Dial-a-Ride Service in Santa Clara County

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Late in 1974 and early in 1975 the Santa Clara County Transit District initiated, operated, and then discontinued a demand-responsive dial-a-ride system within a span of 5½ months. This system's failure was primarily the result of poor systems planning. Specifically, four major mistakes led to the death of the system: an inadequate customer communication system, starting the entire system at once, an inadequate number of vehicles, and taxicab buyout. Each of these four mistakes is discussed in detail, and recommendations are made for instituting dial-a-ride systems. Getting through the difficulties of the start-up period is emphasized. Costs are discussed, and some relevant cost data are presented.

In January 1973, the Santa Clara County Transit District (SCCTD) took over the ownership and operation of all bus systems in the county, which has a population of approximately 1 150 000 and covers a service area of 518 km^2 (200 $miles^2$). The fleet size was 50 buses at that time. The vaguely stated goals of the SCCTD included serving all the people, providing high-quality service, and providing a transit opportunity for 97 percent of the population. Clearly such goals could not be simultaneously met with a fleet of 50 buses, especially in view of the other goals, which included reliability and reasonable speed and trip time. In fact, it has recently been estimated that a fleet of 680 vehicles would be required to accomplish the goals of the SCCTD, assuming the current level of demand (1).

In an attempt to overcome these difficulties, the Transit District Board, acting on the staff's recommendation, decided to institute a countywide demand-responsive transit system to augment a relatively meager fixed-route arterial system. This new Arterial/Personal Transit (APT) system began operation in November 1974, when the fleet size was expanded to 212 buses. Since, even with 212 buses, the goals of the SCCTD could not be met with a single or an integrated series of arterial systems, it was hoped that a dial-a-ride (DAR) system could be established that would provide all county residents, rural as well as urban, with the same opportunity for low-cost transit. Ironically, this reasoning proved to be correct. However, the level of service of the resulting transit opportunity was so bad by any measure and the cost of providing DAR service was so high that the demand-responsive portion of APT was discontinued in May 1975, except in the sparsely populated extreme southern portion of the county, where DAR was continued with 6 vehicles.

Thus in the short span of 5½ months, the SCCTD initiated, operated, and finally dismantled the largest demand-responsive system ever attempted in the United States. The costs of this brief attempt were significant both in terms of dollars and in terms of other less quantifiable but certainly no less real costs. Officials of the SCCTD have called the adventure a technical success, which is rather like saying that the surgery was successful but the patient died. In fact, little in the way of new technology was employed in the DAR system, Most of the original 75 vehicles used on DAR were new, air-conditioned, and propane powered, but they certainly were not of a new untested technology. Likewise the computer-assisted scheduling and routing system was nearly identical to, and in fact was an outgrowth of, the system in operation in Haddonfield, New Jersey. Finally, the telephone reservation system was using the most tested technology of all. Hence, there was no reason to expect anything other than a technical success.

This is not to say that all of these technological subsystems were integrated in such a way as to achieve a systems success. It is clear that they were not. But it is important to note that the systems failure resulted not from the technological components of the system failing to perform up to expectation but from a poor job of systems planning. This is not to say that the difficult things were done well and the easy things were overlooked. Systems planning is not easy. It consists of integrating all of the subsystems into a workable and efficient overall system, and it involves the consideration in detail of the effects that each subsystem has on all other subsystems. Unfortunately the systems planning function is often assumed to be easy, to involve only the application of common sense, and to be secondary in importance to the optimal design of subsystems. These assumptions inevitably lead to suboptimization and only by chance to an efficient and successful overall system design. While it is true that common sense plays a vital role in systems planning, this in no way diminishes the importance of, difficulty of, and time required for good systems planning.

While the systems planning function was badly handled,

if not ignored, in the design of the APT system, the purpose here is not to place blame but to point out some mistakes—specific omissions in the systems planning process—that were costly and that led eventually to the demise of DAR in Santa Clara County. The hope is that the discussion of these mistakes will reduce the probability of their being repeated in other DAR systems.

Post mortems are rarely performed on systems that have failed, since those with the greatest knowledge of the system have often played key roles in its failure and are not anxious to have the results any more widely publicized than is necessary. This lack of documentation unfortunately leads to the repetition of the same mistakes in other systems. In the field of public transportation, this results in placing high values on professionals who have operating experience and have been exposed to mistakes and failures. The experienced professional knows what does not work and is less likely to make mistakes. This is of the utmost importance since the costs of mistakes in public transportation systems can be gargantuan.

