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POTENTIAL FOR FLEXICAB SERVICES: INNOVATIVE USES OF TAXIS AND JITNEYS FOR PUBLIC TRANSPORTATION

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FINAL REPORT

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16. Abstract

Taxis and jitneys can be significant urban transportation resources. Used innovatively to provide public transit services, they can offer mobility in low density areas where mass transit is not feasible, supplement mass transit economically to improve the overall level of service, and promote ridership of regional rapid rail and commuter rail systems and express bus services to reduce the use of private vehicles.

The term *flexicab* has been coined to refer to the range of demand-responsive and fixed-route services that can be offered as extensions of existing taxi/jitney operations. The taxi industry, with its experience in small vehicles, dispatching and flexible routing is particularly suited to flexicab operations. Opportunities for profit exist, particularly when several types of flexicab services are offered by the same operator, permitting him to make maximum use of his labor force and equipment.

Three examples of multi-service flexicab systems are presented in the form of scenarios set in hypothetical urban areas (small, medium, and large). The examples include the calculation of revenues, operating costs, and net earnings.

The report also reviews the present status of the taxi and jitney industry and makes policy and research recommendations. A bibliography and a list of contacts are included in appendixes.

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PREFACE

This report represents a nine-month research effort to investigate the potential of taxis and jitneys for meeting current urban transportation needs and to present the results in a document that would encourage the taxi industry to experiment with innovative services and local government to consider *flexicab* as a public transit option.

The work was carried out under Contract No. DOT-TSC-748 for DOT/Transportation Systems Center, Cambridge, Massachusetts. David B. Hiatt was TSC Project Monitor. Raymond Weil, Office of the Secretary of Transportation, DOT, Washington, D.C., provided overall direction to the study. Their interest in the progress of the study and guidance in the preparation of the report have been very much appreciated.

Appreciation is also extended to the many representatives of the taxi and jitney industry and local transportation authorities who provided insights into the operation of taxi, jitney and dial-a-ride systems and assistance in evaluating the feasibility of innovative flexicab services. Valuable guidance was also supplied by representatives of the Department of Labor and UMTA and the Office of the Secretary in the Department of Transportation.

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1. INTRODUCTION

1.1 PURPOSE AND SCOPE OF THE STUDY

In seeking to improve public transit in urban areas, transportation planners have focused attention on mass transit as the alternative to the use of private automobiles. However, mass transit is designed to move large numbers of people between limited numbers of origin and destination points. Its capital and operating costs are high, and where residential densities are low and commercial and industrial sites dispersed, ridership sufficient to justify these costs cannot be generated by such line-haul services. In these situations public transportation is either not attempted at all, or is provided with inadequate frequency and coverage. Those who own automobiles continue to drive them, adding to congestion and pollution, and those who do not—the poor, the elderly, the handicapped, and those under driving age—are left without adequate transportation.

Often overlooked as a public transportation resource is a third mode offered by various forms of paratransit, such as taxis, jitneys, dial-a-ride systems, cooperative buses, carpools, minicars, and the like. Evidence, especially from other countries, indicates that many of these paratransit forms can be used successfully in situations where mass transit is not feasible, such as in low density suburbs, in small cities, within central business districts, and in transporting workers to places of employment that lie beyond the reach of mass transit.

Paratransit modes can be categorized into three major types: ones that are self-driven, ones that are hailed or telephoned for, and ones that provide prearranged group transportation. The first category includes rental cars and minicars; the second includes taxis, jitneys and dial-a-ride systems; and the third covers carpools and cooperative bus services. The second of these categories—taxis, jitneys and dial-a-ride systems—that are hailed on the street or telephoned for, appears to offer the greatest potential for immediate and widespread implementation.

In recent years federal assistance has made possible a wide range of research and demonstration projects to develop dial-a-ride concepts, computerized dispatching systems, and operating techniques, originally through the

Department of Housing and Urban Development and later through the Department of Transportation. Under DOT sponsorship, studies have also been made of existing taxi and jitney services, but these modes have not received the high level of attention accorded to dial-a-ride. There still exists a need to develop new and expanded uses of these significant transportation resources so that they can function as an important element in urban public transit.

The term *flexicab* has been coined to refer to the broad spectrum of innovative public transit services that can be offered as extensions to traditional taxi operations using taxi-type vehicles. The purpose of this study is to suggest innovative uses of taxi-type vehicles and to assess their potential for performing essential public transit functions. Emphasis is placed on extending the range of existing taxi operations so that they complement mass transit services to create a more effective integrated public transportation system.

