Comparisons of Productivity of Four Modes of Service in Orange, California

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The Orange County Transit District has operated a community-service transit program in the city of Orange, California, since May 1975. Because of an adverse court ruling and a subsequent successful appeal, this service underwent four modal changes. These four modes provide a unique opportunity for comparison. In order of implementation, they were a demand-responsive dial-a-bus, a three-loop fixed-route bus system, a two-loop fixed-route bus system, and a demand-responsive dial-a-taxi system. The four systems were compared by using five performance indicators. The two demand-responsive systems were found more efficient and effective than the fixed-route systems. The dial-a-taxi system, during its first 3 months of operation, compared very favorably to the dial-a-bus system, and continues to show monthly improvements on each indicator. The information gained in this study may be of limited transferability, but the data suggest that dial-a-taxi can be very efficient and effective in serving cities or suburban areas with population densities of 1900/km² (5000/mile²) or less.

One of the goals of the Orange County Transit District (OCTD) is the development of an extensive community-service program. This program is being used to supplement the basic OCTD fixed-route bus system—a 1-km (1-mile) grid spacing and 30-min headways—in areas where transit dependency is greatest. Each community service is associated with a city or area for name identification and takes one of the following forms: dial-a-bus, dial-a-taxi, or an intensive fixed-route loop system. The dial-a-taxi mode may involve the use of some buses in areas where heavy peak-hour traffic merits the use of larger vehicles.

The community-service program that was developed in the city of Orange presents a unique case for study. The original service used a dial-a-bus mode. This was terminated after a court decision (Yellow Cab of Northern Orange County versus Orange County Transit District, No. 229461, Orange County Superior Court, 1975), and the second service—a three-loop, community fixed-route system—was inaugurated. Next, this was converted to the third service—a two-loop, community fixed-route system.

Finally, after an appeals court decision (Yellow Cab of Northern Orange County versus Orange County Transit District, 65 CA App. 3rd 268, 134 CA Rptr. 909, 1976) reversed the ruling of the county court, the fourth service—a dial-a-taxi mode—was inaugurated. The four key dates are those of the service changes given below:

<table>
<thead>
<tr>
<th>Date</th>
<th>Service Change</th>
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<tbody>
<tr>
<td>June 2, 1975</td>
<td>Initiation of dial-a-bus</td>
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<tr>
<td>July 6, 1976</td>
<td>Replacement of dial-a-bus by community fixed-route service</td>
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<tr>
<td>January 2, 1977</td>
<td>Change of community fixed-route service from three to two loops</td>
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<tr>
<td>July 6, 1977</td>
<td>Replacement of community fixed-route service by dial-a-taxi</td>
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This paper describes the results of a study comparing the passenger responses to and the operating costs of the four different modes of community service in the city of Orange.

Obviously, direct comparisons of cost and performance data for different modes or for different areas may have little validity and require careful interpretation, but it is believed that there are performance indicators that at least facilitate comparisons. In the case of the city of Orange, the geographical area and the population served remained constant. The first three modes used were all operated by the same contractor and used the same types of vehicles.

ORANGE COUNTY TRANSIT DISTRICT

Orange County, California, is one of the fastest growing metropolitan areas in the United States. In 1960, its population, assessed valuation, and taxable sales were $704,000, $1,142,000, and $759,000, respectively. By 1970, the figures had increased to $1,420,000, $3,534,000, and $2,819,000, and the 1976 figures are $1,729,294, $8,525,901, and $6,965,894, respectively (1).

Throughout the first 3 years of this period, Orange County residents had to rely almost exclusively on the automobile as the mode of urban travel. The lack of high-density development, the extensive network of wide streets and arterials, and the network of freeway interconnections with other southern California areas resulted in and from this complete dependence on the automobile.

In 1971, however, the OCTD was formed for the purpose of providing cost-effective public transportation to county residents. Its task was not easy. There were two dominant obstacles. One was the unusually strong attachment of southern Californians to their automobiles—brought about in large measure by the ease with which great distances can be traversed at relatively low costs, and the other was the travel pattern of county residents—diverse and diffuse in both space and time.

