MARKETING AND PROMOTION OF DEMAND-RESPONSIVE TRANSPORTATION

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The Haddonfield, New Jersey, demand-responsive transportation (DRT) system has been in operation since February 1972. It is a demonstration sponsored by the New Jersey Department of Transportation under a research, development, and demonstration grant from the Urban Mass Transportation Administration. The objective of this demonstration is to determine public attitudes, economic and technical feasibility, and community impacts of the demand-responsive concept (1). Several controllable parameters were changed during the course of the experiment to determine their effects on the system's performance. One of these parameters, fare, was changed twice during the experiment to determine its impact on public attitudes and its effect on ridership, quality of service, productivity, and economics of the system. This paper summarizes these fare changes and their effects on the system.

DESCRIPTION OF FARE STRUCTURES

There have been basically 2 fare structures and a free-fare day since the inauguration of the demonstration. Until October 1973, the average fare was 55 cents, and the basic fare was 30 cents and 15 cents for senior citizens. This drop in fare was accompanied by the introduction of a shuttle service to carry passengers between the PATCO High Speed Line Station and the Cherry Hill Mall; intermediate stops were made at Cherry Hill Hospital and Ellisburg Shopping Center (Fig. 1). This service remained in operation until May 1974, when it was assumed by the Transport of New Jersey (TNJ) bus system, and a zonal mode of operation was introduced during peak hours; the basic reduced fare structure was not changed. Thus, the changes that occurred in the operating parameters are the combined effects of the reduction in fare and the introduction of the shuttle service or of the reduced-fare condition and the zonal operation.

Another fare change occurred on March 16, 1973, when the basic fare was dropped from 60 to 0 cents for that day only in an attempt to attract more ridership and, consequently, test the performance of the control room staff under increased demand.

EFFECTS OF FREE-FARE DAY ON SYSTEM PARAMETERS

The free-fare day of March 16, 1973, had a substantial impact on the DRT ridership, vehicle supply, productivity, and public attitudes toward the system.

Effect on Ridership

A substantial increase in daily ridership occurred during the free-fare day. For the

Figure 1. DRT shuttle service route.

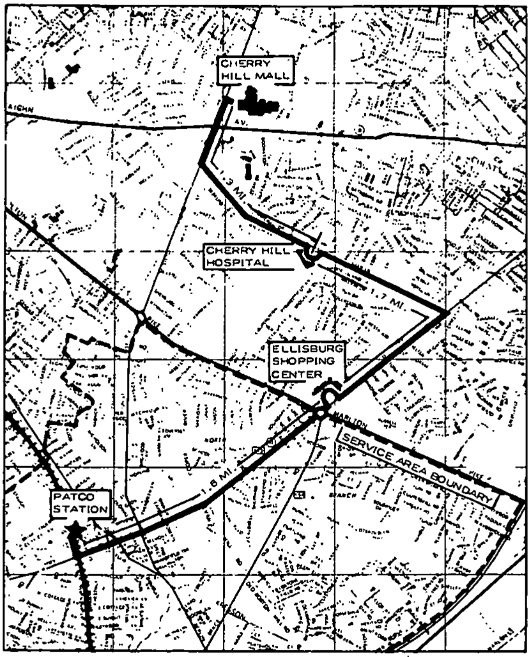
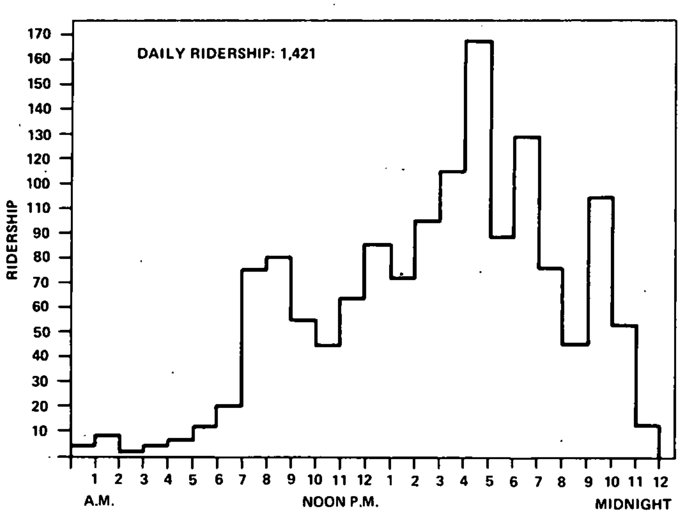


Figure 2. Hourly distribution of free-fare day ridership.



