U.S. Department of Transportation

Taxi-Based Special Transit Services

March 1983

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Final Report
March 1983

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Prepared for
Office of Policy Development
Urban Mass Transportation Administration
U.S. Department of Transportation
Washington, D.C. 20590

In Cooperation with
Technology Sharing Program
Office of the Secretary of Transportation
Washington, D.C. 20590

DOT-I-83-24

ACKNOWLEDGMENTS

Many people deserve special thanks for their contribution to this report. Literally dozens of taxicab company owners and managers and local government officials served as our data sources. Although they are too numerous to mention individually, each provided us with valuable information which we could never have obtained otherwise. Their cooperation and insights were greatly appreciated. Doug Birnie, our contract monitor, first encouraged us to develop this study and then followed it through its lengthy course. His support, forbearence, and guidance were instrumental in bringing the project to a successful conclusion. Norm Paulhus and Gen Giuliano reviewed the final report, and their comments were very useful in enabling us to make appropriate revisions.

The Word Processing Center of the School of Social Sciences produced the final report. Particular thanks are due to Cheryl Larsson and Kathy Alberti for their contribution to this task, and for their care in seeing that the job was done well.

EXECUTIVE SUMMARY

Study Context and Scope

Local government sponsors of demand responsive transit (DRT) have in recent years increasingly opted to restrict access to the services they have established. This policy of restricting ridership to special population groups, typically the elderly and/or the handicapped, results in what is termed a "special transit" service. While DRT in general has widely diffused throughout the U.S. since the mid-1970's, it appears that the "special transit" version of demand responsive transportation has proliferated even more rapidly than DRT services for the general public. At the same time, local government sponsors of both types of DRT have increasingly turned to local taxi operators to provide the necessary service. The result, therefore, has been the establishment of taxi-based special transit services in numerous communities around the country. California alone contains nearly 50 such public transportation systems.

In a previous study for UMTA, UC Irvine examined the institutional issues and analyzed the performance of taxi-based DRT for the general public. This study represents a similar, companion analysis of taxi-based special transit services, with a particular focus on services targeted at the elderly and handicapped population. As in the previous study, the research is based on experiences in California, where 48 taxi-based special transit systems were identified and included in the analysis.

Taxi-based special systems are not simply simply smaller-scale versions of general public DRT systems, but instead represent distinctive forms of community level transit. By limiting ridership to the elderly and handicapped and often imposing further restrictions on usage within these categories, sponsors may find that they have reduced demand below the level at which shared riding is feasible, unless very long waiting and riding times are imposed on users. The low demand of many special transit systems, in the context of using a local taxi company as service provider, may therefore make subsidized exclusive ride taxi (ERT) service an attractive option to a sponsor. Whereas taxi-based general public DRT is always a shared ride service, special transit services can thus be based on either shared riding or subsidized ERT. Not only does this lead to significant differences in organization and performance between general public DRT and special transit services, but the financial and developmental impacts on participating taxi firms also tend to be quite different.

As with taxi-based DRT for the general public, the use of taxi firms as special transit providers raises a number of institutional, organizational, and performance issues. In addition, it raises issues of comparability between the two types of services. Accordingly, the purposes of this study are to:

(1) illustrate through case studies the different roles which taxi-based special transit services play and the different ways in which they are organized;

(2) analyze the issues associated with restricted ridership DRT services provided by taxi firms;

(3) evaluate the performance of taxi-based elderly and handicapped systems; and

(4) compare the results of this study to the previous research on taxi-based DRT for the general public.

The issue analysis component of this study focuses on three broad categories of issues. System organization issues concern the type of eligibility restrictions imposed, the choice of a taxi firm as provider, subsidization and compensation schemes, whether shared riding or ERT is used, and the user payment system. The taxi firm impacts of interest are the financial and organizational development consequences which providers of special transit services experience. An important recent issue pertains to the changing organizational structure of taxi firms, namely the implications of taxi company internal organization for participation in special transit services. Recent trends in the taxi industry raise questions about the ability of certain types of taxi operations to participate fully or effectively in special transit systems.

The performance of taxi-based special transit is of interest in its own right as well as in comparison to general public DRT. A performance indicator fremework is developed for and applied to the California systems which were the focus of this study. The results are then compared to the performance of the subsidized SRT systems analyzed two years previously. In addition, a DRT performance model is used to assess the performance and cost impacts of loosening ridership restrictions for the systems studied.

Case Studies of Special Transit Services

The report presents five case studies which illustrate the wide range of special transit services, their impact on participating taxi companies, and their problems and potentials. Included are case studies of special transit systems in semi-rural areas, suburbs, and large cities; of systems which serve as basic public transportation for a community and those which are strictly supplemental to conventional transit; and of systems organized along traditional dial-a-ride, integrated fleet shared ride taxi (SRT), and subsidized ERT lines. A case study of a paratransit entrepreneur and his company's special transit services is also included.

System Organization

The majority of California's taxi-based special transit services are based on ERT and user-side subsidy. Less than half of the systmes utilize shared ride operations, and only a handful are organized along traditional dial-a-ride lines (dedicated vehicles, provider-side subsidy). Three factors account for these results. The first is that many restricted ridership systems are not only limited to the elderly and handicapped, but also ration service by means of strict eligibility standards and limitations on the number of trips which may be taken. Low ridership

means very low demand densities, often below the point at which shared riding is feasible. Therefore, when restrictions on ridership are at all severe, it may not be possible to organize a shared ride service. Integrated fleet shared ride taxi (SRT) service is virtually always infeasible in very low demand situations, and dedicated vehicle service often promises to be both expensive and limited in availability. Subsidized ERT may be the only reasonable alternative.

Second, when shared ride services are developed, it is usually in situations where the system's public agency sponsor wishes to establish a basic transit service for the elderly and handicapped rather than a strictly supplemental service. When sponsors adopt the former objective, they commit themselves to providing enough service to meeting the unrestricted DRT demands of elderly and handicapped users. At the same time, they also have strong cost-effectiveness concerns. Even though they do not face stringent fiscal constraints, subsidy funds can typically be put to other public uses. Therefore, they tend to thoroughly investigate the different system organization options, and recognize that shared riding is an essential component of any cost-effective system.

The diffusion of information about other DRT systems in California is the third factor influencing system organization choices by sponsors, and often is responsible for their choice of specific organizational parameters. Sponsors who, due to budget limitations, must impose severe ridership restrictions, or who have decided that dedicated vehicle systems offer inadequate service availability (due to the limited capacity and often lengthy waiting times of systems with only 1 or 2 vehicles), have found subsidized ERT services implemented elsewhere in the state to be the solution to their problem. Often a neighboring community serves as the model. The typical result is a service which uses regular taxi service, compensates the taxi company on the basis of meter fares, and allows multiple taxi firms (where they exist) to compete for the patronage of the subsidized users. This combination of user-side subsidy and ERT has proven to be an easily implementable form of special transit.

Sponsors which desire a system capable of serving higher demand have often turned to the highly successful El Cajon SRT system as their model--thereby organizing the service on the basis of shared riding, an integrated fleet, and consumed service compensation. Other sponsors, usually those whose systems transport hundreds of passengers a day, have chosen the traditional dial-a-ride model of DRT service based on observation of successful experiences elsewhere.

Taxi Company Impacts

Financial impacts of special transit provision tend to be much less significant than is the case with provision of general public DRT service. California taxi firms which operate general public DRT systems receive about 5 times as much contract revenues as do those taxi firms which participate only in special transit operations. These differences stem from the fact that many general public DRT contractors operate in more than one system whereas the typical special transit provider participates in a single service, and also from the reality that the low demand of most special transit services make contracts worth less. Within the special transit service category, shared ride systems yield more lucrative contracts as the systems

must be larger in order for shared riding to be feasible. Among providers who operate only special transit services, those with shared ride contracts make about 75 percent more than those which participate only in subsidized ERT services.

Because less than 40 percent of California's special transit providers operate either shared ride special transit or general public DRT, the benefits of contract operations are distributed quite unevenly. The subsidized ERT providers generate less than $5000 per taxi vehicle per year through special transit services, whereas those taxi companies which provide general public DRT as well as special transit generate more than $24,000 per taxi vehicle per year in contract revenues. The latter group of companies is also much more likely to have evolved into paratransit operators than the former, with shared ride services and contract operations an integral part of their enterprise. The subsidized ERT providers, in contrast, are likely to remain as conventional taxicab operators which have not diversified their service offerings or evolved organizationally.

Implications of Taxi Company Internal Organization

Within the past decade the taxi industry has undergone a major change in how companies are internally organized, moving from predominantly employee drivers to the current situation in which most taxi drivers lease or own their vehicles and function as independent operators. The dilution or elimination of management control which has accompanied this development has made it more difficult for certain types of taxi enterprises to participate in certain types of special transit services. Specifically, associations of owner-operators find it very difficult to effectively take part in any type of special transit program other than one based on subsidized ERT. Systems which require shared riding are largely off-limits to such taxi associations, as they are unable to compel drivers to follow dispatch orders, and tight dispatch control is essential for good productivity and acceptable service in shared ride operations. In addition, the management of some companies which have turned to leasing have demonstrated more interested in maximizing leasing fees than in controlling the quality of service or developing new services, and these companies are thus also poor candidates for special transit services more involved than subsidized ERT. Only strong management controlled taxi companies are capable of providing high productivity shared ride service, and the evidence suggests that such companies are declining in number.

Performance

Taxi-based special transit services tend to be considerably more expensive than taxi-based DRT for the general public. The average cost per passenger of the special transit services included in this study was $4.52, whereas the general public services studied previously registered a cost per passenger of $2.87. Even inflating the latter figure by 20 percent to account for cost increases during the two year period intervening between the two data sets, the general public services still cost 25 percent less per passenger ($3.44 vs. $4.52) than the special transit systems. These unfavorable differences in cost-effectiveness for special transit are largely the result of the influence of the subsidized ERT services. Subsidized ERT averaged about $5 per passenger, whereas user-side subsidy SRT systems achieved a cost per

passenger of slightly less than $3. Dedicated vehicle special transit systems were only slightly most cost-effective than subsidized ERT. It is therefore apparent that the best way of maximizing the cost-effectiveness of special transit services is to develop a shared ride taxi system based on consumed service compensation. This is precisely the same conclusion reached by the previous UC Irvine study on taxi-based DRT for the general public.

The low demand of many elderly and handicapped systems is directly responsible for the widespread use of the more expensive forms of service organization. However, this low demand stems from the fiscal constrants imposed on the service, which causes many sponsors to limit eligibility and ration usage. When a DRT performance model was used to determine if shared ride services (either dedicated vehicle or integrated fleet SRT systems) could be developed within the constraints of the existing demand level of the subsidized ERT services, the results were generally negative. That is, at the levels of demand prevailing in most subsidized ERT services, it is usually not possible to develop a shared ride operation, or if so, only at the penalty of poor level of service to the user. Thus subsidized ERT is often the only reasonable solution.

When ridership restrictions are loosened to the point where all elderly and handicapped persons in the service area are eligible to use the special transit service, demand increases to a level at which shared ride operations are feasible and relatively cost-effective in almost all systems. However, although the dedicated vehicle or integrated fleet SRT systems which would result would improve cost-effectiveness compared to subsidized ERT, they would also lead to at least a doubling of total system costs in most cases. Thus they may not be affordable to many special transit sponsors. Nonetheless, if the additional subsidies can be obtained to loosen ridership restrictions, many subsidized ERT services could be transformed into more cost-effective shared ride systems.

Conclusions and Policy Implication

Local government sponsors of special transit services in California have made the taxi industry the primary provider of such services. This development has occurred because taxi firms are low cost providers, offer the advantage of in-place capability, are a local transportation resource whose continued existence is of concern to many local governments, and are uniquely well-suited to the requirements of restricted ridership DRT service. The low demand prevailing in many such systems makes the traditional dial-a-ride form of DRT organization either infeasible or very costly. Integrating a special transit service with the taxi company's other services, using either exclusive riding or shared riding, is usually a simpler and relatively less expensive option.

However, while the low demand of special transit services makes the local taxi company an ideal choice as provider, in other respects it represents a problem. Demand is often too low to make shared riding feasible, and this necessitates the use of subsidized ERT, a less cost-effective system organization option. Overall, taxi-based special transit is significantly less cost-effective than taxi-based general public DRT. Low demand also means the taxi provider will experience relatively

little revenue increase, and when the company also provides subsidized ERT, it typically lacks both the opportunity and the motivation to transform itself into a paratransit enterprise. The impacts of special transit provision on taxi firms, therefore, tends to be much less beneficial than is the provision of general public DRT.

Despite these problems, taxi-based forms of service appear to be the wave of the future in special transit if California's experiences are representative. The issues now are how to improve the cost-effectiveness of these services, and how to maximize their beneficial impacts on taxi providers in order that these firms can continue in business and thus maintain a source of low cost paratransit service.

TABLE OF CONTENTS

Page

TABLE OF FIGURES

TABLE OF TABLES

TABLE OF TABLES (continued)

CHAPTER ONE

STUDY CONTEXT AND ORGANIZATION

I. Introduction

Two trends have dominated the recent diffusion of demand-responsive transit (DRT). The first is the growing reliance on use of private contractors, particularly taxi firms, as DRT providers, albeit within the framework of publicly subsidized and sponsored transit service. The second trend is the increasing tendency of local government sponsors of DRT systems to restrict use of the service to certain population subgroups or individuals believed to have special public transportation needs, most notably the elderly and handicapped. In numerous communities around the country these two developments have coincided, resulting in the establishment of a generation of taxi-based restricted ridership DRT systems, typically targeted at elderly and handicapped individuals. California alone contains nearly 50 such public transportation systems.

These two trends, and their recent convergence, are a reaction both to the economics of demand responsive transit and to its political appeal. DRT was originally conceived and implemented as a transportation service for the general public, with an implicit assumption that service would be provided organizationally in much the same way as other public transit. The early experiments with DRT demonstrated, however, that public agency operation resulted in a very costly service, particularly if the service provider was a conventional public transit agency. Complicating matters, DRT turned out to have limited appeal to the general public, attracting many fewer patrons than had been anticipated, and inducing only a small fraction of automobile users to patronize the service. On the other hand, DRT proved especially attractive to the elderly, who typically comprised 20 to 50 percent of system patronage, or 2 to 5 times their portion of the population.

In response to these realities, the sponsors of most DRT systems established during the past few years have adopted two different strategies to contain costs and preserve DRT benefits. The first, and most widespread, is to contract out operation of the system to a private provider, most commonly a taxi firm. Such providers can typically produce DRT service much less expensively than a public agency. The second strategy is to impose ridership restrictions on the service, thereby limiting total system costs. While this often results in a higher cost per passenger, it does constrain demand and reduce service requirements. Targeting the DRT service at special needs groups, notably the elderly and handicapped, enables sponsors to offer the benefits of DRT to the predominant users of the service, while also restricting system costs. In addition, this strategy solves the political problem posed by the demands of these special needs groups for improved public transit. Obviously, these two strategies can be employed in conjunction with one another. Whether ridership restrictions are imposed or the system is available to the general public, when a taxi firm is utilized as the provider the result is a taxi-based DRT system.

For purposes of definition, in this study restricted ridership DRT systems are generally referred to as "special transit" systems. The "special" refers to the fact

that such systems are targeted at special needs groups. It is important to note that the special transit services which are the focus of this study are sponsored by local governments and are available to all members of the community meeting age, income, or physical condition criteria. Special transit services do not include social service agency transportation services restricted to agency clients; they are simply special forms of public transportation for which eligibility is restricted by affiliation-neutral criteria.

In theory, special transit services could be targeted at a variety of groups. In practice, however, they are almost always restricted to the elderly and handicapped. This has certainly been the case in this study. All of the special transit systems examined are restricted to the elderly and handicapped. Thus in this study the terms special transit system, elderly and handicapped system, and restricted ridership system will be used interchangeably, and refer to the same general type of taxi-based DRT system.

Taxi-based special transit systems targeted at the elderly and handicapped are not simply a smaller-scale version of general public DRT systems, but instead represent distinctive forms of community level transit. The joint decision by local government to restrict ridership and to use a local taxi firm as provider has a significant effect on system organization and performance. Ridership restrictions reduce demand well below the levels achieved by general public DRT systems, in which the elderly and handicapped typically comprise a maximum of 50-60 percent of the passengers. In addition, many local government sponsors impose restrictions within the elderly and handicapped category, further decreasing potential demand. The resulting low demand density limits the ability of the provider to practice shared riding and may render it infeasible. In fact, the use of a local taxi firm gives the sponsor the option of simply subsidizing traditional exclusive ride taxi (ERT) service through user-side subsidy arrangements. Taxi-based general public DRT systems, in contrast, are normally subsidized shared-ride taxi (SRT) services, often using vehicles dedicated solely to the DRT system. However, many taxi-based elderly and handicapped systems more closely resemble ERT operations in their organization, fare structure, productivity achievements, and cost-effectiveness. Moreover, the impacts on participating taxi firms--both financially and in terms of organizational evolution and development--often differ significantly between special transit systems and general public DRT.

Taxi-based DRT thus consists of two distinctive forms of paratransit services. However, only services for the general public have previously been subject to comprehensive analysis (1,2). The purpose of this study is to provide a similar, companion analysis of taxi-based special transit services, quite possibly the most rapidly growing component of taxi-based transit.

II. Study Context

This study is based primarily on the experiences of 48 taxi-based elderly and handicapped systems in California, essentially all such systems currently operating in the state. Data was collected on the operating and financial performance of these systems for the 1979-80 and 1980-81 fiscal years. Information was also

obtained through personal interviews with virtually all local government sponsors and taxi company providers of these services. The interviews were aimed at understanding the process leading to the establishment of these systems, the impacts on the involved taxi firms of participation in public transportation, and the nature and evolution of the public-private sector relationship. These California systems not only represent the largest single data base available for analysis of taxi-based elderly and handicapped services; they also offer the advantages of geographic and organizational diversity as well as relative longevity.

This California data was supplemented by a brief survey of taxi-based DRT systems in Michigan and Minnesota. These two states each have a very active state-subsidized community transit program which funds systems in dozens of localities. Many of the local transit systems implemented as a result of these programs use taxi firms as service providers. The main purpose of examining Michigan and Minnesota's experiences with taxi-based transit was to determine whether Calfornia's extensive experiences were representative of more general developments nationwide.

In all three states, a relatively well-funded state transit subsidy program has been instrumental in affording taxi firms an opportunity to become public transit contractors. This is particularly the case in California, where a sales tax on gasoline is used to finance a formula based transit subsidy program. The Transportation Development Act (TDA) of 1971 returns 1/4 percent of all sales tax revenues to the counties and cities, in proportion to their contribution of gasoline sales, for public transportation purposes. In large urban counties (over 500,000 population) these funds can only be used for transit; in smaller counties they can be used for streets and highways as well as transit, provided that first all unmet transit needs which could reasonably be met have been satisfied. While the subsidy funds go primarily to regional bus and rail systems in the large urban areas, a provision was added to the TDA legislation in 1976 which encourages "community level transit" services in these areas. Article 4.5 of the Act specifies that up to 5 percent of a large urban county's TDA funds may be spent on community level transit, provided that the service meets a local transportation need not being served be existing public transit services. In practice, most such community transit systems have been targeted at special needs groups, although the legislation imposes no such restriction.

The result of the TDA program has been a veritable explosion of DRT systems in California. At present, the state contains on the order of 100 publicly supported demand responsive transportation systems. These are divided almost equally between general public and restricted ridership systems, although the latter category appears to be growing more rapidly. Taxi firms are the providers for about half of all the general public DRT systems, and approximately 80 percent of the restricted ridership systems. As is apparent from these figures, taxi-based transit has become a very important component of local public transportation in California, and transit contracts have become a major revenue source for many taxi firms in the state. As such, the California experience represents an exceilent opportunity to analyze the results and implications of taxi firm involvement in different types of local public transportation services.

III. Study Organization

The quantitative and qualitative information gathered in the course of this study is presented in the form of both case studies and comprehensive issue and performance analyses. Information is current as of April, 1982. Chapter Two consists of five case studies of taxi-based elderly and handicapped services. These case studies examine different types of elderly and handicapped services, established for different purposes and operated by taxi firms characterized by different organizational features and managerial capabilities and perspectives. The case studies detail the process of establishing and organizing a taxi-based DRT system, the relationship between sponsor and provider, system performance, and the implications for the taxi company of public transit involvement.

Chapters Three and Four analyze the institutional issues and the performance aspects respectively of taxi-based special transit systems. In analyzing the experiences with these services our focus has been on three major issue areas. System organization issues include the sponsor's rationale for restricting service to the elderly and handicapped, the institutional reasons for utilizing a taxi firm to deliver the service, and the factors which influence sponsors to choose particular subsidization, compensation, and user payment mechanisms. Of particular interest is the decision of whether to organize a user-side subsidy system or to contract with a single provider to supply DRT service. Table I-1 outlines the different system organization options.

A second set of issues concerns the impacts on taxi firms of participation in elderly and handicapped services. Financial impacts, notably revenues and profitability, are obviously important, but equally significant are potential changes in the internal organization of the firm and in its capabilities, image, and future objectives. The relationship between these impacts and system organization parameters is another key issue. In addition, the effect of the taxi firm's labor organization on its ability to participate in various types of transit programs is considered.

System performance and its determinants is the subject of Chapter Four. Performance is evaluated in terms of an efficiency-effectiveness framework, paying particular attention to the effects of system organization on performance outcomes. Estimates are also made of the performance penalties associated with organizing taxi-based DRT services on a restricted ridership basis compared to general public operations, and on an ERT instead of an SRT basis.

Throughout the institutional and performance analyses, attention is devoted to differences in outcomes between taxi-based DRT services for the elderly and handicapped and for the general public. Not only will this demonstrate the distinctive organization, impacts, and performance of these two forms of taxi-based paratransit, but it also illustrates the tradeoffs between these two different modes of service delivery and the practical considerations which govern their selection.

Chapter Five presents of the conclusions of the study, and the policy implications of California's experiences with taxi-based elderly and handicapped

TABLE 1-1

Types of Taxi-Based Special Transit Services

	Vehicle Utilization	Form of Subsidy	Mode of E&H Operation	Typical Form of Compensation	System Label
1.	Integrated Fleet*	User-side	SRT	Fee per passenger, per trip, or per revenue vehicle mile	Integrated Fleet SRT
2.	Integrated Fleet	User-side	ERT	Meter fare (with possible discount)	Subsidized ERT
3.	Dedicated Vehicles	Provider-side	SRT	Fee per vehicle service hour	Traditional Dial-A-Ride
4.	Dedicated Vehicles	User-side	SRT	Fee per passenger trip, or per revenue vehicle mile	User-side Dedicated Vehicle
5.	Dedicated Vehicles for base level of service and Integrated Fleet for additional service demands	User-side, or combination user-side and provider-side	SRT for dedicated vehicles; ERT or SRT for non-dedicated vehicles	Fee per vehicle service hour or per passenger/trip for dedicated vehicle; fee per passenger/trip or meter fare for non-dedicated vehicles	Hybrid

*Same vehicles deliver regular, unsubsidized ERT service and also provide service to subsidized elderly and handicapped users

services. This chapter summarizes the reasons for the observed pattern of outcomes, assesses the strengths and weaknesses of different types of taxi-based DRT services, and identifies the issues crucial to future development of special transit services.

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CHAPTER TWO

TAXI-BASED SPECIAL TRANSIT: FIVE CASE STUDIES

CASE STUDY I: COMMUNITY PUBLIC TRANSIT-- FOR THE ELDERLY AND HANDICAPPED ONLY

The three major cities of Butte County, a semi-rural area located about 75 miles north of Sacramento, each sponsor a taxi-based DRT system which provides comprehensive transit service to the community's elderly and handicapped residents. Until very recently these taxi-based elderly and handicapped systems represented the sole public transit resource in all three communities--Chico, Oroville, and Paradise--and in Paradise this is still the case. Consequently, there are essentially no restrictions on usage by the elderly and handicapped, and sufficient capacity is provided to meet the level of demand. By examining the establishment and subsequent experiences of these three taxi-based elderly and handicapped services it is possible to illuminate many of the issues which arise when a local government decides to use its indigenous taxi resource to create a public transit system restricted to the population groups believed to need it the most.

I. System Establishment

The City of Chico was the first community in Butte County to establish an elderly and handicapped transportation service. Chico, the largest city in Butte County with a population of about 50,000, is an agribusiness center and the county's commercial hub, as well as the home of Chico State University, with an enrollment of about 14,000 students. The city has experienced significant growth during the past decade, due to the trend towards exurbanization and the community's pleasant, college town ambience. Many of the newcomers are young persons seeking an alternative to big city living, and Chico's (and the County's) politics have recently taken a significant leftward swing as a result. Public transit development has in turn been influenced by these socio-political developments.

The Chico elderly and handicapped system, which began operation in December, 1976 was not the community's first experience with DRT. In 1973, the City established a general public DRT system which operated for over a year before it was terminated by the City Council due to high costs and relatively low patronage. This initial DRT system was thus perceived by public officials as a costly failure, and not only dampened enthusiasm for DRT specifically, but also for public transit generally. Elected officials and political interests in Chico, as in many of California's semi-rural cities, could at this time see no compelling need to spend public funds on a transit system. The community's residents had seemingly accommodated themselves to an automobile-only transportation system and the TDA funds which were available to finance transit service could all easily be absorbed by street and highway needs. Consequently, for approximately two years Chico had absolutely no public transit service.

The Chico elderly and handicapped system came into being as the result of a political event. Chico area voters elected a liberal candidate, who had made the establishment of a Chico public transit service for the elderly and handicapped part of his campaign platform, to the County Board of Supervisors. The county is a very powerful level of government in California, particularly in transportation affairs, since it is the recipient of highway and TDA funds (some of which it passes through to the cities). The election of the new County Supervisor thus resulted in the initiation of planning for a Chico DRT system.

In semi-rural areas such as Butte County most city governments expect the county to provide the staff expertise for transportation planning and engineering. Combined with the county's political power this means that many local transportation decisions are made primarily by the county, subject to city approval. The county itself usually cannot afford a large staff, so it in turn tends to rely on the California Department of Transportation--CALTRANS--for planning and engineering assistance for non-routine projects. Consequently, it was the County transportation staff and the local CALTRANS district office which worked together to plan the new elderly and handicapped system. The Chico City Council had now come around to the belief that it needed some public transit despite the demise of the original DRT system, but was interested primarily in making final decisions about the new elderly and handicapped system, not in planning it.

Financing the Chico elderly and handicapped system was no problem, as abundant TDA funds were available. However, every dollar used for public transit would be less money for streets and highways, the highest transportation priority of local officials. Accordingly, the County and CALTRANS staff who were responsible for designing the elderly and handicapped system were under pressure to develop the most cost-effective service possible, and they investigated other DRT systems in California to understand what would achieve this objective. The El Cajon shared ride taxi system appeared to be a noteworthy success, and it was decided to emulate its features as much as feasible. The two most important aspects of system organization which were copied from El Cajon were shared ride operations and compensation of the DRT provider on a consumed service basis. The latter was accomplished by paying the provider a fixed fee per ticket collected from the riders, the fee being determined by competitive bidding. The ticket system also made it easy to limit eligibility to the elderly and handicapped and eliminated the problem of the operator handling (and possibly mishandling) cash. It was also decided that the provider should supply the vehicles for the system, at least initially, since not only was this the arrangement in El Cajon, but it also meant the system could be implemented immediately.

These features of the system's organization clearly were most compatible with operation by a local taxi company. Not surprisingly, the Chico taxi and ambulance company, owned by Dave Kamp, was the winning bidder. Kamp's bid was $1.95 per ticket collected (up to three can ride on one ticket), and he faced no serious competition for the contract.

Within a short time after its establishment it was apparent that the Chico elderly and handicapped system would be a success. Ridership increased steadily,

patrons were satisfied with the level of service, and costs were reasonable due to the use of the fixed fee per ticket scheme. Accordingly, other cities in Butte County, none of whom had any public transit service at this time, also became interested in local transit.

The City of Paradise, prodded by its senior citizen community, was the next to take the plunge into elderly and handicapped services. In mid-1977 the County solicited bids on the Paradise system. In contrast to the Chico situation, however, the Paradise taxi company did not want to bid on the service. The owner wished to avoid involvement in any way with government or a subsidized service, was opposed philosophically to the entire idea of public transit in Paradise, and simply refused to bid. Once it became clear that the local taxi firm would not participate in the system, Dave Kamp expressed his interest in becoming the Paradise DRT contractor, provided he could limit his risks as he had no taxi operation in Paradise. The City agreed to a compensation scheme based on provider-side subsidies (compensation was based on a rate per vehicle hour of service provided), which was satisfactory to Kamp. In December, 1977 his company initiated elderly and handicapped service in Paradise.

While Oroville was also interested in public transit, it was the most hesitant of the three cities to start a new service. The poorest of the three communities and the home of most of the county's lower income residents, Oroville was concerned that it might become involved in a service that turned out not to be cost-effective and then be unable to extricate itself. The director of the CALTRANS office, who was an advocate of public transit for the Butte County cities, came up with a solution. Butte County and the City of Oroville agreed in August, 1977 to apply for state grant for a transit demonstration project. The grant program was administered by CALTRANS, so obtaining approval was not difficult given the strong support of the local CALTRANS office. The advantage to Oroville was two-fold. First, the grant period was for at most a year, thus giving the City an easy way to drop the elderly and handicapped service if it proved too costly or otherwise unsuccessful. Second, during the grant period the state paid most of the cost of the program, thus enabling Oroville to experiment with only a small amount of TDA funds, the amount needed for the local matching requirement.

