlying attitudes of carpoolers and solo drivers, the survey respondents were asked to describe their feeling toward 11

attributes of carpooling and driving alone: convenience, gasoline cost, travel time, safety, crowding, waiting for others, relaxing, parking costs, arriving for work on time, independence, and conversation during the commute to work. The employee indicated agreement with each statement on a five-position categorical judgment scale, where 1 means convenient and 5 means not convenient. For example, "Carpooling is ...", "Driving alone is ...".

The responses were divided into solo drivers and ridesharers and into test agencies and control agencies. An average score for each group was computed for each attribute. The 1979 response was then compared with that of 1978. In all instances the shift in attitude is small. The most consistent shift is found in the test agencies where the attitudes of the solo drivers and ridesharers toward the opposite mode have shifted to a more extreme value.

A second measure of attitude known as an overall carpool rating (CPRAT) was constructed for each respondent by summing the positive (i.e., 1 or 2) responses to each carpooling attribute. The average CPRAT was then calculated for each market segment for the test and the control agencies. Figure 1 displays the result in the change of the CPRAT with respect to the proportion of ridesharing. It is clear that the carpool coordinator activities have produced a positive shift in both attitude and the proportion of ridesharing. The similar slopes of these lines indicate that this effect has been uniform across all segments of the population. What is not clear is whether the change in attitude influenced an increase in carpooling behavior, vice versa, or both.

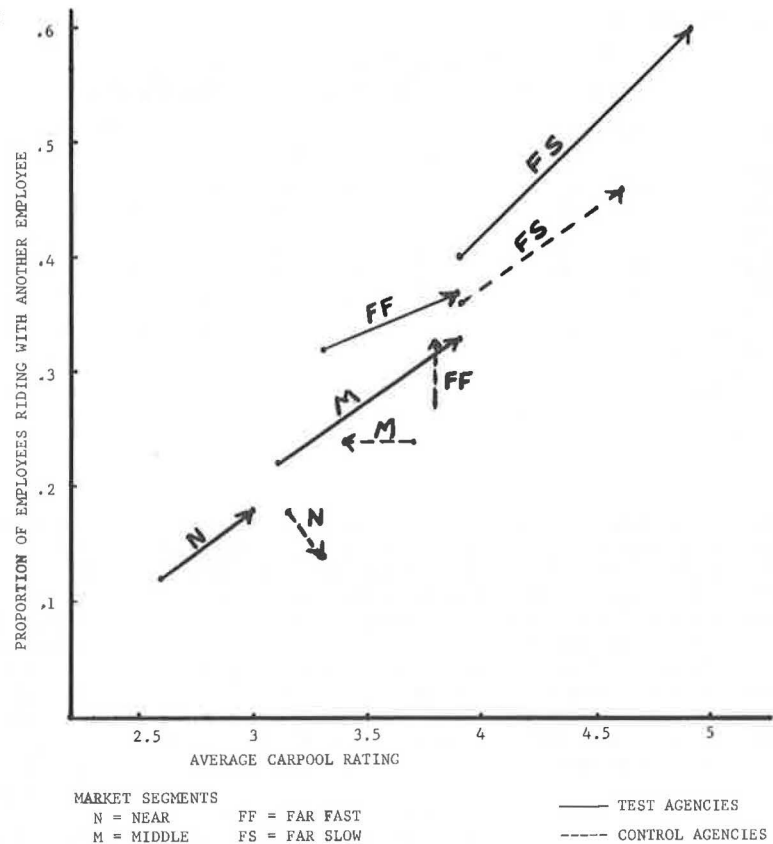
The inconsistent pattern in the control agencies contrasts with the effectiveness of the coordinators' action in the test agencies with the exception of the far fast segment. This again points out the need for additional research into this market segment to develop appropriate ridesharing strategies.