This report is directed toward suggesting to the taxi industry the options available for expanding their current operations into flexicab services and toward providing DOT and local governments with information to assist them in making policy decisions regarding the future use of flexicab services.

1.2 RESEARCH APPROACH

The project was carried out in three successive phases: problem definition, analysis, and synthesis. Figure 1 illustrates by means of a flow diagram the sequence of study tasks undertaken. Phase I was directed toward a review of available literature on innovative uses of taxis and jitneys and the design of a final, detailed research plan for the remainder of the study. This was completed within the first month of the project and was presented to TSC in the form of an interim technical report, Current Knowledge and Final Research Plan for Taxi/Jitney Services (INTERPLAN Report 7348 IR). One of the significant findings of this study phase was that the available literature was inadequate to fulfill the information requirement of the remaining study tasks, and it was therefore necessary to make first-hand observations and evaluations of currently operating services.

Phase II was devoted primarily to field investigation of selected taxi, jitney and dial-a-ride operations and interviews with representatives of the taxi industry of federal and local governments concerned with expanding taxi

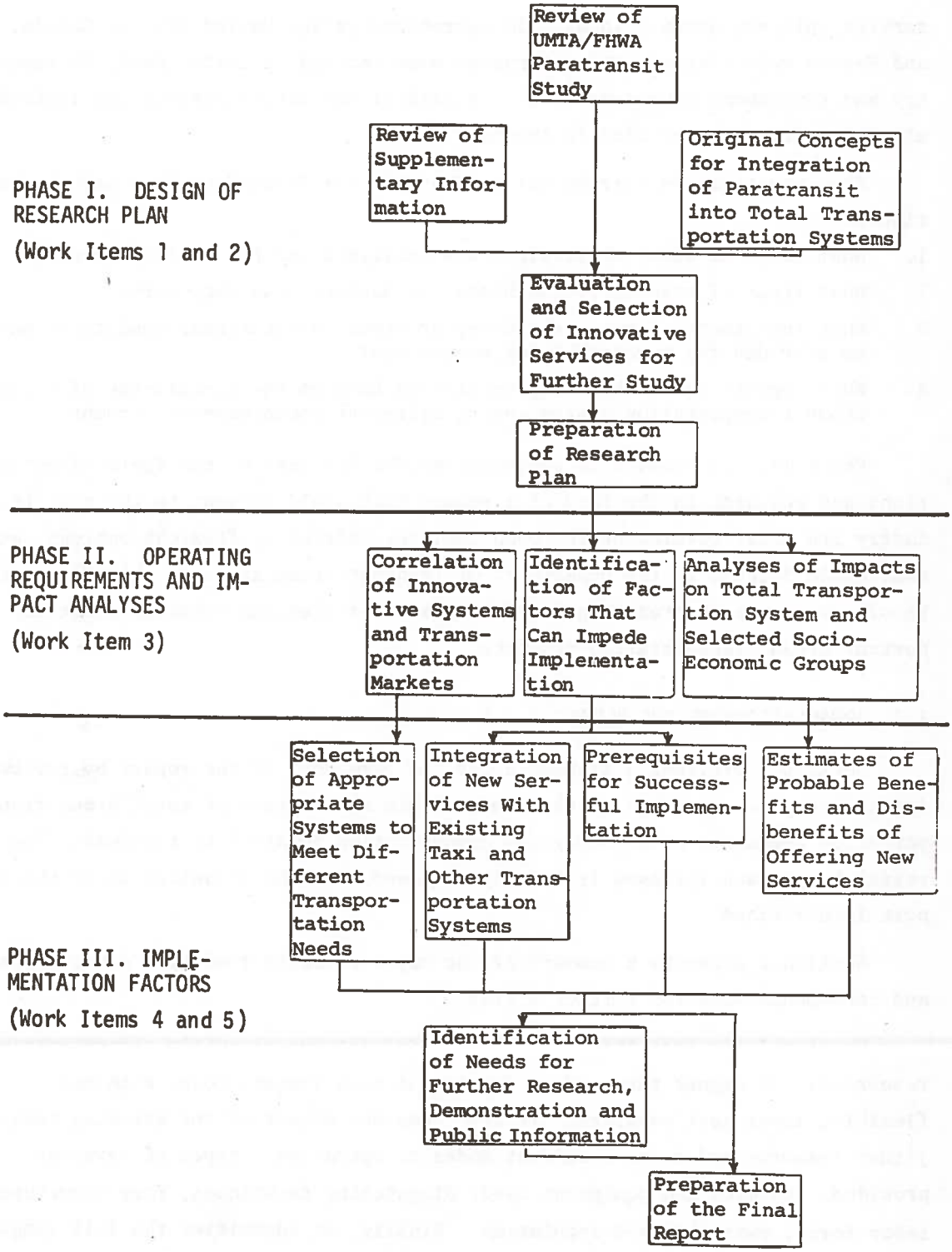


Figure 1. Sequence of study tasks.

service into new areas. In all, 14 operations in the United States, Canada, and Mexico were visited, and interviews were carried out with nearly 40 industry and government representatives. A list of facilities visited and individuals interviewed is provided in Appendix B.

The investigation carried out in Phase II was focused on four major questions:

1. What forms of flexicab services are available and how do they operate?
2. What kinds of transportation needs, or markets, can they serve?
3. What investment, labor, regulatory or other institutional conditions must be provided for successful implementation?
4. What impacts would their implementation have on the functioning of a total urban transportation system and on different socio-economic groups?

Phase III was focused on synthesizing the findings of the field investigations and research in the form of a report that would present to the taxi industry and local government the opportunities offered by flexicab options, and that would suggest to the Department of Transportation areas in which it could be of assistance in promoting the development of flexicab services as an important urban transportation resource.

1.3 ORGANIZATION OF THE REPORT

