A number of metropolitan commuter ride-sharing programs have been instituted. Car pooling is the most common form of prearranged ride sharing. Van pooling is a more recent development involving private companies sponsoring pools involving larger vehicles or vans. Subscription express bus services to specialized work locations have also become more frequent. These urbanwide programs can be viewed not solely as a reaction to the oil embargo of 1973-1974 but as a positive response to a number of urban transportation needs. The oil embargo served as the catalyst to accelerate the emergence and growth of these activities and to provide the initial funding.

Pooling programs have succeeded in large and small cities, in large and small companies, and among white and blue collar employees. They are increasingly effective as the length of the commuter trip increases. In fact, the average van-pool trip is 25 miles one-way; approximately 80 percent of conventional commuter transit trips are less than 10 miles one-way.

All pooling programs seek to close the information gap that exists among commuters. How do employees find convenient pools when they know only a small percentage of the employees at a site? How does an employee finance a $7,000 van and overcome the regulatory or institutional difficulties for a van pool? Many programs provide an organizational or management focus for the individuals involved in various types of pooling modes.

Individual pooling programs have been able to reduce commuter vehicle miles of travel from 5 to 40 percent, but we still lack knowledge about the full potential of pooling for all urban areas. The van-pooling program of the 3M Company, has had a constant demand for an additional 10 to 20 van pools throughout its 2 1/2-year history. This demand continued even as the van-pool fleet expanded from 6 to 75 vans and the car-pool and bus ridership remained constant. We simply do not know the full potential of this pooling arrangement.

Car pools now carry more than 25 percent of the commuters. This figure can certainly be expanded substantially with proper development and marketing of all pooling options, i.e., car, van, and bus pools. Determining overall pooling potential may cost $10 million per major urban area, but that represents only a fraction of the dollars required to build a mile of urban freeway or fixed rail. Portland and Knoxville, the first cities to have pooling programs, achieved excellent returns on the public investment. For example, Portland's $215,000 car-pool project saved consumers a minimum of $1.8 million in gasoline costs in 1 year. In Knoxville, 17 new express bus routes were added in addition to new car and van pools. These 2 programs represent the most diverse and successful ride-sharing programs to date.

The remainder of this paper examines the different operational characteristics...
of each system and generalizes the findings of these projects to make them applicable to a number of U.S. urban areas. In addition to pooling services, an innovative concept—the transportation broker—is being developed and implemented in Knoxville. Like real estate, insurance, and investment brokers, the urban transportation broker will unite buyers and sellers of transportation services. The latent demand for ride-sharing services will be met through a combination of car, van, and bus pools that are sponsored by employees, employers, the transit authority, and private bus operators. Coordination of these options will be a responsibility of the brokerage system. In addition, the broker will have the goal of providing a level of service acceptable to the commuter at an unsubsidized fare the commuter will accept. This paper also highlights the potential of this new transportation concept.

KNOXVILLE

Starting months before the oil embargo in the fall of 1973, the city of Knoxville, the Knoxville Transit Authority (KTA), various homeowner associations, the University of Tennessee, and major employers all pioneered in the development of a comprehensive urbanwide pooling program that emphasized the optimum use of each vehicle type, i.e., cars, vans, and buses.

One of the innovative phases of the commuter ride-sharing program is the new express bus system serving both downtown and suburban employees. An extensive system of approximately 50 park-and-ride lots allowed the buses to circulate approximately 10 minutes in residential communities, stop at 3 or 4 fringe parking areas where the majority of riders board, and travel express to a single employment destination, arriving about 5 minutes before the starting work hour. Staggered working hours allowed some express buses to carry workers to suburban jobs that start at 6:50 a.m. and to return downtown at 7:50 a.m. with suburbanites. These express buses (now 17) initially charged about twice the regular bus fare, a strong indication that commuters will pay for good, fast, and convenient service.

Commuter van pooling began in Knoxville as a nonprofit joint venture between the TVA Employee Credit Union and the Tennessee Valley Authority. Similar to the 3M Company Commute-a-Van Program, the TVA program now uses 12 vans and has 27 more authorized. The vans are leased from the Hertz Company by the Credit Union and during the weekdays from 8:00 a.m. to 4:30 p.m. are subleased to nonprofit agencies for special service activities. Thus, downtown parking charges are avoided, and the vans are more fully used.