To compete with the automobile in this environment of diffuse travel patterns, OCTD developed innovative concepts. The goal was to provide a well-balanced, integrated transportation system composed of a number of community or local-area bus or taxi systems that can simultaneously serve intracommunity travel needs and act as collection and distribution subsystems for a county-wide network of bus routes designed to facilitate intercommunity travel. In the future, this countywide system will, in turn, act as a collection and distribution subsystem for the regional transportation system of the Los Angeles basin.
The first step in the development of a transportation system that could both serve the needs of those without access to an automobile and compete with the automobile was the inauguration of a pilot dial-a-ride service in the city of La Habra, in February 1973. Since then, OCTD has increased its community service with fixed-route services in Orange, Buena Park, and Westminster, a dial-a-taxi in Fullerton, and expansion of the La Habra service into Brea. Three other community services are expected to go into operation before July 1, 1978.

CITY OF ORANGE

The city of Orange, the second city selected for community service, is located in the center of Orange County, approximately 42 km (26 miles) south of Los Angeles. On the edge of the southern California coastal plain, Orange is situated at the foot of the Santa Ana Mountains, with both the Santa Ana River and Santiago Creek running through the city. It has an area of 43.5 km² (16.8 miles²), an estimated total population of 83,900, and a population density of 1928/km (4994/mile²). One-fourth of the population is under 15 years of age, and the elderly, another major transit-dependent group, constitute approximately 7 percent of the population. Recreational opportunities abound; there are six city parks, three public pools, and many horse and bicycle trails.

A wide variety of housing opportunities, ranging from low-cost apartments to expensive condominiums, are available in the city of Orange. Typical costs for housing range from $35,000 to $200,000. Major trip attractions for residents include two regional shopping centers and 1350 retail establishments. Educational facilities include Chapman College within the city and three major universities in the surrounding area. The city also contains four major hospitals including the University of California Medical Center, seven medical laboratories, and seven convalescent homes.

The main industrial area is located on the western edge of the city and covers approximately 5.0 km² (1230 acres). This is divided into 0.5 km² (120 acres) of M-1 zoning and 4.5 km² (1110 acres) of M-2 zoning. Major industries include those concerned with transportation, machinery and metal products, plastics, rubber, fiber products, building materials, and chemicals.

Industry provides employment for 27,068 in the city of Orange, and the mean income is $14,317/year. Thirty-seven percent of the nonagricultural wage and salary employment is in manufacturing, 11 percent of which is devoted to aerospace. Another 25 percent are employed in trade, 19 percent in services, and 16 percent in government. Seventy percent of the work force commute more than 8 km (5 miles) to their place of employment, with 38 percent commuting more than 16 km (10 miles). Fifty-seven percent of the families have two or more automobiles, and only 6 percent of the families do not have an automobile.

Orange County has two types of cities. The first is the completely new city that has rapidly grown on the areas previously used for agriculture. The city of Orange is typical of the second type, i.e., an existing small city with a definite community and cultural center and rapidly expanding new development around the older center. This type of city generally has a more compact destination area and is more responsive to demand-responsive trip consolidations.

COMMUNITY-SERVICE MODES

As a result of the success of the pioneer demand-responsive dial-a-ride in La Habra, the Board of Directors of OCTD decided to expand the local community-service program. A three-tiered policy was developed for use in the selection of cities to receive the service. The first phase was an objective scoring system based on the following demographic characteristics: number of persons over 65 years old, number of persons 14 to 16 years old, existing fixed-route service, and number of low-income families. This phase identified the most eligible eight communities.

The second phase of the policy was the determination that eligible cities that were willing to pay one-third of the operating deficit would be considered for immediate implementation. (This policy was changed on February 1, 1976, and cities were no longer required to share in the cost.) The third phase of the policy dealt with modal selection with community fixed-route and dial-a-bus services the two alternatives.

The city of Orange was among the three most eligible communities, and the Orange City Council committed the city to paying one-third of the operating deficit. Dial-a-bus was selected as the operational mode, and on June 2, 1975, the Orange dial-a-bus began operating in the southern half of the city; 14 days later, operations were expanded into the northern half of the city.

Dial-a-Bus Operations from June 2, 1975, to July 5, 1976

The management and operation of the dial-a-bus system were contracted out. The services provided included the employment and supervision of all personnel including drivers; the operation of a driver training program for additional personnel after the initial training period; supervision of the maintenance and repair of equipment used in the system; preparation of budgets and financial reports; and the clerical, statistical, and bookkeeping services required so that the operation of the system could be compared with the performance of other transit systems.

The maximum yearly total cost to OCTD, including a fixed fee and two incentive fees, was not to exceed $518,815. The first incentive fee was $0.07/revenue and transfer passenger/month, and the second incentive fee was an additional increase per passenger if more than 320,000 passengers were carried in the first year of operation. All fares collected were revenue for OCTD.