Section 1 provides a framework for the remainder of the report by reviewing the purpose and scope of the study within the context of total urban transportation needs and prior study and demonstration relative to flexicab. The research approach followed is briefly reviewed, and the organization of the report is described.

Section 2 presents a summary of the major research findings, conclusions, and recommendations for further action.

Section 3 examines the role of taxis and jitneys as public transportation resources. It argues the need to supplement mass transit modes with more flexible, lower cost services. It describes the extent of the existing taxi/jitney resource and reviews current modes of operation: types of services provided, vehicles and equipment used, dispatching techniques, fare structures, labor force, ownership and regulation. Finally, it identifies the full range of extended services that this taxi resource could offer, the major operating

characteristics and requirements of these services, and the types of public transportation needs they can meet. Opportunities for innovation in flexicab are also described and selected innovative services and operating techniques are discussed.

Section 4 presents three hypothetical flexicab systems, each applied to a different urban transportation setting. The first example shows flexicab as the sole means of public transportation in an urban area too small to support a mass transit operation. The second example describes a flexicab system that supplements a limited mass transit service in a medium-sized urban area. The third example presents a flexicab system that promotes ridership of mass transit in a large urban area. All of the flexicab systems are developed as extensions of existing taxi operations and include a number of different flexicab services integrated so as to achieve maximum use of labor force and equipment.

Section 5 presents recommendations for research and policy development that would facilitate flexicab operations and promote their application in urban areas as a public transit resource.

Six appendixes present reference material and further detailed information on flexicab services. Appendix A lists the 97 reports, articles, and other documents reviewed in the preparation of this report. Appendix B lists the names and affiliations of the individuals interviewed during the field investigation of paratransit operations. Appendix C is a detailed description of the 23 types of flexicab services identified during the study. Appendix D discusses the bases for data presented in the three hypothetical examples of flexicab application. Appendix E reproduces some guidelines for estimating demand which may be useful to operators interested in investigating the possibility of offering some of the services described in this report. Appendix F is the declaration of patentable discoveries required under the contract.

