

time operational information that resulted from the installation of the automated vehicle-monitoring component of the system has already permitted the reduction of total tour time for the experimental route from 120 to 100 min, thus permitting a reduction in the number of buses required to serve the route.

An information and control system of this type is particularly useful for the stop-to-stop type of paratransit service. Because the passengers of a service of this type are picked up at the stops and there is no fixed schedule, the reliability of bus arrival time becomes paramount to the user, as well as to the scheduling and dispatching of buses.

The combination of ABPI and the stop-to-stop concept could prove to be an interesting and cost-effective variation of paratransit services for low-density areas. It

is probable that UTRB will test this concept in a demonstration site in the near future.

DISCLAIMER

The views expressed in this paper are ours. They do not necessarily represent the views of the Urban Transportation Research Branch, Canadian Surface Transportation Administration, Transport Canada.

REFERENCE

1. Transit Financing. Summary of Workshop Discussion at Urban Transit Symposium, Banff, Alta., April 1977, Road and Transportation Association of Canada.

Implementation and Preliminary Impacts of Shared-Ride Taxi Service at Boston Logan International Airport

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On April 26, 1977, the Massachusetts Port Authority introduced a pilot shared-ride taxicab dispatching service called share-a-cab from Boston Logan International Airport to 21 cities and suburban towns to the west and northwest of the city of Boston. The service provides for the grouping of up to four passengers in one taxi for a flat fare known in advance to the passenger that is approximately half the average metered fare to the city or town to which he or she is destined. Share-a-cab passengers are grouped from five airport-terminal locations by means of a central assignment and taxi dispatching system that is linked by telecommunications to personnel in the terminals. On July 19, 1977, the service was expanded to 117 additional eastern Massachusetts cities and towns and, on September 19, 1977, service at reduced fares was guaranteed after a maximum 15-min wait even if only one passenger had requested service. Preliminary impacts for the service area of 138 communities indicate that the share-a-cab service has attracted approximately 3 percent of the total daily trips from Logan Airport to these cities and towns. Among the users of share-a-cab trips, approximately 42 percent had shifted from exclusive-ride taxi, 30 percent had shifted from private or rental automobiles, and about 28 percent had shifted from bus, limousine, or rapid transit services. Share-a-cab has significantly increased taxi ridership and revenue. The service was implemented without any major operational problems, although its labor-intensity has resulted in subsidies per passenger that are relatively high. The expected demand levels and diversions from private automobile trips have not yet been reached. The early results have been evaluated to reach conclusions and provide recommendations for improvements to the initial service.

On April 26, 1977, the Massachusetts Port Authority (Massport) introduced a pilot, shared-ride taxicab dispatching service called share-a-cab from Boston Logan International Airport to 21 cities and suburban towns to the west and northwest of the city of Boston. The service was designed to provide convenient, door-to-door taxi service to airport users for approximately half the fare of regular, exclusive-ride taxi service. It was developed in cooperation with state and local government agencies and the local taxi industry and is unique in several ways:

1. Passengers are grouped from five different ter-

minal locations in the airport.

2. Passengers pay a flat fare that is half the regular taxi fare.

3. All passengers are guaranteed service within 15 min even if there are no other passengers to share the ride.

4. Representatives of more than 200 independent taxicab owners and operators participated in the planning and initiation of the service.

5. An aggressive marketing program and extensive signing at the airport accompanied the introduction of the service.

This paper describes the background of the planning, development, and operating characteristics of this new shared-ride taxi service, reviews its goals and objectives, and reports the extent to which they have been met during the first 12 months of operation. Based on this review, preliminary conclusions are reached and recommendations for improvements to the initial service are made.

The data analyzed here were collected from daily operating statistics for the service and three user surveys conducted during the first 12 months of operation. The first survey was conducted at an earlier period when service was being offered to the initial 21 cities and towns and not guaranteed to the passenger (i.e., taxis were dispatched only when groups of two or more passengers had been formed). The follow-up surveys were conducted in December 1977 and January 1978, after the territory had been expanded to include 138 communities in the Boston metropolitan area and guaranteed service had been instituted.

BACKGROUND—GROUND TRANSPORTATION ACCESS TO LOGAN AIRPORT: CURRENT STATUS AND POLICY

In 1977, more than 12 million airplane passengers passed

through Boston Logan International Airport. It is estimated that air travelers going to and from the airport, their friends and families, and the employees who serve them generated more than 35.2 million person trips between the airport and its surrounding communities. Almost all of these passengers traveled by private automobile (80 percent) or taxi (11 percent). The remainder traveled by bus or limousine (3 percent) or by subway (6 percent). In the peak travel month of August, week-day traffic out of Logan exceeded 30 000 vehicles daily; peak volumes were close to 2300 vehicles/h (1, 2).