24-hour period, the ridership totaled 1,421, which is almost twice as high as the average weekday ridership of 734 for the preceding period, October 30, 1972, to March 15, 1973. The hourly distribution of this ridership, shown in Figure 2, indicates that ridership peaked between 3:00 and 7:00 p.m.; the maximum level was 170 riders for the hour ending at 5:00 p.m. Ridership started increasing beyond the normal weekday levels only in the afternoon, after the widespread publicity of free fare took its full course (2). This increase in ridership implies that DRT demand in Haddonfield is highly price elastic and had an elasticity of about -0.94 when the average fare level dropped from 55 to 0 cents/ride. (The elasticity of demand with respect to price is a dimensionless measure equal to the percentage change in demand resulting from a 1 percent change in fare.) This increase is a result of a larger frequency of trip making of the previous DRT users as well as of an attraction of new users to the system. An on-board survey conducted that same day indicated that most riders were not making the trip because of the free fare and that they had used the system in the past and planned to use it in the future. In fact, a closer examination of this survey shows that most of the interviews were conducted prior to the midafternoon hours when the information concerning the free-fare day had reached the public fully. On the other hand, an analysis of the trip tickets and the telephonist's log of calls showed that nonusers of the system were attracted that day. In fact, the number of calls resulting in trips was 1,421 for the free-fare day as compared with the mean number of 493 for the period July 26, 1972, to January 26, 1973. Similarly, the number of information calls received was 5 times as high as the corresponding previous daily average, and the rate of calls received that day from outside the service area was 4 times higher than that for daily regular operation during the July 1972 to January 1973 period.

Effect on Vehicle Supply

Vehicle supply increased during the free-fare day by 26 percent over the average weekday for the period October 30, 1972, to March 15, 1973. During the 24 hours of free fare, the vehicle supply was 151.5 vehicle hours as compared with the average of 119.5. Hourly distribution of the vehicles during the free-fare day, shown in Figure 3, indicates that, for 5 hours of that day, 10 vehicles or more were in operation. At no hour of the day during the period August 1, 1972, to January 31, 1973, were 10 vehicles in operation. During the free-fare day, 8 vehicles out of the fleet of 12 were in operation for 12 hours, as compared to 4 hours for the average weekday of the period August 1, 1972, to January 31, 1973 (3).

Effect on Productivity

Average productivity during the free-fare day increased by 50 percent over the average weekday for the period of October 30, 1972, to March 15, 1973. It increased from the weekday average of 6.2 to 9.38 passengers/vehicle hour and was above 10 passengers/vehicle hour for most of the afternoon and evening hours of the free-fare day. A peak of 17.67 occurred between 9:00 and 10:00 p.m., as shown in Figure 4. Peak productivity on the average weekday for the period August 1, 1972, to January 31, 1973, was 8.10 passengers/vehicle hour, and this occurred between 7:00 and 8:00 a.m. The afternoon peak of 7.12 passengers/vehicle hour occurred between 1:00 and 2:00 p.m. (4).

Effect on Quality of Service

The increases in ridership and productivity of the system during the free-fare day were accompanied by a decrease in the quality of service, as measured by promised pickup time. The telephonist's log of calls indicates that 117 calls were made on the free-fare day in which customers did not make the trip because the promised pickup time was more than 30 minutes; that situation rarely occurred on regular days. In total, refusals

Figure 3. Hourly distribution of free-fare day vehicle supply.