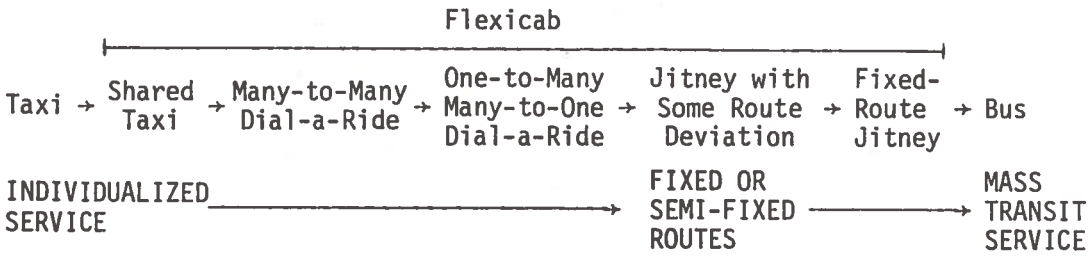
2. SUMMARY OF FINDINGS

2.1 CURRENT STATUS OF THE TAXI/JITNEY INDUSTRY

The nation has a valuable public transportation resource in the 200,000 taxis and jitneys that provide some 2.4 billion rides annually, or nearly 30 percent of the 8.6 billion revenue passengers carried by these and other modes of public urban transportation (1970 figures). There is the potential to make even greater use of these taxi/jitney resources by extending their present modes of operation into new areas. Taxi and jitney operators are concerned with economic difficulties brought about, on the one hand, by inflation that is gradually forcing fares out of the reach of its normal clientele, and on the other hand by competition with subsidized mass transit. The industry is seeking remedies by exploring new types of services and methods of operation and by promoting a closer relationship to the federal urban transportation program.

2.2 EXTENDED USE OF TAXIS AND JITNEYS

Extended forms of taxi/jitney service, or "flexicab," cover a spectrum of public transportation alternatives that range from traditional individualized taxi service to fixed route bus transit, as shown below:



Twenty-three forms of taxi and jitney service have been identified. Several are in common use throughout the United States; some have only been conceptualized but never attempted. All of these forms of flexicab service have the potential to meet certain urban transportation needs, often with greater efficiency and social benefit than can be realized through mass transit or the private automobile.

2.2.1 Markets

Flexicab characteristically provides specialized transportation services for small groups of riders. Its great advantage over public transit in this regard is that the services can be designed to meet the specific needs of these groups. Services can be designed to serve selected socio-economic groups such as residents of a low-income neighborhood, or to provide a specific type of service to a broader group of users, such as feeder service to mass transit systems.

Flexicab offers a feasible alternative to mass transit or the use of private vehicles in five important market areas. It can:

1. Provide the sole means of public transportation in small urban areas when population size and density are not sufficient to support mass transit.
2. Meet the special needs of the elderly, handicapped, and those who cannot drive or have no access to a private car.
3. Supplement mass transit by providing additional peak-period capacity along major transit corridors, substituting for buses during low-demand hours, and offering intermediate services between distant mass transit stops.
4. Increase ridership of mass transit systems by providing feeder services in low-density residential areas and convenient circulation within the CBD.
5. Serve as an immediately available interim public transportation system while extensive mass transit facilities are being developed.

An important feature of flexicab is that several different services, each designed to serve a particular market, can be offered simultaneously by a taxi company within a single integrated operation. In fact, a well-planned, multi-faceted system offers the best potential for optimum utilization of labor force and equipment. One type of service may be directed toward commuters, with a complementary service making use of the same resources during off-peak hours. Services of only moderate urgency such as package delivery can be carried out in slack periods between calls for service requiring immediate response. The same dispatching system and the same maintenance facilities can also be used for more than one service. Many of the operating costs of an additional flexicab service can be absorbed by the original operation.

2.2.2 Vehicles and Equipment

Also characteristic of flexicab is its use of readily available passenger

cars and vans, which permits immediate implementation of new systems at relatively low capital investment. In addition, some form of dispatching system is essential to the operation of the demand-responsive types of flexicab which make up over half of the 23 services identified. Often the taxi company's existing capability can serve both the original taxi operation and new extended services. Development of low-cost, reliable computerized dispatching systems is desirable. However, the need for them can be eliminated in some modes by employing an operating technique called zoning, by means of which demand-responsive vehicles are assigned to only one sector within the service area and each driver plots his own optimum route.

2.2.3 Management and Labor

The taxi industry is capable of carrying out many of these flexicab services at some advantage over mass transit. Taxi operators are experienced in dispatching and flexible routing. Often, a taxi company can use its present dispatch capability to handle a new service. Taxi wage scales are generally lower than transit's, and the taxi industry is oriented to the use of small, less expensive vehicles. Also, as private firms, taxi companies are freer to experiment, to invest in new types of operation, and to abandon those that do not appear fruitful.

The labor force involved is largely determined by the type of management. Where transit authorities extend their activities into flexicab, drivers and mechanics will be members of transit unions. Where taxi operators provide the service, employees will be either non-unionized or members of the Teamsters' Union. Flexicab also offers good opportunities for self-employed owner-drivers and part-time workers.

