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## Van Pooling—New Dimension in Urban Transportation: Results From Two Operational Programs

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The results are described of two experimental, commuter van-pool programs—the Tennessee Valley Authority employer-based program and the Knoxville commuter pool areawide program. The two are compared with each other and with other van-pool programs in an attempt to assess the effectiveness of van pooling on employer and community levels. Van riders and drivers for both programs were surveyed to obtain user profiles and identify the factors felt to underlie the success of the programs. The survey found van pooling to be acceptable to a wide range of individuals, both male and female, representing a broad spectrum of income and occupation. The Knoxville commuter pool vans were found to be operating at various employment centers and successfully mixing employees of different companies in the same van. The survey also found that the two programs have had different success rates in reducing the number of commuter vehicles: Each Tennessee Valley Authority van was replacing 6.1 vehicles, and each Knoxville commuter pool van was replacing 4.5 vehicles. These results are extremely important for the estimation of the reduction in energy and vehicle travel that can be achieved from van pooling and suggest that local assessment must be made with care.

Traditionally, transportation planners have been concerned with providing a supply of transportation facilities to accommodate future levels of travel demand. However, recent events such as the energy crisis, the limitations being imposed on public agencies to finance capital improvements, and the costs of labor-intensive transportation services are leading to a reevaluation of these established transportation concepts. Today, greater consideration is being given to short-range actions that respond to immediate travel needs. Ride sharing is such a strategy as it attempts to increase occupancies through bus, van, and car pooling.

Knoxville, Tennessee, is the site of two experimental commuter ride-sharing programs. At the Tennessee Valley Authority (TVA), the largest employer in downtown Knoxville, an employer-based, commuter ride-sharing program stressing regular and express buses and van and car pools has been active since late 1973.

At present, efforts are being undertaken by the Knox-

ville transportation brokerage demonstration project to extend ride sharing to the community as a whole by creating a transportation brokerage service. The brokerage concept is somewhat unusual in public transportation in that the broker attempts to match individual mobility needs with the available supply of transportation, thereby altering riding habits and achieving more productive use of vehicles and facilities. The service is being operated by the Office of Public Transportation Services of the city of Knoxville and is funded by a 20-month Urban Mass Transportation Administration methods and services demonstration grant. The commuting function of this program is called the Knoxville commuter pool (KCP).

#### OBJECT

The object of this paper is to highlight the relative success and impact of the KCP and TVA commuter van-pooling demonstration programs, describe comparative ride-sharing user profiles, and identify the factors felt to underlie the success of these programs. Comparisons are also made with other van-pooling programs to identify the effects of various market segments on van pooling.

#### TVA COMMUTER POOLING DEMONSTRATION PROGRAM

In 1974, when TVA combined its offices into a new twin tower complex, 1300 downtown parking spaces were lost. In response, TVA management elected to use a ride-sharing solution, oriented around an earlier success of express buses, rather than initiate a massive downtown-parking construction program. Effective January 1975, TVA employees were reimbursed for travel by bus (express or regular fixed route) or van and car pools. For example, the commuter pooling program reimbursed bus

Table 1. Mode to work of TVA work force.

Date	Work Force	Mode to Work (percentage of work force)				Van Pool, Bicycle or Walk
		Drive Alone	Ride Bus	Car Pool		
November 1973	2950	65	3.5	30	1.5	
December 1974	3000	42	14	40	4	
January 1975 <sup>a</sup>	3100	30	23	42	5	
January 1977	3400	18	31 <sup>b</sup>	41	10 <sup>c</sup>	

<sup>a</sup> First month of commuter pooling demonstration.

<sup>b</sup> Approximately 3 percent on express buses and 28 percent on regular buses.

<sup>c</sup> Approximately 7 percent van pooling.

riders for one-third the cost of the commuter bus ticket. Car poolers (defined as three or more riders) were issued a \$5/month municipal parking ticket and van poolers were credited in the amount of \$3 to \$11/month for each employee participating in the TVA credit union van-pool program (1).