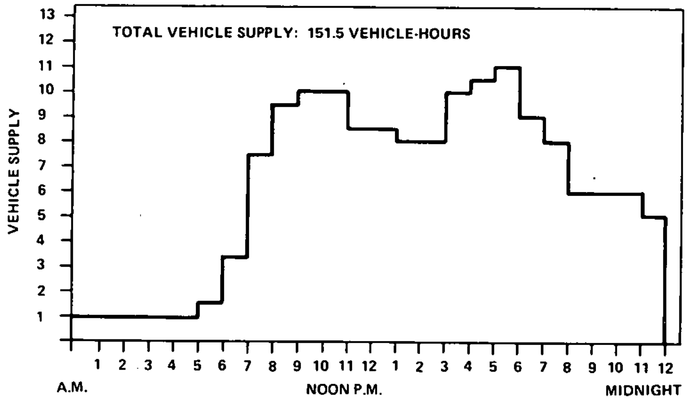


Figure 4. Hourly distribution of free-fare day productivity.

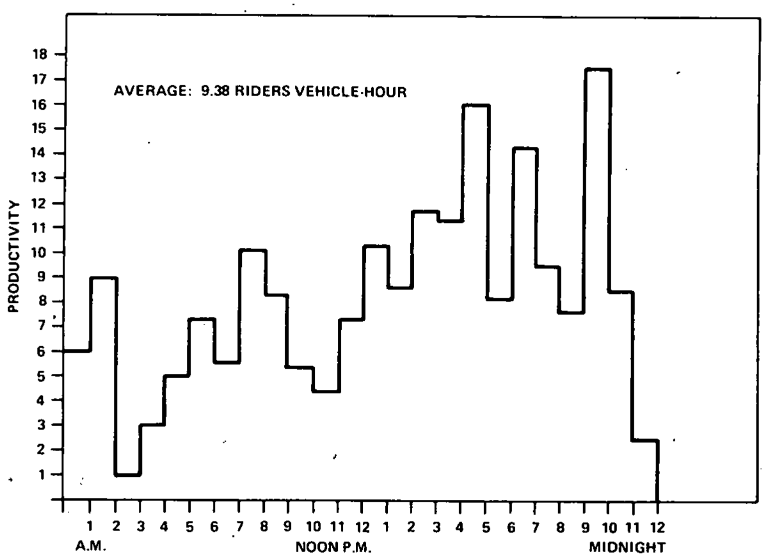
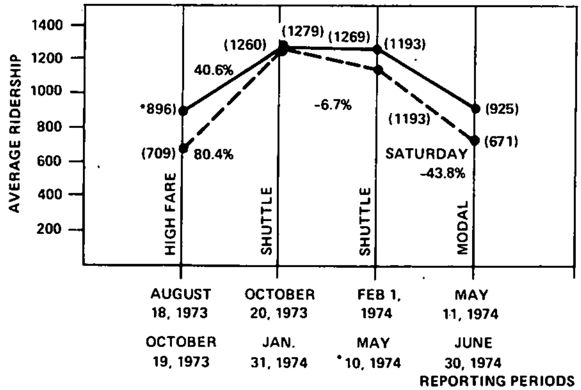


Figure 5. Effect of reduced-fare structure on daily ridership.



because of excessive wait times were about 10 percent of the trips actually made, of which about 8.5 percent were because the promised wait time exceeded 35 minutes (2).

Another measure of service quality is the number of cancellations and no-shows at the pickup point. During the free-fare day, the number of cancellations and no-show customers was about 11 percent of the number of trips actually made, a rate 3 times higher than that for the period of July 1972 to January 1973. This measure confirms the unacceptability of excessively long wait times that resulted from the increase in ridership and productivity on the free-fare day. This measure also suggests that higher ridership levels might have been achieved if quality of service had been maintained at its previous standard. The availability of a larger fleet size would have helped alleviate this problem, and possibly reduced productivity levels.