The Oroville City Council was persuaded of the merits of an elderly and handicapped service on this basis. Oroville's system was also patterned after the El Cajon SRT system. There was a strong presumption that the local taxi company would be the contractor, and local officials even invited its management to accompany them on a trip to Southern California to investigate several DRT systems. While there was a formal award process for the contract, the organizational parameters--consumed service compensation and the use of the provider's own vehicles, in particular--all but preordained the choice. Oroville Yellow Cab is the only taxi company now operating in Oroville, and it was selected as the provider with a bid of $1.75 per ticket. The Oroville elderly and handicapped system began operations in December, 1977.

II. The Providers

A. Chico and Paradise

Both Barney Gabriel, the owner of Oroville Yellow Cab, and Dave Kamp are transportation entrepreneurs, but in many other respects they are more dissimilar than similar. Kamp obtained the Chico DRT contract because he owned the local taxi and ambulance firm at the time, but the taxi business proved a transitory enterprise for him. Kamp had first become involved in the transporation business in Chico by purchasing a local ambulance company, and he then decided to diversify into the taxi business. The opportunity to become a publicly subsidized DRT contractor was quite welcome, as neither the ambulance nor the taxi business was particularly profitable. Within a few months of starting DRT service Kamp sold the Chico taxi company, recognizing that there was much more money in transit contract operations than in regular taxi service, particularly after the initiation of the subsidized elderly and handicapped service cut into the already poor taxi market.

When Kamp sold the taxi company in 1977 to the first of a series of new owners, he did so because it had little or no economic value to him. The poor economic prospects of taxi service in Chico have subsequently been confirmed by ownership turnovers--taxi demand is so low that a profitable service is apparently impossible. Although Kamp wants no part of money-losing ventures, he is astute enough to recognize that the preservation of taxi service has political value in Chico. Therefore, he has tried to help keep the taxi company afloat. If it goes bankrupt he suspects the City will require him to take it over to preserve 24 hour a day transportation service, as DRT only operates 10 hours a day. Accordingly, he has been quite generous with the taxi company's owners, allowing them to use both his companies facilities for office space and his DRT dispatcher to also dispatch taxi vehicles. The latter privilege is obtained by paying an extra $1 per hour to the dispatcher. Sharing the Chico dispatcher is not a great burden on Kamp's operations, however, since he claimed that demand for taxi service had declined to about 20 trips per day by mid-1981.

The biggest threat to Kamp's strategy of operating exclusively as a public transit contractor occurred during 1978, when he lost the Paradise DRT contract. The original Paradise taxi company owner was bought out and the new ownership underbid Kamp for the contract renewal. This taxi company operated the system for 11 months amidst an increasing number of complaints about poor service and a record of steadily declining cost-effectiveness. Finally, the County cancelled the contract, changed system organization, and rebid the system. Kamp was awarded a 3 year contract on the basis of his successful operation of the Chico DRT system. He thus firmly established himself in the County's eyes as the competent operator to do business with.

In 1981 Kamp obtained the contract for a intercity transit service which links together Butte County's three major cities plus a handful of small communities. With three contract services his operation is now grossing well over $400,000 annually. Even though his enterprise is totally dependent on public revenues for its survival, Kamp professes not to be concerned about this. He has no intention of

re-entering the taxi business, which he believes can never be profitable in Chico or Paradise. He is firmly convinced that his reputation for managerial competency, his firm's cost-efficiency, and the local political situation will stand him in good stead over the long run.

Kamp's view of his company's prospects does seem well-grounded in fact. The County staff considers him to be a competent and responsive manager and is pleased with the quality of service provided by his operation. Users respond favorably and complaints are rare. The firm's cost-efficiency is primarily a consequence of low employee wages and capable management. DRT drivers receive only $3.65 an hour, but many are part time employees seeking supplemental income and there is a waiting list of persons wishing to become drivers. Finding willing workers even at these subsistence level wages is no problem because of the labor situation in Chico. Some college students are seeking part time work, and many others wish to stay in the area after graduation. Overall, the area is a magnet for people but less so for economic activity. Thus many people will tolerate low wages either because they do not need a large income (e.g. students) or for an opportunity to become established in the community. Kamp appears to be able to motivate people to perform well despite the wages, since the intercity buses run on time, DRT vehicles arrive within 30 minutes, and patrons like the drivers' friendly style.

The future of transit in Butte County also appears favorable due to the changing political atmosphere. The liberal trend in Chico resulting from the influx of new residents has strengthened support for public transit among elected officials. In addition, the County has been sued by the California Rural Legal Administration (CRLA) for not meeting the "unmet needs" requirement of the TDA legislation. CRLA specifically cited the lack of general public transit services. A negotiated settlement was reached between the County and CRLA in which the former agreed to establish additional services by diverting some TDA funds from street and highway uses. Of course, the existence of the TDA program ensures funding for transit in Butte County as long as the political will exists to use the money for this purpose. As for Kamp, he keeps his political fences mended and believes he has an excellent chance to obtain yet another contract, that for a fixed route bus system being considered for Chico. (In fact, he did receive this contract in 1982.)

The evolution of Dave Kamp's transportation enterprise thus illustrates the ultimate in taxi company diversification--completely out of the taxi business and into public transit contract operations. What impact this will ultimately have on taxi service in Chico and Paradise is difficult to assess, but with the taxi companies in both cities apparently incapable of making a profit, it appears as if uncoupling taxi service from subsidized DRT provision has had a destabilizing effect on the former. If preservation of taxi service in these communities is deemed necessary, as may well be the case, it is conceivable local decision makers will attempt to use Kamp's operation as the vehicle for accomplishing this. That would be a most interesting twist of fate.

B. Oroville

Barney Gabriel, in contrast to Kamp, considers himself a private sector entrepreneur first and a contractor second. Yet it is evident that he has been just as astute as Kamp in parlaying a taxi operation into a multi-faceted transportation enterprise, and contracts have been essential in this process.

In addition to Oroville Yellow Cab, Gabriel also owns Oroville Bus Lines. The latter company does exclusively contract work--transporting handicapped school children for Butte County, carrying fire fighters back and forth, operating a fixed route transit service in Oroville, and providing charter service. Oroville Yellow Cab is the contractor for Oroville's elderly and handicapped DRT service, in addition to providing unsubsidized taxi service. These two companies are in reality a single enterprise, with common management, employees, and facilities.

Gabriel has owned Oroville Yellow Cab since the 1950's, and his company is the lone surviving taxi firm in the city. At one time there were as many as eight companies. Gabriel claims Oroville has always been a good taxi town. This is apparently a function of the large percentage of low income people in the community, the lack of public transit alternatives, the reasonably short trip distances, and the availability of low cost taxi services. Gabriel's company has contributed measurably to this last factor, as its operations are based on shared ride principles. Fares are based on a zone system, shared riding routinely takes place with the consent of the first passenger, and fares are low--$1 for each of the first two zones and 50¢ per zone thereafter. No premium fare is charged for ERT service, but most taxi users have apparently been socialized to view shared riding as the norm. The Oroville Express, the City and County-sponsored elderly and handicapped service provided by Oroville Yellow Cab, is explicitly shared ride in nature. By keeping regular taxi fares low, and now by providing the subsidized elderly and handicapped service, Gabriel has managed to maintain a viable taxi operation in what at first glance appears to be an unpromising environment for taxi service.

Diversified operations and relatively inexpensive taxi service are two of the keys to Barney Gabriel's longevity in the transportation business. A third is the operational efficiency of his two firms. Some of this operational efficiency stems from using family members as management and office staff, which means that the work is done by people with a direct economic stake in the well-being of the company. The taxi drivers are also pressed to be as efficient as possible, in particular to deliver speedy service. This has led to complaints from some of the users of the elderly and handicapped service, who expect more personalized service. Gabriel has resisted these demands, and insisted that his drivers be compensated by patrons for such services as carrying grocery bags to the door. In his view, highly responsive service--which means low wait and ride times--is the real measure of level of service to the user. While this philosophy has enabled Gabriel to keep his company's efficiency high and its costs low, it has resulted in occasional disagreement with the County staff which oversees the Oroville Express. To them, Gabriel often appears to be looking for the way to get the most for the least.

Gabriel himself has contributed to such perceptions, notably when he bid on the Oroville intra-community bus service. Oroville Bus Line's first bid was $31 per vehicle service hour, a figure much higher than the competition. While part of the difference was due to a mistake in costing, Gabriel also apparently did not expect any other firm to bid against his compnay. To his surprise another private contractor submitted a much lower bid. However, there were technical problems with this bid, and so the contract was rebid. The second time around Oroville Bus Lines submitted a bid less than half the amount of its initial figure, and won the contract. This episode helps explain why Oroville Yellow Cab-Oroville Bus Lines, despite its record of undeniably cost-effective service, has not generated the same admiration from the DRT administrators that Dave Kamp's operations have.

III. System Organization and Performance

The elderly and handicapped systems in Chico, Paradise, and Oroville are organized in a way consciously calculated to promote cost-effective service delivery. Shared ride operations are the norm and the providers are compensated only for service usage. In addition, the Oroville system is an integrated fleet operation. This was not the case initially, as the original system design called for Yellow Cab to dedicate part of its taxi fleet to the elderly and handicapped service. However, after briefly trying this mode of operation Barney Gabriel realized that it was an inefficient method of deploying taxi vehicles--for both the elderly and handicapped service and regular taxi operations--and requested the County that he be allowed to use vehicles interchangably for the two services. This was agreed to and Oroville Yellow Cab's six taxi vehicles now are used flexibly as service demands dictate.

The dedicated vehicle operations in Chico and Paradise are necessitated by the fact that Kamp has no other services with which to integrate these vehicles. The combination of dedicated vehicles and user-side subsidy is a rarity, as most providers are unwilling to establish a dedicated vehicle system without guarantees that compensation will be sufficient to cover costs. Consequently, such systems almost always utilize provider-side subsidies. As noted previously, Kamp was not willing to accept the initial Paradise contract without provider-side subsidies. In Chico, on the other hand, Kamp was still involved with the taxi company when the elderly and handicapped system was established. While vehicle integration was not practiced, in other respects the two services shared common resources.

Kamp's willingness to accept the risk of user-side subsidies with dedicated vehicles reflects both necessity and experience. The Board of Supervisors prefer the user-side subsidy method for DRT operations, as cost-effectiveness is largely predetermined and the provider has an incentive to work hard for its money. Given his total reliance on public contracts, Kamp has deemed it necessary to accept this philosophy and work with it. Fortunately, his experience with DRT in Chico and Paradise enables him to make reasonably accurate predictions of demand levels, to then project the level of service required to satisfy that demand, and finally to estimate the costs of providing that amount of service. Kamp is therefore able to establish a fee per ticket which will produce the revenues needed to cover costs and produce a profit. The current rates in Chico and Paradise are $3.40 and $3.35 per

ticket respectively. These rates have increased significantly since 1976-77 in response to the rising costs of operations, notably fuel price increases and higher wages.

One of the interesting aspects of the Oroville elderly and handicapped system is the use of a zonal fare structure. Although the zones are different (and larger) than those used in the regular taxi service, the concept of zonal fares was derived from Yellow Cab's experience with regular taxi service in Oroville. Gabriel suggested the use of a zone system, and the County and City agreed that it made good sense and decided to adopt it for the elderly and handicapped service. Zonal fares--the user pays one 85¢ ticket per zone, up to a maximum of three zones--discourage long trips, and keep costs down. In addition, they permit Gabriel to establish a low fee per ticket--$2.35 currently--due to the additional compensation for long trips (a three zone trip is worth $7.05 to the company). Moreover, short trips--which are encouraged by the price structure--maximize the firm's ability to accomplish shared riding and thus contribute to cost-effective service delivery. The County's ticket surveys indicate that about 90 percent of all trips are one-zone trips, so apparently the zonal fare structure is having the desired effect of keeping costs down.

The three Butte County elderly and handicapped systems have achieved an excellent record of ridership generation and cost-effectiveness compared to other California systems. Ridership ranges from 40,000 annual passengers in Paradise up to 95,000 annual passengers in Oroville. The latter figure represents nearly 5 annual passengers per resident of the service area, the highest such ridership generated by any DRT system in California, whether for the general public or the elderly and handicapped. These high ridership figures reflect the high level of service, the lack of other transit services (at least until recently), and the fact that there are no restriction on usage by the elderly and handicapped other than that they must reside in the service area. During 1980-81, the cost per passenger of the three systems ranged from $2.33 in Oroville to $3.18 in Chico. The differences in cost are primarily a function of different trip lengths, with Oroville having the shortest trips.

These are excellent cost-effectiveness accomplishments for any DRT system, and extremely impressive for elderly and handicapped services. They reflect not only the cost-efficient operations of the two providers and the limitations on cost per passenger imposed by the user-side subsidy scheme, but also the low administrative costs of the three systems. Administrative costs are kept low by simple eligibility requirements, no rationing of tickets, use of existing administrative resources (City Hall, the local senior center and local banks) as ticket distribution agents, and relatively limited intervention by the County staff responsible for overseeing the systems. The County staff leaves day to day operations in the hands of the providers, requires only limited record keeping, and becomes involved only to monitor performance periodically or to resolve problems/complaints. By using their local private transportation resources, these three cities in Butte County have managed to obtain elderly and handicapped transporation whose cost effectiveness and service accomplishments would be the envy of most other communities.

CASE STUDY 2: SUPPLEMENTAL PUBLIC TRANSPORTATION FOR THE ELDERLY AND HANDICAPPED

Hayward and San Leandro are adjacent cities in Alameda County, located in the East Bay of the San Franciso Bay Area. For the past several years each city has used the local taxi company, Veterans Yellow Cab, to provide a supplemental public transportation service to elderly and handicapped residents. In both cities, major public transportation resources are available in the form of the BART rail system and AC Transit's local and regional fixed route bus services. Due to the existence of these other public transit services, which are viewed as sufficient for most transit uses, and to the limited funds available to the cities to finance this program, service is rationed among users and not all elderly and handicapped are even eligible to use the service. Because of these restrictions, demand is so low that it is virtually impossible to accomplish any shared riding, hence the taxi company simply provides subsidized ERT service. These features of the Hayward and San Leandro systems are similar or identical to those of many other taxi-based elderly and handicapped services in California. The Hayward and San Leandro experiences thus reveal how a typical suburban taxi-based elderly and handicapped service is developed, operated and administered.

I. Development

San Leandro was the first of the two communities to establish a taxibased elderly and handicapped service, and indeed it was one of the very first cities in California to do so. San Leandro is one of the East Bay's older suburban communities, and according to city officials 10,000 of the 68,000 residential are elderly, a higher than normal percentage. In 1975, the City's Human Resource Coordinator successfully applied for Older Americans Act Funding from Alameda County's Department on Aging to initiate a transportation program. The grant required that San Leandro provide a one-third match of the County's contribution (for which the City used its own revenue sharing funds), and in this way $20,000 was assembled for an elderly transportation service.

Public transit service within San Leandro is provided by A.C. Transit, which has north-south bus routes running through the city. (A BART station is also located in San Leandro.) Given its lack of experience in local transportation matters the City had no desire to provide the elderly and handicapped service itself, and was eager to contract it out. The fact that the local taxi company, Veterans Yellow Cab (which is located in Hayward, but also serves San Leandro) was interested in participating in the program provided further motivation for contracting, as the resource to do so was already in place. Accordingly, the City negotiated an agreement with Manny Newman, owner of Veterans Yellow Cab, to deliver subsidized taxi service to eligible elderly persons.

Due to the very limited amount of funds available for the initial transportation program, the City decided that the service should be targeted at those individuals

who had no other good transportation alternative for trips within San Leandro. Eligibility was thus restricted to those who could neither drive nor use public transit due to inaccessibility or disability. These restrictions still apply. Initially, only persons 60 years or older were eligible; younger handicapped persons were added in 1978 when the City began using TDA funds. The City's Human Resources Commission also decided to restrict the eligible destinations, reasoning that if users had "carte blanche" on trips, some would abuse the program by taking unnecessary and lengthy trips. Thus, trip purposes are controlled. Users are generally restricted to trips for grocery shopping, personal business, medical services, and senior center and church activities. Eligible users were initially limited to the purchase of 10 taxi coupons a month, good for travel anywhere in San Leandro. The cost of the coupon was initially set at 25¢.

That the service delivery system itself would be regular taxi service (ERT) was apparently never questioned. The elderly and handicapped program was designed as a taxi subsidy system, and neither the City nor Manny Newman had any inclination to change the nature of the taxi firm's operations just for this program. Even if the issue of shared riding had been raised, the level of program ridership was so low initially (30 to 40 trips per day at most) that shared riding was simply infeasible. The City did request, however, that Newman give it a discount from normal taxi rates in return for the additional revenues which the taxi company would generate through the program. Newman was skeptical that much additional revenue would result, as he contended most program users were probably already using taxis. After some negotiating, however, he agreed to give the City a 5 percent discount from the regular taxi fare. A compensation mechanism was worked out whereby the taxi driver would record the meter fare for the trip on the user's coupon, which the user would sign, and these coupons were then submitted to the City for reimbursement (minus the 5 percent discount). With these arrangements, the system was initiated in 1975.

Hayward's elderly and handicapped program was largely inspired by and modeled after the San Leandro system. In 1977, the City used revenue sharing funds to finance a $25,000 senior transportation program. As in San Leandro the City's Human Development Agency spearheaded the effort. This agency does not directly operate its programs, but contracts with other organizations for service delivery. Therefore, using the local taxi firm to provide the senior transportation service was an obvious option given San Leandro's experience. The City also believed that it could get more and better service by utilizing a private provider with transportation expertise. Accordingly, Hayward negotiated a contract with Veterans Yellow Cab that was almost identical to that of San Leandro's--regular taxi service would be provided, and the taxi company would be compensated on the basis of the meter fares minus a 10 percent discount. Manny Newman wished to limit the discount to 5 percent as in San Leandro, but the City of Hayward prevailed.

The user component of the program was also organized similarly to that in San Leandro. Users were limited to 10 taxi coupons per month, although a two person household could only receive 15 coupons per month. Coupons cost 75¢ each. Trips were initially restricted to the city limits and allowable destinations were regulated,

as in San Leandro. In contrast, however, the program was open to all senior citizens of Hayward.

It bears noting that in neither community was the subsidized taxi program started as the result of urging by the Metropolitan Transportation Commission (MTC), the transportation planning--decision making agency (and MPO) for the Bay Area. The MTC has been actively encouraging elderly and handicapped paratransit systems for the past few years, and has made TDA Article 4.5 funds avilable for their support. However, San Leandro and Hayward began providing elderly and handicapped service even before the MTC strongly encouraged such activities. In fact, San Leandro and Hayward were among the handful of communities in the Bay Area which used their own funds to demonstrate the feasibility of subsidized taxi service for the elderly and handicapped, and by so doing helped spark the proliferation of such services, with MTC support, throughout the Bay Area.

II. Evolution

In both Hayward and San Leandro a significant event was the switchover from revenue sharing funds to Article 4.5 funds in 1978. This made about 50 percent more money available for the two programs in 1978-79 than had been the case in 1977-78. In addition, even larger sums promised to be available in coming years. In response to the improved fiscal situation, Hayward extended program eligibility to both low income and handicapped persons during the 1979-80 fiscal year. San Leandro was able to use the additional funds to extend service to more people by allowing all eligible applicants to become program registrants. Due to the previous funding limit the City had been forced to cut-off program registration, and there was a waiting list of about 100 applicants.

Hayward's experiment of extending eligibility to low income persons was terminated after one year. The demise of this feature of the taxi subsidy program was not due to oversubscription relative to budget constraints, as might have been anticipated. In fact, the low income residents of Hayward virtually ignored the program. Only about 50 to 100 low income persons were ever registered, although the eligible population numbers in the thousands and many inquiries were received. The exact causes of this underutilization are not known, although program administrators speculate that it stemmed from lack of information about the program among many low income persons, the limited amount of service available (5 round trips a month), and the cost difference between a taxi coupon and the regular bus fare.

While budgetary limitations were one consideration in discontinuing service to low income residents, two other factors were more important. Alameda County's Paratransit Coordinating Council, an advisory body to the MTC composed of sponsors (cities), paratransit contractors, and user representatives, had prioritized the frail elderly and the handicapped as the prime target population for Article 4.5 funded services. In fact, Hayward was unique in the Bay Area in allowing other individuals to use subsidized taxi services. In addition, Hayward had detected abuse of the taxi subsidy program by the low income registrants. Some people were selling coupons or giving them to non-registered persons. Since the City was working

through a social service agency to distribute the taxi coupons to the low income registrants, it was difficult to monitor the system to prevent such problems. In the end, the low income program appeared to be more trouble than it was worth, particularly as there was no visible constituency for it and some who were visibly against it. Therefore, it was terminated.

Another group, however, succeeded in obtaining more service from the Hayward system. These were the handicapped students, who persuaded the City to give them enough coupons to travel back and forth to school as many times as needed. San Leandro has made similar concessions for college students. It has also relaxed the monthly coupon limit for people who require regular medical treatment (such as kidney dialysis). In addition, individuals who can provide a compelling reason for why they should be permitted to purchase more than 10 coupons are usually accommodated.

When the program expanded with changeover to TDA funds, San Leandro was successful in persuading veterans Yellow Cab to increase its discount from meter fares from 5 percent to 10 percent. The City argued that the taxi company was now receiving more business, and as it had just increased its fares significantly and won the right to levy a gasoline price surcharge, a greater discount was in order. Newman was reluctant to increase the discount, but finally agreed after he persuaded the company's drivers to absorb half of the additional loss of revenue (i.e., they contributed 2 1/2 percent of the 10 percent discount). In the most recent labor contract, the company agreed to absorb the entire discount itself.

Both cities have also made refinements to their user payment systems over time. In 1980, Hayward discontinued controls on allowable trip destinations, and also replaced the requirement that trips originate and terminate within city limits with a $6.00 maximum fare. This fare limit was based on an analysis of how far users could travel within the city. Subsequently as taxi fares increased this fare limitation was increased to $8.00. In both programs, the price to the user has increased to $1.00 per trip. San Leandro continues to use coupons, but Hayward switched to a voucher system in 1981. Users now present a City provided voucher and $1.00 to the taxi driver at the outset of the trip. This relieves the City of the need to handle cash and also allows the rider to pay the fare at the time the trip is taken rather than in advance. Also in mid-1981, funding cutbacks by the MTC caused San Leandro to impose an $8 limit on taxi meter fares and made it necessary for Hayward to reduce its limit to $7.

III. System Performance

The taxi-based elderly and handicapped services in Hayward and San Leandro have been reasonably successful in achieving their objective of providing cost-effective supplemental public transportation to the elderly and handicapped. The number of persons registered for the two services has essentially stabilized, indicating that most people who need the service are in fact eligible to use it. San Leandro has 860 registrants and Hayward about 900. San Leandro has recently been forced to put new applicants on a waiting list because of fears that demand for subsidized service will exceed the budget, but the waiting list contains only 60

persons. Hayward is still accepting new registrants. In Hayward, 50 percent of the registrants use the system regularly, while in San Leandro the comparable figure is closer to 40 percent. Those who do use the service regularly take 4-5 trips per month. Given the relatively low usage by active users, and the large percentage of inactive users who apparently registered simply to have an alternative available in case it is needed, it seems likely that the service is strictly supplementary, as intended. Even most of the active users are obtaining their primary means of transportation elsewhere.

The two services have proven reasonably cost-effective for subsidized ERT. During 1981-82, the average cost per passenger was $3.90 in San Leandro and $4.30 in Hayward. This compares quite favorably to other elderly and handicapped systems in California. The reason for this performance is a combination of short trips, averaging 1 1/2 to 3 miles, which keep the meter fares low, and low administrative costs. The latter is attributable to simplified administrative procedures for determining eligibility and distributing coupons and vouchers (which is done primarily through mail), as well as a preference for charging only directly incurred administrative costs to the program.

IV. Taxi Operator Impacts

Manny Newman, the owner of Veterans Yellow Cab until 1981, and still a principal in the enterprise, has always had a skeptical view of government transportation programs and innovative taxicab services such as shared ride operations. But Newman has also been in the taxi business for over 30 years, and can recognize when the traditional formulas no longer work well. The taxi market in Hayward and San Leandro declined steadily, albeit gradually, during the 1970's and Newman understood the need to counter this trend if his company was to remain a viable enterprise. One measure he took was to diversify into package delivery service in the early 1970's, and this now represents nearly 15 percent of the company's business. The other major change since the early 1970's has been the growth of the subsidized ERT component of the business, which now makes up close to 20 percent of the company's gross revenues, or over $200,000 annually. Newman is quick to point out that a significant number of the subsidized trips would be made by taxi in any case, and thus the net increase in revenues is less than program revenues, but he readily concedes that elderly residents of San Leandro and Hayward are making many more taxi trips than they would without the subsidy programs.

Veterans Yellow Cab is now the provider for three subsidized ERT programs, those in San Leandro and Hayward plus a system in the surrounding unincorporated areas of Alameda County. This latter program is administered by the City of Hayward, so the taxi firm must deal directly with only two sponsors. In addition, the taxi company recently was the successful bidder for leasing three vans purchased by the City of Hayward to provide service to the handicapped in the two systems which Hayward administers.

By putting up $10,000 of the local match, Veterans Yellow Cab received the right to use the vans for the handicapped service and for any other taxi purposes. (The City retains title to the vehicles.) At the City of Hayward's insistence, but

consistent with his own preference for conventional methods of fare computations, Newman plans to have taximeters installed in the vans. This has benefits for both the City and the taxi company. For the former, it means that wheelchair-bound residents can be transported at the same cost as taxi users, or about half the previous cost to the program. For the latter, it enables Veterans Yellow Cab to compete for the business of other trips by handicapped persons or for trips sponsored by social service agencies by offering a price dramatically lower than that charged by other providers of wheelchair service. In a break with tradition, however, Newman plans to pay the van drivers an hourly wage if he can win the approval of the company's union for doing so.

One reason Newman has been so eager to obtain the vans for his service is his view that Veterans Yellow Cab is subject to unfair competition from social service agency providers who obtained vans through the UMTA 16(b)(2) program. One provider in particular has been aggressive in marketing its services. Newman believes that his taxi service is still being hurt by these social service transportation programs, but that the vans will give him a means of fighting back and hopefully obtaining some contract business from social service agencies.

For their part, the cities of Hayward and San Leandro are willing to make reasonable efforts to help maintain the viability of Veterans Yellow Cab. They will not give undue preference to the taxi company, but they are aware that the ERT market has deteriorated and that subsidized services are becoming an integral part of the firm's operations. They are well pleased with the cost-effectiveness of the elderly and handicapped service, and do not expect that other providers could duplicate the performance of the taxi company. In their judgement, Veterans Yellow Cab is likely to be a lower cost provider than any alternative. Consequently, if they can design services which mutually benefit both parties, as in the case of the van purchase and lease agreement, they are willing to do so.

It is something of a paradox that a taxi owner such as Newman, who is so adamantly supportive of traditional ways of doing busines, has been able to benefit so significantly from a government funded transportation program. But in reality Newman has had no other recourse. The company's drivers are unionized (Teamsters), receive a high commission rate (50 percent), and are also entitled to employee benefits. Consequently, labor costs are high and the firm must guard against pricing itself out of the market. The company's records indicate that, taking depreciation into account, it has not made a profit for several years--it is essentially a break even or marginally profitable operation (allowing for creative accounting). Without the elderly and handicapped service the company would probably be in difficult financial straits, certainly more so than at present. Newman has had the good fortune to be in the right place at the right time--the only taxi company in town when funds for elderly and handicapped service became available to the cities his company serves. However, he has also had the business acumen to use this opportunity to demonstrate to the communities that his taxi company is the provider which can best meet their needs for subsidized supplemental transportation services.

CASE STUDY 3: ELDERLY AND HANDICAPPED SERVICE IN A LARGE CITY

I. System History

Los Angeles is not a traditional city, but is rather a modern polycentric city, a collection of diverse communities spreading over 460 square miles. As such, Los Angeles residents have a need to travel both within the communities where they live or work and between the numerous communities which comprise the city as a whole. Public transit within Los Angeles, however, has been primarily oriented toward the latter need. The regional transit operator, the Southern California Rapid Transit District (SCRTD), has adopted a strategy of attempting to enhance intercommunity travel. The nature of an organization with regional responsibilities and the complexity of the task of providing intracommunity transit have steered SCRTD away from the provision of community level transit. Instead, since 1973 the de facto responsibility for providing community transit has fallen to the City of Los Angeles.