Another part of the program was the establishment of the position of a transportation coordinator to assist employees in forming van and car pools and in negotiating services with public and private transit operators, and to administer the reimbursement program through the credit union.

The TVA van-pool program is operated through the credit union, which owns the vans and in turn leases them to the drivers. Leases are set up so that drivers receive a free ride to work for driving the van. Lease rates are established based on round-trip travel distance and the number of riders in the van. Vans are discontinued when the number of riders drops below 6 and an additional monthly charge of \$4/passenger is charged when the number of riders falls below 10.

Drivers are responsible for driving the van to and from work, collecting fares from riders, maintaining a minimum number of riders, and seeing that the van is maintained and kept clean. Maintenance, gasoline, and oil costs are charged directly to the credit union and when necessary a backup van is provided.

In this program, the van drivers receive no monetary incentive to drive. They do not have the opportunity to retain any fares over a minimum ridership and thus receive only a free ride to and from work. They are encouraged not to use the vans for personal use, but are given a 320-km (200-mile) monthly allowance for taking the van in for maintenance and cleaning. This allowance provides some indirect incentive to drivers, but in the case that they exceed the limit, they are charged a rate of 6¢/km (10¢/mile).

The impact of the commuter pooling program was immediate and dramatic. As shown in Table 1, during the 3 years since initiation of the first express bus, the use of bus transportation has increased from 3.5 to 31 percent of TVA's downtown work force, and the proportion of single-occupancy vehicles has decreased from 65 to 18 percent. The incentive program has been continued and expanded to include 18 vans and 24 express buses.

#### KNOXVILLE TRANSPORTATION BROKERAGE SERVICES

There are many reasons for the success of the TVA program, but among the key factors is the transportation brokerage service provided by the transportation coordinator. Since many firms are too small to support a full-time brokerage operation and many employers and employees have not yet recognized the benefits to be derived from ride sharing, the Knoxville Transportation Brokerage Service (KTBS) was initiated in Janu-

ary 1976. The KTBS broker works on a communitywide basis and deals with a range of travel needs.

Brokerage services are different from traditional transit planning because they identify transportation demand on an individual-traveler basis rather than through aggregate statistics. Demand is identified through a general public market analysis and by working with employers to survey individuals within organizations having specific travel needs. The broker also identifies specific transportation suppliers who can fill these needs. A unique aspect of the KTBS program is that 51 seed vans are available to the broker to introduce a new commuter mode—van pooling—to the public. These vans are provided to demonstrate that individuals can operate their own successful van pools with assistance from the broker. Thus, the broker is absorbing the risk involved in permitting commuters to test a new transportation concept.

One of the most important aspects of the Knoxville van-pool program is that the vans are being introduced on a communitywide basis rather than on the more common basis of a single employer. Through this approach, planners will be able to investigate how successfully van pooling is received by the entire community and discover the segments of the commuter market that respond more favorably (2).

Initially, the broker has concentrated efforts in the areas of

1. Overcoming the institutional barriers that hinder implementation of a communitywide ride-sharing program,
2. Increasing the awareness of employees and commuters for ride-sharing opportunities by developing a comprehensive commuter data base, and
3. Organizing the 51 seed vans.

#### Institutional Barriers

Two areas that initially hindered the KTBS were those of regulation and insurance. Before the broker could implement the seed-van program, permission had to be received from the Tennessee Public Service Commission to exempt vehicles carrying 15 or fewer passengers and used for commuting purposes from all regulations except those pertaining to insurance and safety. Also, satisfactory insurance rates had to be negotiated to make van pooling competitive (3). Only recently have insurance rates been established for multiple use of the vans, so that social service agencies can use the vans during noncommuting hours. Although the effects of the broker's efforts in overcoming the institutional barriers to ride sharing cannot be assessed quantitatively, they were vital to the foundation of the program. Without regulatory exemption and the elimination of excessive insurance rates, an environment in which ride sharing can occur cannot be created.