It may be of greater importance to discuss a systems failure in a DAR operation than in other operations in the transportation field because of the relative attractiveness of the demand-responsive concept. DAR has a significant initial cost advantage over other innovative transportation systems. The vehicle cost is relatively low, no fixed-guideway construction costs are required, the technology is available, and growth can be staged. Thus many, and especially smaller, communities can initiate such systems in a short amount of time and without an enormous initial capital outlay. This favorably low ratio of fixed costs to variable costs also provides flexibility; the system can be abandoned without a total economic disaster. With these attractions, it is expected that a large number of communities and transit properties will at least experiment with DAR in the near future. The following discussion will point out several factors that led the SCCTD to a systems failure so that others might not stumble over the same hazards.

FOUR FATAL MISTAKES

In the design of any system, it is inevitable that mistakes will be made. Most will have only minor effects on the eventual success of the system in question. Certainly this was the case in the DAR system in Santa Clara County. These mistakes, while regrettable, are of no concern here. Our interest here will be directed toward four major mistakes that together led to the death of the DAR system. Even though each was a serious error, the system probably could have survived any one of them; together they were fatal. They will be referred to as follows:

1. Inadequate customer communication system,
2. Starting the entire system at once,
3. Inadequate number of vehicles, and
4. Taxicab buyout.

Although the second and third are closely related in this instance, they represent different pitfalls and thus will be discussed independently.

Inadequate Customer Communication System

DAR began operation in the SCCTD on a Sunday; by the following Wednesday virtually everyone in the county had a horror story to tell regarding the telephone communication system. Typical reports had complaints in one (or more) of the following three categories:

1. Number of attempts resulting in busy signals,
2. Holding time once a call was completed, and
3. Service time once a reservationist was reached.

During the first few weeks it was not at all uncommon for a potential customer to place calls over a 2- to 5-hour period before completing one. Many people gave up on DAR very early in its life because they were unable to even complete a call. Once a call was completed, the caller was placed on hold, where he or she often stayed for 45 min or more before ever even speaking to a human being. At the end of this agonizing process, the reservationist took up to 20 min to complete the reservation procedure and communicate the information to the caller. Worse yet, the reservationist sometimes told the caller that it was too early to make this particular reservation and that the caller would have to try again later.

Several poorly solved or unanticipated problems led to the situation just described. First, and probably most importantly, the time the customer and reservationist needed to complete their communication was grossly underestimated—particularly for the start-up period—at 30 s per call. This seems to be an unrealistically low estimate even for a mature system in which both the customer and reservationist are knowledgeable about the information that must be transmitted and the procedures to be used. For example, Alameda-Contra Costa Transit in Oakland, California, used an estimate of 45 to 60 s in planning their systems in Richmond and Fremont. In the start-up of the SCCTD system, the reservationists were inexperienced in handling customer calls and took significantly longer to consult maps, procedural guides, and supervisors than they would in a mature system. Even worse was the fact that the callers had almost no knowledge of the system, of how the system could be used, or of the information required and the procedure for making a reservation. Thus the information interchange was terribly inefficient.

In addition, many of the calls during the first few weeks were calls from people who wanted to learn about the system and how to use it but did not wish to make reservations. At first these calls were handled by regular reservationists who were not well trained to provide general information about the system. These calls required an average of 6 to 9 min of communication. The result was that a caller spent an unusually long time talking to a reservationist and frequently ended up not even making a reservation. The number of telephone lines and the number of reservationists proved to be totally inadequate to serve the realized calling volume.

Eventually this situation eased, but the damage had been done. More telephone lines were obtained, more reservationists were hired (the number of reservationists was increased from 55 to 155), customers began to call only for reservations as they learned about the system, and both customers and reservationists became more knowledgeable, resulting in faster and more efficient information transfer. Thus the time required to make a reservation decreased to about 45 s, but some potential customers had been lost forever. The disastrous early days had made many citizens permanent enemies of DAR. Most of these were transit-dependent people who were doubly hurt since they were not only unable to ride on DAR but had also been deprived by the cutback of fixed-route arterial service that accompanied the initiation of demand-responsive service. Many people gave up on DAR very early, but they continued to be vocal opponents of the system throughout its life, as well as opponents of the SCCTD in general. As large as the dollar cost of DAR was in Santa Clara County, it is much less significant than the residual sentiment

against public transit that remains and probably will continue for quite some time.