In that year, dial-a-ride programs were started by the City Demonstration Agency in the East/Northeast and Greater Watts neighborhoods as part of the Model Cities program. The Community Development Agency (the successor to the City Demonstration Agency) subsequently assessed the extent of the transportation disadvantaged population in each community in Los Angeles with an eye toward establishing additional community transit services where needed. In 1975, $500,000 from the Community Development Block Grant Program was allocated to establish community transit demonstration programs in the Beverly-Fairfax, Hollywood, Westlake-Wilshire, and Pacoima areas. These were traditionally organized dial-a-ride services, although some used taxi firms as providers. They were terminated at the end of 1976 due to a lack of funds and difficulties with one of the operators. In April, 1978 the systems were reinstated and expanded, using Public Works Title II funds. Also in 1978 the Community Development Agency successfully applied for TDA Article 4.5 funds to begin DRT services in the Harbor and Venice areas late in that year. The Venice system was another conventional dial-a-ride service, whereas the Harbor system was a local demonstration project to test the feasibility of the user-side subsidy, shared-ride taxi concept with a single taxi firm as provider.

In mid-1979, funding shifts initiated yet another round of community transit changes. The Beverly-Fairfax, Hollywood, Westlake-Wilshire, and Pacoima systems began to use Article 4.5 funds as the source of subsidy. However, the Los Angeles County Transportation Commission, which allocated these funds to the City, had established a policy that Article 4.5 funds could be used only for elderly and handicapped services. Thus these four systems were restricted to elderly and handicapped users. In October, 1979, a user-side subsidy elderly and handicapped demonstration project was initiated in the Echo Park-Silverlake service area, also using Article 4.5 financing. Several taxi companies were the service providers, but

unlike the Harbor system, the mode of service was ERT. Finally, in fiscal year 1980-81 the dial-a-ride services in the Venice, Pacoima and West Central Los Angeles areas were replaced with elderly and handicapped user-side subsidy ERT systems. (The West Central area is a combination of the old Beverly-Fairfax, Hollywood, and Westlake-Wilshire areas.)

The development of user-side subsidy systems in Los Angeles occurred largely as a result of the performance characteristics of the city's dial-a-ride systems, in conjunction with growing political pressure from the taxi industry for broader participation in the elderly and handicapped contracts. Throughout the history of DRT service in Los Angeles the dedicated vehicle systems have had an unpredictable and often dismal performance record. An illuminating example of the latter is the performance of the Venice DAR system during the 4th quarter of 1979-80. Cost per rider was $10.03 and the number of riders per hour was 1.2--not even up to ERT productivity standards. It bears noting that the performance of the dedicated vehicle DRT systems declined drastically over the last year or so they were in existence, due in large part to the gradual disintegration of the provider, Yellow Cab, as a viable taxicab operation. As the result of a variety of factors, Yellow Cab proved increasingly unable to adequately provide DRT service, and the poor level of service caused users to desert the dedicated vehicle systems in droves. (Ridership declined by over 60 percent in a 2 year period.) Of course, as the dedicated vehicle systems were organized on a provider-side subsidy basis, the reductions in productivity caused cost per passenger to increase to unacceptable levels. Rather than change providers, the City's Department of Transportation opted to transform these system's into user-side subsidy services.

One reason that the City DOT looked favorably on user-side subsidy arrangements was the success of the Harbor area elderly and handicapped system. During the same period of time that the Venice DRT system reached the nadir of its performance, the Harbor area user-side subsidy system was achieving a cost per passenger of approximately $3.00. The Harbor system was shared ride in principle and operator compensation was based on meter fares, with a fare of $3.00 being the maximum--this represented about a 2 mile trip. While the meter fare limits explain in part the relatively low cost of the Harbor system, another factor was the integrated fleet arrangement and consumed service compensation which guaranteed that only the amount of service needed was paid for.

The recent dynamics of the taxicab industry in Los Angeles was the second key factor which favored the development of user-side subsidy systems. The initial participation of taxi firms in the community transit program was by Yellow Cab in the Beverly-Fairfax area and Valley Checker Cab in the Pacoima area. However, both companies ran into trouble: Yellow Cab's parent company went bankrupt in December, 1976 and the taxi firm thus temporarily ceased service. Valley Checker Company was sold in November, 1976 in response to union problems and the Pacoima service was subsequently dropped.

The Yellow Cab bankruptcy, in conjunction with a 1974 change by the City of a 40 year policy of licensing only one operator for each franchise area in Los Angeles, had far reaching affects. Yellow Cab was the largest cab company in Los Angeles

with over 450 cabs. As the result of Yellow Cab's demise a strong independent taxi operator movement developed, resulting in the formation of two driver associations. Although Yellow Cab was operating again by the latter part of 1977, the taxi situation in Los Angeles had irrevocably changed.

Owner-driver associations of the type in Los Angeles have great difficulty participating in dedicated vehicle systems; however, the Los Angeles organizations were aware of the impact contract dollars could have on revenues and profitability. These factors along with the success of the Harbor system and the woeful performance of the Yellow Cab-operated dedicated vehicle systems dovetailed to create the ideal political environment for the introduction of multiple provider, user-side subsidy, integrated fleet ERT systems. Thus a user-side subsidy, multiple provider demonstration project was initiated in the Echo Park-Silverlake area. This concept resulted in relatively cost-effective service compared to the Yellow-Cab operated DRT systems and at the same time included the by now politically active independent associations. The Echo Park program was deemed a success by the City DOT, thus further encouraging the proliferation of this type of system.

II. Present Organization

The current Los Angeles taxi-based elderly and handicapped systems are organized on a user-side subsidy, meter fare compensation, exclusive ride basis. Patrons are allowed to purchase one book containing $20 worth of $.40 coupons per month. Coupons can be used to reimburse the cab operator for rides valued up to $5; anything over this amount is paid for by the user. Users are required to fill out a trip ticket which indicates the date of the trip and cost. Handicapped service is provided by lift equipped vans. Eligibility is restricted to persons over 60 years of age and handicapped individuals.

The systems are nominally administered by a broker whose functions include reimbursing providers, marketing and distributing coupons, printing coupon books, and procuring providers to deliver the service. The broker-multiple provider system was the preferred arrangement during 1980-81 and new systems were to be deployed in this mode. In the Venice system, however, it proved necessary to award the contract for the broker to Celebrity Cab (the low bidder came under investigation by Federal agencies for alleged improper bookkeeping practices and was dropped from the program), which effectively eliminated the potential for multiple providers. Therefore in the Vencie system as well as the Harbor area system the broker and provider are one and the same. Systems with a broker and multiple providers include Echo Park-Silverlake and West Central Pacoima. The broker for both these systems is St. Barnabas Multiservice Senior Center. The use of a broker (separate from the cab firm) also allows for the use of multiple lift van operators for handicapped service.

In the other programs--Venice and Harbor--the contractor provides a lift equipped van on a dedicated vehicle basis. Rides are prescheduled 24 hours in advance. Special coupons are printed for this service. Payment is at the regular meter rate and a $5 limit is also enforced for these rides.

III. Problems Encountered

The 1980-81 program in Echo Park-Silverlake had been preceded by a demonstration program in the same area. As the one program came to a close the other began. The changeover in broker also meant a change in coupons. When the new program began there was considerable confusion over which coupons were valid. This caused some difficulty with drivers, as those who accepted the old coupons and were not reimbursed subsequently became reluctant to accept any coupons at all. Eventually the coupon problem straightened itself out as everyone became more familiar with the rules of the new program. However, other problems involving drivers arose. Users complained about overcharging and refusal to accept coupons for payment. In addition, there is some indication that the lack of tips by elderly and handicapped clientele and general driver reluctance to accept a non-cash fare were a cause of driver's surly attitudes.

The St. Barnabas staff met with the providers and explained the situation. Independent association drivers had been targeted as particularly persistent violators. However, once the urgency of the problem was conveyed to the leaders of the independent associations, they were evidently able to impress upon their members the importance of the program. Table 2-1 indicates that at present the independents have much lower levels of complaints than the other firms involved in the elderly and handicapped program.

An analysis of the contract dollars, total vehicles and complaints is provided in Table 2-1. This analysis supports the assertions made by the broker for the multiple provider areas that the independents are the most competitive providers. It is important to stress that in a multiple provider situation such as in Los Angeles the user has the opportunity to choose any company listed in the table. A twelve-month count of complaints taken by the Los Angeles Department of Transportation is the source of the complaints per vehicle information. It is particularly noteworthy that the contract dollars per vehicle and the complaints per vehicle are inversely correlated, an indication that users are sensitive to the quality of service provided by the competing taxi companies. It is thus apparent that on association of independent operators can be competitive in an ERT-based program and in fact can surpass firms with traditional forms of ownership.

The current status of the Los Angeles programs can be traced to an ever increasing effort to get control of costs. The use of TDA Article 4.5 funds imposes severe constraints on the amount of service which can be provided. A user-side subsidy system has the advantage that ridership can be controlled through limitations on the distribution of coupons or script, thus coinciding with the stringency of the funding constraint. The limited availability of scrip has presented some interesting dilemmas to the St. Barnabas administration. The program area which is administered by St. Barnabas has some of the highest concentrations of elderly in the U.S. In addition, this particular population is not altogether lacking in either political acumen or pecuniary means. At the outset these factors combined to create pandimonium at the distribution centers. Demand was so high that long lines formed at the distribution centers when scrip books went on sale at the beginning of each month. There were even physical altercations reported at one center.

Table 2-1

Distribution of Taxicabs, Subsidies, and Complaints for Central Los Angeles*
Elderly and Handicapped Transportation Service

	Total No. of Cabs	% of Total fleet	% of contract $	% of contract $ / % of total fleet	Complaints/ Vehicle
United Independent	183	.29	.38	1.31	.262
Independent	199	.32	.37	1.15	.261
Red & White, A&W, Checker	201	.315	.20	.63	.517
Monarch	44	.065	.02	.29	.932
Others	2	.004	.03	--	--
	(n=629)				(mean=.493)

*Includes West Central and Echo Park-Silverlake programs

There are two methods employed to distribute the books of scrip. As indicated above, one method is through local senior citizen centers. The other method is by mail. In order to qualify for the mail program, an individual must be aged or disabled with no more than $1,500 worth of assets and less than $459 worth of monthly income. These values were chosen to coincide with the income limits for Medi-Cal, the California Medicaid program. By demonstrating eligibility for Medi-Cal residents can thus participate in the mail program.

It is apparent that these requirements are considerably more stringent than for the program as a whole. The demand for mail order sales was given priority and increased very rapidly. Since there is a limit on the number of scrip books which can be sold, this meant that filling the mail order requests cut into the allocations for the senior centers. In response to these cutbacks users of the service became politically vocal, causing protest letters to be issued to the City DOT by officials from the City Council level all the way to the White House level. As a result of the protests, there has been a freeze on the reduction of allocations to senior centers. Nonetheless, the program administrator foresees a further shift toward mail order sales with senior center sales eventually being eliminated entirely. There are 2,000 $20.00 taxi coupon books available in the combined contract area. This means that for every book available there are 52 persons eligible to purchase that book. Given this situation, the development of allocation procedures in future contracts will be interesting.

While the West Central area was having difficulties with overabundant demand, the situation in the Venice area was just the opposite. During the first six months of operation only 3,000 passengers used the service. While it is true that a user-side subsidy system only pays for the service which is consumed, it is also true that the administrative costs are relatively fixed--therefore intensity of use is a concern. The broker (who is also the provider) apparently had a great deal of difficulty marketing the coupons. Inasmuch as provider compensation is on a consumed service basis there should be sufficient incentive to encourage distribution; that is, no consumption (poor marketing) means no reimbursement. Of course, the broker was compensated regardless of usage, whereas the revenues from service consumption flowed to the taxi drivers, who lease their vehicles, not the taxi firm's management (which is responsible for program administration. One possible reason for low coupon usage is that while the provider may have been interested in obtaining the revenues for its drivers it was not sufficiently knowledgeable of the elderly community to effect an adequate distribution plan. Another possible factor is that the high crime rate in the area dampens the desire of the elderly to travel. Although this reason has been frequently cited, it would appear to be questionable given the door to door nature of the service.

IV. Performance

The overall financial performance of each of the elderly and handicapped systems during 1980-81 is shown in Table 2-2. The systems exhibited non-administrative costs per passenger ranging from $3 to $5, although the cost for the Harbor system was held down by the $3 fare limitation (subsequently increased). With the exception of the Venice system, the administrative cost per passenger is

TABLE 2-2

Performance of Los Angeles Elderly and Handicapped

Transportation Systems (1980-81)

	Passengers	Total Cost	Total Cost/Pass	Admin. Cost	Admin. Cost/Pass	Admin Cost/ Total Cost
West Central-Pacoima	33,398	$200,054	$5.99	$28,326	$.85	.14
Venice	12,728	85,690	6.73	35,202	2.76	.41
Harbor	35,964	136,945	3.80	32,085	.89	.23
Echo Park-Silverlake	26,278	127,520	4.85	24,047	.91	.18

quite comparable. The Venice broker's poor performance in stimulating ridership is the main reason for that system's much higher administrative cost per passenger. Although the costs per passenger shown in Table 2-2 are not overly high for an ERT-based program, they do not reflect more recent conditions. A 40 percent increase in taxi rates in 1982 has pushed program costs up proportionately, to where current non-administrative costs per passenger are $5 to $7.

One of the more interesting aspects of the Los Angeles system is the variety of types of organizations which participate in the user-side subsidy programs. This includes taxi companies with employee drivers, those with lease drivers, and two associations of independent owner-drivers. The owner-drivers have been quite successful in attracting business in the competitive user-side subsidy programs (see Table 2-1), while the employee driver company which operates the Harbor system has managed to provide shared ride service and achieve a superior record of cost-effectiveness. (Most of the lower costs of the Harbor system are attributable to shorter trips, with shared riding being of secondary influence.) These results largely reflect the quality of the organization's leadership and the level of concern which its members have for whether or not they participate in contracts. In the Los Angeles area the taxi operations which are directed by individuals who take a first-hand active interest in the enterprise's well being are those which perform best in the user-side subsidy programs. This is irrespective of the labor characteristics of the organization.

As for labor aspects, that which appears to have the greatest impact on the firm's success in a given program is the driver turnover rate. A driver who has been with the company or association for a long time is likely to have been socialized toward a concern for organizational objectives. Assuming that the quality of leadership is adequate a low driver turnover rate will enhance a firm's likelihood of success in a competitive user-side subsidy program. In Los Angeles, at least, taxi companies which lease vehicles to drivers have had more problems in this area than the employee-driver company or the owner-driver associations, and this is reflected in their less successful generation of subsidized patronage.

CASE STUDY 4: TRADITIONAL DIAL-A-RIDE FOR THE ELDERLY AND HANDICAPPED

One of the largest elderly and handicapped systems in California is located in the Pomona Valley, which includes the cities of Pomona, La Verne, San Dimas, and Claremont. Known as Get About, this DRT system is organized along conventional Dial-A-Ride lines. It is operated by Paul's Yellow Cab, one of California's major paratransit providers. Get About has experienced rapid and sustained growth over its lifetime. During its first six months of operation (in early 1978) the number of passengers per day increased from 35 to over 100; by early 1982 the system was transporting over 400 passengers per day. The budget has grown commensurately, increasing from about $150,000 (annual rate) during 1977-78 to over $750,000 for the 1981-82 fiscal year. Both the size and the growth of Get About make it an ideal system for examining the issues which arise when a taxi company becomes the provider for a large Dial-A-Ride service for the elderly and handicapped.

I. Development

Special transportation service in the Pomona Valley (which includes the cities of Claremont, La Verne, San Dimas, and Pomona) initially developed along human service agency oriented lines. Using agency vehicles and assisted by a $15,000 grant from the Area Agency on Aging, four homes for the elderly established their own transportation service in mid-1975. The service was targeted at isolated, low income elderly persons; they did not have to be agency clients.

In late 1976, Pomona Valley Community Services, Inc. (PVCS) was founded to administer the transportation program, which had acquired the name of Get About. One of PVCS' prime objectives was to expand and upgrade the Get About System, which then was carrying relatively few passengers per day. In pursuit of this objective, PVCS began lobbying for funds with the municipal governments in its service area. It found a receptive audience at the City of Claremont, which two years earlier had established its own DRT system for the general public.

Paul Brotzman, then the Assistant City Manager of Claremont, played a key role in subsequent events. Brotzman helped PVCS in developing its funding proposals, which were aimed at obtaining financial support from the four cities in the Pomona Valley and from state and federal transportation programs. He also worked closely with the staffs of the other city managers in making a case for funding and otherwise building local support for PVCS' transportation program. Equally important, Brotzman brought together PVCS and Paul's Yellow Cab, the only large taxi firm in the Pomona Valley and the service provider for Claremont's DRT system. Gene Stalians, president of Paul's Yellow Cab, immediately perceived the opportunity for his firm presented by PVCS' objective of substantially expanding Get About's activities. Stalians became actively involved in the efforts of PVCS and the cities to develop funding proposals and to establish an organizational structure to deliver the service.

In October, 1977 the four municipalities entered into a joint powers agreement, creating the Pomona Valley Senior Citizens and Handicapped Transportation Authority (PVSCHTA). PVSCHTA in turn entered into an agreement with PVCS, whereby the latter serves as the administrative arm of Get About. PVCS is responsible for such functions as eligibility determination, operator supervision, budget preparation and monitoring, planning, grants preparation, reporting and liaison with funding agencies, and is a recipient of funds in its own right. In return, PVSCHTA acts as funding recipient for state transportation funds and as a policy setting body.

Gene Stalians of Paul's Yellow Cab was a participant in the negotiations that led to the above agreements. Although PVCS could have operated the expanded Get About system itself, extensive interaction with Stalians had convinced the agency's leaders that the taxi operator possessed far more DRT expertise than it did. Paul Brotzman had vouched for Stalians managerial capabilities, and had recommended to PVCS that it contract with Paul's Yellow Cab to operate the system. Although two other private transportation firms in the area initially expressed interest in bidding on the system, PVCS wished to establish a level of service these firms could not provide. Consequently, Paul's Yellow Cab was the only bidder and PVCS and Stalians simply negotiated the terms of the contractual agreement.

Get About commenced operations in November, 1977. PVSCHTA owned only two vehicles, although the taxi sedans of Paul's Yellow Cab were available as back-ups. Within two years Get About was using eight vehicles and ridership had increased to about 250 passengers per weekday. Presently, the system uses 17 vehicles, 13 of which are owned by PVSCHTA, with taxi sedans as back-ups. Most of the vehicles are vans or minibuses equipped with lifts. Current ridership is in excess of 400 passengers per weekday.

Get About's impressive growth has also been accompanied by a marked change in the composition of its users. For the first two years or so of operations, most of the riders were elderly, although some of the elderly had physical handicaps. More recently, the system has been transporting large numbers of developmentally disabled persons (a state hospital which operates programs for this population group is located in the Pomona Valley). Currently, 40-50 percent of the riders are developmentally disabled. The similar origins and/or destinations of this group have facilitated scheduling and routing and enhanced productivity, but the presence of so many additional riders has also decreased the capacity available to the general elderly and handicapped population. Currently, the Get About organization is trying to determine how to resolve this difficulty.

II. Service Organization

Get About provides true door to door transportation for anyone in its service area 60 years of age or older, and for physically handicapped of all ages. The service is available eight hours a day Monday through Friday and seven hours on Sunday. In addition to serving trips within the Pomona Valley cities, Get About provides transportation to both medical facilities and the nearest major shopping center in adjacent San Bernardino County. Coordination with the DRT services in

western San Bernardino County is facilitated by the fact that Paul's Yellow Cab operates these as well.

In general, the vehicles used in the Get About system are dedicated to the service. Occasionally the dedicated vehicles will not be able to accommodate demands on the system, and taxi sedans will be utilized to handle the overload.

Compensation to Paul's Yellow Cab is on a cost-plus basis with a ceiling on the amount of compensation. The taxi company submits a bid based on amont of service provided and cost per vehicle service hour, and if PVSCHTA accepts this bid, it becomes the ceiling on compensation. The taxi firm keeps detailed records of all costs incurred in providing the service, and submits these to PVCS monthly. After review and approval by PVCS, the bills are paid by PVSCHTA, with a 10 percent profit allowance added on. Stalians was the leading exponent of cost-plus compensation, and his argument that it was the most equitable arrangement for both parties met little opposition. Paul Brotzman judged this compensation scheme to be satisfactory, and worked with Stalians to set it up.

Initially, Get About did not require users to preschedule trips, although it did encourage this practice. However, as the numbers of subscription-type trips by the developmentally disabled users have increased, the system is often booked to capacity during peak use periods. Accordingly, PVCS now requests that users preschedule trips 48 hours in advance, although it will accommodate immediate requests for service if capacity is available.

While Paul's Yellow Cab operates the system, PVCS has a major role in ensuring that the system works well. PVCS monitors the performance of the contractor, maintains liaison with the four member cities, and generally functions as the administrative arm of the system. PVCS maintains a full-time staff of several persons, and in 1980-81 its administrative functions consumed over $100,000, or approximately one-sixth of the total cost of the Get About system.

Over time, PVCS and Stalians have agreed to a division of authority in which user concerns, operational performance, and costs are PVCS' baliwick, while Stalians reigns supreme in matters of day to day operations. This understanding emerged out of some early conflicts over PVCS role with respect to user complaints. Because they consider Get About and PVCS to be synonomous, users from the outset lodged complaints about drivers with PVCS. Stalians was not happy with this procedure, as he wanted to receive complaints directly, not from an intermediary which did not understand the operational requirements of DRT. PVCS held firm, however, contending that the service must be user-sensitive, and that it was in the best position to judge whether complaints had merit. Eventually, Stalians accepted the legitimacy of PVCS' driver monitoring function, recognizing that the agency is better attuned to the needs of the systems' users than he is. Stalians has listened to PVCS' recommendations and requires that all Get About drivers, who are Yellow Cab employees, undergo training by PVCS in how to deal with the elderly and handicapped clientele. In addition, Stalians attends meetings of the PVCS Advisory Board, so he is kept in direct touch with user sentiment and needs.

The funding aspects of the Get About system also exhibit the pulling together of parts to form a whole. Operating and capital subsidies come from no fewer than eight sources--the State, Los Angeles County, the Area Agency on Aging, UMTA, and the four municipalities which comprise PVSCHTA. With a budget now in the neighborhood of $750,000 per year, Get About has developed from a very modest transportation venture into a relatively sophisticated organizational complex for the delivery of transportation services to the elderly and handicapped.

III. System Performance

The performance of Get About has steadily improved over time. In June, 1978--seven months after service commenced--the system carried only 100 passengers on an average weekday, achieved a vehicle productivity of only 2.2 passengers per hour, and registered on operating cost of $4.65 per passenger, excluding PVCS' administrative expenses. Three years later, in June, 1981 the system transported 437 passengers per day, had a productivity of 3.8 passengers per vehicle service hour, and had lowered the operating cost per passenger to $4.19.

Until 1982, the increasing productivity of the Get About system largely offset major increases in the price which PVSCHTA has had to pay to purchase service from Paul's Yellow Cab. In 1980-81, Paul's Yellow Cab charged PVSCHTA 33 percent more for a vehicle hour of service than it did during 1978-79. (Some of this increase is due to the changing mix of vehicles in the fleet, as the larger vehicles which have been added are more expensive to operate.) However, due to a 23 percent increase in productivity over this two year time span the operating cost per passenger increased by only 8 percent.

In 1982, however, Get About's performance declined significantly. Operating costs per vehicle hour increased by more than 25 percent even while productivity declined by nearly 5 percent compared to the last quarter of 1981. Administrative costs have also continued to increase, to a level more than 25 percent higher than in 1980-81. The result has been a one-third increase in operating cost per passenger, to a level of $6, and an increase in total cost per passenger to more than $7. This compares to a total cost per passenger of $6.16 for 1980-81. Alarmed by this increase, PVCS has begun to pressure Paul's Yellow Cab to achieve higher productivities, primarily by taking advantage of the many to one and many to few trip patterns of the developmentally disabled users. PVCS even sponsored a study of the current Get About System which resulted in a plan recommending that pre-scheduled group trips be maximized in order to increase productivity. PVCS is now exploring ways to implement these plans.

IV. Taxi Company Impacts

Get About is only one of several DRT systems operated by Paul's Yellow Cab. In addition, the company provides general public DRT service to five cities in western San Bernardino County, operates a DRT system for the transportation handicapped which encompases all these cities plus unincorporated areas, and provides subsidized shared ride taxi service in the City of Claremont. Nonetheless, the Get About system represents the company's largest individual contract; in 1981

it comprised 38 percent of the company's contract revenues, and nearly 25 percent of the company's total revenues. Clearly, the Get About system is an integral part of the Paul's Yellow Cab paratransit enterprise, and as such it commands substantial management attention.

In addition to the obviously beneficial financial impacts, two other impacts of the Get About system have been particularly noteworthy. First, Gene Stalians has become an active participant in both the local and regional level government process. Stalians has found it necessary to cultivate good relations with the member cities of PVSCHTA to protect his contract interests, and also to become involved at the Los Angeles County Transportation Commission level to help lobby for the continued allocation of TDA Article 4.5 funds to the Pomona Valley system. Stalians believes it is necessary for him to be able to communicate directly to the cities, not just through PVCS, as the three parties have overlapping but not identical interests. In addition, the LACTC staff has made certain recommendations to PVSCHTA which Stalians feels have been in opposition to his interests, such as establishing a separate system with another provider for the developmentally disabled. Thus, despite his company's position as a contractor which could be replaced, Stalians has not hesitated to interject himself into the local decision making process in order to be certain that his viewpoint will be clearly expressed. This has become increasingly important as he and PVCS have begun to differ over how much system performance can be improved.

Second, the operational aspects of the Get About system are more sensitive and problematic than those of Paul's Yellow Cab's other DRT systems. Users are more likely to complain about driver behavior, and on several occasions Stalians and PVCS have had to resolve difficulties on this front. In addition, the influx of developmentally disabled clients has created a host of problems, from scheduling to vehicle utilization patterns to proposals for a completely separate system for these users. Although the introduction of developmentally disabled users initially improved productivity, by early 1982 performance had begun to decline, and PVCS began to become dissatisfied with Paul's Yellow Cab's performance. The increasing pressure to improve productivity, combined with the PVCS-sponsored study of the system, led to strained relations between the two parties, as Stalians did not concur in the study's conclusions that a significant increase in productivity could be achieved.

Stalians, therefore, finds himself no longer accepted as the sole source of operational expertise, facing demands to make the system perform better, and dealing with a less compliant sponsor. Given the large contract amounts involved--over $500,000 annually at present--this was probably inevitable, but it has caused considerable friction in the complex relations among PVSCHTA, Paul's Yellow Cab and PVCS. Nonetheless, it is likely that the taxi company will continue to remain the Get About provider due to its ability to produce service less expensively than potential competitors. However, it also seems certain that it will have to contend with less informal relations and with higher levels of operational expectations than have prevailed previously. (To the surprise of all parties, in late 1982 a major DRT management firm underbid Paul's Yellow Cab for the renewal of the Get About contract, and took over operation of the system in early 1983.)

CASE STUDY 5: A PARATRANSIT ENTREPRENEUR

The South Bay area of Los Angeles County includes a diverse collection of cities, extending from the beach cities of Manhattan Beach and Hermosa Beach on the north through the exclusive communities on the Palos Verdes Peninsula to the port city of San Pedro (actually part of Los Angeles) at the south. The South Bay is bounded on the south by Long Beach, an older industrial city of over 300,000 residents. Three taxicab operations, South Bay Yellow Cab, Wilmington Cab, and Diamond Cab of Long Beach, serve this large and varied area. All three are owned by a single company, United Checker Cab, whose president, Mitchell Rouse, has been a noteworthy paratransit entrepreneur. Under Rouse's guidance United Checker Cab now generates over $1 million annually in contract business, almost all for paratransit services. Yet as recently as 1978, the company did not operate a single public paratransit service. The story of the diversification and expansion of United Checker Cab under Mitchell Rouse's guidance is an example of how a skillful businessman can use the elderly and handicapped transportation market to transform a traditional taxicab operation into a paratransit company.

I. Company Development

United Checker Cab was synonymous with Wilmington Cab for many years, and this operation served as the principal building block for Rouse's diversification activities. This company has been in the Rouse family for many years and is presently owned by Mitchell Rouse and his brother. Mitchell Rouse became heavily involved in the affairs of the company as a result of the illness of his father, who was his predecessor as company president. When Rouse took over the business in 1977 he decided that a major effort was necessary to stem the downward trend in demand experienced by the firm, a trend which seemed likely to eventually undermine its viability. The company had no competition in its primary service area of San Pedro, Wilmington, and Harbor City (all part of Los Angeles) due to the City of Los Angeles' monopoly franchising policy, but the absence of competition was small comfort in the face of a declining taxi market. As Rouse viewed the situation, the company would have to find other market opportunities if it expected to prosper.

The first such opportunity was a small one, and ironically it arose as the result of an initiative by the former owner of South Bay Yellow Cab, then a separate company. In 1978, South Bay Yellow Cab persuaded the City of Lomita (a small community adjacent to the Harbor City-San Pedro area of Los Angeles) to establish a subsidized ERT service. Because both South Bay Yellow Cab and United Checker Cab held service rights in different areas outside Lomita which contained eligible trip destinations (medical facilities), the City wanted both companies to participate. Given the small amount of revenue at stake, and the additional trouble of having to deal with Lomita's city government, United Checker was not an enthusiastic participant initially. In fact, Rouse left the Lomita negotiations to the company's manager, as he believed other aspects of the company's operations were more deserving of his attention. This was an attitude that would soon change.