The location of Logan Airport, 1.6 km (1 mile) across Boston Harbor from Boston proper, means that more than 65 percent of the automobile trips to and from Logan must travel through the Sumner and Callahan tunnels (see Figure 1). The tunnels (two lanes in each direction) operate near capacity during peak travel hours, and through trips on Central Artery in downtown Boston (which connects with the tunnels) cause traffic volumes that exceed capacity and result in stop-and-go conditions during many hours of a typical day. The percentage of tunnel traffic that is airport-related varies from 26 to 56 percent during the course of the day, and airport traffic contributes significantly to tunnel congestion (particularly during the afternoon peak-travel hours).

In addition to causing delays to automobile drivers, this congestion increases levels of air pollution near the tunnels and encourages trucks making deliveries at the airport to divert to streets in East Boston, which increases the noise, congestion, and the possibility of accidents in this community. As the demand for air travel grows in the next several years, the problems associated with ground access to the airport are expected to become worse.

Massport has recognized the problems resulting from the current reliance on the automobile as the primary form of ground transportation to and from the airport and begun to encourage a modal shift away from such automobile use. The airport master plan of April 1976 included a policy declaration to promote vigorously the development of an improved network of alternative surface public transportation services for air passengers traveling to and from the airport. In particular, Massport has sought to divert a significant portion of the existing airport access and egress trips from low-occupancy private automobiles to high-occupancy bus, limousine, and rapid transit services.

However, the proposal to expand the use of these services met with strong protest from Boston taxi operators, who provide the primary taxi services at the airport. Airport trips constitute a significant portion of taxi industry revenues, and the operators viewed the promotion of other services as an unfair threat to their competitive position. Because Boston taxis were prohibited by regulation from offering multiple-ride services, the operators felt that they were not being given an opportunity to compete fairly with bus and limousine services. These taxi-industry concerns resulted in a week-long airport taxi strike (which later spread city-wide) and in requests for the right to provide multiple-ride services at the airport.

Because of the pressure generated by the taxi industry and in recognition of the potential transportation benefits to be derived from a sophisticated multiple or shared-ride taxi service, Massport, together with the Massachusetts Executive Office of Transportation and Construction, the city of Boston, and representatives of the taxi industry, developed the share-a-cab service. This service is consistent with federal and state policies to encourage the taxi industry to play a greater role in providing public transportation and, if all goes well, will become an important link in the development of a net-

work of airport ground transportation services.

OBJECTIVES

The development of the share-a-cab service was guided by the objectives of Massport and the taxi industry. Although these groups had distinct sets of objectives, these objectives were generally complementary, a factor that was essential to the coordination and cooperation needed for the development and implementation of the service.

The objectives of Massport in establishing the share-a-cab service were

1. To provide an innovative, high-quality group-ride taxi service to air passengers that would offer personalized door-to-door service at substantially reduced rates per person;
2. To divert airport ground access and egress trips from low-occupancy private automobiles to more efficient, high-occupancy shared-ride taxi service;
3. To reduce the traffic congestion and vehicle travel, air pollution, and energy consumption that are associated with airport ground access and egress; and
4. To ensure the continued economic viability and availability of demand-responsive transportation services at the airport.

The objectives of the private taxi industry in establishing the share-a-cab service were

1. To increase the total number of air passengers using taxi services for their airport ground access and egress trips and
2. To increase the average revenue received per vehicle kilometer for taxi trips to and from the airport.

DESCRIPTION OF SHARE-A-CAB SERVICE

Characteristics of Service

Massport, the city of Boston, and the executive office of transportation and construction spent several months developing and analyzing potential share-a-cab services. The characteristics of the service desired were then reviewed with the taxi industry, and a final set of service characteristics was agreed on. In the course of the discussions with the taxi industry, three important aspects of the service were modified in deference to their concerns.

First, Massport had proposed that the service be developed on a trial basis for 12 communities to the north and west of Boston, but the taxi industry felt that it should be developed for the entire metropolitan area (excluding the city of Boston) as soon as possible. The compromise reached was to initially develop the service for the 21 communities to the north and west of Boston that represent the focal point of travel outside Boston and account for approximately 25 percent of all air passengers. Then, 3 months later, the service was expanded to the remaining 117 communities in the greater Boston metropolitan area (these account for an additional 28 percent of all air passengers). The service was not developed initially for the city of Boston because the taxi industry feared that it might detract from their existing markets without attracting substantial numbers of new passengers. Figure 2 illustrates the locations of the initial and final share-a-cab service areas.