Overall, TVA's commuter ride-sharing effort substantially reduced the number of employees driving alone. Table 1 (1) gives the work travel modes of the 3,000 TVA employees before and after the program began. The improvement in bus patronage from 23 percent to 29 percent in June 1975 occurred concurrently with a new discount fare structure initiated at TVA. Employees pay 40 cents per trip, which is lower than the initial 60 cents but still higher than the 30-cent regular bus fare in Knoxville.

In the Knoxville commuter pooling program, an extensive analysis was made of the commuting needs of Knoxville workers in which their use of public transportation and the economics of alternative forms of public transportation were examined. A summary of the major conclusions follows.

1. Although the traditional transit system offers a vital service to captive riders, it fails either to serve the suburban commuter or to provide substantial unused capacity in high-density, low-income areas.

2. Approximately 3 percent of all Knoxville commuters, including 6 percent of the central business district commuters, are carried by traditional transit, and approximately 40 percent are carried by car pools.

3. Car pooling can be increased at least 5 percent with a strong employer-oriented program and promotion, but the greatest potential for increased vehicle occupancy lies in new forms of public transportation service.

4. There is a strong demand for new consumer-oriented ride-sharing services.
Table 1. Percentage of TVA employees changing work travel modes after commuter pooling program started.

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<tr>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Drive alone</td>
<td>65</td>
<td>42</td>
<td>30</td>
<td>33</td>
</tr>
<tr>
<td>Ride bus</td>
<td>3.5</td>
<td>14</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>Car pool</td>
<td>30</td>
<td>40</td>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td>Van, bike, walk</td>
<td>1.5</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

*aFirst month of commuter pooling program.
*bSixth month of commuter pooling program.

Knoxville express bus service by both public and private carriers grew rapidly throughout 1974, and this growth has been curtailed not by lack of demand but by lack of available service. Also, the TVA van pools were well received. The reason for the desire for new service is simple. The large, regular-route transit buses do not provide a level of service that is competitive with the private automobile, nor do car pools serve all the remaining needs.

5. Of employees surveyed, 14 to 55 percent wanted to have someone else do all the driving. Nonautomobile owners showed a significant resistance to car pooling, which may indicate their reluctance to be dependent on anyone else. Automobile owners appeared to be reluctant to car pool because they did not want to impose on others or to strain friendships and were uncertain about insurance, liability, regulation, and other institutional factors.

6. Traditional transit is not an acceptable substitute for high-level user-oriented commuter service in shifting commuters from their automobiles. In contrast to traditional transit users, who are primarily captive riders, express bus and van-pool riders have options on the way they commute to work. The typical ride sharer in Knoxville is a 26 to 45-year-old family man who has an income of $17,000 to $18,000 and 2 or 3 cars available for the trip. He ride shares because it is more convenient and he wants to.

7. Traditional transit is unable to economically provide more than a token level of express commuter service because of several factors: (a) More buses are needed during the peak hour than can be used during the base period (KTA is currently using 59 buses in the afternoon peak, but needs only 35 during the day); (b) full-time labor contracts prohibit use of part-time labor, and the additional drivers can only be productively used during the peak period since there is no additional demand during the base period; (c) large buses are inefficient and waste fuel in low density suburbs where load factors are low; (d) at least 50 percent of the commuter bus-miles are driven empty as buses go to and from the bus barn, and this is another inefficient use of fuel; and (e) even if the express buses are operated with every seat filled, they are the most expensive mode available unless they can use part-time labor.

8. Increased ride sharing will occur as alternative forms of public transportation are developed including express bus service, employer van pools, private commuter buses, jitneys, private vans, and contract carriage.

9. Effective ride-sharing programs require a strong supporting program of ride-sharing lots at places such as churches and shopping centers and pedestrian vehicle interchanges on Interstate highways.

10. Ride-sharing programs do have a major impact on the community. If the same degree of success could be achieved throughout the community as accomplished at TVA, then urgently needed highway improvements could be postponed for 5 to 15 years.