CARPOOL DROPOUTS

The 1979 survey asked the respondents to identify their usual modes to work in the fall of 1979 and in the fall of 1978. Tabulation of those who commuted to work in automobiles during both years indicates that the majority (86 percent) of employees did not change their modes of either ridesharing or solo driving. However, of those employees who switched, 60 percent converted from solo driving to ridesharing, but 40 percent reverted from ridesharing to solo driving.

Cross-tabulations of these four groups indicate that there is little correlation between socio-

Figure 1. Change in proportion of carpoolers versus carpool rating from 1978 to 1979 for each market segment.



economic variables and the decisions to join or leave carpooling. The key to carpooling longevity is found in attitudinal analysis.

When the attitude of each group toward carpooling is contrasted with the attitude toward driving alone, it becomes clear that the difference for the carpool dropout is more extreme than for even the confirmed solo driver. Although he or she recognizes the money savings aspect of carpooling, the carpool dropout is concerned about convenience, independence, crowding, and waiting for others. He or she puts less value on conversation during the work trip. Clearly, carpooling was an unpleasant experience.

#### COST/BENEFIT ANALYSIS

The cost of the demonstration project represents all salaries paid to DOT employees, including fringe benefits and overhead, additional costs for computer analysis, telephone installation, printing, supplies, and travel (\$38 578) plus additional funds (\$12 432) donated to the project by the test agencies through the services of the carpool coordinators and CETA employees. In total, the project cost \$51 010. The nature of a research project, which will lead eventually to implementation, is such that costs include literature research and analytical analysis to investigate hypotheses that lead to improvements of the program. As such, they would not normally be repeated if others chose to undertake the service. When these costs are subtracted from the program, which will leave salary costs for supervision and carpool coordinators, telephone, supplies, and tabulation of the preliminary and final surveys, the direct operational non-research-and-development cost of the study is \$26 092.

The benefits of the carpool coordinator project

can be measured directly by the benefits to the employees in the gallons of gasoline saved and the resultant dollar savings. Although many additional benefits result to the employee, employer, and the community, such as improvement in traffic flow, freeing up of parking spaces, and improvement in air quality, our survey did not address these issues. To determine the employee benefits, the average distance to work for the test agency employee who drives to work with another employee was calculated by market segments.

The direct operational costs of the program (total costs - research and development cost = \$26 092) were distributed across the market segment proportionally to the distribution of the 1978 employment population, as displayed in Table 2. The gasoline savings (computed by using a midsummer 1979 cost of \$1.00/gal of gasoline in the Albany area) were then reduced to 65 percent (6.5/10), the amount previously calculated as the direct effect of the carpool coordinator. Overall, within the test agencies the program resulted in a benefit/cost ratio of 3.9; the far slow market segment showed an extremely high payoff of 9.9.

The results of this analysis indicate that, even with the existence of a high degree of carpooling at an employee site, the investment of a vigorous ridesharing promotion campaign can result in savings for employees that are significantly greater than the costs of the program. Furthermore, when the attention of the coordinator is initially directed to those employees who have the greatest commuting distances and times, the program can return the investment rapidly.

#### CONCLUSIONS AND POLICY IMPLICATIONS

This study presents an evaluation of the carpool



Table 2. Cost/benefit of carpool coordinator demonstration by market segments.

Market Segment	1978 Population of Test Agencies	Direct Cost <sup>a</sup> (\$)	Avg One-Way Trip <sup>b</sup> (miles)	New Carpoolers	Gasoline Savings per New Carpooler <sup>c</sup> (gal)	Total Savings (\$)	Savings Attributable to Carpool Coordinator <sup>d</sup> (\$)	Benefit/Cost at 1.00/gal
Near	707	4 383	2.3	50	40	2 000	1 300	0.30
Middle	1470	9 112	7.8	167	136	22 712	14 763	1.6
Far fast	1075	6 664	17.1	118	298	35 164	22 857	3.4
Far slow	957	5 933	32.4	160	566	90 560	58 864	9.9
Total	4209	26 092	18.0	495	314	155 430	101 030	3.9