Second, as originally proposed, share-a-cab service at reduced rates was to have been guaranteed to all passengers within 15 min regardless of whether other passengers were available to be matched. This was in-

tended to increase the reliability of the service and its attractiveness to the traveler. The taxi industry, however, was concerned that during the initial months, when demand was only developing, there would be a large number of single-passenger trips at reduced fares, resulting in financial losses for the industry. In deference to this strongly expressed concern, it was agreed that guaranteed service would not be initiated until 2 months after service had been introduced to all of the 138 com-

munities in the Boston metropolitan area.

Finally, it had originally been hoped that two-way service could be developed. However, because of the difficult task of organizing diverse suburban taxi companies for the inbound trips and the pressure from the Boston taxi industry to implement the outbound service as soon as possible, the initial service was limited to trips outbound from the airport.

For the service finally implemented, the following service characteristics were established:

Figure 1. Logan International Airport and downtown Boston.

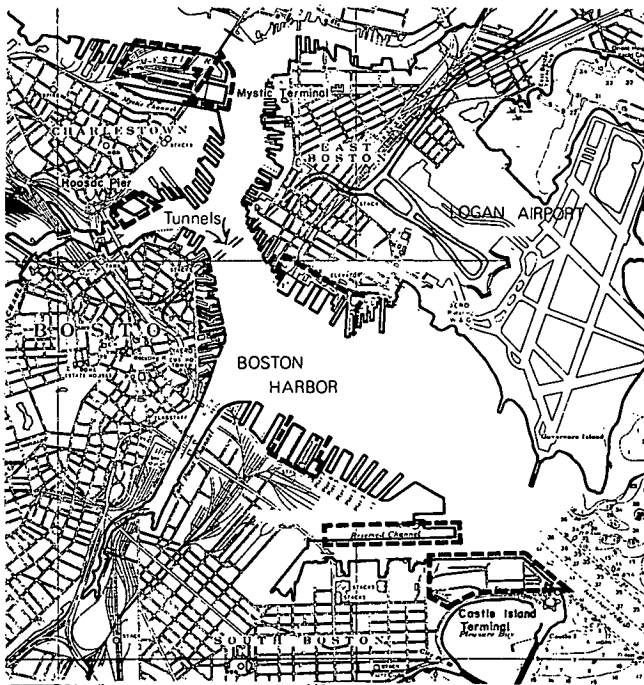
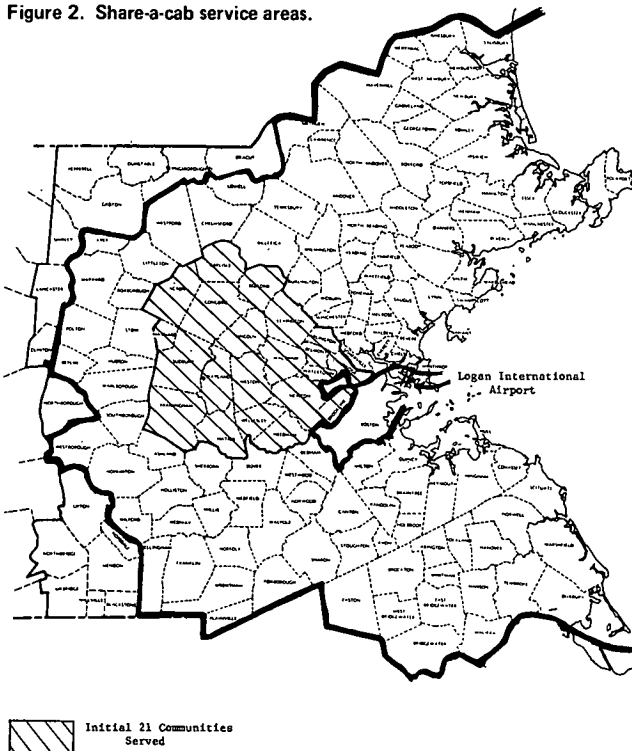


Figure 2. Share-a-cab service areas.



1. Share-a-cab service is available at the airport between 7:30 a.m. and 11:30 p.m., 7 d/week.
2. Each passenger matched in a group receives door-to-door service from the airport to his or her particular destination in any of the communities served.
3. The share-a-cab fares are flat rates established for trips to each of the communities per person and independent of the number of passengers grouped in the vehicle. The rates are set at approximately one-half the average metered rate to each community and include all tolls and other applicable fees. The fare per person is known by the passenger in advance and does not vary with traffic conditions or routes.
4. Share-a-cab service within 15 min is guaranteed to any passenger requesting it. (Before September 19, 1977, service was guaranteed only if two or more passengers could be matched to form a group; if a group could not be formed, the waiting passenger was so informed and given the options of waiting longer or taking an alternative service.)
5. The size of the group is limited to a maximum of 4 passengers/vehicle (in accordance with Boston taxi regulations), and each passenger is limited to two pieces of luggage unless the size of the group or the storage capacity of the vehicle permits more.
6. Once a passenger is assigned a share-a-cab group, he or she is guaranteed service at share-a-cab rates, regardless of whether the other passengers scheduled to ride in the taxi actually join the group.