Operating on a many-to-many basis, the dial-a-bus was in service Monday through Saturday from 7:00 a.m. to 7:00 p.m. Seventeen 19-passenger Transcoach vehicles provided residents with service to anywhere within the city for a $0.50 fare. Residents could obtain this service, which combined the door-to-door convenience of a taxi ride with the economy of bus service, through a phone call to the OCTD control center. The average response time was 30 min, although wait time during the peak-hour periods averaged 60 min. This was in contrast to a planned response time of 20 min and illustrates the problems with the system.

Subscription service that enabled a passenger to call the control center and request a pickup at a certain time each day was also available and accounted for 2 percent of all passengers. This type of operation provided a convenient way to commute between residence and place of employment if both were within the city of Orange. The operation of the control center has been described by Fielding and Shilling.

The dispatcher scheduler combines customer information regarding location, number of riders, and desired pickup time with information regarding vehicle positions, tentative routes, and trip characteristics of other passengers. Using preplanned scheduling and dispatching procedures and a radio communication link to a fleet of small buses, the dispatcher assigns a vehicle to pick up and deliver each customer from origin to desti-
nation. The customer is advised of the expected pickup time and, perhaps, the fare and then waits until the vehicle arrives.

A large metal-backed map and magnetic pieces are used in the control center. The magnetic pieces hold trip tickets containing customer trip data—different pieces denoting origins and destinations. When a trip is assigned, colored markers corresponding to the vehicle are placed on both pieces. These markers also serve as pointers to the vehicle’s next stop and effectively trace out a tentative route for each vehicle.

When the bus arrives at a stop, the driver notifies the control center, which updates the bus position on the map and in turn notifies the driver of the next stop. The map therefore represents quite accurately the true state of the system, i.e., vehicle position, customers on-board, and customers waiting. Given a full view of the system, the control staff can alter tentative routes as necessary to accommodate new trip requests.

Community Fixed-Route Service
from July 6, 1976, to July 5, 1977

As a result of litigation by taxi companies, the dial-a-taxi was discontinued, and a community fixed-route service was implemented in July 1976 (8). An extensive analysis of the dial-a-taxi trip tickets was made by OCTD staff, and a three-loop system was designed to continue to serve those patrons who had used the dial-a-taxi. Service operated Monday through Friday, 6:00 a.m. to 9:00 p.m. in 30-min headways. Saturday service operated on 60-min headways from 9:00 a.m. to 6:00 p.m. The management contract was retained with a few minor amendments. The maximum total cost to OCTD remained at $518,815.

Beginning in July 1976, three community-service routes using seventeen 19-seat Transcoach vehicles were in operation. An evaluation by OCTD showed that this service was not as productive as other fixed-route bus operations and did not approach the established policy standards. In January 1977, the three existing routes were replaced by two new routes, which left eight vehicles operating an average of 37,000 revenue km/month (23,000 revenue miles/month). It was attempted to link the two new routes to major trip attractions whenever possible and feeder distribution to the regular fixed-route bus service was also a factor in scheduling, but the end result for many patrons was long travel times for relatively short direct distance travel.

The replacement of the three routes with two new routes was made when marketing analyses showed that patrons preferred to walk out of their neighborhoods (1 to 3 blocks) to major arterial streets for the trade-off benefit of faster travel time. In other words, residents were willing to sacrifice convenience (closer service) for reduced travel time. Because the community-service routes penetrated deeply many neighborhoods, travel time was increased to the point where ridership was discouraged.

The change from a three-route system to a two-route system was also a result of a policy decision to cut total costs. The appellate court decisions had been rendered in OCTD’s favor, and preliminary planning had begun to reinstate a demand-responsive system. Thus, it was decided to reduce the fixed-route service during the interim period and do minimal advertising. Total costs were greatly decreased, but the individual indicators reflected the high costs per passenger.

Dial-a-Taxi Operations from July 6, 1977, to the Present

On July 6, 1977, a new dial-a-ride consisting of taxicabs and Transcoach buses replaced the community-service operations in the city of Orange. This new system included Orange and Orange Park Acres as well as the city of Villa Park, a community of 7200 people that was not included in the original dial-a-ride service area. Since Villa Park is surrounded by the city of Orange, the dial-a-taxi can effectively serve Villa Park without significantly increasing the cost of operations (?).