Shortly after the Lomita service was initiated, a much more substantial opportunity came United Checker's way. Again, however, the impetus came from another organization, in this instance the City of Los Angeles. The Community Development Agency, having previously established conventional dial-a-ride systems in a few areas of Los Angeles, was seeking a situation in which to try out a user-side subsidy scheme for DRT. It approached United Checker with the idea, and Rouse expressed interest in participating in the system the City had conceived. After some negotiations a plan was agreed upon, although the City provided most of the parameters. United Checker Cab would offer shared ride service to the elderly, handicapped, and low income residents of the Harbor area (essentially San Pedro, Harbor City, and Wilmington), with compensation based on use of the taximeter while patrons were on board. A $3.00 limit was placed on each user's meter charge, with patrons paying the excess. The Harbor area user-side SRT system was implemented in June, 1978.

The Harbor user-side subsidy system firmly launched both Rouse and United Checker Cab into the paratransit arena. The program grossed over $100,000 for United Checker in its first year of operations, and although some of the subsidized patrons had previously used taxis the overall effect was to enhance the company's revenues. Moreover, the shared ride aspect of the Harbor system required that Rouse devote attention to the operational implications of paratransit, and devise procedures for actually accomplishing shared riding. But undoubtedly the most significant effect of the Harbor system was that it drew Rouse into a community of paratransit interests that was then developing in Los Angeles County, a development which is chronicled below.

As Rouse became more deeply involved in helping organize the paratransit interests in Los Angeles County, so he also moved to shape a new taxi company. In 1981 he acquired South Bay Yellow Cab, which expanded his ERT operations outside of the City of Los Angeles into several other cities in the South Bay. The South Bay Yellow operation was available because its owners believed that their dial-a-ride business was the company's only source of profits and that the ERT taxi market in this essentially suburban area was a financial dead-end. Abandoning this market would enhance the health of the more profitable contracting portion of the business. (The former owners still operate dedicated vehicle elderly and handicapped dial-a-ride programs in two South Bay cities.) Obviously, Rouse believed that ERT was not a financial disaster in this service area, and equally important he also recognized the advantages of acquiring the company in order to increase his contract opportunities.

As Rouse had anticipated, the South Bay Yellow Cab takeover realized almost immediate benefits from contracting. Within a matter of months his now expanded company became the provider for elderly and handicapped systems in Redondo Beach, Carson, and Rancho Palos Verdes. In addition, the company began to successfully seek out contracts from social service agencies to provide transportation to their clients. Thus the company was well-positioned when the sole Long Beach taxi company, Diamond Cab, went bankrupt in early 1982. The City of Long Beach turned to Rouse, as the only major paratransit provider in the area, to takeover a $500,000 contract for operating a dial-a-ride system for the

transportationally handicapped. United Checker subsequently was granted the Long Beach taxi franchise, which permitted the company to double the size of its ERT fleet.

II. Involvement with Government

During the five years he has been president of United Checker, Rouse has not only thrust his company squarely into the paratransit business, he has also become an important actor in transportation decision making in Los Angeles County. This process culminated in early 1982 with his election as chairman of the Paratransit Operations Subcommittee of the Los Angeles County Transportation Commission (LACTC).

Rouse's introduction to the transportation plannng-decision making process was through the Paratransit Task Force of the Southern California Association of Governments (SCAG). The SCAG Task Force included private paratransit contractors, municipal paratransit operators, social service agencies, consultants, elderly and handicapped representatives, transportation planners, and others. Soon after Rouse became active on the Task Force, a consensus emerged among its members that paratransit was getting short shrift in Los Angeles County. The Task Force included persons from all the counties in the SCAG region (all of Southern California except San Diego County), and paratransit was relatively well developed in all the areas other than Los Angeles County. In Los Angeles County, however, there had been relatively little support of paratransit, particularly DRT. Moreover, the paratransit interests found themselves largely shut out of the transportation decision making process at the County level. In particular, there was no paratransit input into the decisions of the LACTC, which is responsible for setting transportation policy and allocating funds for public transportation in Los Angeles County. Decisions affecting community level paratransit were being made by largely uninformed LACTC Commissioners with input, if any, from a Bus Operations Subcommittee comprised of fixed route transit operators openly hostile to use of funds for DRT or simiar services and from a staff which seemingly had little interest in or expertise about paratransit.

In response to this situation, the Los Angeles County contingent of the SCAG Paratransit Task Force decided in mid-1980 to organize a Los Angeles County Paratransit Coalition with the aim of persuading the LACTC to create a formal mechanism for paratransit input. The Paratransit Coalition was comprised of essentially the same interests as the SCAG Task Force--private operators, municipalities, social service agencies, and a few others. Over a year of political activism and negotiations with LACTC staff and commissioners was required before the Coalition could achieve its objective, but finally in late 1981 the commissioners agreed to establish a Paratransit Operations Subcommittee (PAROS), largely along the lines suggested by the Coalition.

During this process Rouse emerged as a key spokesman and activist for the community level paratransit interests. He personally lobbied key commissioners and Los Angeles City Council members, was a member of the steering committee of the Coalition, and was a forceful advocate for the creation of PAROS. Rouse assumed

this active role because he was well aware of the need for additional financial support for community level paratransit if it were to have a viable future, and because he had made a decision to tie his company's future to paratransit. Rouse openly admitted his self-interest in the establishment of PAROS, but as everyone in the Coalition had a self-interest for involvement--whether financial, programmatic, or philosophic--this did not seriously undermine his leadership role. However, it did create difficulties with the LACTC staff, who were accustomed to dealing with public agencies whose self-interest was bureaucratic in nature, not financial. The staff never ceased to be suspicious of Rouse, but his ability to effectively lobby political decision makers eventually made it possible for the Coalition to persuade the LACTC commissioners that staff reservations about the Coalition's PAROS plan were not well grounded.

Because of his role in the creation of PAROS, Rouse essentially guaranteed himself a membership slot on the subcommittee. (PAROS reports to a committee of LACTC commissioners--elected officials or their alternates.) Although many of the PAROS members were not Coalition members, Rouse was nonetheless unanimously selected as PAROS chairman by the membership in recognition of his effective advocacy of the paratransit cause. Thus, while Rouse is not yet a part of the "transportation establishment" in Los Angeles County, he has made great strides in that direction, and in the process has greatly improved the prospects for paratransit generally and his company's paratransit business specifically.

III. System Planning, Management, and Operation

United Checker is now the provider for six elderly and handicapped systems, organized in a variety of ways. Three systems--Lomita, Palos Verdes, and Carson--are simply subsidized ERT. The Harbor system in Los Angeles is nominally user-side subsidy SRT, the Long Beach Dial-A-Lift system is a dedicated vehicle operation, and the Redondo Beach service is an example of a "hybrid" system which uses both dedicated vehicle and integrated fleet principles. Rouse had a major role in planning the features of some of these systems, whereas in other cases the system parameters were largely established before Rouse's company began to provide service. Three systems--Redondo Beach, Carson, and Long Beach--illustrate the types of situations in which Rouse must plan, manage, and operate elderly and handicapped services.

The Redondo Beach system is of particular interest because it illustrates the development and operation of a "hybrid" system. The idea for a hybrid system was developed by the Redondo Beach Planning Department. This system is a compromise between the desire for a dedicated vehicle system and a need to minimize costs. The characteristics are a dedicated vehicle core with supplementary service provided on a fixed fee per passenger basis by the ERT fleet. The number of dedicated vehicles is sized to normal demand levels, while the ERT vehicles provide backup during times of peak demand. The objective is to use the dedicated service as intensively as possible, maximizing shared riding through appropriate dispatching techniques, and to use the ERT fleet only when absolutely necessary. When a taxi firm is first beginning to deploy such a system, there can be difficulties with the overuse of the ERT fleet. This, of course, causes costs to rise.

Problems were abundant in the initial phase of the Redondo Beach contract. The service was to be provided at the rate of $16 per vehicle service hour for the single dedicated vehicle and $4 per passenger for the ERT overflow. Based on experience with the previous contractor, the City's Planning Department assumed that the dedicated vehicle would attain a productivity of at least 4 passengers per vehicle service hour, and would carry most of the demand. However, after United Checker became the contractor, this did not prove to be the case initially. During August, 1981 only 422 passengers out of a total of 947 passengers were transported in the dedicated vehicle (a van), and only 13 percent of all trips involved shared riding. Dedicated vehicle productivity was only about 3 passengers per hour. The total monthly cost was $4,300, or about $4.50 per passenger. The higher than anticipated cost per passenger and a high level of passenger complaints, caused both by long waiting times and inconsiderate driver behavior, led the Planning Department to closely scrutinize the system. Of particular concern was that fact that the level of productivity was significantly lower than that achieved by the former management of South Bay Yellow Cab, which had operated the system the previous two years.

It bears emphasizing that the Redondo Beach system was the first dedicated vehicle service that Rouse's operation had participated in, and the first system of any kind in which shared riding was a significant factor. While the Harbor system is nominally SRT in character, in actuality only about 15 percent of all rides are shared, and this includes group rides. Therefore, significant adjustments in dispatching were necessary for the Redondo Beach system if high vehicle productivies were to be achieved. However, the operational personnel at United Checker did not make sufficient changes initially, apparently yielding to the tendency to dispatch the dedicated vehicle using ERT-type practices unless a shared ride vehicle tour could easily be created. In addition, ERT vehicles were called into service whenever a trip request did not readily fit into a vehicle tour. While these practices might be expected to increase level of service to the user, in fact they led to the opposite result, long waiting times. The dedicated vehicle was being used ineffectively and thus was often not available to serve new trip requests. As for the taxis, a relatively small number served a large geographic area and therefore they were often either engaged in regular ERT service or were some distance from a Redondo Beach trip request when they were assigned to it. In either case, response times were high.

The City brought the performance and user complaint problems to Rouse's attention and suggested a number of avenues for improvement. Chief among the recommendations were the establishment of a separate telephone number for the Redondo Beach system and the use of separate personnel from United Checker's regular taxi business.

Once Rouse was aware of the depth of Redondo Beach's dissatisfaction with the system's performance, he personally intervened in the operation. A separate telephone line was installed, dispatching practices were altered, and operational personnel were given orders to utilize the dedicated vehicle as fully as possible. Drivers were also instructed to be more courteous, although as the South Bay Yellow Cab drivers are owner-operators, this was a difficult policy to enforce. Relatively

quickly, the performance of the system improved significantly. By December, 1981, 63 percent of all passengers were being transported in the dedicated vehicle, 34 percent of all rides were shared, and the cost was $4.13 per passenger. This represented a 10 percent reduction in cost per passenger and an increase in dedicated vehicle productivity to 3.8 passengers per vehicle service hour, significant improvements in both cases. This performance was maintained through the first quarter of 1982.

This turn-around in performance is characteristic of Rouse's concern for contract operations. By his own admission, his firm until recently was technically weak in paratransit operations. Therefore, only by personally intervening into problem situations could he stimulate a higher level of performance by the organization. Recognizing the importance of contracts to his company's long term viability, Rouse has been quick to take an active role in resolving problems once it has been clear that a community is dissatisfied. Although his posture may be reactive rather than proactive, the sponsors in the South Bay indicate that Rouse is keenly sensitive to complaints about service and responsive to suggestions. This is in spite of the fact that four of the elderly and handicapped contracts gross less than $5000 per month each.

Some taxi managers have a tendency to look only at the dollar value of each contract, disregarding the collateral benefits accrued from them. In such cases, self-interest is of limited value as a motivator toward innovative management. However, Rouse's experience indicates that a manager who is actively interested in expanding his revenue base can probably be counted upon to learn the lessons of DRT contracting very rapidly, and adapt his operation to accommodate these demands.

In contrast to Redondo Beach's innovative hybrid DRT system, the elderly and handicapped system in the City of Carson is a conventional subsidized ERT system, albeit with unlimited rides by users. Carson is an industrial community located on the southern edge of Los Angeles. It enjoys the enviable situation of having such a strong industrial base that there are no property taxes for home owners. Thus when a City Council member expressed interest in instituting an elderly and handicapped service, the Council was able to act on his request and to finance the service entirely out of municipal general funds. Nonetheless, it did not wish to make a permanent commitment to a transportation program, nor for the city to acquire vehicles or to contract for expensive bus service. Once Rouse learned of the City's interest in community transit, he actively promoted a taxi-based elderly and handicapped system, and a three-month pilot program was subsequently authorized by the City Council. United Checker Cab, as the only taxi company with service rights in Carson which bid on the service, was granted the contract.

Rouse had little difficulty persuading the City that a subsidized ERT system was the most appropriate way to organize the elderly and handicapped system. With less than 5 percent of Carson's population being elderly, demand was expected to be low, particularly during the start-up phase. The City's desire not to purchase vehicles mitigated against a dedicated vehicle system, and the anticipated low

demand ruled out integrated fleet SRT in Rouse's view. Thus ERT service, with compensation based on meter fares, became the agreed-upon arrangement.

As in Redondo Beach, difficulties were encountered during the startup phase of operations. Sometimes cabs did not arrive, and other times they were late. In addition, drivers were not always aware of the service boundaries--the Carson city limits. The City brought these problems to Rouse's attention, and the latter quickly moved to correct the problems. He emphasized to drivers and dispatchers the importance of responding quickly and reliably to trip requests, and complaints have diminished substantially. Although the Carson system generates only about $5000 per month for Rouse's operation, in the poor ERT market of the South Bay such a secure source of revenue is well worth management attention. This is particularly the case since the City faces no financial constraints to service continuation, places emphasis on service quality, and allows unlimited use by the elderly and handicapped. With the improvement in service quality the sponsor now is quite satisfied with the system and also is pleased with the increasing level of cooperation with the taxi company which has evolved.

The Long Beach Dial-A-Lift system is by far the largest contract opportunity which has come Rouse's way. Accordingly, he and his operating personnel devoted a substantial amount of effort to making the system work well when they took it over in late 1981. Since the Long Beach system had been operating for several years (it was instituted in 1977), standard operating procedures had been in existence for some time and United Checker had to break no new ground. On the other hand, the system employs 15 dedicated vehicles and relies on shared riding whenever possible. It thus posed a major challenge to United Checker's dispatching abilities, which are oriented primarily to ERT. Moreover, the stakes were high, as good performance seemed likely to enable United Checker to retain the contract without difficulty, whereas poor performance would probably cause the City of Long Beach to actively seek alternative providers.

Rouse accordingly decided to retain the previous provider's work force to operate the system, and United Checker provides only the management function. In this way the service has not experienced problems due to changes in operating personnel, and service quality has been maintained. In addition, Rouse managed to obtain an increase in the compensation rate (the previous provider's rates were among the lowest in the state) which puts the system on sound financial footing and makes it a source of profitability, not merely revenues. Thus, when it came time for the contract to be renewed in mid-1982, it was simply extended in view of the good performance record United Checker had achieved in the several months it had operated the system. This one system now represents over half of all of the taxi company's contract revenues, and has contributed substantially to the emergence of United Checker as one of the five largest paratransit contractors in California.

CHAPTER THREE

ISSUE ANALYSIS

The numerous organizational, managerial, and political issues associated with the development of taxi-based special transit services can be grouped into three major categories: (1) system organization; (2) taxi company impacts; and (3) the joint effect of taxi company organization and system organization on taxi participation in the service, and the success of that participation.

I. System Organization

The organization of a taxi-based special transit system encompasses six factors: (1) the decision to restrict ridership, and the severity of the restriction; (2) the decision to use a taxi firm as provider; (3) the determination of whether to use dedicated vehicles or an integrated fleet system; (4) the selection of a subsidization option, (5) the adoption of a provider compensation mechanism; (6) and the choice of a user payment system. In practice, these factors are highly interrelated. A sponsor's decision to restrict ridership and its determination of what the role of the system will be--ranging from basic community public transit at one extreme to a strictly supplemental service to fixed-route transit for the most mobility impaired individuals at the other--significantly affects the feasibility and attractiveness of the other system organization options. Instead of an infinite variety of systems, the reality is a small number of distinct types, organized in ways which are internally consistent as well as compatible with sponsor objectives, the taxi and transit market situation, and the operating capabilities of the taxi provider.

A. Ridership Restrictions

Over the past several years, sponsors of DRT systems have increasingly opted to restrict eligibility of use, almost invariably as a strategy for containing costs. Cost containment considerations alone, however, do not explain why so many California DRT systems carry ridership restrictions. In Minnesota and Michigan, where local transit services are typically less generously funded than in California, virtually every DRT system in the state is open to the general public. The decision to restrict ridership is best understood as the result of both budgetary limitations and local government perceptions that acceptable transportation alternatives exist for those among the general public denied access to the DRT system.

Cost considerations have certainly been important in sponsor decisions to restrict ridership to the elderly and handicapped, or more typically, some subset of this population group. All but two of the 48 California taxi-based elderly and handicapped systems faced either absolute funding limitations or serious competition for the funds that have been used to subsidize service. Table 3-1 presents the source of subsidy for these systems. As is indicated, the most frequently utilized funding source has been Article 4.5 of the TDA program, the special community transit funding category. But while Article 4.5 provides for up to 5 percent of TDA funds to be used for community transit in the largest urban counties, these are

precisely the areas in which fixed-route transit is dominant. Thus merely obtaining the 5 percent funding for local DRT services has been quite difficult politically, and has only been accomplished in the San Francisco Bay Area. In Los Angeles County, in contrast, only 1.5 percent of TDA funds were set aside for Article 4.5 subsidized services in 1980-81. Moreover, even when the full 5 percent is available, it represents a relatively small sum to a city wishing to sponsor a DRT system, less than $100,000 annually for a community of 100,000 persons. Financing a general public DRT system from this meagre funding base alone would be virtually impossible for a city of such size, and 26 of the 48 taxi-based elderly and handicapped systems have no other source of subsidy.

TABLE 3-1
SOURCE OF SUBSIDY

Source	Number of Systems*
State transit subsidy program, special funds (Article 4.5)	27
State transit subsidy program, regular funds	13
Municipal general funds	5
Transit agency funds--State and Federal subsidies intermixed	4
Social service program funds	1

*Sums to more than 48 because two systems use multiple sources of subsidy.

While fiscal realities made a restricted ridership system a strong possibility when Article 4.5 funds were used, it was the political pressure to maximize the availability of TDA funds for conventional transit services being operated in these areas which made ridership restrictions all but inevitable. All of the Article 4.5 funded systems are located in the San Francisco Bay Area and Los Angeles County. In these two areas, the respective planning/decision making agencies, the Metropolitan Transportation Commission (MTC) and the Los Angeles County Transportation Commission (LACTC), have adopted the position that DRT is not needed for the general public, nor in many cases even for all of the elderly and handicapped, due to the availability of fixed route service. Many local sponsors have concurred in these views. The MTC and the LACTC thus take the stance that DRT should be a specialized service reserved for those who have difficulty using fixed route transit. In only two systems in these areas have even low income individuals been eligible to use the Article 4.5 funded DRT services, and in both cases they have subsequently been excluded from participation. The presence of transit alternatives,

of whatever quality, creates a political situation in which ridership restrictions can be justified when cost constraints are an issue and the conventional transit agencies themselves are financially strapped.

Although none of the remaining 21 systems not using Article 4.5 funds faced stringent absolute limits on available subsidies, all were funded by sources which could be allocated to competing purposes--streets and roads in the case of the regular TDA funds, other municipal programs in the case of increasingly scarce municipal general funds, and other transit services in the case of transit agency funds. Even though regular TDA funds can be used for streets and roads in non-urban counties only if no "unmet transit needs" exist, it has been the common practice in such areas to spend as little as possible on transit and the remainder on highways. Restricting DRT use to the elderly and handicapped thus preserves most of the TDA funds for the community's highest transportation priority, highway maintenance and construction, while alleviating the plight of those ostensibly in greatest need of a transit alternative. However, the absence of transit alternatives for the general public has prompted lawsuits in several locales, on the grounds that unmet transit needs remain despite the elderly and handicapped service. These legal actions have usually resulted in DRT being extended to the general public or a fixed route system being established. In addition, two other communities studied in this project are now planning to adopt similar strategies on their own initiative, aware that an elderly and handicappedonly public transportation system is vulnerable to political and/or legal challenge.

Ridership restrictions are important not only because they reveal the policy priority that decision makers place on scarce resources, but also because a restricted ridership DRT system is almost always less costeffective than a general public DRT service. This occurs because of the significantly lower demand densities which mitigate against extensive ridesharing. However, the cost-effectiveness implications of ridership restriction were never an issue in local government decisions about system organization. In deciding to restrict DRT ridership public officials in California were predominantly concerned with the total cost of the system, and not its potential performance or cost-effectiveness. The relative weight given in subsequent system design to the two factors of total cost and cost-effectiveness depended on the stringency of the fiscal constraint, but in every case the former was deemed much more important when initial decisions about the system were made. As a result, a political and planning climate has been created in California in which the elderly and handicapped have policy priority for scarce DRT resources, when such resources are in fact scarce.

The different situation in Michigan and Minnesota is largely attributable to different transit financing arrangements. In California, transit funds are allocated back to cities and counties on a pro-rata basis, whereas in these other two states local transit funds for small and medium size cities are disbursed by the state on a discretionary basis, with local governments submitting annual proposals for funding. Since the state funds cannot be used for other non-transit purposes at the local level, there is no incentive to restrict service usage in order to minimize the cost of the transit operation. Of course, where a city could not obtain enough state transit subsidies to afford a system sufficient for overall community transit needs, ridership

priorities would have to be established, but this apparently is uncommon. In the large metropolitan areas of these two states, moreover, a separate source of funds is available for transit, including separate categories for specialized services. In these metropolitan areas special elderly and handicapped services do exist, and the rationale for restricting DRT usage is essentially the same as in California. However, because the state transit funds are explicitly state funds, not recycled local tax revenues as in California, suburban communities who wish to obtain supplements to fixed route service have successfully applied to the state DOT for funds for general public DRT. In California's metropolitan areas, state transit subsidies are viewed as primarily the property of the regional transit agencies, and all such allocation decisions are made locally (regionally) where the transit agency is a powerful actor.

These differences in funding arrangements are clearly important in explaining the tendency towards DRT ridership restrictions in California. However, they should not obscure the fact that where funds are limited and the general public is already receiving some transit service, there is a general policy preference in all three states towards imposing ridership restrictions.

B. Choice of Taxi Firm as Provider

Most of the restricted ridership DRT systems established in California have been designed specifically as taxi-based elderly and handicapped systems. About 80 percent of all elderly and handicapped systems in the state employ a taxi firm as provider, whereas only about half of all general public DRT systems are operated by a taxi provider. Of the 48 elderly and handicapped systems which were the focus of this study, only two had a provider other than a taxi company bid on the system. That is, in 46 of the 48 systems, the only feasible provider was a taxi firm. The two exceptions, moreover, are systems which use dedicated vans and are targeted primarily at the transportationally handicapped. In the large majority of cases there was no competitive bidding. A contract for service was generally negotiated with either the sole local taxi company or all the taxi firms serving the area.

It bears noting that this level of taxi firm participation in local transit is considerably higher than that experienced in Minnesota or Michigan. Although the Minnesota DOT, in particular, has stressed the desirability of local governments involving taxi firms in community transit service delivery, only about one-fourth of all Minnesota local transit and paratransit systems use taxi providers. The comparable figures are even lower in Michigan. One important reason for this lower level of taxi participation is that many of the local transit systems in Minnesota are fixed route services. Taxi firms in that state have demonstrated virtually no interest in such operations. In addition, in both states there are a number of communities with DRT systems where no local taxi firm was operating at the time the transit service was initiated, and thus the local government was the logical provider. Moreover, state officials report that some taxi firms have proven uninterested in becoming local transit providers, not wishing to do shared riding, to operate fixed route buses, or to endure the hassles of becoming involved with government. Of course, since most transit opportunities in these two states involve general public services in which subsidized ERT is not an acceptable option to

sponsors, the degree of change required on the part of the taxi firm is typically greater than is the case with an elderly and handicapped service in California.

There are several reasons why California's elderly and handicapped systems have been targeted at and operated by taxi firms. In common with taxi provision of general public DRT, the use of a taxi firm in an elderly and handicapped system offers the sponsor the advantages of low production costs, in-place capability, and rapid implementation. Moreover, few sponsors of either general public or elderly and handicapped service wish to incur the difficulty or expense of being in the "transportation business" if practical alternatives exist. Using a local firm also provides political advantages; it avoids potential government competition with private firms, and it may insure that taxi service is available to the community by keeping the local taxi firm (or firms) afloat financially. The latter objective has become increasingly important in many small cities, where conventional taxi service alone often will no longer sustain a company. In fact, several small cities in Minnesota have found it necessary to re-create taxicab service, albeit on a publicly subsidized basis, after the local private operator went out of business. Finally, the taxi industry in California has been relatively aggressive in pursuing local transit contractors. The prospect of participating in an elderly and handicapped system has been particularly attractive, inasmuch as it requires little change in operating practices if a subsidized ERT system is established, as is often the case.

There is also a highly practical reason why so many sponsors of elderly and handicapped systems in California have turned first to the taxi industry. Many of these systems are not suited to cost-effective operation by any provider other than the local taxi firm due to their low demand. Financial viability requires that a provider must obtain a certain level of revenue per vehicle hour of service, regardless of demand level. At low elderly and handicapped demand densities there exist only two ways to accomplish this. The first is to pay the provider a high fee per passenger transported, whether by guaranteeing compensation on an hourly basis despite low productivity or by explicitly paying a high fee per trip. The second is to combine the revenue from the elderly and handicapped service with that from other, simultaneously produced services of the firm. The latter strategy helps keep elderly and handicapped service costs down, but also requires that the provider be able to generate other revenues from the same vehicles. This is usually possible only if the provider is also the local taxi operator. Other potential providers (DRT management firms, local bus companies) could not use vehicles and personnel productively for much of the day, and either would generate insufficient revenues or would require a high fee per trip unit. The sponsor has the alternative of establishing a traditional Dial-A-Ride form of service using dedicated vehicles and provider-side subsidy, but with a fixed hourly service fee apportioned among a low number of passengers per hour (due to low demand densities), the result is typically a relatively expensive service.

It bears noting that in California various forms of taxi-based transit have become DRT options in and of themselves through a diffusion of innovation process. Many sponsors cited well-known successful experiences with taxi-based DRT as inspiration for using a taxi provider for their system, or simply emulated the features of a neighboring elderly and handicapped system which seemed to perform

satisfactorily. The latter mode of diffusion was particularly important in the San Francisco Bay Area, which contains 22 taxi-based elderly and handicapped systems, most of them highly similar in organization. Many sponsors in this region did not even consider the possibility of organizing the service differently.

It is apparent then that taxi firms have predominated in California's elderly and handicapped services because this arrangement addresses local political concerns, is simple for sponsors to implement, and presents a compatible base for the typically low demand system.

C. Subsidization, Compensation, and Mode of Operation

California's taxi-based elderly and handicapped systems are predominantly organized along user-side subsidy principles, whereby a provider receives payment only for consumed service (e.g., passenger trips). As indicated in Table 3-2, 85 percent of all systems are subsidized in this fashion. Overall, only 25 percent of the systems use dedicated vehicles, the traditional method of organizing a Dial-A-Ride service. Fully 75 percent of the systems are based on the combination of an integrated fleet operation and payment for consumed service, a combination shown to be associated with a high level of cost-effectiveness when taxi vehicles are deployed in a shared-ride mode of operation (1). However, threefourths of the systems utilizing this particular combination of organizational arrangements do not practice shared riding, but instead are ERT operations. In fact, only 20 of the 48 systems included in this study are organized on shared-ride principles; the remainder are simply subsidized ERT systems, most of which use ERT meter fares as the basis for provider compensation. This stands in marked contrast to California's approximately 25 taxi-based general public DRT systems, all of which are shared-ride operations, and most of which use dedicated vehicles.

These distinctive organizational features of taxi-based elderly and handicapped systems stem primarily from four factors. (1) Low demand for service, often by design; (2) limited awareness on the part of sponsors of options for organizing the service, and their consequences; (3) greater concern with total cost than with cost-effectiveness on the part of many sponsors; and (4) taxi company resistance to changes in its operations when financial rewards are limited.

The Influence of Low Demand

The most basic factor behind the trend towards user-side subsidy, integration of subsidized and non-subsidized service in the same vehicle fleet, and ERT operations is the low level of demand in most restricted ridership transportation services. Based on the portion of elderly and handicapped riders in general public DRT systems, most elderly and handicapped systems will generate no more than 25-50 percent as much ridership as a general public system in the same service area. Stated another way, the demand density (demand per unit area per unit time) for elderly and handicapped service will be at most half that of a general public DRT system. As has been established since the beginnings of DRT, demand density is critically important in determining system productivity. As demand density declines, the potential for sharing rides also decreases. At low demand density the

TABLE 3-2

COMPENSATION ARRANGEMENTS AND MODE OF OPERATION

BY DIFFERENT SUBSIDY AND VEHICLE USE COMBINATIONS

System Organization Arrangement	Number of Systems*
1. User-Side Subsidy, Integrated Fleet Systems	(39)
ERT operations, ERT meter fare compensation	25**
ERT operations, fixed fee compensation	4
SRT operations, fixed fee, zonal fare, or mileage compensation	6
SRT operations, ERT meter fare compensation	4***
2. User-Side Subsidy, Dedicated Vehicle Systems	(5)
SRT operations, fixed fee compensation	5
3. Provider-Side Subsidy, Dedicated Vehicle Systems	(7)
SRT operations, vehicle hour compensation	6
SRT operations, cost-plus compensation	1

* Total sums to more than 48 because three systems use multiple arrangements.