Mechanics of Share-a-Cab Service

Massport is responsible for the share-a-cab dispatching system at the airport. Only city of Boston licensed taxis can participate in the service. (According to state statute, only city of Boston taxis can pick up fares at Logan Airport unless a prior arrangement has been made with an out-of-town taxi.)

The service is designed to fit smoothly into the passenger's normal routine for leaving the airport. After claiming his or her baggage, the passenger approaches one of the share-a-cab booths located in the baggage claim areas of the terminals. At the booth, a trained attendant and informative signing provide information about the service and aid the passenger in making a service request. The attendant and the passenger use an easy-to-read service-area map to locate the passenger's destination zone, and the attendant then relays this information to a central control office.

At the central control office, a call taker records the request, marks a dispatch constraint time 15-min hence, and relays the information to the dispatcher. By using a large-scale area map and personal knowledge of the service area, the dispatcher forms the groups from among the passengers waiting at all the terminals. To aid in this process, a series of matching guidelines that minimize wait and travel times have been established. After a group has been formed or when 15 min have passed, the dispatcher calls the next taxi in the taxi queue and gives the driver a dispatch form that identifies how many passengers are waiting at each terminal. The dispatcher

then notifies the attendants in the terminals that a taxi is on the way. The passenger is informed of the number of the dispatched taxi by the attendant and then waits at the curb to be picked up. Because the fares do not vary with time or incremental distance, the driver has an incentive to find the shortest and quickest route for delivering the passengers.

Taxi operators can choose to provide either share-a-cab or regular (exclusive-ride) service by entering the separate queues for each. In the share-a-cab queue, the driver may be assigned between one and four passengers. A driver who picks up only one passenger receives a rain check that allows preferential placement when he or she returns to the queue.

Costs of Share-a-Cab Service

Capital Costs

Fixed one-time costs for the Logan Airport share-a-cab system included a number of low-cost improvements to the terminal and taxi-pool holding areas. These costs included the design and construction of a special share-a-cab-pool holding area; the purchase and furnishing of the central dispatching and matching center in the taxi-pool area; the construction of share-a-cab information booths in each of the five terminal areas; and the design and purchase of dispatching equipment (such as maps, time clocks, and telecommunication and paging systems). These costs totaled approximately \$130 000. In addition, there was a one-time initiation marketing cost of approximately \$60 000 to introduce the service to the public and develop a permanent share-a-cab signing program for the airport.

Operating Costs

Annual operating costs for the share-a-cab program include personnel salaries and benefits, expenditures such as utilities and maintenance, and a continuing marketing expenditure. These costs totaled \$293 000 for the first year, of which approximately 67 percent are attributable to personnel costs. The system as currently designed is labor-intensive because of the need to match passengers at a number of terminals at the same time.

Revenues and Deficit

A \$0.50 fee is charged to each taxi entering the share-a-cab taxi-pool area. For the first full year of service, it is expected that an average of 100 taxis/d will be dispatched, which will result in an annual revenue of \$18 250 and an operating deficit of \$275 750.

This deficit is being partially offset by an increase in revenue from the regular taxi pool. Before the initiation of share-a-cab service, only the regular taxi pool existed, and taxis paid a \$0.10 entrance fee to help pay for the regular dispatching personnel (who are located at curbside in each terminal area). The revenue from this charge was very small compared with the labor costs of maintaining the regular dispatchers at each terminal and in the central area; the annual deficit was \$286 250. At the initiation of the share-a-cab service, the fee for entering either pool (regular or share-a-cab) was set at \$0.50 and, because of the high continued use of regular taxis, this has resulted in a reduction of the regular service deficit to \$11 400. Therefore, the total annual deficit from taxi operations after the introduction of share-a-cab service was \$287 150, which is only a slight increase.

PROJECTED EFFECTS

In the course of developing the share-a-cab service, a demand prediction methodology was developed to compare alternative corridors, fare structures, and dispatching techniques. By using this methodology, predictions of shared-ride taxi trips, exclusive-ride taxi trips, revenue per taxi, and taxi industry revenue could be made. The methodology allowed the planners to explore the effects of the shared-ride strategy with respect to the objectives set for the service. A summary of the expected results was produced for the initial 21 communities served by assuming a flat half fare, the availability of share-a-cab service for trips to as well as from the airport, and guaranteed rides for single passengers. Demand was estimated based on the size of the potential market among automobile users and on the potential for diversion of existing regular taxi users. Given the anticipated demand, estimates of one-, two-, three-, and four-passenger share-a-cab groups were made by assuming a Poisson arrival rate over 15-min periods.