Service is provided by a contractor and consists of 12 vehicles—seven 7-passenger sedans provided by the contractor and five 19-passenger Transcoach buses provided by OCTD (8). The contractor operates and maintains all vehicles and is responsible for hiring and supervising all personnel including drivers, dispatchers, supervisors, and maintenance employees. These services are provided on a cost-plus-fee basis. OCTD monitors the efficiency of the operation to ensure that the transit district service standards, safety, courtesy, and maintenance are followed. OCTD provides uniforms and conducts initial training for all drivers. According to the officials involved, this new service concept is a "step forward in public agency relationships with private industries."

A unique feature of the contract is that the contractor retains all passenger revenue. This is an incentive feature for the operator, who becomes a real partner in the attempt to increase patronage. The advantage to the transit district is the ability to plan for a fixed cost of service. Increases in patronage are reflected in the performance statistics as decreasing costs per passenger carried.

PERFORMANCE ANALYSIS

Research in performance evaluation generally concludes that direct comparison of demand-responsive and fixed-route services by using performance indicators is not proper because of basic differences in service. Such differences as vehicle size, access to vehicles, and that one service is demand activated while the other provides continuous service over specific routes result in statistics that are inherently different (9).

However, in the case of the city of Orange, the fact that the two services were offered in much the same area during successive time periods makes some comparison possible. Vehicle size was identical for the dial-a-taxi and fixed-route vehicles, and this aids in the comparison. In addition, the two services had the same administrative structure so that there was very little difference in overhead expense between them.

The indicators used in this analysis are (a) net cost per vehicle service hour, (b) percentage of population served, (c) revenue passengers per service-area population, (d) passengers per vehicle service hour, and (e) net cost per passenger. The certain basic operating and financial statistics needed to prepare these indicators include the monthly totals for patronage, net cost, and vehicle service hours. The data from which these can be calculated are summarized in Table 1.

Before comparing the performance indicators, it will be informative to look at the monthly averages for patronage, revenue, and net cost. Such statistics cannot be exactly compared with each other, but they give a general picture of the four systems over time.

1. Passengers per month: The dial-a-taxi served an average of 15,051 passengers/month with a peak (March 1976) of 19,200. When the first (three-loop) community fixed-route service was implemented, the average fell to 7231 passengers/month—a decrease of more than 50 percent. During the peak month of this service (December 1976), 9100 passengers were carried. When this service was replaced by the two-loop service, the average fell to a low of 3412 passengers/month. During this period, patronage remained relatively stable with no real peak month. After only three months in service, the dial-a-taxi is serving an average of 8861 passengers/
month, and this is increasing each month. In the most recent month (September 1977) for which data are available, 10,100 passengers were carried. Month-by-month passenger totals are shown in Figure 1.

2. Vehicle service hours per month: This is a measure of total units of service produced during a certain period of time (in this case, a month); thus, it follows that a higher value means that more service was provided. Figure 2 shows that the dial-a-bus and the three-loop, community fixed-route system provided nearly the same amount of service. The implementation of the two-loop, fixed-route system, however, resulted in a 62 percent reduction in service. After 3 months of operation, the dial-a-taxi is providing approximately 482 h/month of service more than the two-loop system. Although these figures tell us how much service was provided, they do not tell us how much of the provided service was used.

3. Net cost per month: This is a measure of net input per unit of time (again, one month). A lower cost indicates either a more efficient system or a lower level of provided service (i.e., total service hours). The largest value ($62,550) was that for the three-loop, community fixed-route system; the next largest was that for the dial-a-bus ($49,290). The two lowest values are those of the two-loop, community fixed-route system ($32,431) and the dial-a-taxi ($23,268). The net cost per month for the new dial-a-taxi is a reduction of 53 percent from the first dial-a-bus and of 63 percent from the first community fixed-route system. The monthly net cost figures are summarized in Figure 3.

Performance Indicators

The performance indicators used in evaluating and comparing transit systems in general and the four modes used in the city of Orange in particular can be categorized as those that evaluate efficiency and those that evaluate effectiveness (Table 2). "Efficiency concerns the process by which services are produced, particularly through the relationship of inputs to produced output; that is, it concerns doing things right" (9). "Effectiveness is concerned with the service which is actually provided: its accessibility to the area residents, and its correspondence to the transportation requirements of the particular area" (10). It is concerned with doing the right things. The interpretation of the performance indicators may differ somewhat among service modes, and these differences must be considered when making comparisons.

Comparison of Orange Services

1. Net cost per vehicle service hour: This is an efficiency indicator of the net inputs per unit of service produced. A low value is favorable. Thus, by this measure, the new dial-a-taxi is the most efficient system. However, to determine service utilization, performance indicators that evaluate effectiveness must also be examined.