<sup>a</sup> Direct costs are distributed proportional to population.  
<sup>b</sup> Average one-way-trip distance for employees who drive with another employee.  
<sup>c</sup> Assumes 14.5 miles/gal, 220 days/year, 2 trips/day, 10 percent excess circuitry, factor to account for shared driving is  $(2.75 - 1)/2.75 = .64$ .  
<sup>d</sup> Amount is 65 percent of savings.

coordination project undertaken in six state agencies located in the Albany, New York, area. The study was undertaken under contract to the SEO and was evaluated to determine the effect of carpool coordinator activities on the incidence of ridesharing in a white-collar working environment and the resulting energy saving that can be attributed to such a project.

A quasi-experimental study design was developed by using three state agencies as test sites and three state agencies as control groups. Random sample surveys taken at the beginning and end of the project indicate that the incidence of ridesharing directly attributable to the carpool coordinators is 6.5 percent. The study concluded that a trained carpool coordinator, working actively within an employment site and using manual and personalized methods, can increase the incidence of carpooling significantly, even though the level of ridesharing was comparatively high at the beginning of the project.

Energy savings can be substantial. Approximately 195 000 gal of gasoline were saved by the increase in ridesharing in all agencies. Overall, each new carpooler attracted to the program can be expected to save an average of 283 gal of gasoline/year.

Cost-Effectiveness

The carpool coordinator method is extremely cost effective. The direct cost of the project within three agencies was \$26 092; the overall cost/benefit ratio was 3.9. Relative savings to employees are greatest among those in the market segment that commutes more than 10 miles and 40 min. Since benefits to employees can approach project costs rapidly among employees who have the greatest vehicle miles of travel, carpool coordinators are urged to concentrate initially on this market.

Interpretation of the shifts in attitudes of solo drivers and carpoolers in both test and control agencies demonstrate that the coordinator activities resulted in a positive shift in attitude as well as ridesharing in the test agencies. Although previous research suggests that ridesharing behavior is both influenced by and influences attitude, the extent to which this is true remains to be tested. Such an evaluation can serve to refine carpool coordinator techniques, company policies toward ridesharing, and marketing strategies by government to promote ride-sharing programs among employers within its jurisdiction.

Policy Implications

The following policy implications can be immediately drawn from this study:

1. Since ridesharing is basically a social

phenomenon, appeals based on pure economics are not likely to be successful. Government should emphasize that noncomputer informal approaches are more sensitive to personal concerns and more effective than mechanistic privacy-invasive techniques.

2. Money for the carpool project is not really necessary: What is needed is a strong commitment by employers to provide the service to their employees. Federal programs that emphasize the capital needs of ridesharing (e.g., park-and-ride lots) have their place but should not be pushed ahead of noncapital approaches.

3. The inability of ridesharing agencies to isolate the effectiveness of their programs has probably hurt the course of ridesharing by providing unrealistic goals that cannot be achieved. More care should be taken in program design such that various impacts can be isolated.

4. For greater cost-effectiveness, ridesharing programs should probably not be based on areawide campaigns but rather should focus on selected markets characterized by long commutes to major work sites.

5. Research into the social and psychological aspects of carpool formation and retention should be continued. Although much is known, much more can be learned from such research, particularly if coupled with carefully constructed demonstrations.

Although the carpool coordinator project has proved successful in its initial stages, three immediate effects remain to be tested. The project was undertaken during a period of rapid gasoline price increases and intermittent restriction of supply. These facts served to highlight the efforts of the coordinators. The project is being continued to determine the stability of the carpooling behavior of these new carpoolers. Can the program sustain its effectiveness and rate of growth through continued awareness and promotion and more-effective techniques? The program remains to be tested in other business environments under various combinations of white- and blue-collar workers.

Finally, since carpooling has been shown to be a psychosocial phenomenon rather than an economic one and long-term ridesharing behavior is formed most successfully among friends and acquaintances, the carpool coordinator concept should be tested at the residential level. Coordinator techniques must be developed and refined for this market. Evaluation designs must include tests to control for external economic and political forces as well as to contrast with existing employer-based carpooling programs. These efforts are now on-going and will be reported on in the future.