11. The major obstacles to implementing effective ride-sharing programs relate to 3 factors: (a) the community attitude that commuter transportation is the exclusive responsibility of the public sector; (b) legislation and regulation at the state, federal, and local levels for the past 60 years that have been designed to restrict ride-sharing programs and protect traditional bus and trolley companies through tax policies,
regulatory policy, antijitney laws, and anti-car-pool promotion laws; and (c) local agencies that are organized to promote a specific form of transportation and not to solve transportation problems.

12. One of the major advantages of a ride-sharing program is that political pressure is taken off of transit authorities that are faced with a high demand for commuter service that they cannot economically provide once peak-hour demand is 1.5 to 2 times greater than base-period demand.

A recent survey of public officials in Knoxville indicated that "mass transit is viewed as a major, if not the major, solution to traffic congestion, parking problems, air pollution, downtown redevelopment, and the development of job opportunities for the unemployed." This same survey, however, indicated "an almost unanimous agreement that the current service did not meet the needs of the community." This realization and laboratory testing of new commuter concepts provide Knoxville with the background to pursue an expanded approach to commuter ride sharing.

To fully develop low-cost alternatives for operation under a systems approach, Knoxville has been awarded an Urban Mass Transportation Administration grant. The demonstration program will be oriented toward problem-solving rather than toward promoting a single mode, technology, or facility. One of the major objectives of the Knoxville approach is to determine the amount of private capital that can be used to solve local transportation problems and reduce dependence on federal subsidy.

The demonstration project will concentrate on starting, operating, managing, and evaluating a balanced multimodal, multiownership public transportation service in Knoxville and surrounding areas. The project will implement a public transportation brokerage service by establishing a brokerage agency that will have responsibilities in the following areas:

1. Coordinate existing agencies, which includes (a) developing methods for increasing the ability of regular transit to provide additional commuter express service and (b) coordinating with highway and traffic groups to ensure that public transportation needs are considered in the design and operation of highway facilities.

2. Identify needs of new clients, which includes (a) surveying employees to locate pool groups who wish to or can pool, (b) locating large groups of workers coming from rural areas, (c) determining need patterns of social service agencies, (d) determining needs of jobless who are dependent on public transportation for jobs, and (e) determining the degree that package and baggage service can be integrated with passenger service.

3. Develop brokerage procedures, which include procedures for van-pool and express bus operations, for involvement of small and minority businesses in public transportation, and for involvement of paratransit operations such as taxi, limousine, and rental car operators.


PORTLAND

Because of the oil embargo and the swift approval by the Federal Highway Administration (FHWA) of its grant application in January 1974, the Oregon Department of Transportation appealed to government agencies for personnel to be lent to it on a short-term basis to set up the pooling program. In addition, various radio and television stations and universities that had previously started developing car-pool promotional programs combined into one car-pool campaign. This added significant resources. The car-pool program consisted of essentially 3 phases: employer-based programs, general public promotion and matching, and incentives.
Employer-Based Programs

By the end of February, 150 employers with nearly 100,000 employees were contacted. Fourteen workshops were conducted for employers to provide information on program purposes and capabilities. As in many sales programs, employer follow-up and support made the difference between success and failure. The staff continually made calls and provided service to encourage top management support. The greater the support from top management was, the greater was the success. If a clerk was assigned the car-pool responsibilities, generally little was accomplished because of a lack of authority and motivation to do the job properly. In contrast, excellent company programs existed if the president of the company took a personal interest and appointed an individual (in some cases, full-time) to see that complete cooperation was accorded the program. In all, 215 employers participated, and 139 large companies had in-house transportation coordinators. The program staff worked effectively with these coordinators in maintaining internal promotion (employee newsletter, posters, paycheck enclosures, contests), establishing company incentives for car poolers (priority parking, adjustment of work hours), and in performing other program functions.

Employers were offered a choice between participating in the central computer-matching system and developing their own. Interestingly, employers using in-house systems not only were more numerous but also provided more vigorous and continual support than those using the central computer system. Many of these employers preferred an in-house system, for they were concerned about placing employee names in a centralized computerized data bank. These independent matching systems gave the staff more time to assist a greater number of employers. Interest during this phase peaked during the oil embargo, degenerated somewhat during the summer months, and revived as summer vacations ended and inflation increased in the fall. Of the 400,000 commuters in the area, 130,000 were exposed to car-pool matching through their employers.