EFFECTS OF FARE REDUCTION ON SYSTEM PARAMETERS

The reduction in fare from an average of 55 to 25 cents, accompanied by the introduction of the shuttle service, caused substantial increases in ridership and productivity of the DRT system. This combined condition of reduced fare and shuttle service remained until May 11, 1974, when the shuttle service was assumed by TNJ.

At that time, the zonal mode of operation was instituted during peak hours (7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. on weekdays and 10:00 a.m. to 5:00 p.m. on Saturdays) and began at the PATCO station, where transfer was made for many-to-many trips between zones. The reduced-fare structure was still maintained with a slight change of senior citizens' fares (books of 10 tickets for $1.50). These tickets were not being honored by TNJ; instead, a 15-cent cash fare entitled them to a free transfer to the DRT system (4).

Effect on Ridership

The reduction of fare and the introduction of shuttle service resulted in a 40 percent increase in average weekday ridership and an 80 percent increase in average Saturday ridership. In fact, the average weekday ridership increased from the August 18 to October 19, 1973, level of 896 riders to the October 20, 1973, to January 31, 1974, level of 1,260 riders. Average Saturday and Sunday ridership increased from 709 to 1,279 and from 317 to 488 riders respectively. These high levels of ridership were maintained until the assumption of the shuttle service by TNJ (Fig. 5). This increase in ridership should not imply that the Haddonfield DRT has a high elasticity of demand with respect to fare because this increase is the combined effect of fare reduction and improvement or addition to the service quality. As a matter of fact, shuttle ridership alone consisted of about 30 percent of the average weekday and about 42 percent of the average Saturday figures. When the shuttle service was assumed by TNJ and the zonal operation instituted, the average ridership was reduced to 925 riders on weekdays and 671 riders on Saturdays (Fig. 5). This reduction was paralleled on the 3 TNJ routes by an increase of 435 riders to the total weekday ridership and 550 riders to the total Saturday ridership.

Even though the effect of fare reduction on ridership cannot be completely isolated from the effects of the shuttle or zonal modes of operation, nonshuttle hourly ridership distributions indicate that the effect of the shuttle service on ridership is highly significant (Figs. 6, 7, and 8). Thus, the reduction of fare alone did not significantly affect the increase in ridership, and the Haddonfield DRT demand is more elastic in the improvement or addition of the shuttle mode of operation than in fare reduction.

Effect on Vehicle Supply

The reduced fare and shuttle service did not seem to affect the vehicle supply. The average weekday number of vehicle hours for the DRT system was about 173 vehicle

Figure 6. Hourly distribution of average weekday nonshuttle ridership for high-fare and reduced-fare periods.

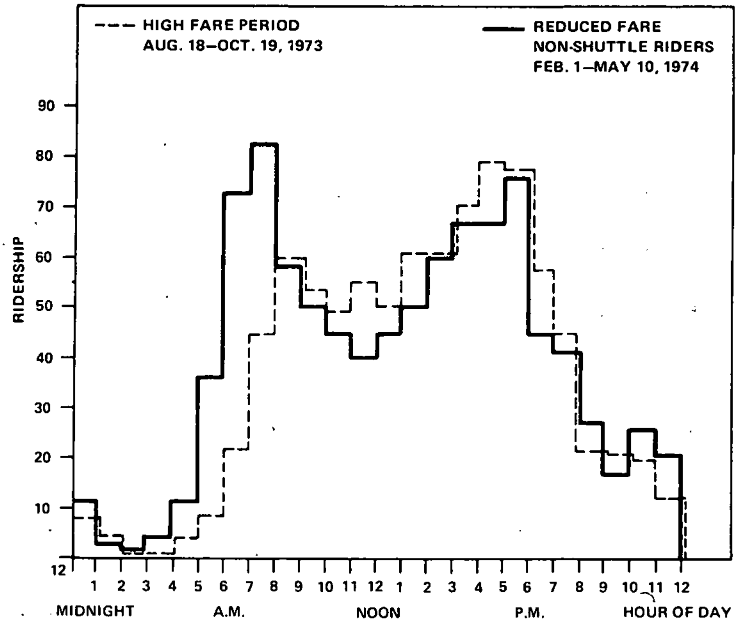


Figure 7. Hourly distribution of average Saturday nonshuttle ridership for high-fare and reduced-fare periods.