#### Data Base Development

In the KCP survey program, the benefits of ride sharing were outlined to 520 firms in the Knoxville area. Approximately 300 firms allowed KCP to survey their employees' travel patterns. Each employee was asked his or her home origin of the regular commuter trip, regular work hours, and degree of interest in ride sharing as (a) driver only, (b) shared driver, and (c) rider only. The surveys enabled the broker to determine the commuting potentials of the work force for various ride-sharing modes. The survey forms were then coded and computer matched to identify possible ride-sharing arrangements among groups of employees

within a firm and among nearby firms. A data file containing more than 18 000 travel records was accumulated. Each individual participating in the survey received a computer-matched list identifying other individuals living within a 1.6- by 1.6-km (1- by 1-mile) zone, traveling within the same 15-min time period, and going to the same destination zone. In areas and at times where few matches were available, the home origin was expanded to the surrounding 20-km<sup>2</sup> (8-mile<sup>2</sup>) area.

Concurrently, the broker used the media to aggressively market ride sharing to the community. There was an extensive television, radio, billboard, and newspaper advertising program that stressed a telephone number that individuals could call for ride-sharing matching information. A survey at the end of this program found that 72 and 46 percent respectively of the commuter population were aware of KCP and knew how to contact the broker.

### Seed-Van Program

KCP vans are leased to individuals having a one-way commuting distance greater than 24 km (15 miles). The monthly lease rate is based on the daily round-trip commuting distance and computed on the basis of eight paying riders for 12-seat vans and nine paying riders for 15-seat vans. This rate structure allows the driver to ride free and, if desired, keep those fares above the minimum limit. Rates are negotiated between driver and riders in a free marketplace and are often cut if suggestions lead to increased profitability by increasing volume. In a few cases, drivers have switched from 12- to 15-passenger vans in an effort to lower rates and attract more riders and thus increase profit.

In the lease agreement, KCP is responsible for all maintenance, repairs, tires, and taxes and reimburses the driver for gasoline and oil. The KCP also makes available a backup van and provides sufficient insurance coverage.

In many cases, drivers attempting to form van pools are unable to obtain the minimum passenger load because riders are hesitant to commit themselves before the van is operating. Thus, if a driver has five or six riders, the van is leased on a trial basis, and the first month's lease is computed on the basis of the reduced number of paying passengers. The trial program has worked well; many riders have started to van pool once the van has started operation. Of the 39 vans that were started in the trial program, 28 (72 percent) continue to operate.

### KCP Van-Pool Results

The primary method of promoting the seed vans has been through surveying employee travel patterns at the site of employment. In this procedure, employees are given information describing van pooling and the benefits that can be derived from riding or driving a van. In these surveys, 1321 individuals (8.9 percent of those completing a survey) expressed an interest in becoming van drivers. An additional 275 individuals have expressed interest in driving a van in response to television, radio, billboard, and newspaper advertising.

At present, KCP is operating 47 van pools—43 with 12-passenger vans and 4 with 15-passenger vans. These van pools are hauling more than 500 commuters and serve 15 different firms. Of the 47 van pools operating, 12 are composed of passengers who work at different firms. These pools are concentrated in the central business district and University of Tennessee area and demonstrate that van pooling can be successful on an intercompany basis.

Many van pools had to be terminated within 30 to 75 d of initiation when the minimum load of eight individuals could not be achieved. Termination is consistent with the concept of seed vans as an experiment. The turn-overs suggest that the concept is working well with much experimentation taking place. Some of the pools that initially failed were reinstated with a new driver, but the same nucleus of riders. The key elements in the formation of a van pool are identifying a concentration of individuals through the assistance of the matching list, spreading the idea by word of mouth among co-workers and, most important, locating an enthusiastic driver willing to make contacts and market the vans.

The longest KCP van-pool trip has a one-way distance of 120 km (75 miles), and the shortest is 24 km (15 miles) one-way. The average one-way trip for vans with Knoxville destinations is 58 km (36 miles) and for vans with Oak Ridge destinations, the average distance is 55 km (34 miles).