Three of the projected effects—level of projected ridership, impact on vehicle travel, and impact on taxi industry revenues—are worth reviewing here.

The expected increase in taxi ridership was 149 passengers/d in the western corridor and 217 passengers/d in the northwestern area. The percentage increases in the taxi market ranged from 20 in Cambridge (where taxis already carried 41 percent of the trips) to 165 in Framingham (where taxis carried only 7 percent of the trips). The demand estimates were based primarily on diversion from regular taxi and the automobile, although it was assumed that a certain amount of the total demand would probably come from other modes.

One of the important potential benefits of share-a-cab service is a reduction in vehicle travel (VT) for airport trips. Although a detailed analysis was not performed before implementation, the following example illustrates the projected benefits. The average round-trip VT for share-a-cab trips to the western corridor was estimated by (a) computing the probability (based on the relative number of trips to each town) that the last destination for a certain size group is in each town and (b) adding a penalty of 3.2 km/round trip (2 miles/round trip) for each additional passenger. This technique gives an average share-a-cab round-trip VT to the western corridor, assuming four passengers per taxi, of approximately 56 km (35 miles). Average two-way VT to the western corridor by exclusive-ride taxi is approximately 42 km (26 miles) and by automobile is 46 km (29 miles). For those who would have taken an automobile parked at the airport or have rented an automobile, the average one-way VT is 23 km (14.5 miles). Thus, a four-passenger share-a-cab group would have a 24 percent saving in VT over a parked or rented automobile, a 62 percent saving over an automobile pick-up trip, and a 58 percent saving over exclusive-ride taxi. At the average projected occupancy for share-a-cab service of 3.9 persons/taxi, there would be considerable VT saving. Of course, this saving would be partially offset by increases in VT for passengers formerly using transit or buses, but the expected diversions were not large enough to completely offset the potential benefits of share-a-cab service.

Total taxi industry revenues were projected to increase by 41 percent with the introduction of share-a-cab service because of the high number of new riders that would be attracted. Given that average occupancy was also expected to increase, taxi VT was projected to increase more slowly than revenue, which would result in a projected 14 percent increase in revenue per vehicle kilometer.

Thus, the projected effects were highly beneficial to

both the transportation system and the taxi industry. However, as indicated above, at meetings between Massport, the city of Boston, the executive office of transportation and construction, and the taxi industry before implementation of the service, several important changes in the specifications were made. Two of these changes—the delay of provision of guaranteed service and delay of provision of two-way service—strongly affected the attractiveness and marketability of the service. As a result, the initial demand levels for the service were well below those originally projected.

RESULTS

During the first 12 months of operation of share-a-cab service, two forms of data were collected about passenger levels and user characteristics. Weekly statistical reports were compiled directly from the operation (these included numbers of service requests, passengers served, and taxis dispatched; taxi occupancy; and frequency of destinations served). In addition, a user survey that consisted of nine short questions was conducted on three week-long occasions by share-a-cab personnel. The survey requested information about user modal choice in the absence of share-a-cab service, frequency of airport use, method by which the user first learned of share-a-cab service, and other items. The first survey was conducted during the week of July 12-18, 1977 (when nonguaranteed service was being provided to only the initial 21 communities). The second and third surveys were conducted during the weeks of December 16-22, 1977, and January 10-17, 1978 (when guaranteed service was being provided to 138 communities).

Service Use Before Guaranteed Service

The initial service patronage was lower than projected. A total of 10 600 passengers (174 passengers/d) used the service during May and June. Daily average patronage increased during May and June from an initial 148 passengers/d to a peak of 196/d. The number of taxis dispatched averaged 60/d during May and June, which resulted in an average occupancy of 2.9 passengers/taxi. This occupancy was below that expected and was caused by a lower level of demand than that expected.

On July 19, 1977, the share-a-cab service was expanded to 117 additional communities, but still excluded the city of Boston. Despite the higher potential demand of the expanded service area, total share-a-cab patronage remained about the same as in May and June and there was an actual decrease in patronage in the initial 21 communities. In early September, average share-a-cab patronage was 189 passengers/d (of which 151 were from the initial 21 communities) or 2.1 percent of total travel to the 138 communities (and 3.5 percent of total travel to the 21 communities).

Demand by the additional 117 communities was much below that expected from the overall travel demand in these communities. This was due in part to the introduction of service to these communities during the summer and in part to the high number of potential users to those communities who were not matched because of the dispersed nature of the demand. The number of potential users not matched increased from 1.4 percent (with 21 communities served) to 10 percent (with 138 communities served). At the same time, the average taxi occupancy decreased from 2.9 to 2.7 passengers/taxi. In addition, the unreliability of the nonguaranteed service apparently hindered the normal growth one would expect after the introduction of a new service (although it is difficult to estimate the normal growth curve of an airport service that serves infrequently made trips).