** In several systems meter fares are discounted by 10 percent.

*** In three systems shared riding practiced is on only one leg of a user round trip, and meter fares are discounted by 25¢.

only way to accomplish any significant amount of ridesharing is to impose unacceptably high waiting and riding times on users. If a reasonable level of service is to be provided (for example, a 30 minute response time limit), however, the inability to do much shared riding leads to low vehicle productivities.

This problem has plagued most general public DRT systems, and even the best such systems typically achieve productivities no higher than 6-8 passengers per vehicle service hour (VSH). At typical elderly and handicapped demand density, productivities of 3-4 passengers per VSH could be expected. This is precisely the range in which productivities fall for many elderly and handicapped systems organized like the typical general public DRT system, that is, using dedicated vehicles. Moreover, in many elderly and handicapped systems in California demand density is much lower than 25-50 percent of general public DRT levels due to further restrictions on usage imposed by eligibility standards and to limitations on the number of trips which each user may take. In such cases demand density is even well below the level which prevails for ERT service.

These low demand densities severely constrain the feasible options for organizing the elderly and handicapped service. When demand is very low due to eligibility and/or usage constraints it is all but impossible to design the system in such a way that any significant amount of shared riding can occur. In particular, the option of using the traditional DRT form of service organization--dedicated vehicles and provider-side subsidy--loses its desirability, as the result would be a low productivity, highly expensive service. In Chapter 4, the potential for changing userside subsidy ERT services to dedicated vehicle SRT operations is analyzed, and it is shown that in only 6 of the 29 systems organized in this fashion is the current level of ridership sufficient to justify considering such a change. Moreover, in only two of the six candidate systems would this change have resulted in a system with lower cost per passenger; in the others it would have increased unit costs somewhat. Ridership restrictions, especially if severe, thus tend to make user-side subsidy options especially attractive for organizing elderly and handicapped service.

Sponsor Perspectives and Awareness

It must be emphasized that the sponsors themselves, who were largely responsible for system organization decisions, were only occasionally aware of the realities discussed above. Many sponsoring agencies, in fact, did not even know that their method of compensating the provider was termed user-side subsidy, or what the distinction was between user-side and provider-side subsidy.

Sponsors tended to find user-side subsidy attractive for other reasons. First, it greatly simplifies system planning. No vehicles have to be acquired for the service, nor do an optimum fleet size and level of service need to be established. The transportation aspects of the service become the taxi company's responsibility, while the sponsor is essentially responsible only for the financial aspects of the system, a much more familiar role for local officials. Moreover, this ability to focus on program finances is crucial to sponsors, since it enables them to target service only at certain types of individuals, to restrict the number of trips people take, and to maintain tight control over the budget. None of these objectives are

necessarily incompatible with provider-side subsidy, but all are somewhat more difficult to accomplish, and require the sponsor to become more involved in the details of service delivery.

Another attractive feature of user-side subsidy is that it enables sponsors to allow multiple providers to participate in the elderly and handicapped system. This had practical import in less than a dozen systems in California, but in those systems it was an imporant consideration. Organizing the system on the basis of user-side subsidy eliminated the need to choose among competing taxi firms, which invariably would make the losers extremely upset and possibly create adverse political repercussions for local officials.

Although many sponsors adopted user-side subsidy for essentially pragmatic reasons, another group of sponsors viewed this option as desirable on cost-effectiveness grounds. This latter group, significantly, tended to evaluate all aspects of system organization from this perspective. These were the sponsors of systems which had as their objective the provision of a basic level of community transit service for the elderly and handicapped. However, these represented only about one quarter of all the sponsors. The majority viewing the elderly and handicapped system as a limited, supplemental service to fixed route transit for those with difficulty using or accessing the bus system.

Sponsor objectives are of course heavily influenced by the level of funding available for operating the DRT system. As Table 3-3 indicates, when sponsors are reasonably well endowed financially (as measured by their use of regular TDA funds to support the system) and view the DRT system as basic public transit for the elderly and handicapped, they are three times more likely to have organized their system along SRT lines than sponsors contending with significant fiscal constraints (as measured by their use of Article 4.5 TDA funds) and viewing their system as a supplementary service.

While both groups of sponsors were concerned with the total cost of the system, the former group did not deem it necessary to constrain demand to keep within an absolute budget ceiling. However, these sponsors did wish to achieve maximum community benefits without using funds unproductively. Therefore, most of them thoroughly investigated their options, and realized that shared riding was an essential component of any cost-effective system design. Most of these same sponsors also concluded that user-side subsidy was more desirable than provider-side subsidy since the former option gave the provider a clear incentive to be as productive as possible while also limiting sponsor outlays to service actually consumed. Two sponsors had prior experience with provider-side subsidy and switched to user-side subsidy due to such considerations.

The sponsors which did establish provider-side subsidy systems did so at least in part because of the perceived need for dedicated vehicles in these operations. These vehicles were lift-equipped vans or small buses which the taxi company could not use productively in other, simultaneously produced taxi services. Consequently, the taxi firm viewed user-side subsidy as an unacceptable financial risk, and the sponsor adopted other mechanisms to provide an incentive for cost-effectiveness (performance incentives in one instance, close oversight and financial hold backs in others).

TABLE 3-3

MODE OF OPERATION BY SPONSOR OBJECTIVES AND MAJOR FUNDING SOURCE

Sponsor Objectives and Major Funding Source	Number of Systems	
1. Supplement to Fixed Route for elderly and handicapped	ERT	SRT
State transit subsidies, special funding20	6*	
State transit subsidies, regular funding3	0	
Municipal general funds	2	2
Transit agency funds	0	1
Subtotal	25	9
2. Basic Public Transit for elderly and handicapped		
State transit subsidies, special funding	0	1
State transit subsidies, regular funding	3	7
Subtotal	3	8
3. Special Transit Agency Service for Mobility Impaired		
Transit agency funds	0	3
Total	28	20

* In three systems, shared riding practiced only on one leg of user roundtrip.

For both provider-side subsidy systems and user-side subsidy SRT systems, decisions about system subsidization and taxi firm compensation were jointly made. That is, the adoption of user-side subsidy was connected to a preference for compensating the provider on the basis of the number of passengers carried (or trips made), usually through a fixed fee per passenger or trip. These preferences were grounded in the belief that they would promote cost-effectiveness. Similarly, having opted for a dedicated vehicle system, sponsors simultaneously decided that the basis of provider compensation should be vehicle service hours (or actual costs with a ceiling based on a specified fee per vehicle service hour). This was an essentially pragmatic decision, for even though four providers have proven willing both to dedicate vehicles and to accept fee per passenger compensation, only one deploys enough dedicated vehicles relative to demand to experience any serious risk that compensation would be inadequate to meet expenses.

The Role of Taxi Firms in System Organization

Sponsors of subsidized ERT systems typically gave little thought to provider compensation, and generally found themselves stuck with using ERT meter fares as the basis for such compensation. This was primarily the result of taxi company resistance to providing ERT service at a price below the normal rates. In the few instances when fixed fee compensation is used, the community is either very small in area, hence there is little variation in taxi trip lengths (and meter fare per trip), or the ERT service is part of a hybrid system. More generally, taxi firms have insisted upon meter rates, and sponsors have accepted their argument that this is a fair basis for compensation, as the elderly and handicapped service is essentially the same as regular taxi service.

Very few sponsors of subsidized ERT have recognized that if the elderly and handicapped ridership represents any significant increase in overall taxi patronage, yet does not require the taxi firm to increase its level of service, the provider obtains significant new revenues with a less than proportional increase in costs. This occurs because most ERT operations have a considerable amount of slack in them, with only 40 to 50 percent of all vehicle miles being revenue miles. (The amount of time spent in revenue service is even less.) Modest increases in demand can be accommodated without adding to either the number of vehicles in service, control room staff, or organizational overhead; the only cost increases are those directly related to additional vehicle miles driven, if any. A few sponsors, aware that the additional business from the elderly and handicapped program represents a higher portion of incremental revenue than incremental costs, have successfully requested the taxi company to give them a discount from the meter rates, but this never exceeds 10 percent. In the large majority of subsidized ERT systems, the basis of provider compensation is full meter fares.

It is tempting to criticize as short-sighted the many taxi firms which have insisted on full meter fares for subsidized ERT, inasmuch as the high costs which result for the elderly and handicapped service can over time lead to sponsor dissatisfaction, particularly as ERT fares continue to increase. It is important to emphasize, however, that most of the taxi firms involved in elderly and handicapped services are very traditional companies which view with disfavor virtually any

aspect of operational change. This resistance to change extends to shared ride operations, with most elderly and handicapped contractors firmly believing shared riding is infeasible in their system. Although this is often a correct perception, it is not because shared riding is too complex operationally, unacceptable to drivers, disliked by the public, impossible to price correctly, or the like--all reasons cited by taxi managers. Rather, it is due to the fact that elderly and handicapped demand is often so low that shared riding would work only if part of an overall shared ride operation. That is, there is not enough elderly and handicapped demand to do shared riding exclusively with these passengers.

While resistance to change can be overcome if the financial rewards are sufficient, most elderly and handicapped systems, particularly those which are organized as subsidized ERT, do not involve a level of contractor revenues likely to make a non-innovative taxi firm eager to alter long established operational practices such as exclusive riding, meter fares, or incentive-based payment for drivers. Not only is taxi management concerned that any operational changes will have adverse financial consequences, but negative reactions from drivers are also feared. Taxi managers are fond of emphasizing that if drivers cannot make money, they won't work, and that current operational practices have demonstrated their ability to make money for both drivers and management. Without question, an important element of self-deception lies behind such attitudes, given the enormous amount of driver turnover (100 percent or more in many companies) in the taxi business and the marginal financial condition of many companies. Nonetheless, these beliefs are important obstacles to organizing elderly and handicapped systems in ways likely to be more cost-effective than subsidized ERT. As demonstrated in Chapter 4, subsidized ERT is the least cost-effective form of elderly and handicapped service.

Diffusion of Information

The diffusion of information about other DRT systems in California is another factor influencing system organization choices by sponsors. Typically lacking any detailed knowledge of paratransit operations, and often unable to afford a consultant to plan the system, most sponsors of systems sought to simplify the task of designing the service by seeking out models that had achieved good results elsewhere. When a sponsor's search was motivated by cost-effectiveness considerations, most typically the case when the objective was a basic public transit system for the elderly and handicapped, this search process usually paid dividends. Several sponsors in this category used the highly successful El Cajon SRT system as their model, thereby organizing their system on the basis of an integrated fleet, shared riding, and compensation for consumed service. Not only did this model prove workable, it also led to a cost-effective service wherever it was tried.

Sponsors of strictly supplemental services did less well by emulating others. In important part this was due to the paucity of service models for a very low demand service--the only model which has been widely adopted is subsidized ERT. Many of the sponsors who organized subsidized ERT systems admitted that they were simply following the lead of a neighboring city, or adopting the general practice in their region. While it would be easy to criticize them for not looking further, it should be

emphasized that subsidized ERT has proven its feasibility, and that it is difficult to devise more cost-effective methods of organizing an elderly and handicapped system when demand is so low. (Hybrid systems are the only real alternative.) Nonetheless, to a much greater extent than was the case for the taxi-based general public DRT systems studied previously by UC Irvine, the search for the best system organization scheme for a particular local situation tended to be quite limited except in cases where the sponsor was either unusually knowledgeable or required a cost-effective basic transit system.

The System Organization Process

Figures 3-1 to 3-3 illustrate diagramatically the factors and the process involved in arriving at the three different major types of system organization. Two points should be emphasized about this process. First, initial decisions about target population, the objectives of the service, and the amount of service to be provided have a critical influence on subsequent actions and decisions. Second, the sponsor's access to the information needed to make fully informed choices about trade-offs between cost, service coverage, and organizational features can make a large difference in outcomes. Where information is limited and of a selective character, one set of choices may be made, whereas another community, with more comprehensive information at its disposal, may adopt a strategy which promises greater cost-effectiveness. For example, the City of Sunnyvale has very mild eligibility restrictions for its elderly and handicapped service, which has led to a relatively high level of demand. Because demand is high enough to make shared riding feasible, Sunnyvale has been able to organize a more cost-effective system than of its neighboring communities, whose elderly and handicapped systems are simply subsidized ERT service. Sunnyvale has had to use revenue sharing funds in addition to TDA Article 4.5 subsidies to support this more extensive service, but is willing to do so because of the cost-effectiveness achievements of the system. Thus additional information can expand the range of options in the system design process, and offers the potential for freeing sponsors from what often seem like inevitable outcomes once the first decision in the process is made.

D. User Payment System

Many sponsors of California's taxi-based elderly and handicapped system devoted at least as much attention to devising a user payment mechanism as they did to such factors as provider compensation and mode of operation. In part, this preoccupation with revenue management is attributable to a state requirement that at least 10 percent of a special transit system must be recovered from the farebox. Equally important, the use of a taxi provider, particularly in the context of user-side subsidy arrangements, creates additional options for user fare payment compared to conventional transit. As indicated in Table 3-4, sponsors have utilized four different methods for recovering revenues from users of the system.

There is a strong relationship between system mode of operation (SRT or ERT) and user payment mechanism. Shared ride systems rely either on tickets, which users typically purchase from the sponsor for 50¢ to $1.00, or on cash fares, generally in the 50-75¢ range. The SRT systems using tickets are predominantly

Figure 3-1

Establishing a Taxi-Based Elderly and Handicapped System:
Subsidized Exclusive Ride Taxi Operations

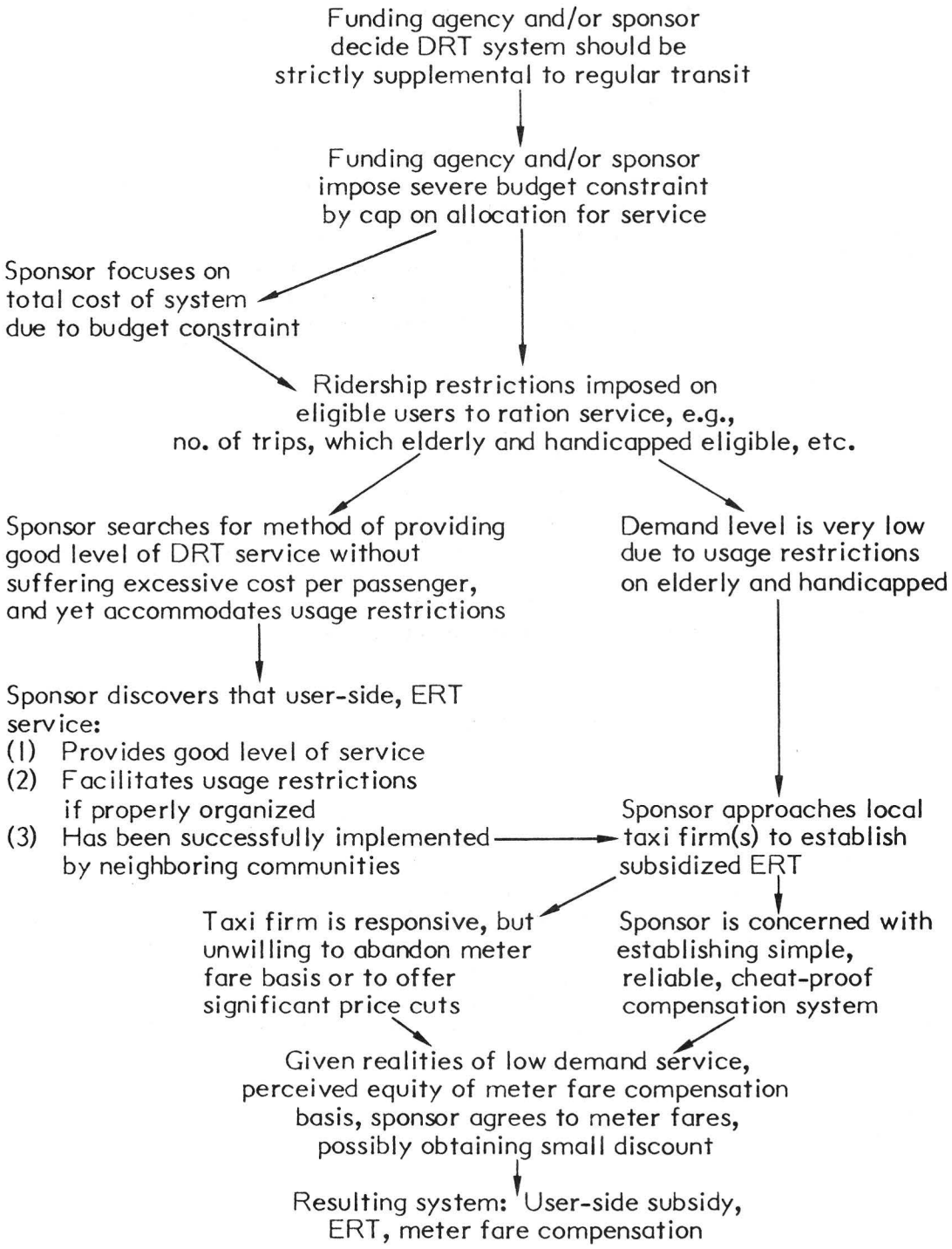

Figure 3-2

Establishing a Taxi-Based Elderly and Handicapped System:
Shared Ride Operations, Consumed Service Compensation (User-Side Subsidy)

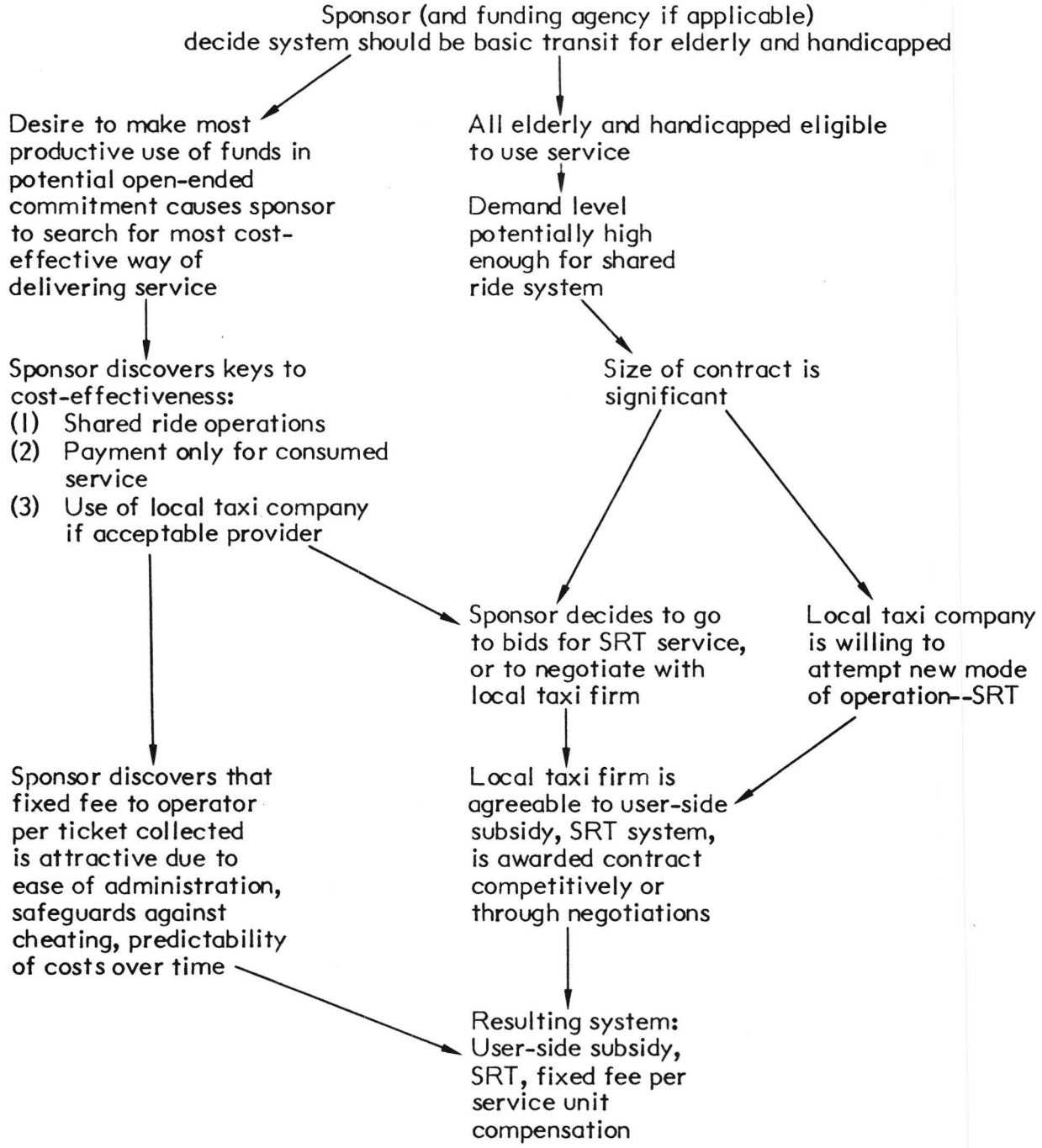

Figure 3-3

Establishing a Taxi-Based Elderly and Handicapped System:
Traditional Dial-A-Ride Form of Organization

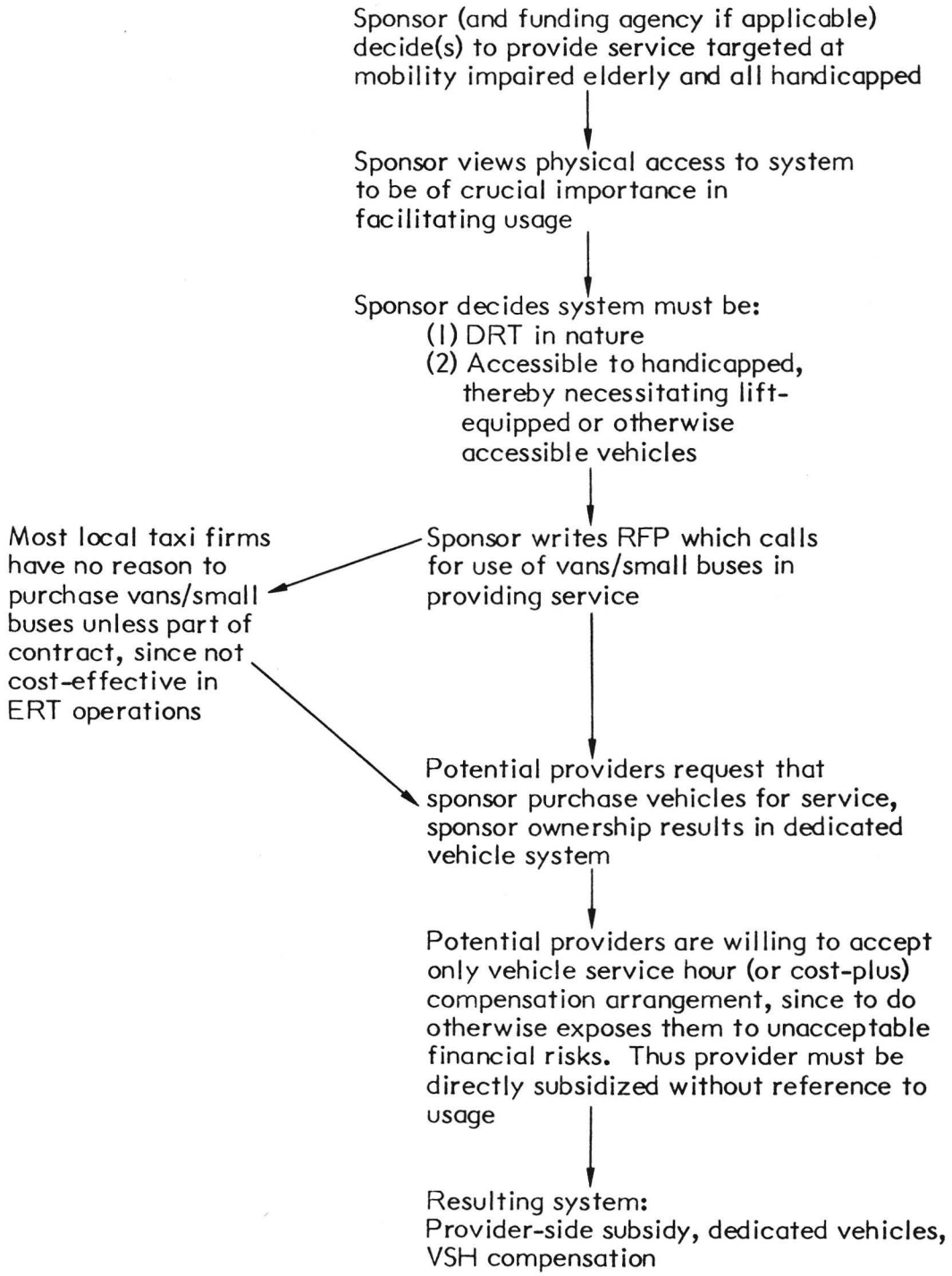

TABLE 3-4

USER PAYMENT MECHANISM

Mechanism	Number of Systems		
	SRT	ERT	Total
Scrip with discount*	0	15	15
Tickets/Coupons	9	6	15
Tickets with meter limits	1	7	8
Cash Fare	10	0	10

*Cash discount of 50-90% of scrip face value.

those based on integrated fleet, userside subsidy arrangements, whereas the cash fares are used primarily in dedicated vehicle, provider-side subsidy systems. In general, the more complicated ticket mechanism is used instead of cash fares only when it is an integral part of the provider compensation scheme, that is, when the provider is reimbursed a fixed fee per ticket collected. In such cases, the ticket mechanism enables the sponsor to target subsidy at eligible users, to easily adjust level of subsidy and provider payment, and to insure provider honesty in reimbursement claims. When provider-side subsidy is utilized, however, these benefits are substantially reduced, and sponsors are more sensitive to the administrative costs and inconveniences of ticket schemes.

ERT systems, on the other hand, have made extensive use of scrip payment schemes, while completely shunning cash fares. The scrip system is well-suited to subsidized ERT: it works well with meter fares, and is readily converted to cash, and therefore meets little resistance from drivers or owners. Perhaps the main advantage of the scrip system is that it enables sponsors to recover a guaranteed, and usually higher, percentage of service costs from the user compared to the other user payment mechanisms. Scrip discounts to the user average 75 percent, and range between 50 and 90 percent. Scrip, like tickets, can be rationed when the system operates under a tight budget. Moreover, another attraction to budget conscious sponsors is that scrip systems contain an inherent disincentive to long, costly ERT trips, since the user is paying a fixed percentage of the actual meter fare. A simple ticket system, in contrast, does not discourage such trips. About half of all sponsors of subsidized ERT systems which use tickets have been forced to adopt a limit on the meter fare for which the ticket is sufficient user payment; any additional charge is paid for solely by the user. The scrip system and the ticket scheme with a meter fare limit are employed predominantly by the most fiscally constrained sponsors, and they have proven to be effective mechanisms for keeping subsidy requirements within stringent budget limitations.

II. Taxi Firm Impacts

A. Financial Impacts

Becoming a public transportation provider is a significant development for any taxi firm. Nonetheless, the impacts on elderly and handicapped providers are typically much less significant than on taxi companies which operate general public DRT. Two readily available measures of impact are the number of public transportation systems--both elderly and handicapped and general public--for which the taxi company is a provider, and the revenues the firm receives from its transit contracts.

Taxi firms which provide public transportation service can be divided into three categories: (1) companies which operate elderly and handicapped services only; (2) companies which provide both elderly and handicapped and general public DRT services; and (3) companies which operate only general public DRT services. As the following table indicates, most California taxi firms involved in public transit fall into the first category.

TABLE 3-5

Number of Taxi Companies

Provider operates elderly and handicapped systems only	41
Provider operates elderly and handicapped and general public systems	7
Provider operates general public DRT only	6

Taxi firms whose participation in public transportation is restricted to elderly and handicapped service generally have a lower level of involvement in public transportation operations than do providers of general public DRT. Just four of the 41 California taxi firms belonging to the former category have multiple exclusive contracts for public transit service which are the most lucrative type as all revenue goes to a single provider. In contrast, 73 percent of the taxi firms in the latter category are exclusive providers for more than one system. Due to the prevalence of user-side subsidy arrangements for elderly and handicapped service, a number of the provides of these services participate in more than one ystem on a non-exclusive basis. Nonetheless, sixty percent of the elderly and handicapped-only providers participate in but a single public transportation operation.