By comparison, unsuccessful van pools had on the average 49-km (30.5-mile) one-way trip lengths, thus indicating that distance by itself is not a reason for an unsuccessful van pool.

### KCP Van-Pool Driver and Rider Characteristics

The characteristics of KCP van riders can be divided into two segments—one for Oak Ridge vans and the other for Knoxville area vans. This division was made to highlight any differentiation between the two segments because of the different work forces and the extensive spatial separation of the Union Carbide (Oak Ridge) plants from neighboring residential areas. These rider characteristics were obtained through a self-administered mail survey sent to the members of each van pool approximately 2 months after the van had begun operation.

Table 2 shows that van poolers are not limited to certain occupations or income levels, but are well distributed over a broad spectrum of socioeconomic characteristics. This then gives positive indications of the acceptance of van pooling across a range of employees. The differences between Knoxville and Oak Ridge vans can be attributed to the different nature of the work forces. The majority of KCP van pools have a mixture of professional and technical workers, craftspersons and foremen, and laborers. In a few cases, the riders are all in one category because of the dominance of that occupation at the work site. Van pooling also appeals to both males and females; of the 47 KCP vans, 41 have a mixture of male and female riders with an average of 6.8 male and 3.8 female riders/van. The riders of the remaining 6 vans are all of one sex because of the nature of the work force (construction workers, sewing machine operators). The riders are predominantly noncaptive and have been making this same home-to-work trip for approximately 8 years.

Many riders have chosen van pooling to reduce the cost and inconvenience of driving each day while also conserving gasoline, and many have chosen it so that their vehicle can be made available for someone else to use during the day. The major dislikes about van pooling are not being able to leave work early and not being able to work overtime on short notice. It is impressive that 44 percent of KCP van riders have no dislikes about van pooling.

Table 3 gives an indication of how van poolers are picked up by the van in the morning. One interesting result is that more riders in Knoxville vans are picked up at their homes, but Oak Ridge vans have more riders meeting at pickup points. The average distances to pickup points are 4.8 km (3.0 miles) for Oak Ridge vans and 4.0 km (2.5 miles) for Knoxville vans. These distances may explain the greater use of pickup points by Oak

Table 2. Characteristics of van-pool riders in percentages.

Characteristic	Knoxville Vans (n = 95)	Oak Ridge Vans (n = 199)	Total KCP Vans (n = 294)	TVA Vans (n = 176)
Number of vehicles available for travel to work				
None	13.0	4.1	7.0	1.7
One	48.9	46.9	47.6	33.1
Two	30.4	40.2	37.1	53.3
Three or more	7.7	8.8	8.3	10.9
Annual household income, \$				
<4 000	7.9	0.6	2.9	1.2
4 000 to 8 000	28.9	5.4	12.8	6.9
8 000 to 12 000	22.4	24.1	23.6	10.0
12 000 to 16 000	25.0	36.7	33.1	18.8
16 000 to 20 000	9.2	18.1	15.2	23.1
>20 000	6.6	15.1	12.4	40.0
Occupation				
Professional or technical	5.6	18.5	14.2	30.4
Managerial or administrative	8.9	4.9	6.2	19.4
Clerical	13.2	12.6	12.8	29.2
Craftsperson or foreman	22.2	38.0	32.8	19.0
Operator (nontransportation)	21.2	0.5	7.3	0.0
Laborer	27.8	21.7	23.7	1.2
Service worker	1.1	3.8	2.9	0.0
Sex				
Male	45.9	76.9	64.0	66.3
Female	54.1	23.1	36.0	33.7
Average time in van pool, months	2.2	2.6	2.4	11.6
Average time of making the trip, years	7.9	7.7	7.8	5.7
Average one-way trip length, km	41.9	58.0	45.1	35.1

Note: 1 km = 0.6 mile.

Table 3. Mode of travel to pickup point in percentages.