2.2.4 Impact on Other Transit Modes

Flexicab is capable of performing an essential role in promoting overall ridership of an integrated transit system. It is especially suited to providing feeder services to regional rail transit and express bus systems, and can relieve some of the peak-period demands on transit facilities along major travel corridors. However, if flexicab is implemented in competition to mass transit rather than coordinated with it, its more personalized mode of service can attract riders away from line-haul systems, especially in lower density areas where existing mass transit service is poor.

2.2.5 Regulation

Taxis and jitneys are commonly regulated at the local level, and most existing city ordinances prohibit both shared-use of taxi vehicles and all jitney operations. Eight of the flexicab services described in this report would fall under these prohibitions, and local ordinances would have to be changed to permit their operation. The private operator may find this an almost insurmountable problem, especially where the local transit district opposes his entry into public transit. But if the city government can be persuaded to sponsor the innovative taxi and jitney services, recent experience has shown that it is a fairly simple matter to make the necessary revisions in the ordinances.

2.2.6 Innovation in Flexicab Service

Innovation is an essential ingredient of a successful flexicab operation. It will occasionally take the form of a new mode, but primarily it lies in the inventive application of familiar techniques. Each city has its own unique transportation environment, determined by the characteristics of its population, economy, physical features and existing public transit resources. The challenge is to identify where needs for transportation exist and to design a flexicab system that specifically meets them.

Only two of the 23 extended forms of taxi/jitney service appear not to have been previously applied in U.S. urban areas. The first is the use of jitneys to serve bus routes at times, such as evening hours and weekends, when bus services are suspended. Jitneys can operate more economically than buses at these low-demand times, and their capacity is adequate for small passenger loads. Continuation of service over these periods is of special benefit to those in the community who rely entirely on public transit, and the transit authority may choose to contract for the jitney operation as an alternative to serving the routes with buses.

A second innovative use of jitneys is to supplement bus transit capacity during peak commuting hours. Routed along parallel streets, jitneys could serve not only to improve access to public transportation, but would reduce the number of transit vehicles and personnel required to meet the intense demands of these short periods. The economies derived from more extensive utilization of a smaller fleet might be such that the transit authority could subsidize the peak-period operation of jitneys for commuter transportation.

Two innovative approaches to flexicab operation not yet widely recognized are "turn-key" implementation and zoning of dial-a-ride operations. Turn-key operation allows a private, profit-making taxi company to provide a low-fare subsidized public transit service. Basically, the city defines the type of service the community desires and contracts with a taxi company to operate the service. The taxi company provides drivers, dispatching services, vehicle maintenance, fuel, and all aspects of system management, for which he charges the city at a rate which allows him a profit, usually $10 to $15 per vehicle hour. The city, since it is eligible for capital grants for transit, provides the vehicles. Farebox receipts are credited to the city and reduce the amount of subsidy necessary to cover the contract costs.

Zoning of dial-a-ride operations is carried out by dividing the service area into sectors and confining the operation of any one vehicle to a single sector. Transfer points permit riders to continue their trips into other sectors by changing to other dial-a-ride vehicles or line-haul buses. Dial-a-ride vehicles tour the sector at regular intervals, picking up passengers at their doors, and arrive back at the transfer point to meet the scheduled runs of vehicles from other parts of the city. This system permits a driver to become sufficiently familiar with his zone to design his own optimum routing for a list of riders which he receives at the beginning of each tour. The need for a complex centralized dispatching system is avoided by this method of operation.

2.3 APPLICATION OF FLEXICAB SERVICES

Flexicab services are potentially applicable to a wide range of urban transportation settings. They can be designed to meet needs for public transit in cities of all sizes and can contribute to urban mobility either in conjunction with existing mass transit or as the community's sole means of public transportation.

Three examples of hypothetical flexicab systems, presented in Section 4, are summarized below and serve to validate this finding.