Clearly then a mistake was made in not providing adequate service capacity in terms of telephone lines and reservationists. This was especially true during start-up and resulted in part from an unrealistically low estimate of communication time. However, there is another reason that the calling volume overwhelmed the system. The SCCTD undertook a large advertising campaign before beginning the DAR service. County residents were bombarded via several media with messages extolling the virtues of the soon-to-be-initiated system. The advertising was very effective in creating interest in the new system, but it conveyed almost no information about how to use DAR. This added greatly to the initial calling volume, especially the large number of information-only calls.

A few recommendations seem to follow directly from the problems caused by the inadequacy of the customer communication system. First, care should be taken not to overadvertise the system before beginning its operation. It is desirable to have a small initial calling volume, with subsequent advertising, if necessary, to increase the volume as the reservationists become more skilled in handling calls. This will maintain a balance between the demands on the communication system and its call-handling capacity. Second, advertising should contain information on how to use the system. Third, during start-up, special information operators should handle questions regarding the system, leaving reservationists to perform their special task. In this way, the bulk of the queuing will occur initially in the information area and will not tie up the reservation system. This will prevent the anomaly of having too few vehicles to serve the customers, but simultaneously having those vehicles underused because customers cannot get reservation calls through.

Fourth, for a period of 1 to 2 weeks before the initiation of service, an information number should be available for questions about the system. Instructions can be given on how to use the system and how and when to make reservations. This personalized information service should be widely advertised, and the telephone number can continue to be the information-only number after service begins. Fifth, realistic (even conservative) estimates must be made of the communication time required to make reservations. Further, recognition that this time will decrease as the system matures through the use of elementary learning curves is recommended. The importance of these estimates cannot be overemphasized since, together with estimates of the volume of calls, they determine the required number of telephone lines and reservationists for a given level of service. Finally, the system should start small and grow as the reservationists learn more about their jobs, the system, the geography of the area, and the arterial routes. That is, of course, the second of the great mistakes made in the Santa Clara County system.

Starting the Entire System at Once

The DAR system served essentially the entire county from the first day service was offered. As a consequence, all mistakes had large impacts and all problems were systemwide from the very beginning. With large expensive problems always at the forefront of public attention, the staff of the SCCTD had no choice but to constantly be putting out fires. They had essentially no time for even short-range planning during the 5½-month life of DAR. The system soon became a hodgepodge of the initial design plus the design changes made to correct immediate problems. Most of these immediate problems were not unusual or unusually difficult; they were the kind that always arise when a new system is implemented. Given sufficient time to work on them, the SCCTD staff would probably have solved them efficiently, but the magnitude of the system multiplied the visibility of the problems and, hence, the importance placed on their immediate solution. This time pressure on the staff meant that the systems aspect of the problem in particular was largely ignored. That is, not enough time was spent determining how that part of the system under examination interacted with other parts and thus how the various alternative solutions to the problem affected other parts of the system. Predictably, these patchwork solutions nearly always created new problems, and the staff ended up chasing its tail.

An example of this is the manner in which the problem of inadequate call-handling capacity was handled. The public outcry caused the Transit Board to direct the staff to immediately increase the number of telephone lines and reservationists. This increase of more than 60 percent was more than could be efficiently and adequately trained and supervised, so the call-handling capacity was not increased sufficiently. In response, even more telephone lines and reservationists were added. Their insufficient training and supervision led to increased call-handling times. To counteract this, an automated "address look-up" file was added to the computer system, but the file-maintenance system necessary to keep the file updated was never implemented. Thus, although reservations could be made more quickly, the accuracy of the file deteriorated with time; this of course degraded the entire system.

Another example comes from the relationship of DAR to the fixed-route system. Shortly after demand-responsive service began, the fixed routes were modified, with the new routes determined at least partially by DAR zone boundaries. They were less extensive than the old routes because fewer buses were available. The idea was that areas not well served by the new routes could be served by DAR. Intense public pressure forced the SCCTD to resume service on some old routes. This not only took buses away from an already vehicle-deficient DAR system, but it also added routes somewhat randomly to an existing network without considering how they interacted with existing routes.

There are several reasons that public systems tend to be put into operation all at once, some of which have to do with optimal systems design and economics. However, the reasons are often purely political, as in the case of the SCCTD. It is difficult to tell the county residents, most of whom are voters, that a new transportation system providing high-quality service is going to be available in only a limited section of the county, even though all county residents are paying for the costs of the system. This is especially true when the new system is not experimental but is intended to eventually be part of the total county public transportation system.