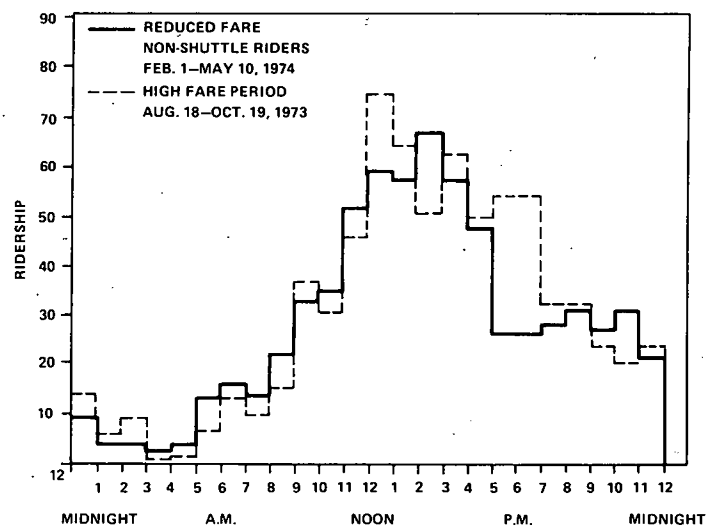


Figure 8. Effect of reduced-fare structure on weekday hourly ridership distribution.

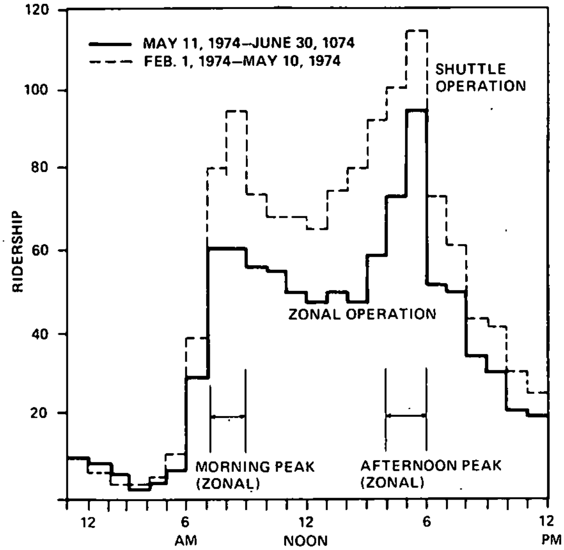
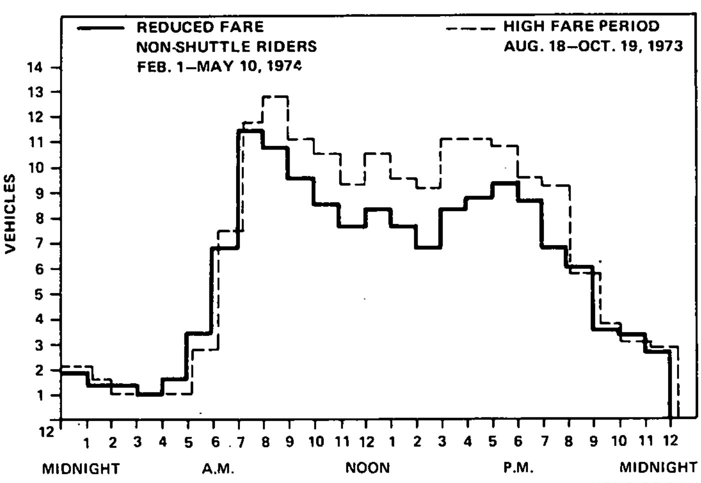


Figure 9. Hourly distribution of average weekly vehicle supply for high-fare and reduced-fare periods.



hours during the shuttle period and about 177 vehicle hours for the previous period of May 11 to June 30, 1974. The nonshuttle vehicle supply was, however, about 145 vehicle hours on the average weekday and 177 vehicle hours after the shuttle service was assumed by TNJ. Hourly distribution of vehicle supply for the preshuttle high-fare period and reduced-fare shuttle periods also shows that the vehicle supply for nonshuttle riders was lower in the latter period (Figs. 9 and 10).