As the size of DRT contracts can vary widely, the amount of revenues the firm receives from contract operations is probably a better measure of impacts than the number of systems in which it participates. As indicated in Table 3-6, 29 percent of

TABLE 3-6

E&H PROVIDER CONTRACT REVENUES BY TYPE OF CONTRACT OPERATIONS

	Number of Providers by Type of Contract Operations			
	Provider operates E&H systems only			
Contract Revenues	At least one shared ride system	ERT systems only	Provider Operates E&H and General Public Systems	All Providers
Greater than $500,000	1	0	3	4
$250,000-500,000	1	0	2	3
$100,000-250,000	3	4	0	7
$50,000-100,000	2	10	2	14
$25,000-50,000	3	6	0	9
Less than $25,000	1	10	0	11
All revenue levels	11	30	7	48
Mean contract revenues	$147,140 ($107,260)*	$62,200	$510,000 (approximate)	
Mean contract revenues per vehicle	$ 6,570 (6,130)*	$ 3,825	$ 24,200	

*Excludes one disproportionately large contract.

all elderly and handicapped providers obtain at least $100,000 from contract operations, and about 15 percent make $250,000 or more. However, among providers who participate only in elderly and handicapped systems, only 22 percent derive $100,000 or more from contracts, and a mere 5 percent make as much as $250,000. In contrast, 55 percent of all taxi firms with general public DRT contracts make at least $250,000 from these operations (see Table 3-7). These results strongly imply that taxi firms which are only elderly and handicapped providers benefit much less financially from their participation in public transportation than do general public DRT providers.

As indicated in Table 3-6, providers of elderly and handicapped services who also operate general public transit systems (DRT or fixed-route) gross an average of approximately $510,000 annually from their public transportation contracts. For all California taxi firms which are general public DRT providers, average annual contract revenues are about $390,000. In contrast, firms which operate only elderly and handicapped systems receive an average of $76,000 annually from these contracts. Such providers thus make an average of only 15 to 20 percent as much from public transit contracts as do those taxi firms which have diversified into other areas of transit operations.

TABLE 3-7

CONTRACT REVENUES FOR TAXI COMPANY PROVIDERS OF GENERAL PUBLIC DRT SYSTEMS

	Number of Providers with Indicated Level of Revenues From:		
Contract Revenues	General public systems only	E & H Systems only	All contract operations
Greater than $500,000	3	0	4
$250,000-500,000	3	1	2
$100,000-250,000	0	1	0
$50,000-100,000	2	1	2
Less than $50,000	3	2	3

Financial impacts on providers are also significantly affected by system organization factors, in particular whether or not the taxi firm is the operator of a

shared-ride system. Providers with at least one shared ride operation obtained on the average nearly 2 1/2 times as much contract revenue as did firms which participate only in subsidized ERT systems. Even excluding one provider with an exceptionally large contract, the former group of companies still made an average of nearly 75 percent more from contracts than did the latter group.

Perhaps a more meaningful indicator of financial impacts on taxi firms is the relative contribution of contract revenues to the firm's revenue base. This should be assessed in terms of contract dollars vs. regular taxi revenues. A complication arises because about 40 percent of the companies involved in elderly and handicapped services make partial or total use of owner-driver or leasing relationships. The management of these firms were therefore unable to provide overall fare revenues, as they simply did not know how much total revenue the taxi operation generated.

As this information was unavailable, fleet size was used as a proxy for the firm's potential to generate ERT revenues. Revenue generating potential was measured in each category by comparing contract dollars to the number of vehicles (Table 3-6). This comparison indicates that the effects of system organization are similar to the trends noted previously. That is, shared ride operations and general public DRT contracts are associated with significantly more revenue per vehicle, than ERT-only operations.

Of course, firms operating in different environments (e.g., central cities vs. small towns) can generate significantly different amounts of ERT revenue per vehicle. The practical effect of these differences is to reduce the importance of elderly and handicapped contract revenues (relative to mean values) in central cities and to increase the impact in small towns. However, companies located either in small cities in nonurbanized areas or in suburban areas were far more likely to have multiple contracts, to do shared riding, or to operate general public DRT systems than their central city counterparts. In addition, whatever the operating environment, providers of only elderly and handicapped service usually participate in but a single system, whereas the general public DRT operators tend to provide multiple public transit services. These considerations all support the conclusion that the former group of taxi firms is much less favorably impacted financially than are those companies involved in subsidized paratransit and transit operations for the general public.

The picture which thus emerges is that of a majority of special transit providers with only limited participation in and limited benefits from public transportation, and of a minority of firms which have been impacted substantially and favorably through more extensive involvement in transit operations. The former group is typically involved in only a single elderly and handicapped system and has no other public transit contracts. The latter group's involvement in public transportation usually includes some combination of multiple exclusive elderly and handicapped contracts, shared-ride elderly and handicapped service, and other community transit operations.

B. Special Transit Services and Taxi Company Evolution

In U.C. Irvine's initial study of taxi-based DRT in California, it was concluded that many taxi companies which became providers for general public DRT systems underwent significant internal adjustments as the result of their new status as public transit contractors. In particular, their managers tended to seek out additional contract opportunities, to upgrade dispatching capabilities, to improve data collection and to analysis, and gain a new managerial perspective on their business. More generally, they became more willing to innovate and to consider the broader possibilities of their company. Although some companies conformed more closely to this description than others, most demonstrated movement in the directions indicated above.

A much different picture emerged from the interviews with the management of the taxi companies involved in elderly and handicapped systems. With only a handful of exceptions, these companies have not evolved in the ways outlined above; the vast majority remain as traditional taxicab operations. While taxi managers acknowledge the importance of contract revenues in sustaining the company financially, they often assert that many of the subsidized elderly and handicapped patrons were already using taxis, and that no great increase in profitability has resulted from the public transportaion program. Only a few such companies have actively sought out additional contract business; management has typically reacted to proposals rather than attempted to market the company's services. Since many companies provide only subsidized ERT service there has been no need to improve dispatching capabilities or to use different labor compensation arrangements, such as hourly wages for drivers.

Record keeping in most firms is rudimentary at best, and some of these companies do not even keep track of the number of passengers they serve on an annual basis. Any serious attempt at analyzing the limited data which is collected is exceedingly rare. The company's balance sheet is often the only reliable source of information about its operations, and even these numbers are only partially believable in many cases.

Perhaps the most important finding is that the management of most such firms has not perceived contract operations as a new opportunity. A business-as-usual attitude was evident among many managers, even though most also freely admitted that their company's financial prospects were not favorable. The main response to such difficulties has been to switch to leasing and/or to owner-drivers, which reduces costs but does not increase overall operational revenues. More innovative actions, e.g., diversification into new markets such as shared riding and social service transportation, were conspicuous by their absence. Despite ERT's current problems, most managers seemed unable to devise strategies to supplement their current reliance on the diminishing ERT market.

This pattern of organizational stasis was particularly pronounced among the companies which participate only in elderly and handicapped systems. Only three of the 41 companies in this category have evolved into anything resembling a diversified paratransit operation, and one of these viewed ERT as so unprofitable

that it recently sold that end of the operation. (Ironically, it sold its ERT operation to another company which has diversified.) The handful of other elderly and handicapped providers which have diversified have also been contractors for general public transit services.

Why has participation in elderly and handicapped services made so little difference in the managerial outlook and organizational capabilities of taxi companies? Two interrelated factors appear to supply the answer. First, most of these systems do not require any significant operational changes on the part of the taxi firm. Second, they usually are not financially lucrative enough to cause taxi company management to perceive that contract services could be its financial salvation. The thread which connects these two factors is system organization, or more specifically, the prevalence of subsidized ERT operations among elderly and handicapped services.

Involvement in a subsidized ERT system carries neither the motivation nor the opportunity for taxi company evolution, as operational changes are not necessary and additional revenues are limited. Consequently, most such providers do not venture onto the diversification path. Of the 34 firms which provide subsidized ERT service, only two are also the providers for a shared-ride system in which the operator is responsible for accomplishing the shared riding, and in one case this is a one-vehicle operation. Only five of these firms have multiple exclusive transit contracts of any type. While welcoming the added revenue of the subsidized elderly and handicapped program, most operators have not viewed this as sufficient reason (or opportunity) to change the company's capabilities or image.

In contrast, becoming the provider of a shared-ride elderly and handicapped system has a major influence on taxi firm evolution. As noted previously, firms with at least one such contract receive significantly more revenues than subsidized ERT providers. Not only are SRT systems typically more lucrative than ERT contracts, but the firm is required to change at least some features of its operation in order to perform shared riding effectively and to accommodate a new compensation scheme. Sponsors of SRT systems, moreover, tend to have higher expectations about performance than do sponsors of subsidized ERT. This creates new responsibilities and challenges for management, whereas subsidized ERT is largely business as usual. The result is an opportunity to upgrade the company's capabilities, to become more than a conventional taxi operation at minimal risk to the firm and with some financial security. Having accomplished this, management is then in a position to obtain other new sources of revenues. Additional public transit operations are among the most promising opportunities for such further diversification.

Perhaps the most telling indication of the differences between the firms which provide shared-ride services and those which operate only subsidized ERT services is how they have reacted to the financial difficulties besetting the taxi industry. The SRT providers have adopted a strategy of revenue expansion, attempting to obtain public transportation contracts to improve profitability in light of the decline in ERT revenues. On the other hand, the managers of the ERT-only providers have typically attempted to cope by reducing their operating costs. The most popular strategy for accomplishing this aim has been to make the transition from employee

drivers to owner-drivers and/or lease drivers. This is a national trend among taxi companies; however, it does little to attack the root causes of the problem, namely inadequate revenue opportunities. In fact, by diluting management concern about the overall operation revenues (as opposed to fees received by management), it may reduce the potential for more creative action. In addition, the loss of control over drivers makes participation in shared-ride systems--where tight dispatch control is essential for productivity--difficult or impossible. The implications of internal organization are explored in the following section.

III. Implications of Taxi Company Internal Organization for Special Transit Services

A. Internal Organization, System Organization and Driver Control

Nature of the Problem

In any small vehicle DRT system the driver plays a crucial role in the service delivery process. He/she is the system in the eyes of many patrons, since the driver represents the only sustained human contact they have with the suppliers of the service. When the service is delivered in taxi vehicles, where driver and user are in close physical proximity and may have occasion to interact verbally, the driver is even more important. Moreover, the patrons of elderly and handicapped services appear to be expecially sensitive to driver behavior, perhaps due to their vulnerable position in society. It is thus essential that both the sponsor and the provider of an elderly and handicapped service consider how they will ensure that drivers are courteous, responsive, and safety-minded. In other words, quality control over driver behavior must be exerted.

The issue of driver control is particularly relevant because of the demands which arise from the provision of service to the elderly and handicapped population, and how these differ from the regular taxi market. Taxi drivers in today's ERT market are required to be competitive to survive. The market situation conditions the driver to pursue the call with a large fare (long trip), rapid turnover (short load and unload time), and the prospect of a gratuity. Elderly and handicapped trips are generally not long, indeed many are expressly limited by program constraints. Not only are fares (and thus driver compensation) lower to begin with, but when the company gives the sponsor a discount from the meter, the drivers usually must accept even less compensation. The characteristics of the patrons can make the pickup and drop-off time much longer than usual. In addition, the elderly and handicapped patrons usually are not profligate tippers, if indeed they tip at all. The extra care (time) required and lower average fare of these trips often make ERT drivers less than enthusiastic about particpating in these programs.

These concerns are somewhat less problematic with a shared ride system, as the drivers must accommodate themselves to a new mode of service delivery and in particular tolerate tight dispatch control if they are to function in the system at all. In an integrated fleet SRT system, however, the issue of differential compensation for elderly and handicapped trips and regular ERT trips may arise. Of course, appropriate driver behavior is no less important in SRT than ERT services.

Given the additional pressures that an elderly and handicapped program puts on drivers, it becomes imperative that a reasonable caliber of individual is being employed by the taxi firm. Sponsors can best assure this by reviewing the selection process employed by the contractor. A distinction must be made between dedicated vehicle systems, in which the driver serves only program patrons, and integrated fleet operations, where a mixture of patrons is served.

In an integrated operation there is no opportunity to select a few drivers and assign them to elderly and handicapped duties. Therefore, the initial selection process (hiring) becomes the key to success. Specifically, does the employer-contractor investigate the background and references of his prospective employees or will the employer-contractor hire anyone who applies? Taxi firms have become less and less able to compete in the labor market. Consequently, the tendency to accept whoever comes along has been on the upswing. This has led to very large turnover rates among drivers, which results in many inexperienced (and unprofessional) drivers. Many cities require a hack's license, and part of the application process includes fingerprints which are submitted to the FBI for analysis. However, the fact that an individual is not wanted by the FBI and possesses an adequate driving record does not mean that he/she will be an exemplary elderly and handicapped driver. The more thorough the background check and the more stringent the requirements for employment, the greater the likelihood that the sponsor will be satisfied with the actual delivery of services.

In dedicated vehicle systems, the driver is serving one population and therefore company management has the opportunity to choose an individual suited to working with the elderly and handicapped. Taxi managers indicate that it is much easier to train a driver for these duties than to retrain a driver who has been in the ERT market. When asked for a profile of the ideal elderly and handicapped driver, this picture emerged: over 50; very good driving record; if transferred from within the company, a low level of complaints from patrons. Often when given the opportunity, these individuals will select themselves from within the ranks of the existing drivers. Older drivers tend to view favorably the prospect of a steady income and insulation from excessive competition. In addition, they are more inclined to understand the necessity for tight control which is typically a requirement in shared ride services.

Structural Changes in the Taxi Industry and their Impacts on Special Transit Service

Whatever the nature of system organization, the authority structure (i.e., the internal organization) of the taxi company is of major importance in influencing driver behavior in an elderly and handicapped system. There are four major types of authority structures prevalent in the taxi industry today:

(1) Fleet operator with employee drivers;

(2) Fleet operator with lease drivers and/or owner-drivers and possibly employee drivers;

(3) Owner-driver association;

(4) Owner-driver cooperative (may include employee drivers)

In fleet operations, the traditional form of company organization, the firm is managed by an owner or manager who is ultimately responsible for profits or losses. In the most traditional situation, drivers are employees and vehicles are owned and maintained by the firm. Control of drivers is relatively straightforward and assuming that the individual in charge is competent, sponsors seem to experience no great difficulty in obtaining satisfactory response to driver behavior problems. Actual firing of drivers due to sponsor complaints is rare, although it has occurred, but management seems willing to deal directly with problem drivers or to remove them from participation in the elderly and handicapped system.

An increasingly popular version of the traditional fleet operation is one in which some or all of the drivers are not employees, but rather lease or own the vehicles they drive. The objective of management in this type of company is still to make a profit, but the mechanism for generating revenue is different from the employee-driver firm. In the non-employee regime, management's income derives from the daily fee paid by lessees and owner-drivers for the privilege of using dispatching services and, in the case of lease drivers, insurance and maintenance services. By collecting a flat fee, management insulates itself from the risks related to the low demand for ERT, placing the majority of the risk on the drivers. Naturally, this situation imposes pressure on the driver to generate as much income as possible, since he/she is actually losing money until sufficient fares have been collected to pay the lease fee. The result of such risk shifting is often an aggressive driver primarily interested in highly lucrative trips. Such drivers tend not to be good elderly and handicapped drivers; moreover, management has little direct control over their behavior since they are not employees. While several taxi managers stated they would not hesitate to pull the insurance of a problem driver, thereby eliminating him/her from participation in the company's operations, it appeared that only egregious driver misbehavior would lead to such a response. Most managers of such enterprises seem to have a wide zone of tolerance with respect to driver behavior.

The current trend within the taxi industry toward non-employee ERT drivers, combined with the tumultuous nature of labor-management relations in recent years, particularly long strikes in some cities, has led to the development of taxi companies based on even more nontraditional management-driver relations. When traditional firms have been forced to cease operations due to financial difficulties or labor problems, or when taxi regulators have loosened entry restrictions, the response of former employee drivers has been to form their own taxi organizations. These have been of two principal types: owner-driver associations and owner-driver (and employee-driver) co-operatives. (Some analysts consider these organizational forms similar, but important differences do exist.)

The first of these types of organizations has usually developed as a response to the shutdown of the companies that previously employed the drivers. In these situations drivers were generally suspicious of the previous management and felt

that the authority exercised by management was a license to exploit the drivers. This fact and the lack of any inherited shared capital responsibilities are the primary reasons that organizations of this type are generally loose confederations.

Drivers did not wish to repeat the negative experience encountered with the previous authority structure and therefore wanted an organization which provided the most service with the least control over the drivers' daily operations and profits. Another factor favoring a loose confederation is the lack of inherited capital facilities. When a group of drivers are starting from scratch, that is, without purchasing the capital of the previous ownership, they generally will attempt to minimize their risk and avoid a large capital investment. Avoiding capital investment also avoids the need for organizational complexity which goes hand in hand with certain types of functions. For instance, if a company and its facilities were to be acquired, the use of maintenance facilities would increase organizational complexity. Any non-ERT services inherited would also diminish the likelihood of an association type organizational structure due to the necessity for creating a mechanism for distributing profits.

Therefore, these organizations are designed to provide dispatching, a minimum of bookkeeping, and other minor coordinating functions for a regular fee. All other functions are delegated to the drivers. Associations are democratically operated and generally have a president and other executives (treasurer, etc.) along with a board. Changes or innovations of any type are subject to democratic channels.

A driver-owner, driver-employee co-operative is characterized somewhat differently from an association. This type of organization has also sprung up around irresolute labor issues and drivers have expressed some of the same feelings. However, apparently as a result of large strike funds and initial capital commitments, a significant difference in organization prevails. In the most successful example of the co-op, the strike fund was used to purchase the company. This shared capital brought about an entirely different relationship between drivers and the organization. In essence, the co-op is a company owned by its employees, who then select the organization's management. While drivers are not formally employees of the company (although they can be), the co-op is more tightly organized than an association. In the co-op, a union is present and represents the drivers, and a board of directors is elected from the company at large. The board of directors and its officers are responsible for the day-to-day operation of the orgnization. The union is a mechanism to address drivers' wishes and grievances.

The co-op, like the association, provides telephone answering, dispatching, and record keeping services. Unlike an association, it also provides maintenance and repair services at its own facilities, and arranges for vehicle insurance for its members. When there are profits generated by a co-op, they are distributed on the basis of shifts worked. Thus, while drivers work for themselves, they also have an incentive for the company as a whole to do well.

In both the association and the co-op the driver control issue is similar. How can an organization, itself more or less loosely structured, induce drivers who work for themselves to first participate in an elderly and handicapped program and then

behave appropriately when delivering services to this user group? As is apparent from the above discussion, the co-op has somewhat more influence over its drivers than does the association, but in both cases it may be difficult for leaders to induce the desired responses. While the prospect of additional income is often sufficient incentive to produce desired driver behavior, this is not always the case. Some associations of independent owner-drivers have had difficulty functioning effectively in a subsidized ERT system due to the problems of persistent driver turn-downs and ineffective management leading to poor service quality. An owner-driver association in Northern California recently lost a contract for precisely these reasons, and other sponsors have become been disenchanted with the performance of owner-driver companies, both associations and fleet operations. Perhaps even more significant, however, are the limitations which these taxi organizational forms place on system organization possibilities, an issue explored below.

B. Internal Organization Constraints on Special Transit System Organization

Traditional taxicab companies, i.e., fleet operations with employee drivers, confront no inherent obstacles to participation in any of the five types of elderly and handicapped systems described in Table 3-8. They are limited only by the managerial capacities and the market constraints peculiar to their situation. The only restrictions would be in their willingness to participate and their ability to acquire any capital necessary to purchase whatever special equipment is dictated by program needs.

Fleet operations which rely on non-employee drivers for ERT are only restricted in participating in integrated fleet, SRT systems. Inasmuch as a successful SRT service requires drivers to adhere to strict dispatch control, and management cannot directly control lease drivers or owner-drivers, an integrated fleet SRT system operated by such a company would be a risky proposition for both provider and sponsor. However, there is no obstacle to participation in shared ride systems where dedicated vehicles are utilized, including hybrid systems, as the company can simply hire hourly employees to drive such vehicles.

An owner-driver association faces much more serious limitations on the type of systems in which it can participate. In general, associations are restricted to participating in subsidized ERT (with user-side subsidy) services. Other system organization schemes require the association either to: (1) closely control driver behavior in order to accomplish ridesharing; or (2) acquire drivers and vehicles to use in a dedicated vehicle service. With respect to the former, the association is not able to control its drivers, since they are independent entrepreneurs. With respect to the latter, two obstacles are present. First, if vehicles must be acquired, obtaining the needed capital is difficult. In general, associations obtain capital on an individual driver basis. Since there is no legal organizational responsibility for overall profit or loss, it is difficult to borrow large sums of money. Banks are understandably leary about the prospect of lending to a loose confederation of individual businessmen. Second, even if vehicle acquisition is not a problem, for whom do the Employees of the elderly and handicapped system work? Since the

TABLE 3-8

Types of Taxi-Based Special Transit Services

	Vehicle Utilization	Form of Subsidy	Mode of E&H Operation	Typical Form of Compensation	System Label
1.	Integrated Fleet*	User-side	SRT	Fee per passenger, per trip, or per revenue vehicle mile	Integrated Fleet SRT
2.	Integrated Fleet	User-side	ERT	Meter fare (with possible discount)	Subsidized ERT
3.	Dedicated Vehicles	Provider-side	SRT	Fee per vehicle service hour	Traditional Dial-A-Ride
4.	Dedicated Vehicles	User-side	SRT	Fee per passenger trip, or per revenue vehicle mile	User-side Dedicated Vehicle
5.	Dedicated Vehicles for base level of service and Integrated Fleet for additional service demands	User-side, or combination user-side and provider-side	SRT for dedicated vehicles; ERT or SRT for non-dedicated vehicles	Fee per vehicle service hour or per passenger/trip for dedicated vehicle; fee per passenger/trip or meter fare for non-dedicated vehicles	Hybrid

*Same vehicles deliver regular, unsubsidized ERT service and also provide service to subsidized elderly and handicapped users

association provides for no common interest other than dispatching and a minimum of bookkeeping, it is not geared to managing drivers, operating a system, or interacting with a service sponsor. Moreover, there is no mechanism for distributing any profits which accrue from such a service, hence the members of the association have no incentive to encourage the leadership to pursue contract opportunities in which members do not directly participate.

A driver controlled co-op, on the other hand, is structured with the capacity for capital acquisition and distribution as well as profit distribution. Assuming the opportunity exists to participate in a dedicated vehicle program, the co-op could simply purchase the vehicles and arrange for employees to operate them. The profits from this arrangement would then be distributed among all co-op members. The centralization of authority and profit sharing therefore provide an immense boost to the flexibility of an owner-driver organization.

These mechanisms can make all the difference to a program organizer. It would be virtually impossible to implement a shared ride service or dedicated vehicle system using a driver association without internal reorganization, but a co-op can make whatever arrangements are necessary and participate in a wide variety of programs. In the integrated regime the entire company could participate, while in a dedicated vehicle system the co-op could deploy employees and special equipment as necessary.

REFERENCE

1. R. F. Teal and G. Giuliano. "Taxi-Based Community Transit: A Comparative Analysis of System Alternatives and Outcomes," Proceedings of the Transportation Research Forum, Oxford, Indiana, Richard B. Cross, 1980, pp. 86-93.

CHAPTER FOUR

PERFORMANCE ANALYSIS OF TAXI-BASED SPECIAL TRANSIT SERVICES

Better understanding of taxi-based special transit services and evaluation of different systems and system organization features can be accomplished through performance analysis. Performance analysis involves the creation of a framework that allows one to evaluate different systems on the basis of common scales. The scales, or performance indicators, are selected based on both conceptual considerations and data availability. The resulting indicators are then applied to California's taxibased elderly and handicapped services, and used to compare various features of the systems.

The objective of this performance analysis is three-fold. The first objective is to evaluate the overall performance of the taxi-based elderly and handicapped services, and then to compare their performance to that of general public DRT systems in California.

Second, the effect of different system organization parameters on performance is investigated. This involves several comparisons of organizational features: (1) provider-side subsidy systems are compared to those utilizing a user-side subsidy mechanism; (2) systems practicing shared riding are compared to those organized along subsidized ERT lines; (3) systems which ration usage within the eligible user group are compared to those in which elderly and handicapped persons face no restrictions on service use; and (4) dedicated vehicle systems are compared to integrated fleet systems.

Third, the potential for improving performance by changing the organizational parameters of existing systems is analyzed. A DRT supply model is used to generate and evaluate alternative service organization schemes, whose performance is then compared to that of the existing system. Directions for improvement of services are then indicated.

I. Selection of Appropriate Performance Indicators

Performance indicators for demand responsive transit have been developed in previous studies, and have even been applied to taxi-based DRT systems (1,2). The problem with the frameworks which have been previously utilized is that they are mainly applicable to dedicated vehicle DRT systems. This is because they rely heavily on measures of produced service as the basis for many performance criteria. However, measures of produced service are typically unavailable from integrated fleet DRT systems; even when such data can be obtained it has a different and noncomparable meaning than for dedicated vehicle systems. Unfortunately for the purpose of performance analysis, many taxi-based elderly and handicapped services are based on integrated fleet arrangements; in this study 37 of 48 systems were so organized. Consequently, existing DRT performance frameworks had only limited applicability.

A. Performance Concepts, Data Limitations, and System Comparability

Three concepts are central to the development of the typical performance indicator framework: efficiency, effectiveness, and utilization. Efficiency concerns the relationship between inputs and produced output, whereas effectiveness is a measure of how intensively output is consumed once it is produced. The primary distinction is thus between measures of produced output and consumed output. The relationship between efficiency and effectiveness is mediated by utilization. At any given level of efficiency, an increase in service utilization will result in improved effectiveness.

Ideally, a performance indicator framework will include measures of efficiency, effectiveness, and utilization. However, utilization and efficiency measures typically require data on produced output. Due to the nature of integrated fleet systems they usually cannot supply such data, and most of California's taxi-based elderly and handicapped services use an integrated fleet.

Produced output is usually measured in vehicle service hours (VSH). This statistic has little meaning for integrated fleet systems as vehicles are used interchangeably for subsidized and regular taxi services. Even in the rare cases where taxi operators keep track of the amount of time a vehicle spends in special transit revenue service (i.e., has a subsidized passenger(s) on board), the number of vehicle hours which results is not comparable to the same statistic for a dedicated vehicle system.

In the latter, vehicle service hours are determined by the total amount of time a vehicle is <u>available</u> for use, which includes time spent travelling with no riders on board, as between the end of one vehicle tour and the beginning of another. This can be a significant fraction of total service hours in many systems. On the other hand, it is virtually impossible to determine the number of hours a day a vehicle is available for special transit service in an integrated fleet system even when direct revenue hours for the special service are known. Clearly, the vehicle is not available for special transit service when it is responding to a request for regular taxi service, but the amount of time spent in both transporting ERT passengers and in travelling to pick them up is never known. Even if it were, there is the problem of deciding how to allocate the idle time of vehicles between the two services. The same difficulties confront attempts to allocate any system inputs, such as employee hours, between two or more services.

Although vehicle service hours is the preferred measure of produced output in DRT systems, the problem described above required that other measures be sought. None proved satisfactory, however. The next best measure, vehicle miles, suffered from the same problem, namely lack of comparability between different types of systems. Most integrated fleet systems keep track only of <u>revenue vehicle miles</u>, that is, of miles driven with at least one passenger on board, whereas dedicated vehicle systems invariably record <u>total vehicle miles</u> while available for service (including miles driven with no one on board). In addition, many integrated fleet systems could not even supply reliable data on revenue vehicle miles generated by their service, as they did not collect this data directly. Therefore, it was not

possible to utilize any performance indicators which required data on produced output, as it could not be measured consistently or reliably.

In the case of California's taxi-based special transit services, the only data which are well-documented and consistently and readily available for performance analysis are passenger counts and cost and revenue figures. Even the passenger data collected for this study was not without problems, as some systems recorded the number of trips--which could account for more than one person--rather than the number of passengers. This stems from the inability or reluctance of sponsors to require providers to record information on number of passengers in those systems where tickets or taxi scrip is used to pay for the ride. The provider would simply turn in the number of tickets without counting passengers, as compensation was based on the former number. As the available information was already down to a minimum it was essential that the passenger variable be salvaged. By using data from systems in this study which collected both passenger and trip statistics, an estimate of average number of passengers per trip was obtained and this was used to transform the trip figures into equivalent passenger numbers in those few systems where this information was not collected directly.

With only cost, passenger, and revenue data available, most of the performance indicators concern consumed service, that is, are measures of effectiveness. This creates two problems. First, it is not possible to determine the relative contributions of efficiency and utilization to cost-effectiveness. That is, a service may score poorly on cost-effectiveness due to low utilization even though the service is organized and operated very efficiently. However, without the data needed to apply the appropriate cost-efficiency or utilization indicators it is not possible to determine when this is the case. Second, cost-effectiveness is significantly influenced by unmeasured characteristics of the operating environment, most notably the distribution of trip lengths. This is particularly the case in subsidized ERT systems, where a 50 percent difference in trip lengths between two systems typically results in a 30-40 percent difference in cost-effectiveness. Particularly when comparing groups of systems with small sample sizes the trip length factor may bias the cost-effectiveness results, as there are too few systems to balance out the effects of one or two with exceptionally long or short trip lengths.

B. The Performance Indicator Framework

As a result of the data limitations imposed by the nature of California's taxi-based elderly and handicapped services, only a single efficiency indicator could be developed. The cost-efficiency indicator selected was the ratio of administrative costs to total system costs. This is an indicator of the sponsor's efficiency in organizing and administering the program. Systems with lower ratios will be more efficient as they require less administrative resources for a given level of transportation provision. That is, relatively more money is spent on the actual provision of transportation in such systems. While the ideal measure would be administrative cost per vehicle service hour, or some other denominator which directly measures produced output, it is not unreasonable to assume that total

system costs are a surrogate for output level. Thus the ratio of administrative costs to total costs indicates the sponsor's administrative efficiency.