As politically difficult as initiating a DAR system in only a portion of the county (or any overall service area) may be, the recommendation is obvious. Start the system small and let it grow as capabilities increase and normal problems are solved. We have already seen that this can have the beneficial effect on the communication system of keeping the demands on that system in balance with the capacity. Here we have seen that, with an initially small system, the normal and expected problems will not be magnified to an extent that will result in a public outcry. An added bonus of starting small is that some overcapacity will likely exist, which can be used to make certain that the level-of-service goals decided on are met. These goals must of course be realistic, so as not to create a crisis in expectations when the sys-

tem is enlarged to its eventual size. Meeting the level-of-service goals will result in satisfied customers, who will be friends of DAR and probably proponents of public transportation in general.

Inadequate Number of Vehicles

Throughout the life of DAR in Santa Clara County, the number of vehicles was inadequate for the established level-of-service goal, which was specified as a waiting time of 5 to 10 min for DAR (1). To achieve this level of service, 334 buses would have been required during the peak commuting periods and 210 buses for the average midday demand in the SCCTD (1). What actually occurred was that about 75 buses were assigned to DAR during midday and between 40 and 50 for the peak commuting hours. Due to vehicle breakdowns and routine maintenance, between 5 and 10 of these buses were not dispatched during any given day. Thus 65 to 70 buses were available when at least 210 were required to meet the goals set by the SCCTD. It may be that the 5- to 10-min waiting time level-of-service goal was unrealistic and more than people were willing to pay for. Nevertheless, it was a stated goal and contributed to the aforementioned crisis in expectations.

The inadequate number of buses led to unacceptably long waiting times in some cases and very unreliable service. The long waiting times were especially bad for transit-dependent people with no alternative modes of transportation, and they complained bitterly. For others, the long waiting times simply meant that another mode of transportation would be selected; many learned not to even consider DAR as an alternative unless they were able to plan their trips far in advance. Thus DAR was not useful for the spur-of-the-moment trip, the very kind of trip that it should serve, since the alternative is usually the automobile carrying only one person.

The unreliability of service, however, had a far more devastating effect on customers. People were afraid to use DAR because of the uncertainty of being picked up for the return trip. There were numerous letters published in local papers recounting stories of people being stranded in some remote and unfamiliar location. Given that they had taken DAR to that location, their alternatives for the return trip were significantly reduced.

The problem of stranded customers may not be primarily due to the shortage of vehicles. A person planning a trip may not know exactly when he or she will be ready to return and may therefore make only one reservation. If, when the customer is ready to return and calls to make the reservation, he or she is given an unrealistically long waiting time, like 1 or 2 hours, this customer has been effectively stranded due to a shortage of vehicles. However, consider the case in which reservations for the return trip are made at the same time as the reservation for the outbound trip. In this case the customer is stranded if the bus for the return trip is unduly late. If there is a telephone within walking distance, a call can be made to check the reservation, but this involves the risk of missing a bus that arrives while the call is being made. If a telephone is not available, the customer cannot even call a cab. Thus stranding can occur even when the number of vehicles is adequate; it can result from breakdowns in routing, scheduling, or reservation accumulation. It is probably the worst thing (other than physical harm) that a transportation system can do to a customer. Stranded customers completely lose confidence in the system, and they will not continue to use it if they have alternative means of transportation.

Taxicab Buyout

The fourth mistake was the straw that broke the camel's back, since its effects became known after the effects of the other mistakes were apparent. Early in January 1975, the Santa Clara County Superior Court ruled that the SCCTD must either discontinue DAR or immediately begin negotiations to buy out eight competing taxicab companies that were then operating in Santa Clara County. The presiding judge ruled that the SCCTD was operating in violation of the legislative act under which the SCCTD was formed. This act rather clearly specified that if the SCCTD initiated a service that competed with any existing public transit operation, the district must either compensate the competing system or buy them out. It was clear from the beginning that the taxicab companies were a public transit operation. However, the staff of the SCCTD took the position that DAR was not in competition with them primarily due to the shared-ride nature of DAR and its circuitous routes with multiple scheduled pickups and drop-offs. The Superior Court did not agree and held that the door-to-door service of DAR, the fact that routes and schedules were not fixed, and the use of the telephone to make reservations taken together made DAR a service essentially similar to and hence in competition with the taxicab companies.

Immediately following this ruling, the Transit Board voted to continue DAR and begin negotiations with the taxicab companies. Before negotiations reached the point at which offers were made, DAR was dropped in all but the southern portion of the county, where it continues with six vehicles. Based on the cost of the taxicab buyout in the southern portion and other estimates, it is estimated that the total cost of the countywide buyout would have been in the neighborhood of $1.5 million.