Effect on Productivity

The productivity of the entire DRT system increased substantially after the fare was dropped and the shuttle operation introduced. The average weekday productivity increased from 5.5 to about 7.7 riders/vehicle hour. However, when the shuttle service by TNJ and the zonal operation began, the average daily productivity dropped to about 5.2 riders/vehicle hour. On Saturday, the productivity increased from 7.7 to 11.4 riders/vehicle hour when the shuttle began and decreased to 5.4 riders/vehicle hour when the zonal operation began.

A breakdown of the productivities by mode of operation shows that the shuttle mode had productivities of 13.1 and 18.8 riders/vehicle hour and the nonshuttle mode had productivities of 6.2 and 7.8 riders/vehicle hour on the average weekday and Saturday respectively. These nonshuttle productivities occurring during the reduced-fare shuttle operation were higher than the average weekday and Saturday productivities of 5.2 and 5.4 riders/vehicle hour after the shuttle service was assumed by TNJ. Thus, the nonshuttle mode productivity increased with the reduction in fare and the introduction of the shuttle because of the decrease in vehicle supply that was allocated to the shuttle service.

COMPARATIVE ANALYSIS OF PRICE-DEMAND ELASTICITIES

The previous observations of effects of fare on ridership suggest a comparison of DRT elasticities with those of other transit modes. This comparison is descriptive and, thus, should not be generalized. These limitations arise from the relatively scant knowledge of effects of fare on demand for transit systems and especially for demand-responsive systems.

Available data indicate that, for most current conventional transit systems in the United States, the elasticity of demand tends to be about -0.3 at 25-cent fare, -0.6 at 40-cent fare, and -1.0 at 75-cent fare. These elasticities imply that demand is price inelastic at low fare levels and unit elastic or more around 75-cent fares. Conversely, scattered data on taxi systems seem to indicate that taxi demand is unit elastic or higher and that average taxi fare is around 95 cents (5, 6). Figure 11 shows these elasticities of demand for different fare levels and for a limited number of fare changes.

The Haddonfield DRT system free-fare day resulted in a ridership ratio of 1.98. The attitudinal on-board survey of riders during January 1973 resulted in ridership ratios of 0.72 for a fare increase from 60 to 85 cents and of 1.49 for a fare decrease from 60 to 35 cents (7). Similarly, the Ann Arbor DRT system fare change resulted in a ridership ratio of 1.48 for a fare reduction from 60 to 25 cents (8). Finally, in the Bay Ridges DRT system, a fare increase from 25 to 30 cents did not result in any change in ridership.

Comparison of these limited DRT system fare changes with the conventional transit system relation seems to indicate that DRT system elasticities of demand with respect to fare are similar to those of conventional transit systems at about the 60-cent fare level (Fig. 11). This implies a rough elasticity of demand ranging between -0.6 and -0.75 at a fare level of about 60 cents/ride.

Figure 10. Hourly distribution of average Saturday vehicle supply for high-fare and reduced-fare periods.