Mode	Knoxville Vans	Oak Ridge Vans	Total KCP Vans	TVA Vans
Dropped off by automobile	12.4	7.7	9.2	7.6
Parked automobile at pickup point	30.3	51.8	44.7	45.6
Picked up at house	46.1	31.9	36.4	32.3
Walked	11.2	8.6	9.7	14.5

Table 4. Characteristics of van-pool drivers in percentages.

Characteristic	KCP Vans (n = 18)	TVA Vans (n = 17)
Number of vehicles available for travel to work		
None	5.6	17.6
One	27.8	47.1
Two	55.6	29.4
Three or more	11.0	5.9
Annual household income, \$		
<4 000	0.0	0.0
4 000 to 8 000	0.0	0.0
8 000 to 12 000	6.7	5.9
12 000 to 16 000	46.7	35.3
16 000 to 20 000	13.3	23.5
>20 000	33.3	35.3
Occupation		
Professional or technical	23.5	41.2
Managerial or administrative	11.8	17.6
Clerical	0.0	17.6
Craftsperson or foreman	52.9	23.5
Operator (nontransportation)	5.9	0.0
Laborer	5.9	—
Service worker	—	—
Sex		
Male	83.0	93.8
Female	17.0	6.3
Average time in van pool, months	3.8	13.5
Average time of making the trip, years	8.0	5.3

Ridge vans in that their riders may be more dispersed about the residential area, which makes home pickup more time consuming. This locational dispersion also affects the reduction in vehicle travel of van pooling and the necessity of owning an automobile to get to the pickup point.

Table 4 shows that the KCP van drivers tend to have higher incomes and job statuses than the van riders and have been making the trip for about the same length of time, 8 years. Of the 47 vans, 8 are driven by women and 13 are driven by minority members. An interesting characteristic of van drivers is that 88.9 percent were previously in car pools and thus already had ride-sharing experience.

As of June 30, 1977, there had been 82 different KCP drivers of whom 47 were still driving, 2 had bought their own vans for commuting, 9 had been replaced by other drivers with the same nucleus of riders, 3 were driving vans that were temporarily leased to social service agencies, and 3 were driving vans that were leased to two different companies in rural areas to see whether their employees would like van pooling. Thus, only 18 drivers (22 percent) who attempted to organize van pools were unsuccessful.

When the failure of these 18 was investigated, two predominant causes were found. First, those drivers typically were less enthusiastic about making contact with potential riders and generally made little effort to market their vans. Second, in some cases, even enthusiastic drivers had few potential riders to contact.

#### Vehicle Travel Reductions

The question of modal change and reduction in vehicle travel (VT) that will result from van pooling is answered in Table 5. The two KCP segments have different characteristics. The higher previous rate of car pooling of the Oak Ridge van poolers can be explained by their longer trips [the average one-way distance of the Oak Ridge poolers is 58 km (34 miles), while the average one-way distance of the Knoxville poolers is 42 km (26 miles)].

These modal changes from car pools to van pools can be expected to occur in the initial stages of forming van pools and should not be alarming. The important finding of the differences between the two KCP segments emphasizes the effect of the remoteness of the work site from residential areas on the number of vehicles no longer being used for commuting. In the case of the KCP vans, the major shift was from car pools and has resulted in 210 vehicles no longer being used for traveling to the work site (an average of only 4.5 vehicles/van). The removal of these 210 vehicles has resulted in daily reductions of 16 180 km (10 056 miles) of VT and 1920 L (670 gal) of gasoline and a daily average cost saving of \$2.06/person.

#### COMPARISON WITH TVA VAN POOLERS

To gain a better understanding of van riders and drivers and the resulting impacts of van-pool programs, the TVA van poolers were compared with the KCP van poolers by using the same survey form. Direct comparisons could not be made because of differences in the work forces, but when their likes and dislikes of van pooling are compared, the two groups are basically similar. TVA riders and drivers, however, do like the increased availability and reduced cost of parking, but this is mainly due to their downtown location. TVA van poolers dislike not being able to leave work at any time and mention this problem almost twice as frequently

Table 5. Mode before van pooling by percentage of van poolers.