The major mistake in connection with this ruling was one of omission. The taxicab competition issue should have been resolved before the system progressed past the initial design stage. The resolution of that issue would have had a bearing on what kinds of service DAR should have provided and on what the vehicle mix should have been. Furthermore, a cost of the magnitude of $1.5 million and the necessity of providing taxilike service could have had an effect on whether or not the SCCTD still wanted to go ahead with DAR. It is therefore recommended that all legal issues be carefully examined and resolved as far as possible well in advance of the final system design stage of a DAR project. This is especially true with respect to issues involving the possibility of driving extant privately owned firms out of business. Regardless of the provisions of transit acts and public utility codes, the courts are probably not going to look kindly on the use of public funds to subsidize public transit organizations in competition with already existing private companies.

COSTS

Even though the costs of the SCCTD DAR were not unusual as DAR systems go, costs are worth discussing briefly because they are relatively high in any DAR system. If a system is initiated and none of the foregoing mistakes is made, nor any other serious mistakes, the system could still be an economic failure due to the failure to realize that the system is so costly. The problem is the gross mismatch between revenues and costs in a DAR system such as Santa Clara County's. A large number of cost and revenue figures are available (1) and could be presented, but the three shown below are sufficient to indicate the magnitude of the problem. For comparison purposes, data from the Haddonfield DAR system are also shown. The Haddonfield data

are for the period from October 20, 1973, to January 31, 1974, and are taken from a recent report (2).

System	Productivity (riders/ vehicle-hr)	Revenue ($/ vehicle-hr)	Cost ($/ vehicle-hr)
Santa Clara DAR	5	0.75	20-21
Haddonfield DAR	8	2.26	19.25

Note that, although the Haddonfield cost figure is about 6 to 7 percent lower than that for the SCCTD, the data from Haddonfield were collected one year earlier. The particular period selected for Haddonfield's data was just following a fare reduction from 60 to 30 cents. Thus both the fare schedule and the costs were very similar to those experienced by the SCCTD. This is not unexpected since the systems are both relatively new and very much alike in most respects. The major difference is in the size of the service area; Haddonfield is about 28 km^2 (11 $miles^2$) and the SCCTD serves about 518 km^2 (200 $miles^2$). The tremendous start-up difficulties of the SCCTD's system, described earlier, account for the low productivity. Haddonfield, having begun operations in February 1972, is a more mature system. Finally, the revenue for Haddonfield is higher due to both a higher productivity and a higher average fare.

The numbers shown should not be considered exact. They are subject to considerable error in measurement, and it is almost a certainty that they are calculated in at least slightly different ways in the two systems. However, even with this in mind, there are two significant points to be made. First, the costs incurred by the SCCTD system do not seem to be out of line for the type of system they chose to implement. Second, there is a huge gap between revenues and costs in the SCCTD system, and this gap would remain even if the productivity doubled. In fact, if the productivity tripled to 15, which is the level in SCCTD for scheduled commuter-special buses and also for arterial bus routes (1), the revenue would increase to about $2.25/vehicle-h, assuming no change in fare structure. A large gap would still remain between revenues and costs. A productivity of 15 is certainly an upper limit for many-to-many DAR services, and 10 is probably a much more reasonable upper limit. These are staggering and sobering figures, but they must be considered when decisions are being made regarding the establishment of a DAR system.

CONCLUSIONS AND RECOMMENDATIONS

For the four major mistakes discussed earlier, detailed recommendations have already been made. However, there are several other recommendations that should be made for completeness. They do not necessarily pertain to mistakes made in the SCCTD system, or any other system for that matter, but they do represent the accumulated experience I acquired during my work on DAR systems.

DAR should be considered for implementation only in areas of low demand density. For the SCCTD the overall productivity for arterial routes is 15 with some routes achieving 70 passengers/vehicle-h during peak periods (1). From this it is evident that arterial routes can exploit high densities and achieve corresponding increases in productivity. However DAR, by its very nature, cannot take advantage of high density when operating in the many-to-many mode. Because of the multiplicity of trip origins and destinations, an increase in productivity can be achieved only with a corresponding deterioration in the level of service. However when the demand density is low, arterial routes will suffer low rates of productivity since buses are nearly empty much of the time. If headways are increased in order to increase productivity, for example, the level of service will deteriorate. In summary, if demand density is high, use arterial service because productivity can be increased without a corresponding deterioration in the level of service. If demand density is low, use DAR because the level of service can be held to the desired level without a corresponding decrease in productivity.