2.3.1 Example 1. Flexicab as the Sole Means of Public Transit in a Small Urban Area

Serving an urban area of 51,000 population where demand densities are too low to support mass transit, the taxi company offers six kinds of flexi-

cab services:

1. A combined dial-a-ride and jitney service during daytime hours subsidized by local government to permit a 25-cent fare. It uses 10-passenger vans and taxis, which provide demand-responsive services by zones and adopt a jitney (fixed route) mode in the CBD.
2. Premium taxi service, expanded from daytime only to 24-hour service.
3. Evening shoppers' transit on late-closing days under contract with the CBD Merchants Association. Daytime dial-a-ride/jitney services are extended past regular operating hours.
4. Occasional evening transit for the City Recreation Department, the Community College and local service organizations to encourage attendance at theater performances, art festivals, rodeos and other public affairs. The daytime service is duplicated in the evenings with these organizations assuming the costs of operation.
5. Subscription commuter services for night-shift workers during the peak food packing seasons. Riders are picked up and delivered to their homes in a manner similar to a commercial carpool operation. The service is free to the workers, and the packing plants pay the taxi operator to organize and manage the service.
6. Delivery services for hospitals, city and county agencies, and local businesses. Urgent deliveries are handled by taxis, others by dial-a-ride drivers on regular tours.

2.3.2 Example 2. Flexicab as a Supplement to a Limited Mass Transit Service in a Medium-Size Urban Area

A taxi company operating in an urban area of 190,000 recognizes the need to supplement a limited transit service that operates only on a few widely dispersed routes and suspends service after 7 p.m. and on Sundays. The flexicab system developed in response to this need includes four types of services.

1. Day-time dial-a-ride by zone providing both internal circulation and feeder service to main line buses. Ten-passenger vans are used, with taxi vehicles available for back-up service. Transfers between dial-a-ride and bus are partially subsidized by the transit district. Standard fare allows for a profit-making operation, but local government selectively subsidizes its use by low-income residents.
2. Jitney service along bus routes during hours when bus service is suspended. This service is subsidized by the transit authority.
3. Evening and weekend dial-a-ride service operated with reduced options for main-line transfer. The same transfer subsidy applies as for weekday service.
4. Continuation of the original shared-taxi service on a reduced scale, used only by those who wish direct transport to their final destinations.

Local government does not subsidize the entire system, but purchases tickets for free distribution to low-income residents.

2.3.3 Example 3. Flexicab as a Promoter of Mass Transit Use in a Large Urban Area

The setting is an urban area of 2 million population, nearly half of which is located in the central city with the remainder divided among four smaller cities and the unincorporated areas. Public transit resources are buses, a commuter rail route, and a partially completed rapid rail system. The flexicab system developed by a large central city taxi company offers four types of services:

1. Shared taxi on a zone-fare basis. Changes in taxi regulations were necessary to permit shared use of vehicles and a shift from metered to zonal fares.
2. Continuation of a much reduced premium taxi service on payment of a surcharge for exclusive use of the vehicle.
3. Dial-a-ride services for smaller outlying communities under turn-key contracts with local governments. These systems provide both internal circulation and feeder service to commuter rail stations and express bus routes.
4. Leasing of jitney vehicles and provision of management services to self-employed jitney drivers for operation on major travel corridors in the central city. Jitneys are routed along streets parallel to those used by buses to reduce traffic congestion. A subsidy is paid by the transit district to jitney drivers operating during peak commuting hours.

2.3.4 Results of Flexicab Implementation

In all three hypothetical cases earnings by the taxi company were improved by entering into flexicab operation. The communities have also benefited by the improvement in public transit. In the small urban area, mobility for those without access to cars has been provided. In the medium-sized urban area, flexicab has improved public transit coverage and service hours at lower cost than would have been possible with mass transit techniques alone. In the large urban area, transit ridership has been increased through suburban feeder services and improved CBD circulation via shared taxi. This has resulted in a reduction in traffic congestion and air pollution, previously at critical levels. In addition, the transit authority has been able to transfer some of the extreme peak demand for transit to jitneys and make more efficient all-day use of a smaller number of vehicles and drivers.

2.4 RECOMMENDATIONS FOR FURTHER RESEARCH AND POLICY DEVELOPMENT

Eight recommendations are made in Section 5 for further research and policy development that INTERPLAN believes will promote the application of flexicab techniques as solutions to current urban transportation problems. These are:

1. Investigation of the actual impacts of jitney operation on mass transit ridership and traffic congestion.
2. Demonstration under DOT sponsorship of subsidized peak-period jitney operation as a supplement to mass transit.
3. Continued development of low-cost, reliable computer dispatching systems.
4. Design of a comfortable, attractive, low-cost vehicle that can be utilized for a wide range of passenger and goods transport services within a flexicab system.
5. Development of simple, low-cost techniques for estimating potential demand for flexicab services as an aid to the design of new systems.
6. Study of existing state and local regulations affecting potential flexicab operations and recommendations for model ordinances that encourage extended uses of taxis and jitneys while maintaining adequate controls.
7. Development of a DOT program to provide local governments with capital assistance to purchase vehicles and equipment for turn-key transit systems.
8. Development of a DOT program for continuous dissemination to the taxi industry and local governments of new information about flexicab applications, operating procedures, and technology.