Among the significant findings of the first user survey (July 1977) was that 52 percent of users were going to a residence and 25 percent were going to a hotel. The majority of users were relatively infrequent airport travelers; 15 percent had never traveled through Logan Airport before. If share-a-cab service had not been available, about 60 percent of the respondents would have used a regular taxi, 20 percent a private or a rental automobile, and 19 percent bus, limousine, or transit service. However, for trips to the airport, modal use shifts significantly; 36 percent would have used private or rental automobiles, 36 percent would have used regular taxis, and 12 percent would have used bus, limousine, or transit services. Seventeen percent of the users (1 in 6) had used share-a-cab service before. In terms of learning about the service, the extensive airport signing was clearly the most effective marketing mechanism, and newspapers and friends and relatives were next most effective.

Effects of Guaranteed Service

The introduction of guaranteed service on September 19, 1977, had significant effects on share-a-cab patronage and taxi occupancy. Patronage increased from 189 passengers/d in early September to 245 passengers/d in October and November (or 2.7 percent of all travelers to the communities served) to an average of 291 passengers/d in the January to March period (or 3.2 percent of all travelers). Single-person trips ranged between 10 and 15 percent of all trips and, as a result, average share-a-cab taxi occupancy decreased to 2.2 passengers/taxi during the fall (although by March 1978 it had increased to about 2.4). Trips to the 117 additional communities increased from 16 percent of all share-a-cab trips to more than 30 percent as previously unmatched passengers were provided guaranteed service.

The findings of the second and third user surveys (December 1977 and January 1978) include important changes in service use. The combined results are summarized in Figure 3. Had share-a-cab service not been available, approximately 42 percent of users would have used regular taxi, 30 percent would have used automobiles (including rental ones), and 28 percent would have used limousines, buses, or rapid transit. This is a substantial change in previously used modes (compared with the first user survey); many more respondents to these surveys had shifted from automobile and transit to share-a-cab service. This shift occurred throughout the 138 communities served, but was most evident in the 117 new communities where less than one-third of the users would previously have used taxis.

In addition to these changes in previously used modes, these surveys indicated that the percentage of users who had previously used the service had more than doubled (from 17 percent in the first survey to 35 percent).

Service Objectives

The data now available (Table 1) allow a preliminary evaluation of the ability of share-a-cab service to meet the objectives set forth.

1. To provide high quality service: Service implementation went smoothly; the telecommunications and logistics worked well. At first, when service was not guaranteed, the percentage of potential users who were not matched into groups was higher than expected, but monitoring the dispatching techniques and guidelines reduced the percentage of nonmatches to 1.4 percent (with 21 communities served). Group formation and dispatching also generally went well, although there was an early

Figure 3. Share-a-cab questionnaire.

Date _____ Time _____ Terminal _____

Please help us to evaluate and improve our airport ground transportation services by answering the following questions.

Please return completed questionnaire to Share-A-Cab counter

- To what city or town are you travelling? _____
- Are you travelling to a:
 - 17.3% Hotel 58.5% Home
 - 11.2% Business 8.6% University or School
 - 0.7% Hospital 3.7% Other
- Is this your first trip to Logan Airport? 10.6% Yes 89.4% No
- How often do you use Logan Airport each year? 0-15 trips (70.7%)
16 trips (29.3%)
- If Share-A-Cab had not been available, how would you have made your trip from Logan Airport? (please check one)
 - 7.0% Rental car 41.7% Regular taxi
 - 14.9% Limousine or private bus line 15.5% Private auto (picked up by someone else)
 - 12.3% Rapid transit (T) 2.3% Other
 - 6.2% Private auto (parked at airport)
- What type of ground transportation do you use most frequently to get to Logan Airport? (please check one)
 - 12.8% Rapid transit (T) 4.4% Rental car
 - 8.9% Limousine or bus 15.1% Private auto (parked at airport)
 - 25.5% Regular taxi 26.6% Private auto (dropped off by someone else)
 - 0 Not applicable 6.7% Other
 - 7.5% Two choices made
- Have you used Share-A-Cab before? 34.8% Yes 65.2% No
- How did you first learn about Share-A-Cab? (please check one)
 - 8.8% Newspaper ad 12.2% From a friend or relative
 - 3.3% Radio ad 3.6% From your employer
 - 57.3% Airport signing 1.5% From a taxicab company or driver
 - 2.1% From an airline 7.1% Other
 - 4.2% Television 4.0% Two Choices made

Table 1. Service data.