General Public Promotion and Matching

The general public promotion and matching phase was initiated in mid-March and was urbanwide. One major objective was to make the car-pool matching accessible to persons whose employers did not provide a satisfactory matching system. A second objective was to promote favorable attitudes toward car pooling through a heavy media campaign. Billboards, radio and television spot announcements, and public displays virtually saturated the community. More than $100,000 in mass media time including some prime time was donated to the project.

Incentives

Incentives were provided through development of priority parking and park-and-ride facilities. The park-and-ride program was sparked by Ecumenical Ministries of Oregon, who felt that excess church parking facilities could be used by commuters. However, churches risked tax-exempt status if they permitted their parking lots to be used for anything except church-related activities. A special state bill was therefore passed to allow churches to donate parking lot space for park-and-ride purposes while retaining tax-exempt status. By December, 73 park-and-ride lots including non-church facilities were under contract with the car-pool program. The program was responsible for damage, litter control, and signing. Lots selected were located within 75 yards of a bus-boarding area.

To assess the accomplishments of the program, a survey of car-pool participation was conducted in fall 1974 in which 49 companies circulated survey cards to 34,000 employees. Two employer groups were surveyed—subject companies that had in-house car-pool programs and control companies that did not. The subject companies provided the basis for determining the effectiveness of the employer-based campaign,
and the control companies provided the basis for determining the effectiveness of the general campaign. Results showed an increase of 22,000 new car poolers as compared with the project goal of 15,000. The percentage of new car poolers in companies receiving no assistance but whose employees were exposed to mass media campaigns was significant but much lower than that in companies that received direct assistance. It was noted that these figures were down dramatically from the levels achieved in late spring. Even so, based just on Portland's conservative projections, the monetary savings in gasoline alone was about $1.8 million in one year, making the benefit-cost ratio of this $215,000 project an astounding 28 to 1 for the first year. A summary of projected benefits is given in Table 2 (2).

INSTITUTIONAL ISSUES

The lack of natural promotion, prohibitive regulations and the impact of such restrictions on insurance, and the difficulty of individuals acting alone to establish a convenient commuter pool all hinder the growth of commuter pooling systems. But the overriding issue appears to be an institutional one centering on the legality. If such services are legal, a mechanism will likely emerge to serve the new markets of such systems. The possible illegality of such services, however, suppresses their potential.

Many state laws are unclear with regard to commuter pooling, and such uncertainty tends to discourage innovation and development of new services. If the exact legal definition of these arrangements is unclear, they are subject to regulation and their operation is potentially illegal. Assume that a state public utilities commission (PUC) does not seek to regulate privately arranged pooling, issues no exemptions, but retains authority. An individual has few attractive options available. Equipment can be purchased and operations commenced, but the operation is illegal since proper authorization has not been procured. Hence, the operator can be enjoined, sued for financial damages, subject to the penalties of the act (which include possible imprisonment), and suffer serious consequences from any lawsuit arising out of an accident. If by chance the PUC refuses authorization, the operator will also suffer a financial loss. A second alternative is to seek authorization before starting operations by submitting required fees, meeting statutory and PUC requirements, and waiting as much as a year. One private operator commented that it cost $6,000 per route and more than a year to meet requirements, and the operator still runs the risk of being refused. The third alternative is to petition the PUC for a declaratory judgment, which might prove onerous if the resultant hearing required an attorney. None of these alternatives is conducive to encouraging the development of ride sharing. The problem is compounded by 50 different state laws and regulatory powers that have been delegated to the municipalities. There is no model approach, for each situation is different.

Table 2. Projection of benefits of commuter pooling in Portland.