In addition to specifying arterial or DAR service on the basis of the geographical characteristics of demand density, the time characteristics can also be used. In almost all geographical regions, demand density is greatest during the peak commuting hours. For exactly the same reasons discussed above, it is desirable to curtail DAR service during these periods and replace it with an arterial-like service that is scheduled and that has a sharply reduced number of origins or destinations, perhaps with gather or scatter modes of operation, which have many origins and one destination or one origin and many destinations, respectively. The objective is to increase the productivity of the buses that are diverted from regular many-to-many DAR service by taking advantage of the temporarily high demand density. Once the peak period has passed, the buses return to regular DAR activity. Even during peak periods, some buses should continue to provide many-to-many service for emergencies, for the handicapped, and for others who for some reason are not able to use arterial or arterial-like service. However, it must be clearly understood by everyone that the level of service in the many-to-many mode will deteriorate severely during these peak periods.

A related issue that should be resolved before service is initiated concerns the transportation of school children. This is especially relevant for private schools for which publicly supported school buses are not available. In many areas, the number of students to be transported could swamp the system during certain hours. Essentially, the transit agency must determine whether or not it wants to be in the school busing business and, if so, how that function should be organized. This is a very emotional issue for taxpayers whose children attend private school. The right solution depends entirely on the goals and resources of the agency and citizens involved. The recommendation here is that the issue be thoroughly discussed and decided upon before DAR service is begun.

It is recommended that every new DAR system be thought of as an experiment, regardless of the degree of enthusiasm for and commitment to the new system. This kind of attitude will greatly facilitate the routine collection of data that will be important in making decisions regarding the system. A recent report (3) detailed the data that should be collected for the Haddonfield DAR system, but it applies equally well to any DAR system. This experimental attitude during the early stages of systems planning will lead to the most efficient design for data collection. During the early stages of any new DAR system, a great many questions will be asked about the system. The existence of reliable data logically and efficiently summarized can immensely improve the chances for a systems success.

The normal procedure is to initially purchase all vehicles of exactly the same size. Under some circumstances, that may be the appropriate action. However, since both large and small vehicles have advantages, it is possible that a mix of vehicle sizes will be more efficient. Large vehicles have the important advantage of flexibility. These buses can easily be used for arterial routes, bus pools, charter service, and so forth when

they are not being used in DAR service. On the other hand, smaller vehicles are less expensive, have lower operating costs, and are more easily maneuverable on residential streets. Due to the nature of DAR, it is rare to have many passengers on board simultaneously, and a vehicle that carries 10 to 15 passengers may be more than sufficient. This has the added psychological advantage of not having mostly empty large buses on display for the taxpayers to observe. It is therefore recommended that two or more vehicle sizes be considered, particularly if many-to-many service is going to be maintained during peak hours.

Finally the question of what fare to charge must be carefully considered. The SCCTD selected 25 cents, which was felt by many to be too low. When DAR is operating at or near its level-of-service goals, it is a high-quality service; customers will realize this and expect a reasonable fare. It is important to remember that the fare serves two primary functions. It contributes to paying system costs and it helps to allocate a scarce resource—transportation opportunity. The fare will probably never even approach paying the operating costs of the DAR system, but the gap between revenues and costs can be minimized by a judicious choice of fare levels.

It is also clear that in most places public transportation is being used as an instrument of social policy. The young, the aged, and the handicapped are almost always offered reduced fares. This has an effect on the overall fare level since planners feel a social obligation to keep the cost of transit within reach of the transit-dependent citizens, who also tend to be poor. The use of the fare as a rationing device gives the DAR operators a degree of control over demand for the service. The estimation or prediction of transit demand is one of the most difficult transportation problems in existence. It may be wise to initiate DAR service at a fare larger than the expected steady-state level to ensure that the system will not be overwhelmed by initial demand. It will be a relatively easy matter to reduce fares later when the system is past the start-up difficulties. Also, this kind of a change may provide valuable information regarding the response of ridership to fare reductions.

The purpose of this paper has not been to criticize but rather to analyze. A number of recommendations have been made that may prove useful to systems planners in various stages of designing DAR systems. The SCCTD's system was analyzed with respect to four major mistakes to provide a case study in which issues that seem now to be easily resolvable led to the death of the system. The lesson is that no matter how good the system or how talented the people involved a systems failure can, and probably will, result from a lack of or a poor job of systems planning.

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