Item	Before Share-a-Cab Service	After Implementation of Guaranteed Service to 138 Communities	
		All Taxi Service	Share-a-Cab Service Only
Total no. of daily passengers	1196	1366	291
Change, \$	-	+14.2	-
Total no. of daily taxis	747	749	123
Change, \$	-	+0.3	-
Avg no. of passengers/taxi	1.6	1.82	2.4
Change, \$	-	+13.8	-
Total daily revenue, \$	8420	8948	1892
Change, \$	-	+6.3	-
Avg revenue/taxi trip, \$	11.27	11.95	15.38
Change, \$	-	+6.0	-
Total daily taxi travel, km	31 314	33 464	4514
Change, \$	-	+6.9	-
Revenue/vehicle-km, \$	0.27	0.27	0.42
Change, \$	-	0	-

Note: 1 km = 0.6 mile.

tendency of the dispatchers to wait too long for an additional rider. Correcting this resulted in a slight decrease in average occupancy but also in reductions in cancelled requests for service and average wait times.

Overall, the service worked very well. The lower than expected demand levels resulted in some com-

plaints of less than optimal matches, but passenger and media response has generally been enthusiastic. By July 1977, 17 percent of the users were repeat users and, by January 1978, there were 35 percent repeat users. When cross tabulated with frequency of travel through the airport, more than 50 percent of users who were frequent airport travelers had used the service before.

Taxi industry response has been similarly enthusiastic; the major concern has been that waits in the taxi pool have been too long. The industry was extremely interested in the July 1977 expansion of share-a-cab service to additional communities so as to increase overall use and awareness of the service. The industry did have some concern that initiation of guaranteed service was premature, but this proved unfounded and there have been no driver complaints since September 1977.

2. To divert trips from automobiles: The results of the December and January user surveys indicated that a significant part (41.7 percent) of share-a-cab users would previously have used regular taxis. Nonetheless, 15.5 percent would have been picked up in automobiles, 6.2 percent would have parked automobiles at the airport, and 7.0 percent would have used rental automobiles. Table 2 summarizes these data and shows that a total of 1.3 percent of automobile users changed to share-a-cab service. This modal-split shift varied significantly among the towns served; in the farther-out towns as

Table 2. Estimated modal shifts.

Item	Percentage of Total		Previous Modal Split (%)	Estimated New Modal Split (%)	Shift (%)
	Share-a-Cab Passengers	Airport Trips Using Share-a-Cab			
Previous mode for trips shifting to taxi service					
Bus, limousine, or transit	27.2	0.9	9.7	8.8	-9.3
Automobile (including rental)	28.8	0.9	66.8	65.9	-1.3
Other	2.3	0.1	0.9	0.8	-11.1
Total shifting to taxi service	58.3	1.9	77.4	75.5	-2.5
Trips shifting from regular taxi	41.7	1.3	22.6	21.3	-5.8
Total share-a-cab trips	100.0	3.2	—	3.2	—

Table 3. Effect on daily vehicle travel.

Mode	Daily Passengers From Mode	Previous VT (km)	Share-a-Cab VT	
			Value	Change (%)
Rental automobile	20.8	484	510	+5
Bus or limousine	44.3	—	1082	
Transit	36.5	—	894	
Automobile (park and fly)	18.4	428	450	+5
Automobile (pick up)	46.3	2149	1133	-47
Taxi	124.7	5187	3051	-41
Total	291	8248	7220	-14

Note: 1 km = 0.6 mile.

many as 40 percent of share-a-cab users would have previously used automobiles. Had share-a-cab service not been available, 27.2 percent of users would have chosen rapid transit, bus, or limousine service. This represents a shift of 9.3 percent of the previous users of these modes to share-a-cab service.

3. To reduce vehicle travel, traffic congestion, and air pollution: Share-a-cab service has had both positive and negative effects on vehicle activity, but overall has resulted in a significant reduction in VT. As indicated in Table 3, VT by share-a-cab users to the 138 communities served has been reduced by 1100 vehicle•km/d (700 vehicle miles/d) or 14 percent. The most significant reductions have been from previous automobile users and regular taxi users who have shifted to share-a-cab service. Despite the relatively low patronage in the period before service was guaranteed, overall taxi occupancy increased from 1.6 to 1.82 passengers/taxi (which was instrumental in the significant reduction in VT). Bus, limousine, and transit users changing to share-a-cab service caused a gain in VT, but this was more than offset by the reductions.