<table>
<thead>
<tr>
<th>Item</th>
<th>Subject Companies</th>
<th>Subject Companies and Control Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of persons who began pooling since February 1, 1974</td>
<td>11,007</td>
<td>22,007</td>
</tr>
<tr>
<td>Number of car pools</td>
<td>4,420</td>
<td>8,838</td>
</tr>
<tr>
<td>Automobiles removed from the road</td>
<td>6,587</td>
<td>13,169</td>
</tr>
<tr>
<td>Miles saved per year at 22.1 miles per round trip</td>
<td>36,431,192</td>
<td>78,833,313</td>
</tr>
<tr>
<td>Gallons of gasoline saved per year at 12.92 miles per gallon</td>
<td>2,974,550</td>
<td>5,946,843</td>
</tr>
<tr>
<td>Dollars saved per year at 15.9 cents per mile</td>
<td>$6,110,559</td>
<td>$12,216,480</td>
</tr>
<tr>
<td>Tons of emissions reduced per year at 145.8 per 1,000 miles</td>
<td>2,803</td>
<td>5,605</td>
</tr>
</tbody>
</table>
Obstacles to car pools vary from state to state. In some situations, if a person charges people to ride to work, his or her house and garage may be assessed at 55 percent instead of 25 percent for property tax purposes. In other situations, a carpool arrangement among coemployees makes the riders passengers and not guests. In this situation, the liability of the driver is significantly broadened. If the guest statute applies, a person injured while riding in an automobile cannot recover from the driver unless the driver's conduct amounted to willful and wanton misconduct. If the protection of the guest statute is removed, the driver may be sued for injuries to the passenger arising out of simple negligence. In effect, if the protection of guest statute is removed, coverage provisions of the automobile insurance may be affected.

This only scratches the surface of regulatory issues. Fortunately, existing federal, state, and municipal regulations relating to commuter ride sharing are being reviewed and updated in a number of states. These reviews are identifying major obstacles to swift implementation of commuter-organized ride sharing. Often, they focus on commuter van pools, which fall within the uncertain areas between car pools and buses. Seemingly insurmountable regulatory roadblocks to commuter bus groups, small independent bus operators, individual or employer-sponsored van pools, and even car pools are being dropped in favor of regulations that protect the consumer with minimum insurance and safety requirements.

Since van pools generally involve cost sharing and single driver operation, they may come under the regulation of the state public utilities commissions. In Connecticut, California, and Virginia, general statutes concerning van pools have been changed. Essentially new legislation excludes vans from economic regulation, provided the vehicle has fewer than 15 passenger seats and the driver is on the way to or from his or her place of employment.

Although adequate funds to promote and capitalize commuter ride sharing may be severely affected by regulation that limits legal operations, any concept that can voluntarily reduce vehicle miles of travel by 5 to 40 percent should receive top priority. This is especially true if the concept has benefit-cost ratios of more than 10 to 1 in a year.

CONCLUSIONS

Many cities are currently seeking direction for solving transportation needs. It is extremely unfortunate to hear comments such as "We tried car pooling, but it does not work" or "We have heard of van pooling, but it only works in special situations."

Only $10 million has been spent in the last 20 years on car pools, but billions have been spent on new construction. Is this balanced transportation? It may require $10 million in a major city to successfully reduce commuter vehicle miles of travel by 5 percent through car and van pools, but that is only a fraction of the cost to build a mile of urban freeway or railway. If genuine incentives and worthwhile performance clauses were provided to urbanwide organizers of commuter ride-sharing programs, proper mechanisms would certainly be developed to tap this potential.

Much of the skepticism about commuter pooling can be traced to lack of adequate understanding of the potential of this transit option. As cities expand, travel patterns become more dispersed. This creates a need for more accessible and ubiquitous commuter service. What matters to the user is the level of service provided. This can be measured largely by door-to-door travel times, which automatically include factors of waiting time, reliability, walking distance, transfers, and contact with inclement weather. Other factors such as guaranteed seat, interior comfort, security, and reasonable cost are likewise important. Pooling programs will close the information gaps that limit commuters' ability to form acceptable commuter pools.

Until social and legal institutions are changed or altered, traffic can be accommodated by 2 basic methods: construct new facilities or increase vehicle occupancy. The latter approach can offer society the best return on its investment and the commuter excellent door-to-door service. Already both public and private employers have experimented successfully with car, van, and bus pools, and commuters have demonstrated
their willingness to "pool it." Additional activities, such as the Knoxville brokerage system, are certain to expand the acceptance of pooling by tailoring services to user's needs regardless of mode. Private bus operators, individual van-pool entrepreneurs, conventional car poolers, and transit authorities will be coordinated into an effective systems approach to commuting.

The immediate challenge is to provide adequate urban mobility while reducing air pollution and the demand for petroleum fuel. Other benefits are also forthcoming. Ride sharing combined with traffic control advances will make rush-hour congestion a thing of the past.

REFERENCES