Previous Mode	Knoxville Vans	Oak Ridge Vans	Total KCP Vans	TVA Vans	Conoco Vans	3M Vans	Golden Gate Vans
Bus	0.0	0.0	0.0	11.2	0.0	0.0	49.0
Car pool	38.3	63.1	58.4	35.5	55.0	46.0	26.0
Drive alone	50.0	35.9	36.3	45.0	42.0	49.0	21.0
Drive with other family members	5.0	0.5	2.5	2.4	0.0	0.0	0.0
Other	6.7	0.5	2.8	5.9	3.0	5.0	4.0

as KCP van poolers, but this higher response may largely be attributed to their longer experience with the inconvenience.

The major difference between the two programs is in the mode of travel before van pooling. In the case of TVA riders, a greater proportion previously drove alone than car pooled. The TVA vans have one-way commuting distances of only 35 km (22 miles), but the primary reason for the low car-pooling rate is the higher income and professional status of these riders and the greater number of vehicles they have available for traveling to work. This higher drive-alone rate has resulted in 110 vehicles being no longer used for commuting (an average of 6.1 vehicles/van).

#### COMPARISON WITH OTHER VAN-POOL PROGRAMS

Comparing the KCP and TVA van-pool programs with other programs can be done in only a few areas because rider surveys are not available.

The major area of concern for which data are available is the method of travel before van pooling. The results of the Conoco and 3M Company programs in Houston and Minneapolis respectively (as given in Table 5) show results that are similar to those of the TVA program (5, 6). This probably can be attributed to the fact that all three have a majority of professional, higher income employees who enjoy greater mobility and the ability to drive their own automobile to work. Thus, these three programs on the average replace 6 vehicles/van. When the previous mode used by van poolers in the Golden Gate corridor is examined, a different set of results emerges (7). The bus mode is the dominant previous mode (49 percent). This diversion was the result of decreased travel time by van as compared to bus. These surveys suggest that when estimating the expected results of a van-pool program on VT reduction and energy conservation, one must look closely at area employment centers, their spatial relation to employee residences, the types of employees involved, and the extent of transit service in the area.

In the cases of Conoco and 3M, the vans are serving only one company and not carrying riders of other firms. In the Golden Gate corridor, on the other hand, 17 of the 18 vans are carrying riders who work in different firms. These intercompany vans are once again a positive indication of the potential of van pooling in areas having a cluster of small employers.

In all of these programs, van poolers are happy with van pooling and have few complaints.

#### SUMMARY

The TVA commuter pooling demonstration project and the KCP have done much to foster areawide appreciation of and experience with van pooling. The demonstration project introduced a new mode of commuter transportation—van pooling. At present, 47 KCP and 18 TVA vans are operating daily in Knoxville and serving more than 700 commuters working in 16 different firms. As 39.5 percent of the van poolers formerly drove alone, the

programs have eliminated 22 809 km (14 176 miles) of VT daily.

The results from the two van programs suggest some important findings concerning the potential market for van pooling. First, van pooling, due to economic constraints, is generally felt to be attractive for one-way commuting distances greater than 24 km. In the KCP, 85 percent of the van pools had one-way trip lengths greater than 40 km, and 58 percent were in the range of 40 to 56 km (25 to 35 miles). This indicates that the differential in travel cost by van versus that of driving alone is not sufficient to compensate commuters for the inconveniences created by van pooling for distances less than 40 km. In the case of TVA vans, where travel costs are higher because of downtown parking charges, 50 percent of the vans have one-way commuting distances less than 40 km. Thus, specific elements of the TVA program (such as parking charges, traffic congestion, increased travel time due to pickup and delivery, and incentive programs) may encourage employees with shorter travel distances to van pool. No one cause can be singled out, but all relevant factors should be considered when marketing a van-pool program.

Second, van formation has more potential and is easier to arrange at large employment centers, preferably those involving a single large employer. Although the experience in Knoxville indicates that vans can operate with riders drawn from various employers, the ease of forming and maintaining the pool is much simpler if only a single large employer is involved because of compatibility in work times, closeness of work site (reduced travel time and cost), and the ability to recruit new riders easily.