2. Percentage of population served: High values on this effectiveness indicator are favorable, but it must be remembered that demand-responsive systems, by definition, present service to 100 percent of the population of the area they serve, a score that is given without consideration of the hours of operation or the planned response times. In the fixed-route systems, the residential population within 0.4 km (0.25 mile) of the route is considered to be served.

3. Revenue passengers per service-area population: This effectiveness indicator has more meaning than the percentage of population served because actual service use is involved. High values are favorable. Thus, by this measure, the dial-a-bus was the most effective system, but the dial-a-taxi is approaching an equivalent value.

4. Passengers per vehicle service hour: This is an effectiveness indicator of system patronage with high values being most favorable. Thus, by this measure,
the dial-a-taxi is the most effective system.

5. Net cost per passenger: This is an effectiveness indicator of net inputs per trip within the system; thus, a low value is favorable. It is really an overall performance indicator combining efficiency (net operating costs) with effectiveness (number of passengers). Usually, systems with low passenger volumes, by virtue of their service characteristics (demand-responsive), will have high costs per passenger, and systems with high ridership and short trip lengths will have low costs per passenger. However, contrary to this prediction, Table 2 shows that both community fixed-route systems had much higher net costs per passenger ($8.65 and $9.51 respectively) and that the current dial-a-taxi has the lowest value.

All the effectiveness indicators showed that the two dial-a-ride systems were more effective than the community fixed-route systems. Systemwide Comparison

Table 3 gives 1977 data for the OCTD fixed-route system and four of its community-service operations. These data were selected for months appropriate for comparison with the performance indicators of the Orange systems.

1. Dial-a-bus: When the Orange dial-a-bus is compared to the La Habra-Brea dial-a-bus, the difference in efficiency is not great. The net cost per vehicle service hour in Orange is $1.00 less than that in La Habra, but this is of little significance because of vehicle and personnel variables.

The effectiveness indicators, however, tend to favor the La Habra dial-a-bus. The lower number of passengers per vehicle service hour of the Orange system indicates that the La Habra system was used at a higher rate than the Orange system, and this is supported by the net cost per passenger, which is also lower for the La Habra system.

2. Three-loop, community fixed-route service: When this service is compared to the community fixed-route service in either Buena Park or Westminster, its inefficiency and ineffectiveness are readily apparent. Both its cost per vehicle service hour and its cost per passenger are higher than those of the other two systems, and its number of passengers per vehicle service hour is lower.

3. Two-loop, community fixed-route service: The implementation of the two-loop, community fixed-route system did not improve the situation in Orange: An inefficient system was replaced by an even more inefficient system. The cost per vehicle service hour increased significantly, although the total cost per month did decrease due to the drastic reduction in vehicle service hours.

The number of passengers per vehicle service hour did show a slight increase, but still remained substantially below the other two systems. The net cost per passenger increased, indicating that although the total net cost decreased with the service reduction, passenger use decreased even more. In an attempt to cut cost, OCTD had lost a large number of passengers.

4. Dial-a-taxi: When the Orange dial-a-taxi is compared to the Fullerton dial-a-taxi, Orange, after only 3 months of operation, is very close to Fullerton in all categories. The net costs per vehicle service hour and the net costs per passenger are both very close. The effectiveness measure, passengers per vehicle service hour, is higher for Orange than for Fullerton.

Ridership Survey

In August 1977, OCTD conducted a ridership survey of all dial-a-taxi patrons in both Orange and Fullerton. All riders calling for service were asked the single question, "How did you make this trip before the dial-a-taxi?" Their responses are given in Table 4.

The most surprising result in the case of Orange was the extremely small number of people that had previously used the three- and two-loop community fixed-route services. It appears that the patrons for the two types of services come from two different populations. Fullerton did not have a prior community service.

As expected, the availability of the dial-a-taxi did not have much impact on automobile drivers, but 16.5 percent of the Fullerton trips and 18.3 percent of the Orange trips had previously been made as passengers in someone else's automobile.
The impact on trips made by the OCTD fixed-route system is comparable to the reduction in automobile trips. Approximately one-third of the patrons had previously used some other means (e.g., walking or bicycling) for their trip making.

Twenty-seven percent of the patrons in Fullerton and 13.2 percent of the patrons in Orange indicated that they had not made the trip before. This may indicate that this service is playing an important social function by allowing senior citizens and other transit-dependent persons to participate in recreational and educational activities.