4. To increase taxi market share: One of the prime objectives of the taxi industry was to increase the share of the airport travel market being served by taxis. Based on the December and January surveys, 58 percent of the users of share-a-cab service (approximately 170 persons/d) would not have used taxi services before the initiation of share-a-cab; this is a shift of 1.9 percent of total airport travelers to the share-a-cab service area. Taxis previously served approximately 1196 daily trips to the service area; thus, even the low level of current patronage has resulted in over a 14 percent increase in total taxi passengers.

5. To increase taxi revenue per vehicle kilometer: As shown in Table 1, the overall taxi-industry revenue to the service area has increased by about \$500/d or 6 percent. Since the total number of taxi trips to the service area has remained almost constant, the overall average revenue per taxi trip has also increased by about 6 percent. But the higher average round-trip travel of share-a-cab trips [58.8 km (36.7 miles)] as compared with 42.0 km (26.2 miles) for regular taxi] has resulted in a growth

in daily taxi VT of about 7 percent. Therefore, the industry revenue per vehicle kilometer has remained about the same because the increase in taxi VT has offset the increase in revenue. However, as passenger volume and taxi occupancy grow, the revenues per vehicle kilometer should increase.

CONCLUSIONS AND FUTURE DIRECTIONS

The few-to-many share-a-cab service at Logan Airport is a precedent-setting service in many ways. The fare structure and the dispatching system, which guarantee service at a reduced fare, are unlike those of any other airport taxi service. Implementation of the service required the cooperation of diverse public agencies and many independent taxi operators. And, despite the short time since implementation, the service works well and is being enthusiastically received by the traveling public.

In its first 12 months of service, share-a-cab service has accomplished several important objectives. It is providing door-to-door service to almost 300 airport users daily at half the regular taxi fare. It has attracted a large number of new riders to taxi service, which has resulted in substantial increases in taxi markets and revenues. Because the total number of taxi trips has remained about the same, the new fares have significantly increased industry revenue per trip in the share-a-cab service area. It has also reduced total VT from Logan by a slight but significant amount.

Several of the objectives of share-a-cab service, however, have not yet been fully obtained. Demand for the service has been lower than expected and, as a result, occupancy of share-a-cab service is only 2.4 passengers/taxi. Taxi vehicle kilometers have increased along with taxi revenues and, thus, revenue per kilometer has not changed. Therefore, although share-a-cab service has improved average taxi occupancy at Logan, it has not, as yet, increased taxi industry profitability.

Although 30 percent of the users of share-a-cab service have been diverted from the automobile, 28 percent have been diverted from bus, transit, and limousine services. Reductions in VT by former automobile users are thus partially offset by increases in VT by former public transportation users. The net effect, however, is a reduction in VT and this can be expected to increase as ridership and occupancy increase.

Share-a-cab service had relatively high operating costs during its first 12 months. At the current level of ridership, the subsidy for the dispatching costs incurred by Massport is approximately \$2.50/passenger.

Share-a-cab service will be able to attain all of its objectives in the future if its ridership grows. Increased passenger levels will increase taxi occupancy and profitability while reducing VT and the subsidy per passenger. The steady growth observed since the introduction of guaranteed service is expected to continue as the service becomes more reliable.

In addition to the expected natural growth in service

use, several planned or proposed improvements could greatly improve the ability of share-a-cab service to meet its objectives. First, share-a-cab service to the city of Boston is proposed to begin sometime in 1978. Boston was not served initially because of taxi industry concerns that the service would damage their existing strong market. With the general success of the service, however, it is expected that industry support for the Boston service will be forthcoming. Initiation of share-a-cab service to Boston will greatly increase demand and enable dispatchers to make more and better matches. Although service to downtown Boston will probably attract a high number of users from existing taxi service, these diversions should be more than offset by diversions from automobiles and other modes in other sections of the city, which will result in increases for the taxi industry and reductions in VT.

Second, Massport is currently investigating potential ways to reduce the operating cost of the service without sacrificing its quality. Automation of portions of the dispatching system may increase its cost-effectiveness while also aiding dispatchers to minimize air-traveler wait times and travel times. Also, less costly dispatching systems are being reviewed for possible use in off-peak hours (e.g., direct passenger telephone communications from less busy terminals to eliminate the staffing of share-a-cab desks during morning hours).

Finally, continuing efforts will be directed toward developing inbound share-a-cab service. Before implementation of the service, Massport contacted all the taxi companies in the initial 21 communities and sought their interest in providing inbound service but, although a small number expressed interest at that time, it was determined that the small number of towns those companies served would not provide the level of demand required for efficient grouping of passengers. The lack of a uniform suburban taxi industry and the fractured nature of the service areas hinder development of inbound service. Nonetheless, provision of two-way service could

substantially increase the attractiveness of share-a-cab service to current automobile users, and efforts at developing a central inbound dispatching system will continue.

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**Mr. Greenbaum was with the Massachusetts Port Authority when this research was performed.*