Third, no one particular type of occupation appears to be attracted to van pooling. KCP vans are serving a variety of occupational classes including manufacturing-plant, hospital, central business district, and university-area workers. Van pooling is acceptable to a wide range of individuals. The mixing of both males and females representing a broad spectrum of income and occupations in the same van has been received quite favorably.

For planners, it is important to recognize the potential contributions of van pooling. It is also important to note alternative delivery systems available—both employer-oriented and communitywide brokerage programs. The success of these programs in diverting the solo driver from the automobile will vary by type of employee, the extent of transit service available, and the spatial relation between employee residences and work site, and care must be taken when projecting the expected energy and VT reductions of van pooling.

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## Evaluation of an Employer-Based Commuter Ride-Sharing Program

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The commuter ride-sharing program developed by the Tennessee Valley Authority for its employees in Knoxville, Tennessee, uses a variety of transportation modes—express buses, van pools, and car pools. The program has been very successful with 2686 employees (79 percent of the total work force of 3400 employees) participating. The program has different implications for the employer, the employees, and the community; these implications for each interest group are quantified in terms of benefits and costs. The analysis shows that by supporting the ride-sharing demonstration program, the employer was able to avoid the cost of constructing a new parking structure for the employees and that the resulting annual savings are larger than the annual cost of the subsidies to the program that are paid as an incentive to participating employees. From the standpoint of the employees, the program resulted in a substantial reduction in commuting costs. The reduction in fuel consumption that can be attributed to ride sharing was quantified, and the consequences in terms of improved traffic operating conditions along a major travel corridor and the favorable impact on the local transit system were examined.

The traditional approach in transportation planning has been to increase the supplies of transportation facilities and services to match the growing levels of travel demand. Recent events and trends, such as the energy crisis and the fiscal constraints faced by public agencies in financing capital improvement projects, have led to a reexamination of this approach. Today, a greater emphasis is being given to transportation alternatives that can respond to the immediate travel needs and achieve greater use of the facilities and services already available to a community. Among the examples of such alternatives are promoting the use of high-occupancy vehicles such as buses and vans and increasing the occupancy of private automobiles.

Many communitywide demonstration projects on car pools and van pools, sponsored by public agencies, have been implemented across the country, and there are also several ride-sharing programs that have been developed and supported by private employers for their own employees. One of the employer-based programs, which has received national attention, is the commuter-pooling demonstration program of the Tennessee Valley Authority (TVA) in Knoxville, Tennessee. These programs have apparently been successful, but there is a lack of readily accessible data on their benefits and costs. With the increased interest in such programs, questions are being asked about the effectiveness of those already imple-

mented, and it is appropriate to develop the needed information. The object of this paper is to quantify the benefits and costs and identify the nonquantifiable implications of the TVA program.

#### PROGRAM DEVELOPMENT

The commuter ride-sharing program in Knoxville evolved gradually over 3 to 4 years (1973 to 1977). Before the inception of express buses and van pools, TVA employees participated in ride sharing primarily in the form of car pooling and to a lesser extent through the use of regular bus service. The first proposal for an express bus was made at a citizens' meeting with city traffic engineers and planners in West Knoxville. The citizens were concerned about the traffic congestion on I-40 and that sole reliance was being placed on the automobile to meet all current and future needs in the corridor. The group represented an area that had a large concentration of TVA employees, and they seriously pursued the proposal for an express bus.

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

A major change in the ride-sharing program occurred in January 1975, when the TVA incentive program, which was called the commuter pooling demonstration program, was initiated. This incentive plan called for

1. A one-third discount on commuter bus tickets,
2. Issuance of a \$5/month municipal parking ticket to each bona fide car pool (defined for this purpose as a group of three or more riders including at least two TVA employees),
3. Credit to van-pool accounts of \$11/month for each TVA employee participating in the van pool, and
4. Reimbursement to handicapped employees for the direct cost of parking in a commercial lot convenient to their place of work.