SUMMARY

This study did not produce any conclusions that could be directly transferred to other cities or areas. Many factors such as population density, street patterns, and population characteristics should be considered when determining whether or not a community transit service is required and what mode of service would be most efficient and effective.

After 3 months, a dial-a-taxi appears to be the best choice for communities such as the Orange County suburban cities having population densities of 1000 persons/km² (5000 persons/mile²) or less. The dial-a-taxi as implemented in Orange and Fullerton uses some small buses during the peak hours, and this provides for higher performance in the important indicators of passengers per vehicle service hour and cost per passenger. It is not an all-taxicab system.

Dial-a-taxi has gained wide acceptance in the community of Orange. It is strongly supported by the city council, the chamber of commerce, service and social organizations, and the local newspaper. Letters and comments to the OCTD by patrons and relatives of patrons have been highly favorable, and the complaint level has been lower than that of any other OCTD service.

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REFERENCES


DISCUSSION

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The history and productivity comparisons of different types and levels of service in Orange, California, have a number of implications for rural transit and raise some questions.

IMPLICATIONS FOR RURAL TRANSIT

The history of the transit service changes in Orange is very informative. The comparison of costs and ridership for differing types and levels of service system-wide for the same area is a first in transportation research. Other demonstrations have attempted to measure and compare changes in ridership and costs. However, most of these have not been system-wide or representative of the extent of change that occurred in Orange County. Moreover, that the Orange County services were not federal demonstrations may have resulted in a better understanding of the demand for different types and levels of service because many persons may perceive a demonstration service as a temporary service and choose not to try it or rely on it.

One interesting finding of the Orange experience is that the costs per passenger were less for the demand-
responsive services than for the fixed-route services. This was primarily due to the higher ridership on the demand-responsive systems and is important for rural passenger transportation because it helps disprove the common belief that fixed-route service is less expensive (cost and subsidy required) than demand-responsive service. Thus, local and county officials in rural areas might be more willing to consider alternatives other than the known fixed-route type of service. Also, the Orange performance indicators help dispel the belief that rural public transportation is so expensive (at least as compared to urban transit). Data from 16 rural systems in Pennsylvania showed an average cost per passenger trip of $1.17, compared to $2.87 and $2.48 respectively for the dial-a-bus and the dial-a-taxi in Orange (11). This is important because rural transit operators often must justify their costs and put them into perspective for local rural officials who, in turn, often must convince taxpayers and state legislatures that their rural passenger transportation systems provide efficient service and deserve financial assistance.

Another important finding is that Orange provides another example of a situation where an existing taxi operator is able to provide more, but less costly, service than a public agency. The use of taxis in rural areas has great potential for satisfying public transportation and social service needs. However, the potential will be achieved only if private operators are involved from the beginning in the development of the rural service and users, decision makers, operators, and agencies recognize the mutual benefits of such coordination. This will require educational efforts and institutional changes: All concerned must understand how to write equitable contracts and improve service, and institutional arrangements and interpretations of laws that inhibit such service and innovation must be amended.

A third implication of the experiences in Orange, as well as in Westport, Connecticut, and the other places is that incentives to improve system efficiency will result in lower costs and subsidies per passenger trip. This finding is important for both rural and urban systems faced with inflation and pressure from decision makers and taxpayers to be more efficient and accountable.

SOME QUESTIONS

The paper also raises some questions. They are summarized below.

1. Are the performance indicators useful for comparing systems providing service in different places? My opinion is that other measures, such as cost per passenger unit trip length, will be necessary for sensitivity to different passenger trip lengths and patterns.

2. Are the performance indicators sufficient and useful to the operator? If not, what additional measures are needed and what is the cost of collecting such information?

3. What changes and cautions would be necessary if such indicators were used to allocate state or federal funding for passenger transportation?

4. The performance indicators used provide estimates of the effectiveness and efficiency of the service, but what measures could be used to estimate the equity of the service? (Many workers ignore or blur the distinction between efficiency and effectiveness. Efficiency is an economic measure relating input to output, while effectiveness and measures of effectiveness relate to the objectives of the system, which may not be strictly economic. Both types are important for comparing and improving service, but it is important to distinguish between them and use appropriate indicators.)

5. The Orange experience suggests what incentives are appropriate for privately owned or operated transportation systems. What incentives would be effective for publicly owned or operated systems?

DISCLAIMER

The preceding comments do not necessarily reflect the views of the National Transportation Policy Study Commission.

REFERENCES