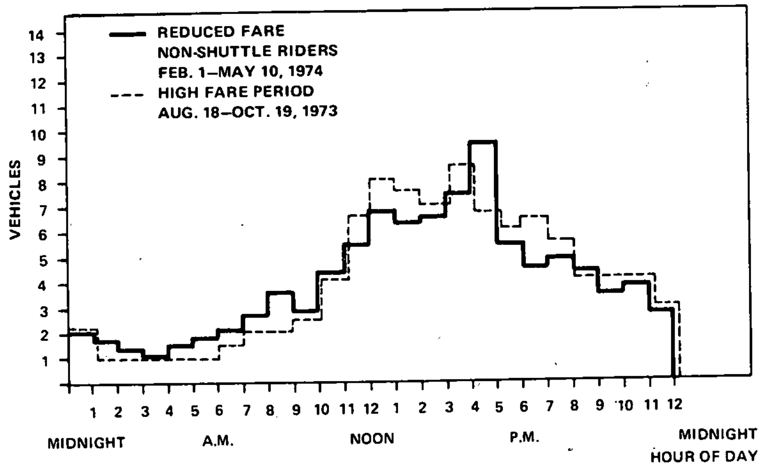
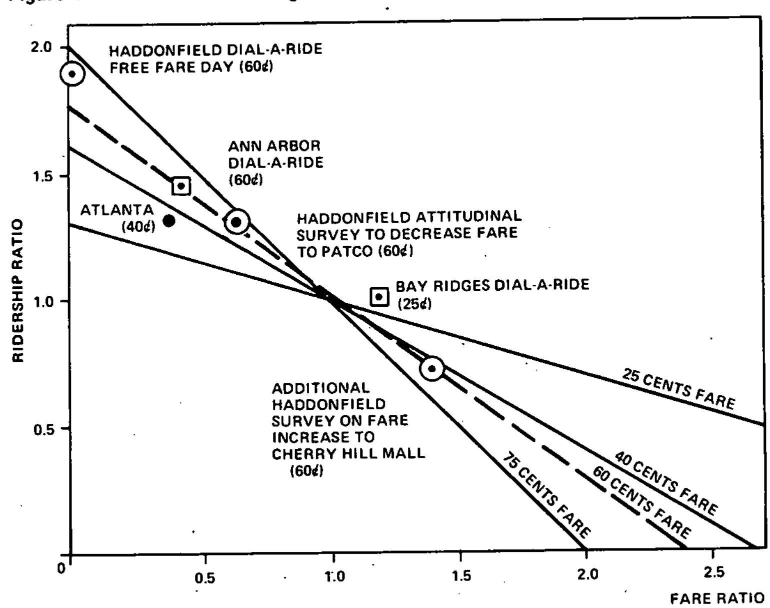


Figure 11. Effect of fare change on transit demand.



CONCLUSION

This brief description of the fare policy in the Haddonfield DRT demonstration indicates that the reduction of fare from 60 to 0 cents/ride substantially increased the ridership and productivity of the system. It also shows that the effect of fare reduction from 60 to 30 cents per ride could not be isolated because of the parallel changes in the mode of operation (shuttle, zonal, computer scheduling) and, possibly, the energy crisis. However, the effect of fare reduction and improvement or additions to the service resulted in high elasticity of demand. This fact seems to conform with experiences of conventional transit systems, whose riders are more sensitive to service quality or travel time changes than to fare changes.

The comparison of the DRT systems with conventional transit systems indicates that the riders of DRT respond to fare changes (at the 60-cent fare level) similarly to riders of conventional transit systems.

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This discussion is based largely on experiences gained in Rochester, New York, where a DRT system was implemented in August 1973. I will also mention a new service in Denver.

Marketing transit, as I view it, is the dynamics of making a beneficial service available to the communities served for value received. It is a total concept—not just advertising or public relations. It requires that goals and objectives be established. To understand the transportation problems of people is absolutely essential if meaningful solutions are to be provided for their mobility needs.

As early as 1968, when I began dreaming of setting up a system by which people could telephone for transportation service, it was understood that such service would be economically unfeasible. It is and has been my belief that DRT cannot pay its own way through the fare box. To justify the system requires some trade-offs. For one thing, there should be a solid base of ridership in the peak periods. This could be persons going to and from work or to and from school. Also, new service must not compete with but should extend, complement, and supplement existing transit service—or, better, replace fixed-route transit in high-loss areas to provide greater mobility for a greater number of persons while cutting back on expenses. This approach has