There are two aspects of effectiveness, namely cost-effectiveness and consumption-effectiveness. Cost-effectiveness is a measure of the relationship between consumed output and the costs of achieving this consumption, and can best be measured in terms of cost per passenger. Another way of viewing cost-effectiveness is as a measure of the intensity of service utilization for a given level of resource expenditure, although this description best applies to dedicated vehicle systems, in which output is produced in anticipation of demand. In addition to total system cost per passenger, cost-effectiveness is also measured by subsidy cost per passenger and administrative cost per passenger. The former indicator is used to evaluate how effectively public resources are used to provide consumed output, while the latter measures the amount of administrative resources which are necessary to provide a particular level of consumption.

Consumption effectiveness is a measure of how well a system matches supply to demand. One of the most important indicators of consumption effectiveness, namely vehicle productivity, cannot be used due to the problems with vehicle service hour data described previously. Nonetheless, two other aspects of consumption effectiveness can be measured.

The first is market penetration. Presumably a high level of demand indicates that a system is ef of mobility people desire. Therefore, the indicator used f ss aspect of consumption effectiveness is annual passenger on. Ideally, this indicator would have been the number o nd handicapped population, since only elderly and handicc special transit systems in California. However, reliable he elderly and handicapped proved impossible to obtai rts were unavailable at the time this analysis was being thus a more meaningful figure despite its limitations. It i that many of the services are strictly rationed, and thus a low score on this indicator may simply reflect this fact, not the overall attractiveness of the service.

Second, the degree to which a service matches demand can also be measured in terms of passenger willingness to pay. The selected indicators are fare revenue per passenger and the ratio of fare revenue to total system cost. Both reflect the service user's contribution to the expenses of providing service, the former absolutely and the latter relatively.

Table 4-1 presents the set of performance indicators selected and a brief description of what each measures.

II. Performance Analysis

Of the 48 systems included in this study, sufficient reliable data was available on 42 systems to calculate a complete set of performance indicators. When these 42 systems were further subdivided for the purpose of comparing the effects on

Table 4-1

PERFORMANCE INDICATORS FOR TAXI-BASED SPECIAL TRANSIT

Performance Aspect	Indicator	Description
Cost-efficiency	Administrative cost/total cost	Efficiency in allocation of funds for administering special transit program
Cost-effectiveness	Total cost/passenger	Overall cost-effectiveness of special transit program
	Subsidy/passenger	Public cost per passenger, or the cost-effectiveness of public inputs
	Administrative cost/passenger	Cost-effectiveness of the sponsor in organizing and administering the special transit program
Consumption-effectiveness	Fare/passenger	Average cost of consuming the service; passenger contribution
	Fare/total cost	Passenger willingness to pay; relative contribution of passenger revenues
	Passengers/service area population	Market penetration, or intensity of service consumption

performance of different service organization parameters, each of the resulting categories contained at least 6 systems. Examination of the systems within each category revealed significant variations in operating environment, thus reducing the possibility that performance differences between categories were more reflective of environmental conditions (which are difficult to control for statistically since most of these factors cannot be easily quantified) than of organizational parameters. Nonetheless, the results of the comparisons should be interpreted cautiously, as some of the sample sizes are small, uncertainty exists about certain aspects of the data (most notably the completeness of administrative costs, which vary widely among systems), and the operating environment exerts a definite influence on performance.

A. Overall Results: Special Transit Services vs. General Public DRT

Table 4-2 presents the results of the overall performance analysis, as well as the comparable figures, where available, from UC Irvine's previous study of subsidized SRT services. All cost figures for the latter study have been inflated by 20 percent to account for inflation of operating expenses in the two year period intervening between the two studies. In addition, the overall performance of the general public systems is shown with and without the inclusion of five systems which operated in one large city. The rationale for eliminating these systems is that they were extremely ineffective due to poor management even though they operated in a service area where they should have been quite successful. These systems were subsequently reorganized and now function as a subsidized ERT service for the elderly and handicapped.

As Table 4-2 indicates, the cost of taxi-based special transit services is relatively high, averaging about $4.50 per passenger. This is more than 30 percent above the (inflated) average cost per passenger of all the taxi-based general public DRT systems, and nearly 45 percent greater than the average cost of the more representative set of general public systems. The pattern is similar for subsidy per passenger. These cost-effectiveness differences are due primarily to: (1) the lower productivities of elderly and handicapped services, which stem from their inherently lower demand densities; and (2) the fact that the majority of California's elderly and handicapped systems use ERT service, which is more expensive than shared ride services. In addition, administrative costs tend to be higher for elderly and handicapped systems due to the need to establish eligibility and, in many systems, to also ration service. This usually involves considerable administrative time and cost. Finally, there are significant differences in market penetration between elderly and handicapped and general public services, with the latter generating an average of two to three times as many passengers per service area population as the former. Much of this difference reflects the fact that restricting service to the elderly and handicapped usually lowers demand for DRT by at least 50 percent. Another major contributing factor is service rationing among the eligible population, which further limits ridership in comparison to general public systems, which have no usage restrictions.

Table 4-2

COMPARATIVE PERFORMANCE OF GENERAL PUBLIC AND E&H SYSTEMS

Type of System	Performance Indicator						
	Total Cost/ Passenger	Subsidy/ Passenger	Administrative Cost/ Passenger	Administrative Cost/ Total Cost	Fare/ Passenger	Fare Revenue/ Total Cost	Passengers/ Service Area Population
Elderly and Handicapped (n=42)	$4.52	$3.75	.89	.14	$.75	.20	.53
General Public I (n=22)	3.44	3.00	NA	NA	.44	.15	1.16
General Public II (n=17)	3.12	2.69	NA	NA	.43	.16	1.43

B. The Effect of Subsidy Mechanism on Performance

DRT services may be subsidized in two ways, namely through providerside subsidy, where produced output is subsidized, and through user-side subsidy, in which consumed service is subsidized. In the former scheme, the provider is subsidized simply for operating the service, whereas with user-side subsidy the provider receives publicly subsidized compensation only when services are actually utilized by eligible passengers. Another feature of user-side subsidy is that multiple providers can be included in a system, with each competing for passengers and the compensation associated with transporting them. In recent years transportation analysts have debated the merits of these two subsidy mechanisms, with some arguing strongly for the superiority of user-side subsidy.(3,4)

As a means of shedding some light on this question, the California sample of taxi-based elderly and handicapped systems was divided according to which subsidy mechanism was used, and the performance of each group of systems then was analyzed. Table 4-3 presents the results of the comparison. As indicated in the table, the user-side subsidy systems recorded a slightly lower cost per passenger, a significantly higher ratio of fare revenues to total cost, and somewhat higher administrative costs. These results must be treated carefully, however, as the two groups differ on some important dimensions. Most significantly, over two-thirds of the user-side subsidy systems are subsidized ERT services, whereas all the provider-side subsidy systems are based on shared ride operations. Thus the performance of the user-side subsidy group reflects the influence of a number of high cost services, not simply the effect of user-side subsidy. When only shared ride user-side subsidy systems are compared to the provider-side subsidy systems, the former achieve a cost per passenger level nearly 40 percent lower than the latter. On the other hand, some of the provider-side subsidy systems are targeted at the transportation handicapped, a group more expensive to serve than the general elderly and handicapped population.

Given the demand densities that prevail in the systems included in this data set, it is not surprising that provider-side subsidy systems registered a lower level of cost-effectiveness. The demand densities for the six provider-side subsidy systems were all in the neighborhood of one passenger per square mile per hour, which appears to be the minimum level for shared riding. The productivities of the systems, which ranged from 2.2 to 4.0 passengers per vehicle service hour, reflect this. When the provider is receiving a fixed level of compensation for operating the service, such productivities are invariably associated with relatively high costs per passenger, often approaching or exceeding ERT levels despite the shared ride operations. While this analysis does not support the clear cut superiority of either subsidy mechanism, it does suggest that provider-side subsidy should be used with caution in low demand situations, as it may inevitably lead to high cost per passenger.

C. The Effect of Shared Riding on Performance

As shared ride systems use the same vehicle to accommodate more than one trip, they should be more cost-effective than elderly and handicapped services based

Table 4-3

COMPARATIVE PERFORMANCE OF SYSTEMS USING DIFFERENT SUBSIDY MECHANISMS

Type of Subsidy	Total Cost/ Passenger	Subsidy/ Passenger	Administrative Cost/ Passenger	Administrative Cost/ Total Cost	Fare/ Passenger	Fare Revenue/ Total Cost	Passengers/ Service Area Population
User-side subsidy (n=36)	$4.45	$3.68	$.95	.15	$.81	.22	.55
Provider-side subsidy (n=6)	4.80	4.10	.73	.15	.32	.07	.51
Total Sample (n=42)	4.52	3.75	.89	.14	.75	.20	.53

on subsidized ERT. As Table 4-4 indicates, this is indeed the case. The 14 shared ride systems in our sample registered an average cost per passenger of $3.73, or 21 percent less than the average cost per passenger of the ERT-based systems. (Three systems which used prescheduling to accomplish shared riding on the initial leg of a user's round trip but relied on ERT service for the return trip were eliminated from this comparison since they did not fall into either category.) Cost per passenger of these shared ride elderly and handicapped systems is about 10 to 20 percent higher than the estimates made earlier for taxi-based general public DRT. Given the lower demand densities of the elderly and handicapped services, which typically result in lower productivities compared to general public services, these relative cost-effectiveness achievements appear reasonable.

While at first glance this comparison suggests that special transit systems should be based on shared ride operations, the results require more sensitive interpretation. First, a significant amount of the difference in cost-effectiveness between subsidized SRT and ERT services is attributable to differences in administrative costs. If these are eliminated, the cost differential is halved. On the other hand, it is likely that ERT systems have inherently higher administrative costs per passenger. This is due to fewer riders over which to spread these costs and the greater administrative effort required to ration usage and redeem tickets or taxi scrip, typical features of subsidized ERT systems. For example, in this study the SRT systems generated an average of nearly twice as many annual riders as did the ERT systems. Since administrative costs are not likely to increase in direct proportion to service usage, this factor alone may account for much of the observed differences in administative cost per passenger.

Second, many of the subsidized ERT services would perform no better as shared ride operations, and indeed shared riding would simply be infeasible in many of these systems. This is due to severe restrictions on usage which reduces demand density to levels at which little or no shared riding can take place. As Table 4-4 indicates, due to service rationing the ERT services generate only about one quarter as much ridership per capita as the shared ride systems, and the demand densities are comparably lower. As will be discussed later in this chapter, analysis has demonstrated that most of these ERT services could not be converted into viable shared ride systems without loosening the ridership restrictions and thereby increasing demand. For sponsors which are not able or willing to take such steps, the greater cost-effectiveness of shared ride services is both illusory and irrelevant. There is also a limit on their ability to improve administrative cost-efficiency, as they are forced to ration service to keep within a stringent budget and this requires a certain level of administrative expenditures, irrespective of usage.

D. Dedicated Vehicles vs. Integrated Fleet Operations

Integrated fleet systems have proven to be the optimal mode of operation for general public DRT systems in which a taxi company is the service provider.(5) Integration allows for complete sharing of resources among SRT and ERT services, thus lowering the cost of the former to the sponsor. In addition, providers are able to keep a greater proportion of their fleet in revenue producing services.

Table 4-4

COMPARATIVE PERFORMANCE OF SYSTEMS BASED ON SHARED RIDING AND REGULAR TAXI SERVICE

Mode of Vehicle Use	Total Cost/ Passenger	Subsidy/ Passenger	Administrative Cost/ Passenger	Administrative Cost/ Total Cost	Fare/ Passenger	Fare Revenue/ Total Cost	Passengers/ Service Area Population
Shared ride operations (n=25)	$3.73	$3.07	$ .50	.11	$.50	.17	1.08
Exclusive ride operations (n=14)	4.70	3.83	1.12	.16	.81	.23	.29
Total Sample (n=42)	4.52	3.75	.89	.14	.75	.20	.53

However, when services are restricted to the elderly and handicapped only, or rationed among this group, DRT demand drops considerably. As demand density declines a point is reached where shared ride operations no longer become feasible for the entire taxi fleet. That is, the additional demand from the special transit service is spread among sufficiently many vehicles that all trip requests can be accommodated on an ERT basis. Thus under low demand conditions an ostensibly shared ride demand responsive service invariably tends towards ERT unless all demand is consolidated in a few vehicles, which in practice means a dedicated vehicle system. Even if shared riding were seriously attempted in a low demand situation it would require that excessive wait and ride times be imposed on passengers. In fact, this exact phenomenon often occurs in dedicated vehicle systems with small fleets. Thus the service and performance advantages of integrated fleet SRT systems can only be obtained when demand is sufficient--a demand density near 1 passenger per square mile per hour is usually the minimum necessary. The issue of dedicated vehicle service vs. integrated fleet SRT is explored further later in this chapter, when a DRT supply model is used to analyze alternatives to subsidized ERT service.

E. Performance of the Three Basic Modes of Special Transit Service Delivery

Taxi-based special transit systems are organized in essentially three ways. First, some systems are organized along traditional Dial-A-Ride lines--vehicles are dedicated to the system, provider-side subsidy is the means of compensating the operator, and usage is unlimited for eligible persons. Second, systems may be organized on the basis of an integrated fleet, shared ride operations, and user-side subsidy (consumed service compensation). In such systems the provider typically receives a fixed fee for each passsenger or party transported. In some cases a zonal SRT fare structure is established, or a fee per revenue vehicle mile is negotiated. Third, many sponsors simply subsidize regular ERT service on a user-side subsidy basis with compensation to the provider based on ERT meter fares (occasionally the taxi operator gives a small discount from the meter). In this study, 36 of the 42 systems for which complete data was available could be placed in one of these categories. (It was decided to expand the second category to include two user-side subsidy SRT systems which utilize dedicated vehicles, as in all other respects they were similar to the integrated fleet SRT systems.)

Table 4-5 presents the results of the performance analysis of these three different modes of service organization. From a cost-effectiveness standpoint, the user-side subsidy SRT systems are clearly superior to either of the other two organizational options. Cost per passenger is 38-42 percent less and administrative costs are much lower. Moreover, market penetration of these services is three to five times greater than for services organized in the other ways. In fact, market penetration is comparable to the achievements of taxi-based DRT for the general public, even though use is restricted to the elderly and handicapped. A probable explanation for this ridership generation ability is that in five of the eight communities there is no other public transportation available, and in another community the bus system consists of only two routes on which service is provided during limited hours. Combined with reasonable fares and lack of restrictions on usage, this leads to relatively high utilization among the target population. Thus the

Table 4-5

COMPARATIVE PERFORMANCE OF THREE MAJOR TYPES OF E&H SYSTEMS

Mode of Organization	Total Cost/ Passenger	Subsidy/ Passenger	Administrative Cost/ Passenger	Administrative Cost/ Total Cost	Fare/ Passenger	Fare Revenue/ Total Cost	Passengers/ Service Area Population
User-side subsidy, SRT, fixed fee compensation (n=8)	$2.92	$2.34	$ .32	.08	$.64	.24	1.51
User-side subsidy, ERT, meter fare compensation (n=22)	5.02	4.11	1.22	.17	.91	.22	.27
Dial-A-Ride (provider-side subsidy, dedicated vehicles) (n=6)	4.80	4.10	.73	.15	.32	.07	.51
Total sample (n=42)	4.52	3.75	.89	.14	.75	.20	.53

sponsors' objective for the service--basic public transit for the elderly and handicapped--has been achieved.

The results of the analysis also suggest that the user-side subsidy SRT systems are administratively efficient, as they register a low ratio of administrative cost to total system cost. This finding should be viewed with caution, however, as some of these systems reported very low administrative costs, implying less than complete cost accounting. Nonetheless, interviews with their sponsors revealed that many devoted little administrative time to the systems, other than monthly (or weekly) monitoring of operating data submitted by the provider and occasional trouble shooting, and that there was a conscious effort to keep administrative costs low. New staff was never hired to administer the program, tickets were distributed through existing city government mechanisms, the mails, or even local banks, and eligibility checking was pro-forma.

Even if administrative costs--and hence total system costs--are somewhat understated for the user-side subsidy SRT systems, the effect is not significant. If administrative costs are completely eliminated from the calculations, the subsidized ERT systems are 38-46 percent more expensive per passenger than user-side subsidy SRT, and the Dial-A-Ride systems 55 percent more expensive. These differences are all statistically significant. Moreover, it is to be expected that the subsidized ERT systems would have higher administrative costs per passenger, as such costs are spread among only about half as many passengers per system (on average) than the SRT systems. In addition, all but a handful of these systems ration usage, which adds to the administrative requirements and expense. Although it was not possible to determine precisely how much extra administative expense is caused by rationing, when comparably sized subsidized ERT and Dial-A-Ride systems were examined, the former had 25 to 50 percent higher administrative costs per passenger than the latter.

The results of this comparative analysis of system performance make a persuasive case for the user-side subsidy SRT system as the optimal means of organizing a taxi-based elderly and handicapped service. However, two important caveats must be attached. First, it bears emphasizing that all of the user-side subsidy SRT systems included in this analysis had but a single provider. User-side subsidies can be, and have been, employed in situations where there are multiple participating taxi firms. However, even when systems organized in this way are nominally SRT in character, relatively little actual shared riding usually takes place.(3,6,7) The reason is to be found in the competition for subsidized passengers (and associated compensation) among the participating providers.

To accomplish shared riding, a taxi firm must reduce its level of service below ERT standards, notably by increasing response time. By extending response time, the dispatcher allows trip requests to (hopefully) form a spatial pattern in which a single vehicle can efficiently serve several trip demands sequentially by means of a multiple origindestination vehicle tour. The user of a subsidized taxi service, however, is not interested in the efficiencies of shared ride operations, but rather in the best level of service which he/she can obtain. When several taxi firms participate in a user-side subsidy SRT system, each has a strong incentive to

increase its level of service at the expense of shared riding, since this promises to capture the most patronage. All participants are forced to play this game; those who do reduce level of service to permit shared riding will lose patrons to those who offer shorter reponse time and an exclusive ride service.

Inasmuch as the fare structure and the compensation level for the subsidized patrons have been pegged to a shared ride service, the providers end up delivering mostly ERT service at shared ride compensation rates. If the special transit program results in a major increase in taxi ridership this may be financially viable. Otherwise, there is certain to be upward pressure on the SRT compensation rate as the providers find themselves subsidizing the sponsor. Alternatively, the inadequate compensation may undermine the financial health of the participating taxi firms.

These considerations suggest that user-side subsidy SRT systems may be considerably less cost-effective when more than one taxi firm is the provider, and that their superiority over the other two major forms of service organization will be significantly diminished. Clearly, both shared ride operations and consumed service compensation are the keys to long run cost-effectiveness, and if one of these attributes is compromised, costs are likely to increase.

The second caveat concerns the ability of the sponsors of elderly and handicapped services to actually organize a shared ride system. If demand must be strictly limited in order to stay within a budget, the resulting ridership restrictions may result in a level of use which yields very low demand density. Should this occur, shared riding simply becomes infeasible. It is thus essential to determine under what conditions a shared ride system can be implemented. This issue is the subject of the following section.

III. Determining the Appropriate Form of System Organization

A. Nature of the Analysis

The widespread adoption by California cities of subsidized ERT as a means of delivering public transportation service to the elderly and handicapped raises an important issue: given the inherently low productivity and relatively high costs of ERT service, could such communities obtain more cost-effective service by organizing their systems differently? The most important change in system organization, of course, would be to change from ERT to shared ride operations. But is shared riding even feasible in these systems at present? If not, what would have to be done to make it so, and at what cost?

In order to address these questions, a DRT supply model was selected to analyze the possibilties of changes in system organization. The model utilized was a deterministic descriptive model developed by Martin Flusberg and Nigel Wilson (8). The outputs of this model include level of service for users and the necessary fleet size and resulting vehicle productivity of the operator. Flusberg and Wilson formulated the model taking into account the theoretical relationship of parameters, the real world behavior of DRT systems, and data generated by simulation models. The model has given good results when tested against actual DRT systems (9).

The model developers themselves believe that it is very accurate for low demand density situations, which are the norm for the systems included in this study. Additional detail on the model, including the equations used to determine fleet size, is presented in the Appendix.

Inputs to the supply model consist of demand density (demands per square mile per hour), service area size, vehicle speed while in motion, and pick-up and drop-off times for passengers. Demand density was difficult to determine for those systems which are available 24 hours, 7 days a week. Although they are theoretically available 168 hours a week, the large majority of their ridership is compressed into a much smaller time period. Since average weekday ridership is the relevant figure for comparing systems, and weekend ridership is considerably lower, it was decided to assume 300 days per year for purposes of calculating average daily riders. It was further assumed that service was available only 10 hours per day, or alternatively, that riders made use of the service for only 10 hours a day. While the latter assumption is obviously a divergence from reality, data from some elderly and handicapped systems which are available 24 hours a day indicates that 80-90 percent of all travel takes place between 8AM and 6PM, so this assumption is reasonable under the circumstances. With these two assumptions, it was possible to calculate a demand density for all the subsidized ERT systems.

Vehicle speeds and pick-up and drop-off times were selected to be consistent with the experience of shared ride elderly and handicapped systems. The vehicle speed was set at 13 MPH, and pick-up and drop-off times were set at 1 minute each. The effective vehicle speed was about 11 MPH, which is somewhat less than that of dedicated vehicle DRT systems for the elderly and handicapped in California. As this figure is lower than can be achieved in practice, it should ensure that the analysis results are conservative.

The supply analysis was initially carried out for the existing level of demand for each of the systems in the data set, both to determine whether changes in service organization for the subsidized ERT systems were warranted and to check whether the model satisfactorily duplicated the performance of the shared ride systems. Good agreement was obtained between the model results and the actual experience of shared ride systems with respect to necessary fleet size, vehicle productivity, and average user wait time.

Both dedicated vehicle systems and integrated fleet shared ride systems were developed as alternatives to the subsidized ERT services. In each case the inputs to the model were demand density and service area size. The outputs were the fleet size necessary to serve the demand, expected wait times, and average vehicle productivity. The fleet size was selected so that vehicle productivity was at least 4 passengers per vehicle service hour. This is the productivity level at which a significant amount of shared riding begins to occur--typical ERT productivities are 3 passengers per VSH or less. If the average wait time at this fleet size was unacceptable, i.e., greater than about 35 minutes (implying a maximum wait of about one hour), then a dedicated vehicle system was deemed infeasible.

For integrated fleet SRT systems, the procedure was somewhat different, namely to use the model to determine initially how many taxi vehicles would be needed to serve exclusively the special transit demand, subject to a maximum average waiting time of 25 minutes (implying a maximum waiting time of about 45 minutes). That is, vehicles were assigned to the DRT fleet until wait time was 25 minutes or less. Shared riding was deemed feasible if productivity remained above approximately 4 passengers per vehicle service hour at this fleet size. The resulting figure was then multiplied by three (3) to arrive at the maximum size of the total taxi fleet which could accomplish shared riding. If the actual existing fleet size was larger than this number, an integrated fleet SRT system was deemed infeasible because demand density was too low to support a significant amount of shared riding by the entire fleet.

This last procedure merits futher explanation, as there is no firm empirical basis for determining the level of special transit demand needed to support a particular size of integrated fleet SRT system. The problem in introducing shared riding using an existing taxi fleet is that the demand density for the subsidized users must be sufficiently high to prevent their demand from being so diffused among the vehicles that it is serviced in an ERT mode. In a sense, the resulting demand density must force the operator to do shared riding in order to utilize existing vehicles efficiently. As noted above, a vehicle productivity of 4 passengers per vehicle service hour is the minimum at which a significant amount of shared riding can be assumed to take place. However, as the supply model assumed dedicated vehicle operations it could not be used to directly determine the performance of an integrated fleet SRT system.

It was thus necessary to split the taxi fleet into two parts: one which did all the shared riding and the other to carry the ERT demand. The relative size of these two pools of vehicles then becomes the critical variable for the feasibility of integrated fleet operations. If the dedicated SRT fleet is small compared to the total fleet, special transit demand will in practice be diffused among the entire fleet. This is because the dispatcher always assigns the nearest vehicle heading in the right direction to a trip, and does not use only part of the fleet for SRT. In the modelling framework used here, the question thus becomes: what percentage of the total fleet must be required to service the special transit demand in order for an integrated fleet SRT system to be practicable?

The answer would appear to be that at least one-third of the fleet must be needed to handle special transit demand--at a productivity level of at least 4 passengers per vehicle service hour--if shared riding is to be feasible. Under these circumstances the overall taxi fleet productivity also increases to about 4 passengers per vehicle service hour (the ERT demand is now confined to vehicles equal to two-thirds of the original fleet), assuming a using a typical level of ERT productivity initially. In fact, in most integrated fleet SRT systems at least half the taxi fleet is used for SRT service, but these systems also achieve considerably higher productivities than 4 passengers per VSH.(1) Moreover, some operators have greatly expanded their taxi fleet in order to accommodate the additional demand generated by the SRT service, which accounts for the higher percentage of vehicles needed to service SRT demand.

It thus seems reasonable to multiply the required SRT fleet size by three to arrive at the maximum total fleet size for which an integrated fleet system is feasible. As a rule of thumb this is very approximate, but some value is needed to make the conversion if the model is to be used, and a factor of three appears most appropriate based on the above considerations. Therefore, if the elderly and handicapped demand requires 5 dedicated SRT vehicles, then the provider can have no more than 15 total vehicles in service for shared riding to be feasible for the entire integrated fleet. If the actual fleet size is 20, shared riding is deemed infeasible.

In order to compare the costs of the current subsidized ERT services with the shared ride alternatives, a simple cost model was developed. The cost of a dedicated vehicle system is a product of the number of vehicle hours of service and the cost per vehicle service hour (VSH). A range of both variables was deemed preferrable to a single level of cost and service. Table 4-7 provides information on the annual cost of a single dedicated vehicle for combinations of three different levels of both weekly service hours and cost per VSH. It should be noted that dedicated vehicle systems in California average about 65 service hours per week and that the dedicated vehicle elderly and handicapped systems included in this study recorded a cost per VSH of $14-19 in 1980-81. The slightly higher costs used here are an attempt to account for some administrative costs as well as service provision costs.

TABLE 4-7

ANNUAL COST OF A DEDICATED SRT VEHICLE

	Weekly Hours of Service		
Cost per VSH	60	66	72
$15.00	$45,360	$49,896	$54,420
$17.50	$52,920	$58,212	$66,528
$20.00	$54,420	$63,490	$72,560

For integrated fleet SRT systems two different cost levels were used: $3.00 per passenger, the approximate average cost of user-side subsidy SRT systems in this study, and $3.50 per ticket collected, the average fee of the providers for some of the larger of these systems. In the second case an additional 10 percent was added for administrative costs, bringing the total cost per ticket to $3.85. However, more than one passenger can ride on a single ticket; a group factor of 1.1 was used, reducing cost per passenger to $3.50. These cost factors were then applied to the total number of passengers using the service.

B. System Organization Changes with Existing Demand

Using the supply model, the cost factors, and the existing level of elderly and handicapped demand, the 27 subsidized ERT systems for which complete data were available were analyzed to determine if alternative forms of system organization could improve cost-effectiveness. In only seven (7) cases did a change of system organization even merit close scrutiny. In four of these instances a change to a dedicated vehicle system was warranted only under the more optimistic costing assumptions. Even then, there was little or no improvement in cost-effectiveness as a result. In only two cases was there a clear cut advantage to changing system organization. In both of these cases, moreover, the change was to a dedicated vehicle system with limited capacity (1 to 3 vehicles) and relatively high user waiting time. The analytic procedures indicated one other system could probably support an integrated fleet service, but that the cost savings would be only about 10 percent at most. Table 4-8 summarizes the results of the analysis.

TABLE 4-8

EFFECTS OF SYSTEM ORGANIZATION CHANGE ON COST-EFFECTIVENESS

System Designation	Type of System for which Change Indicated	ERT Cost per passenger	Projected SRT Cost per Passenger [a]	Average Waiting Time
A	Dedicated vehicle (1) [b]	$4.30	$3.40 (2.64-4.23) [c]	37 min
B	Dedicated vehicle (2)	3.40	4.41 (3.43-5.49)	20
E	Dedicated vehicle (2-3)	4.96	4.20 (3.28-5.24)	33
M	Dedicated vehicle (4)	4.21	4.68 (3.65-5.83)	22
N	Integrated fleet	3.43	3.25 (3.00-3.50)	27
R	Dedicated vehicle (3)	3.20	3.57 (2.78-4.46)	38
V	Dedicated vehicle (4)	2.86	3.72 (2.90-4.64)	28

a Based on mid-range assumptions of service hours and cost per VSH or cost per passenger

b Number of dedicated vehicles required

c Cost per passenger range based on different assumptions about number of service hours and cost per VSH or cost per passenger

These results, when considered in conjunction with the previous performance analysis which indicated that Dial-A-Ride service for the elderly and handicapped were not significantly more cost-effective than subsidized ERT, suggest a rather sobering conclusion. Namely, for low demand special transit systems there may be no more cost-effective way to organize service than to utilize subsidized ERT, which itself is not notably cost-effective. The infeasibility of the integrated fleet SRT option except in a single case is particularly disappointing, as this option has the greatest potential for minimizing the costs of taxi-based DRT service when demand conditions are favorable.