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New York State DOT and SEO. We, however, assume responsibility for any errors of fact or omission. This demonstration project could not have been accomplished without the assistance and cooperation of many individuals and agencies. We wish to express thanks to Wayne R. Ugolik of the Planning Research Unit for his assistance. Special thanks must go to the carpool coordinators, George Gaspard of OGS, Dee McCormack of DMV, Irene Reidy of DOT, and Richard Funk and Melvin Bellamy of Albany CETA for their earnest cooperation. In addition, we wish to acknowledge the many employees of the six agencies who responded to the survey, as well as the assistance of D.F. Whalen, OGS; A.D. Fine, DMV; B. Abruzzo and L. DiFibbio, DOL; E.F. Czajak, DPS; K.L. Jones and S.P. Krill, DH; and E.W. Swanker and S.P. Daly, DOT. The assistance of Diane Davis and Linda Unangst in typing this manuscript is gratefully appreciated.

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#### Abridgment

## Texas Vanpool Program

DONALD A. MAXWELL AND JAMES P. McINTYRE

The U.S. Department of Energy's annual report on state energy conservation programs for 1979 cites the Texas vanpool program as one of the most innovative programs in the nation. This report ranked Texas first nationwide in the number of official programs in existence (54) and first in the number of vans on the road (910). Between January 1978 and January 1981, the number of vans on the road increased by more than 900 percent. Vanpooling continues to grow in Texas, but not at the furious pace of 1000/year set during the last half of 1979. According to the January 1981 edition of the Texas vanpool census, there are 2008 vans on the road (with 34 more on order) at 122 sites as part of 103 individual programs. These 2008 vans carry 22 100 passengers, eliminate 16 000 cars from the road, and save 8.12 million gal of fuel each year. These vans represent an investment of \$20 million in private capital. This paper attempts to explain how and why the Texas vanpool program grew from 14 vans in 1974 to the present totals.

The Texas vanpool program is best defined as a cooperative effort involving the Texas Energy and Natural Resources Advisory Council (TENRAC) and the Texas Transportation Institute (TTI), about 100 vanpool program coordinators (almost all in the private sector), and various other state agencies. The roles of TENRAC and TTI have been to provide a focal point for technical assistance and information exchange and to persuade other organizations to initiate programs. The Texas Railroad Commission, Department of Public Safety, Department of Highways and Public Transportation, and State Board of Insurance all support the program.

The key to the success of the program, however, has been the willingness of farsighted employers to accept that they have a stake in how their employees get to work. These employers established programs at their own facilities, and many of the early van-

poolers have played a significant role in promoting the vanpool concept. Under the leadership of the Houston National Association of Vanpool Operators (NAVPO), Houston is now the "vanpool capital of the world" and has 1511 vans at 60 sites.

The basic strategy of the program has been to create a vanpooling community that embraces all active participants without creating a vanpooling bureaucracy to get in the way. The idea is to enlist as many salespersons as possible to market vanpooling at every opportunity--not to set up a tsar of vanpooling to market a specific house brand.

The remainder of this paper describes how the Texas vanpool community emerged and gained the position of prominence it now enjoys. Included is a short review of the history of Texas vanpooling (1974-1977), the recent period of rapid growth (1978-1980), and a description of how we attempt to coordinate a statewide effort.

#### BEGINNINGS: 1974-1977

Contrary to some published reports, the first Texas vanpool program was implemented in Dallas, not Houston. Texas Instruments initiated their first program with 9 vans in March 1974 at their main facility. By the end of 1977, this program had grown to 14 vans. The next program in Dallas was a one-van pilot program initiated by Crum and Forester Insurance Company in 1977.

Although Dallas had Texas' first program, the focus of vanpooling quickly moved from Dallas to Houston. The primary reason for this shift was the