3. THE ROLE OF TAXIS AND JITNEYS IN URBAN TRANSPORTATION

3.1 THE NEED TO SUPPLEMENT MASS TRANSIT

To urban areas plagued with problems of traffic congestion, air pollution, and lack of mobility for large segments of the urban population, and to a nation seeking to curb its growing consumption of automotive fuels, the substitution of mass transit for the private automobile appears to offer one of the most promising solutions. However, there are some important practical difficulties that stand in the way of solving these urgent problems by this approach.

First, mass transit systems are costly, and cannot be put into operation immediately. A new rapid rail system may require as long as 20 years to implement and cost in the billions of dollars.* Mass transit bus systems can be implemented more easily and at lower cost ($50,000 per vehicle) and can make use of existing roadways, but delays in delivery of new buses are now as long as 3 years.

The second reason that mass transit cannot be universally applied to public transportation needs is that it does not function efficiently except under conditions of high demand density. Moreover, a mass transit vehicle carrying only two or three passengers can contribute as much to traffic congestion and air pollution and use as much fuel as several private autos carrying the same passengers.

Finally, mass transit does not appear as an attractive alternative to those used to the convenience and privacy of their own cars. Except for the captive rider who has no alternative, and the occasional health-conscious

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*The Bay Area Rapid Transit (BART) system in the San Francisco-Oakland metropolitan area serves as an example. In 1951, the California Legislature created a commission to study regional transportation problems; the commission recommended the construction of a rapid rail system. In 1957, the commission was replaced with the Bay Area Rapid Transit District, which was given the authority to plan, construct and operate such a system. It was not until October 1972 that the first 40-mile segment of the system was put into operation, and it was not until mid-1974 that service across the bay to downtown San Francisco was opened to the public. Construction was subject to delays due to engineering design problems, labor disputes and political difficulties, and cost exceeded original cost estimates by $600 million [11].

person looking for exercise, a five-minute walk to a transit stop is about the maximum effort that will be made by users of the system. Similarly, a ten-minute wait for a transit vehicle once the stop is reached appears to be the riders' limit of tolerance. In any other than a high density area, it is not economically feasible to provide that high a level of service.

The flexicab mode, on the other hand, can provide solutions to these problems. It is much less costly and time consuming to implement. The passenger vehicles and vans used for extended taxi/jitney service are more readily available and can be obtained at lower cost than buses. The City of La Mesa, California, for example, faced with a three-week deadline for implementing its taxi-based dial-a-ride system, was able to obtain a fleet of five new vehicles, painted to city specifications, at less than $3000 each within that period. This was done despite the fact that the vehicles had to be purchased by Yellow Cab Company of San Diego, transferred to city ownership at cost, and then leased back to Yellow Cab to operate the new dial-a-ride service.

Flexicab services also function well under conditions of low-demand densities and can efficiently transport a few riders at a time without high consumption of automotive fuels and without aggravating existing problems of traffic congestion and air pollution. Finally, by offering personalized transit designed to meet individual needs of users, the flexicab service more closely approximates the convenience and flexibility of private automobiles than does mass transit and is more effective in attracting former drivers to public transportation.

Five important urban transportation functions can be performed by the flexicab mode:

1. Provide the sole means of public transportation in small urban areas.
2. Provide services that meet the special needs of the elderly, the handicapped, the poor and culturally disadvantaged, and those too young to drive.
3. Supplement mass transit by providing extra peak-period capacity, by taking over services along mass transit routes at low-demand times, by extending services beyond the limits of mass transit routes, and by providing intermediate services between distant mass transit stops.
4. Increase ridership of mass transit systems by providing integrated feeder services through low-density residential areas and convenient short-haul transit within CBDs.
5. Serve as an immediately available interim public transportation mode while a more extensive mass transit network is being developed.