C. The Effect on Optimal System Organization of Eliminating Service Restrictions

The basic obstacle to more cost-effective service organization is the low demand of the subsidized ERT systems, itself a result of stringent budget constraints and subsequent rationing of service among potential users. What might happen if the restrictions on use were eased? The results from the Butte County systems suggest that demand would increase to a level where shared riding became feasible and that the cost-effectiveness of the service would greatly improve, albeit at the penalty of higher (perhaps much higher) total system costs. In order to explore the effect of service rationing on both cost-effectiveness and the feasibility of alternatives to subsidized ERT, as well as to assess the tradeoffs between total system costs and cost-effectiveness, a second analysis was undertaken using the DRT supply model. In this analysis, however, the level of demand was increased to correspond to what might occur if service restrictions were removed or at least greatly liberalized.

Mature, viable DRT systems for the general public typically generate an average weekday ridership equal to 1-2 percent of total service area population (1,10). These systems are usually in communities which have no other public transit available. Accordingly, it was conservatively assumed that if a general public DRT system were established in any of the communities included in this study it would generate a weekday ridership of 1 percent of total population, except that if it were located in an area with good transit service the DRT ridership would be only 0.5 percent of service area population. If ridership were restricted to the elderly and handicapped, but there were no other severe usage restrictions, the system would probably generate 25 to 50 percent of potential total DRT ridership. (In most DRT systems available to the general public 25 to 50 percent of the riders are elderly and handicapped.(1,10)) Thus unrestricted daily elderly and handicapped ridership in each of the systems was projected to be 0.25-0.50 percent of service area population, and half of these amounts if a bus network were present. When these demand factors were checked against the actual ridership generation ability of those elderly and handicapped systems in this study which did not carry usage restrictions, there was excellent agreement. All but one of all the existing systems fell into the indicated range; the deviating system had much higher ridership.

Using the demand projections, the supply model, and the cost factors developed previously, the 27 subsidized ERT systems were analyzed again to determine whether a change in system organization would improve cost-effectiveness. On the

basis of this analysis 16 systems are candidates for the establishment of shared ride operations, using either dedicated vehicles or an integrated fleet.

Of the 16 systems with potential to benefit from shared riding if usage restrictions are eliminated, 6 systems would experience a 35 percent or more reduction in cost per passenger, 5 systems would experience a 15 to 27 percent decrease in cost per passenger, and the remaining 5 systems would at best experience a very slight improvement in cost-effectiveness. Table 4-9 summarizes the results of the analysis, indicating for each of the 16 systems the changes in total cost, cost-effectiveness, and passengers when ridership restrictions are removed, and the type of shared ride operation (dedicated vehicle or integrated fleet) which is most feasible for the system.

In most cases the results in this table are based upon the lower estimate of demand. This leads to conservative results, as cost-effectiveness tends to increase with demand due to higher system productivity at increased demand density. In a few cases, however, the upper estimate of demand is utilized, as the lower estimate was not substantially higher than current demand levels. In one instance the current level of demand is used, as the system is essentially unrestricted and current demand approximates the upper estimate of demand.

This analysis demonstrates that in many systems cost-effectiveness can be significantly improved through a strategy of eliminating restrictions on elderly and handicapped demand and then organizing a shared ride service. It also demonstrates that this strategy is relatively expensive for sponsors. With only a few exceptions the cost-effectiveness gains are not dramatic, and in the cases where they are, they are purchased at the price of a very large increase in total costs. For example, changing three of Los Angeles' subsidized ERT systems to dedicated vehicle operations would increase their ridership by a factor of more than four, but would also increase total system costs by 155 percent, or about $675,000 annually. Although the incremental cost per added passenger would be only about $2.50, a bargain for DRT service, it would be difficult for the City of Los Angeles to obtain the additional required subsidies, which would probably amount to about $600,000 annually. (Approval in mid-1982 of a local sales tax dedicated to transit makes it much easier for Los Angeles to finance these system changes.) If it could do so, however, it would decrease the cost per passenger for these systems by about 45 percent, to less than $3 per passenger according to the analysis results.

In general, total costs at least doubled when demand constraints were relaxed and system organization changed. In only two systems were relatively small cost increases needed to improve cost-effectiveness, and the supply model predicted that both of these systems might successfully reduce cost per passenger by changing system organization at current demand levels. More typically, sponsors would have to obtain upwards of an additional $50,000-150,000 annually in subsidies to allow unrestricted use of the elderly and handicapped service, and much more in the case of large cities like Los Angeles and Oakland. It is quite possible, therefore, that the strategy of eliminating usage restrictions to achieve cost-effectiveness improvements may be too expensive for many sponsors, even though its efficacy would seem to be demonstrated by this analysis.

Table 4-9

Performance of Alternative Methods of System Organization

System	Present Passengers	Projected Pasengers	% Change	Present Cost/ Passenger	Projected Cost/ Passenger	% Change	Low	High	Present Total Cost	Projected Total Cost	% Change	Low	High
A D*	17152	47775	179	$ 4.30	$ 3.66	-14.9	2.85	4.56	$ 73705	$ 174636	137	$ 136080	$ 217680
A I	17152	47775	179	4.30	3.25	-24.4	3.00	3.50	73705	155268	111	143325	167212
B D	26416	82800	213	3.40	2.81	-17.4	2.19	3.51	89936	232848	159	181440	290240
B I	26416	82800	213	3.40	3.25	-4.5	3.00	3.50	89936	269100	199	248100	289100
C D	1404	13200	840	6.80	4.41	-35.1	3.44	5.50	9546	58212	510	45360	72560
F D	4277	47738	1016	3.75	3.66	-2.4	2.85	4.56	16030	174636	989	136080	217680
L1 D	33398	186372	458	5.99	3.44	-42.6	2.68	4.28	200000	640332	220	498960	798160
L2 D	12726	74074	482	6.73	3.14	-53.3	2.45	3.92	85660	232848	172	181440	290240
L3 D	35964	97566	171	4.46	3.58	-19.7	2.79	4.46	160345	349272	118	272160	435360
L3 I	35964	97566	171	4.46	3.25	-27.1	3.00	3.50	160345	317090	98	292699	341482
L4 D	26287	81179	209	5.62	2.87	-48.9	2.24	3.58	147727	232848	58	181440	290240
M D	37332	50595	35	4.21	3.45	-17.9	2.69	4.30	157034	174636	11	136080	217680
M I	45200	82500	82	3.43	3.25	-5.1	3.00	3.50	154880	268125	73	247100	288749
O D	36616	122737	235	7.24	4.27	-41.0	3.33	5.32	265130	523908	98	408240	653040
P1 D	18720	40500	116	4.44	4.31	-2.9	3.36	3.37	83116	174636	110	136080	217680
P1 I	18720	40500	116	4.44	3.25	-26.8	3.00	3.50	83116	131625	58	121500	141750
P2 D	2000	47250	2262	11.85	3.70	-68.8	2.88	4.61	23700	174636	637	136080	217680
R D	48858	87750	79	3.20	3.32	3.6	2.58	4.13	156388	291060	86	226800	362800
R I	48858	87750	79	3.20	3.25	1.5	3.00	3.50	156388	285187	82	263250	307125
S D	16069	50325	213	3.18	3.47	9.1	2.70	4.33	51104	174636	242	136080	217680
V D	62595	62595	-	2.86	3.72	30.1	2.90	4.64	179000	232848	30	181440	290240
V I	62595	62595	-	2.86	3.25	13.6	3.00	3.50	179000	203433	74	187785	219082

*D = dedicated vehicle system, I = integrated fleet system

Perhaps the most compelling argument in favor of the strategy of increasing total spending to increase cost-effectiveness is that subsidized ERT services are highly vulnerable to major cost increases due to rising taxi fares. In the City of Los Angeles taxi fares were recently raised 45 percent, causing a dramatic increase in the cost per passenger (to about $7) of the subsidized taxi program. Users, who are restricted to $20 worth of taxi scrip per month, can now take only about three trips per month. The total cost of the program has also increased due to the fare hike despite this stringent rationing. It may be, therefore, that some of the ERT services which are now cost-competitive with shared ride operations will not be in the near future. Shared ride services, of course, are also subject to cost inflation, but the potential exists to offset some of this with improved productivity, an option not available with ERT. Nonetheless, the critical issue is whether sponsors are willing or able to increase total spending on the special transit service in order to take advantage of the options with potentially superior cost-effectiveness.

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CHAPTER FIVE

CONCLUSIONS AND POLICY IMPLICATIONS

I. The Trend to Taxi-Based Special Transit

During the past several years, the taxi industry in California has emerged as a primary provider of special transit services. While social service agencies continue to be the principal providers of transportation services to their clients, many of whom are elderly and handicapped, publicly subsidized transportation services targeted at the general elderly and handicapped population are in most cases provided by a taxi company.

The reasons for this trend are easily discerned. Not only are taxi firms low cost providers, but their services are immediately available and they possess demonstrated capability in demand responsive transportation. Moreover, local governments often perceive political advantages to awarding contracts to local private enterprise, particularly when doing so helps preserve an important public service in the private sector. Finally, taxi firms are uniquely well suited to the requirements of a restricted ridership DRT system. The low demand prevailing in many such systems makes the traditional Dial-A-Ride form of DRT organization either infeasible or very costly. Integrating a special transit service for the elderly and handicapped with the local taxi firm's other services, using either shared riding or exclusive riding, is usually a simpler and relatively less expensive option.

II. System Organization and Performance

Although most sponsors of elderly and handicapped transportation services in California have selected a local taxi company as provider due to its cost advantages, they have often been unable or unwilling to organize the service in the most cost-effective manner possible. A majority of California's elderly and handicapped services are simply subsidized ERT, a relatively costly form of service. The subsidized ERT services registered an average cost per passenger of approximately $5, whereas the user-side subsidy, SRT systems in operation in California achieved an average cost of about $3 per passenger trip, or 40 percent less.

The small scale, i.e., low demand, of many elderly and handicapped systems is directly responsible for the widespread use of the less costeffective forms of system organization. Small scale, in turn, is primarily the result of fiscal constraints which lead sponsors to ration service among the elderly and handicapped population, limiting both eligibility and subsequent utilization.

The consequence of establishing a transportation service for which demand is deliberately kept low is that in many cases the demand density is insufficient to support shared riding without imposing high waiting times on users. Many California special transit sponsors are thus faced with a choice between a one or two vehicle traditional Dial-A-Ride operation and subsidized ERT. In low demand situations, the Dial-A-Ride option suffers from lower productivity than general public DRT and is

therefore expensive. Moreover, the level of service to the user is relatively poor as long waiting times or extensive prescheduling are needed to achieve even a minimally acceptable level of shared riding. While ERT can provide a more responsive service, it is an inherently expensive service due to very low productivity. However, the analyses reported in Chapter 4 indicate that only a handful of subsidized ERT services could be transformed into shared ride systems at current demand levels. For many sponsors, therefore, more cost-effective service organization alternatives are beyond their grasp unless they loosen demand, and hence cost, constraints.

The prevailing system organization trends are largely responsible for the fact that taxi-based elderly and handicapped services are significantly less cost-effective than taxi-based general public DRT. Overall, the former are about 30 percent more expensive than the latter. Among the elderly and handicapped systems, only the user-side subsidy, shared ride systems achieve a level of cost-effectiveness comparable to the better taxi-based general public DRT systems.

III. Taxi Company Impacts

One of the most important findings of this study is that the impacts of taxi company participation in special transit services are much different than those arising from provision of transit services for the general public. Nearly 50 taxi firms are currently involved in subsidized elderly and handicapped transportation in California, but far fewer are experiencing substantial favorable impacts as a result. Although a handful of companies have benefitted significantly from a single subsidized ERT contract, the largest benefits have typically accrued to firms which operate shared-ride elderly and handicapped services, are general public DRT providers, and possess multiple public transportation contracts.

Significant impacts from public transportation involvement are particularly related to a taxi company's provision of shared-ride services. Not only do such providers receive more revenue than those firms which provide only subsidized ERT service, but many are also engaged in a diversification process which has improved their overall capabilities and established them as a competent paratransit contractor. In contrast, companies whose only contracts are for subsidized ERT services typically remain as conventional taxi operators, non-innovative and heavily dependent on a single type of service which has steadily experienced a market shrinkage. While subsidized ERT has short run benefits for these firms, it may not be a long run solution to the problem of ERT decline.

IV. The Influence of Financial Constraints on Organization, Performance, and Impacts

The underlying reason for the twin phenomena of limited beneficial impacts on taxi firms and the widespread use of system organization models which yield relatively high cost service is the financial constraints which are imposed on most elderly and handicapped systems. Whereas general public DRT systems are normally sized to the estimated level of demand and will be expanded if demand

increases over expectations, most elderly and handicapped services in California are scaled to the level of a pre-determined budget.

Two factors account for this situation. The first is the public transit funding system in California. The existence of a community transit funding program (Article 4.5) has encouraged transportation decision makers in large urban areas to fund elderly and handicapped transportation entirely from this source, even though other state subsidies could be used as well. The limited amount of funds available through this program necessitates stringent funding constraints on local government sponsors of special transit services if this is the only source of subsidy. Second, transportation policy makers in large urban areas have typically placed a relatively low priority on special transit services compared to regular transit service. Where elderly and handicapped services exist alongside a reasonably good level of conventional transit, usually the situation in large urban areas, policymakers tend to view them as necessary only for "lifeline" service for "essential" trips. Given the availability of another, usually less expensive public transit option, policy makers in such environments typically oppose the establishment of a comprehensive DRT system for special needs groups and are willing to support only a limited, strictly supplemental demand responsive service. In contrast, communities which have turned to DRT as their entire transit system view the service as providing comprehensive transportation for carless members of the community.

These policy preferences translate directly into funding priorities, with the result that most special transit services must rely on strictly limited fiscal allocations. The funds available are then much less than would be required to allow all the elderly and handicapped in the area to use the service on an unrestricted basis. The end results are twofold: (1) a tendency towards subsidized ERT services; and (2) a level of financial involvement for participating taxi firms which affords them little motivation or opportunity to diversify and evolve into paratransit enterprises, although the additional revenue does stave off financial disaster at least temporarily.

It is only when a community adopts a more comprehensive view of DRT that a different pattern of outcomes is observed. When cities have decided that DRT service should function as more than a supplemental form of local transit, the absence of ridership restrictions permits a level of demand to occur which is compatible with shared ride service. This makes possible the selection of the more cost-effective service organization options and also leads to greater financial impacts for the taxi company provider. Such impacts may in turn stimulate a diversification process by the taxicab organization, similar to that chronicled in some of the case studies of Chapter 2. Nonetheless, it bears emphasizing that these developments will not occur unless the sponsor is willing, or able, to fund the service at a level which eliminates the need for any significant ridership restrictions among the elderly and handicapped (or other special needs) users.

V. Taxi Industry Developments and Special Transit Impacts

Developments in the private sector also seem likely to affect both the cost-effectiveness of special transit services and their impacts on taxi firms. In

particular, current trends in the labor arrangements being utilized by taxi firms are reducing their ability to participate in certain types of special transit systems. Large numbers of taxi companies have switched from employee drivers to lease drivers and owner-drivers, in an effort both to reduce operating costs and to shift the risk for raising revenues from management to drivers. However, when drivers are not employees of the taxi company it is no longer possible to control their behavior closely or to compel them to follow dispatch orders. This loss of tight dispatch control makes participation in integrated fleet SRT systems difficult or impossible, and thus severely limits the ability of taxi operations with such labor arrangements to take part in user-side subsidy SRT systems.

Fleet operators which utilize lease drivers and even owner-drivers can still participate in dedicated vehicle systems by hiring drivers to operate the DRT vehicles. However, associations of owner-drivers are typically unable to even do this, as they lack the means to manage, operate, and finance such a system, and to distribute profits from its operation. Taxi cooperatives may possess such capabilities if capital is held in common and everyone works for a jointly owned enterprise. Nonetheless, taxi cooperatives of this nature are uncommon, as the trend among owner-driver taxi operations appears to be in the direction of loose associations.

Perhaps a more ominous aspect of the labor trends in the taxi industry is their impact on management. As management has attempted to shield itself from financial risk by moving towards leasing and owner-driver arrangements for ERT service, it seems inevitable that those companies which do not already have large contract operations will become progressively less able, or motivated, to acquire paratransit contracts. Leasing and its variants focus management attention on the fees received from drivers, not the operation's overall revenues. While this does not necessarily preclude an interest in obtaining paratransit contracts, it reduces the incentives for doing so as long as enough drivers are willing to participate in the ERT operation to cover its dispatching and management costs. The relevant market thus shifts from revenue generating patrons to revenue generating drivers. Subsidized ERT poses no compatibility problems for companies which do not utilize employee drivers, but contracts requiring shared ride operations may simply be viewed by management as too much trouble. Even though the management implications of the changing labor arrangements in the taxi industry are by no means clear cut, our reading of the evidence from this research and elsewhere suggests that the strategy of risk shielding blunts management incentives to seek out contracts for innovative services.(1)

The taxi industry is now at a critical juncture, as traditional markets are declining, costs are continuing to increase, and new sources of revenue are urgently needed. Subsidized elderly and handicapped transportation is one important new revenue source, but this study indicates that for most companies it does not represent financial salvation. Only if special transit contracts are part of a larger diversification process will they in most cases return a company to genuine financial health. Moreover, although diversification into new markets, particularly paratransit contracts, is essential for many firms if they are to prosper, subsidized ERT is not the ideal stepping stone. It usually offers neither sufficient revenue to

motivate major diversification nor the operational challenge to stimulate the acquisition of new organizational capabilities. In large cities with still-viable taxi markets the industry may not require extensive diversification in order to maintain itself. In medium and small cities, however, the survival of many taxi companies seems likely to depend upon diversification into new types of revenue generating services. However, subsidized elderly and handicapped transportation is likely to play a major role in reinvigorating such taxi companies only if it includes a large component of shared ride services.

VI. Challenge for the Future

We are thus left with the central dilemma of taxi-based special transit services. Shared ride operation is the key to good system performance, the most favorable financial impacts, and the initiation of the taxi provider's evolution toward a paratransit contractor; it therefore should be employed whenever possible. However, restricting use of the service to the elderly and handicapped in response to financial constraints results in low demand, an impediment to shared riding. On the other hand, low demand is the factor which makes the local taxi firm such an appropriate choice of provider for many special transit programs. If California's experiences are representative, taxi-based forms of service are the wave of the future in special transit. The issues now are how to improve the cost-effectiveness of these services, and how to organize and use them to foster long-lasting beneficial impacts for participating taxi firms. In this way, these firms can continue in business and thereby maintain a source of low cost provision of paratransit service.

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APPENDIX

Flusberg - Wilson DRT Performance Model

A. Model Approach

The Flusberg - Wilson DRT performance model is a descriptive supply model useful for predicting the performance of many-to-many DRT systems. The major strength of the model is its simplicity in representing the DRT system, which is accomplished by means of closed form equations specifying the relationships among the key parameters of interest, e.g., vehicle fleet size and service levels. This analytic approach avoids the major difficulties of simulation models, namely the computational and data requirements. At the same time, by calibrating and validating the performance model through the use of simulation as well as empirical data, it is possible to ensure that it represents reasonably faithfully the behavior of actual DRT systems.

The heart of the Flusberg - Wilson model is two equations which predict level of service (wait times and ride times) as a function of level of demand, service area characteristics, and the number of DRT vehicles in service. In order to derive the model's relationships, however, certain simplifying assumptions must be made about average trip lengths and the average distance to pick-up points. These values are derived from considerations of geometric probability, as explained below.

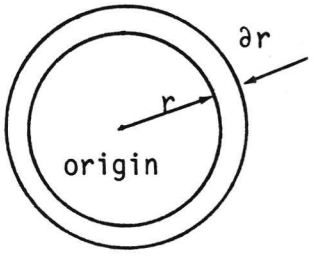
B. Derivation of Distance Relationships

Consider a given area A, with n randomly distributed points. We wish to find the expected distance between an origin and a random destination. The distances between the origins and the nearest points form a distribution. Likewise there are similar distributions for the second nearest, third nearest ...m^{th} nearest points. Assuming Poisson distributions, and where m = degree of proximity, the probability of x points in a given area A is

$$P(x,k) = \frac{e^{-k_k x}}{x!}$$

where k = expected number of points in area.

We define density $d = m/A$ and assume a circular service area.



Thus the number of points in circle with radius = r is

$$k_1 = (\pi r^2)d$$

and the number of points in annulus (∂r) is

$$k_2 = (2\pi r \partial r)d \quad .$$

In order to have the nearest point, there must be no points in the circle and one point in the annulus. Likewise for the 2nd nearest point we must have one point in the circle and one point in the annulus. Thus in general the probability of the m^{th} nearest point being in the annulus is equal to the probability of $(m - 1)$ points in the circle and one point in the annulus. The probability of $(m - 1)$ points in the circle is

$$P(m - 1, k_1) = p_1 = \frac{e^{-\pi r^2 d}(\pi r^2 d)^{m-1}}{(m - 1)!}$$

The probability of one point in the annulus is

$$P(1, k_2) = p_2 = e^{-2\pi r \partial r d} 2\pi r \partial r d$$

as $\partial r \to 0, e^{-\partial r} \to 1$, therefore

$$p_2 = 2\pi r \partial r d$$

and thus the probability of the m^{th} nearest point being in the annulus becomes

$$p_3 = (p_1) X (p_2)$$

$$P_3 = \frac{e^{-\pi r^2 d}(\pi r^2 d)^{m-1} 2\pi r \partial r d}{(m - 1)!}$$

If r is now made variable $P_m(r) = P_3$ is the probability density function of the distance between any one points and its m^{th} nearest point. To verify this, the following should hold.

$$\int_0^\infty P_3 \partial r = 1 \tag{1}$$

$$\frac{1}{(m-1)!} \int e^{-\pi r^2 d} (\pi r^2 d)^{m-1} 2\pi r d \partial r = 1$$

Let

$$z = \pi r^2 d \quad dz = 2\pi r d \partial r$$

$$\frac{1}{(m-1)!} \int e^{-z} z^{m-1} dz$$

We know that

$$\int e^{-t} t^{m-1} dt = \Gamma(m) = (m-1)!$$

Therefore

$$\frac{1}{(m-1)!} \int e^{-z} z^{m-1} dz = \frac{\Gamma(m)}{(m-1)!} = \frac{(m-1)!}{(m-1)!} = 1$$

Returning to equation (1) the mean can be expressed as

$$L_m = \int_0^X r P_3 \partial r = \int_0^X \frac{e^{-\pi r^2 d} (r^2 \pi d)^{m-1} 2r^2 \pi d}{(m-1)!} \partial r$$

Let

$$z = \pi r^2 d \qquad dz = 2\pi r d \partial r$$

$$r = \left(\frac{\pi d}{z}\right)^{\frac{1}{2}}$$

Substituting we get

$$L_m = \frac{1}{(m-1)!\sqrt{\pi d}} \int_0^X e^{-z} z^{m-\frac{1}{2}}\, dz$$

$$= \frac{1}{(m-1)!\sqrt{\pi d}}\, \Gamma\left(m + \frac{1}{2}\right)$$

Using the gamma function properties and the fact that

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$$

$$L_m = \frac{\left(m - \frac{1}{2}\right)!}{(m-1)!\sqrt{d}}$$

Let

$$f_m = \frac{\left(m - \frac{1}{2}\right)!}{(m-1)!} = \frac{1}{2} \times \frac{3}{4} \times \frac{15}{16} \cdots\cdots \frac{\left(m - \frac{1}{2}\right)}{(m-1)}$$

For the nearest point $m = 1$, and recalling $d = \frac{m}{A}$

$$L_m = \frac{1}{2}\sqrt{\frac{A}{N}} \qquad (2)$$

As a special case consider $N = 2$

$$L_m' = \frac{1}{2}\sqrt{\frac{A}{2}} = \frac{\sqrt{2}}{4}\sqrt{A} \approx \frac{\sqrt{A}}{3} \qquad (3)$$

C. Derivation of Model Relationships

Returning to the performance model, we can now say that the expected distance between an origin and N randomly distributed vehicles in an area A is

$$L = \frac{1}{2}\sqrt{\frac{A}{N}}$$

L is the mean nearest distance and thus waiting time is

$$T_w = \frac{L}{V_{eff}} = \frac{\sqrt{A/N}}{2V_{eff}} \tag{4}$$

where V_{eff} = effective vehicle speed. The minimum riding time is the mean expected distance between two points (Eq. 3) divided by the speed

$$T_R = \frac{L'}{V} = \frac{\sqrt{A}}{3V_{eff}} \tag{5}$$

we now define $V_{eff} = V - M$ where

V = line haul speed (no stops)

M = speed loss due to stops

since M is a function of system productivity (λ = PASS/VSH), speed V, boarding time t_1 (min) and alighting times t_2 (min).

$$M = \frac{\lambda V}{60}(t_1 + t_2)$$

$$V_{eff} = V\left(1 - \frac{\lambda}{60}(t_1 + t_2)\right) \tag{6}$$

$$\lambda = \frac{DA}{N} \quad (D = \text{passengers/hour-mile}^2)$$

Finally we must consider the street network effect on T_w and T_R, we define

$$f_a = \frac{\text{straight line distance}}{\text{street distance}}$$

and rewriting 4 and 5

$$T_w = \frac{fa\ \sqrt{A/N}}{2\ V_{eff}} \tag{7}$$

$$T_R = \frac{fa\ \sqrt{A}}{3\ V_{eff}} \tag{8}$$

Considering the system boundaries

$$\lambda \to X \qquad T_w, T_R \to \infty$$
$$A \to \infty \qquad T_w, T_R \to \infty$$
$$N \to 0 \qquad T_w, T_R \to \infty$$

and the simulation data the following functional form resulted

$$T_w = \frac{fa}{2V_{eff}} \sqrt{\frac{A}{N}}\ \exp\left[c_1 \sqrt{\frac{A+4}{N+12}}\ \lambda^{c_2}\right] \tag{9}$$

$$T_R = \frac{fa}{3V_{eff}} \sqrt{A}\ \exp\left[c_3\ \left(\frac{A\lambda}{N}\right)^{c_4}\right] \tag{10}$$

Using eq. (3), eq. (10) reduced to

$$T_R = \frac{f_a L'}{V_{eff}} \exp\left[c_3 \left(\frac{A\lambda}{N}\right)^{c_4}\right] \tag{11}$$

The constants and ranges are:

A (area) = 4 - 24 $mile^2$

N (fleet size) = 4 - 34

f_a = (street network effect) = 1.3 - 1.4

t_1, t_2 = (board and alight times) = .375 - 1.25 min

D = (pass/hour-$mile^2$) = 1 - 45

λ = (pass/VSH) = 4 - 12.7

c_1 = 0.22 for bus based systems

= 0.20 for taxi based systems

c_2 = 0.9 for bus based systems

= 1.0 for taxi based systems

c_3 = 0.084 all systems

c_4 = 0.7 all systems

Equation 10 and 11 assume computerized dispatching and equal weighting of T_R and T_w. However, DRT systems might weigh T_w more or less than riding time, and dispatch accordingly. In order to account for the above we can write

$$T_{wa} = (1 - \alpha - \beta)T_w$$

$$T_{Ra} = T_R - \beta T_w$$

T_{wa} = wait time adjusted for dispatching conditions

T_{Ra} = ride time adjusted for dispatching conditions

α = 0 for computer dispatched systems

α = .1 - .3 for manual dispatched systems

β = -0.6 to +0.6, negative if T_w is weighted higher than ride time, positive if T_w weighted lower.

MODEL VALIDATION

Even though sufficient validation and documentation of this model exists, the model was also tested with data obtained from the subsidized shared ride taxi study and from the Orange County Transit District (OCTD). The SRT study did not include any ride times, so only the wait time predictions were checked. The observed data is not precise, but represents estimates based on several operator analyses of wait time. The results appear in Table 1.

	wait time (min)		
System	predicted	estimated	%deviation
Fullerton	30.1	30.0	3.2
Orange-Villa	30.2	30.0	0.7
La Habra	18.6	20.0	6.8
El Cajon	15.3	20.0	23.5
La Mesa	19.2	15.0	28.1
San Bernardino	26.9	23.0	17.3
		Mean	13.26
		Std. Dev.	11.5

Table 1

OCTD's Dial-A-Ride system works on a reservation basis. Thus the data here lacked wait times, although the ride time data is precise. The results are presented in Table 2.

System	ride time (min) predicted	observed	deviation
La Habra (Oct-80)	13.98	13.36	4.2
La Habra (Nov-80)	13.93	12.84	8.5
Orange/Villa (Oct-80)	19.74	15.74	25.1
Orange/Villa (Nov-80)	18.52	14 89	24.5
Fullerton (Oct-80)	16.92	13.82	22.4
Fullerton (Nov-80)	17.1	15.32	11.82
			Mean 16.12
			Std. Dev. 8.95

Table 2

Based on Tables 1 and 2 we can see that the model predicts T_W and T_R reasonably well. Considering the stochastic nature of DRT systems the Flusburg-Wilson Model is a good predictor and its simplicity makes it easy to use as a planning tool.