3.2 THE TAXI/JITNEY RESOURCE

3.2.1 Current Status

It is estimated that nearly 200,000 taxi and jitney vehicles are currently in use providing public transportation services in the United States. This number includes 170,000 taxis operating in 7,200 fleets and associations, 25,000 non-fleet owner-driver vehicles serving as taxis, liveries and illegal cabs, and between 400 and 500 jitneys operating in at least nine cities (see Table 1). Annual ridership of these services is estimated to be approximately 2.4 billion, with taxis accounting for 2.38 billion and jitneys an additional 20 to 30 million.* This amounts to about 40 percent of the 6.2 billion revenue passengers carried annually by all other modes of public transportation combined [1].** An estimated 3,361 urban areas are served by taxicabs, while other modes of public transportation serve only 800 such areas.

Because taxi and jitney operations lie entirely within the private sector, and financial data are made public only as is necessary to support applications to regulating bodies for rate changes, it is difficult to form a clear picture of the present financial condition of the industry. This is especially true of jitney operations, since the owners' associations do not even attempt to keep records of daily ridership or fares collected by the individual owner-drivers. The profitability of any one of these businesses depends greatly on the entrepreneurial skill of the operator: his ability to purchase equipment and supplies at low cost, to provide his own maintenance services, to negotiate successfully with local government and with labor, to seek out profitable new areas of business, and to recognize and meet the specific needs of his clientele.

Difficult as it is to evaluate the industry's financial well-being, there are indications that taxi and jitney operations are in difficulty. Between 1964 and 1972 the number of taxi companies nationwide declined by 25 percent and employment in the industry dropped by 15 percent (see Figure 2). In

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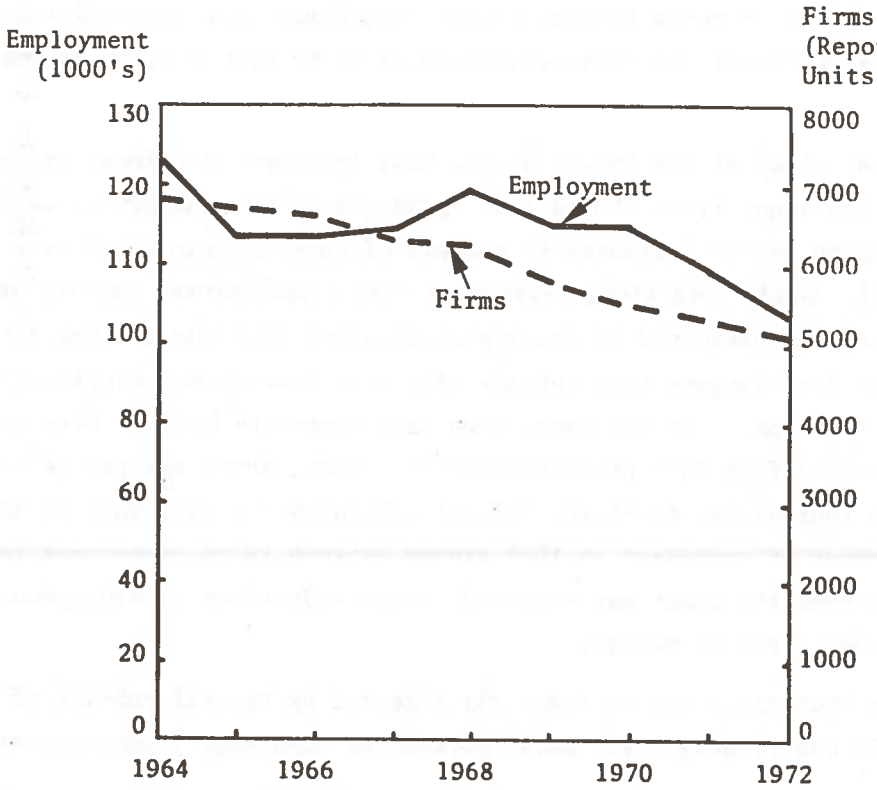
*Based on estimates of 150 passengers per day per vehicle in San Francisco.
**References, Section 6, are listed on page 87.

Table 1. Estimates of taxi and jitney vehicles currently operating in the United States.

	Number of Vehicles	
Taxis in fleets and associations[1]		170,000
Non-fleet owner-driver taxi vehicles:		
Liveries and illegal cabs in ghetto areas[2]	17,000	
Taxis in free-entry cities and small communities[3]	8,000	25,000
Jitneys[4]		400-500
TOTAL		195,400-195,500

[1]International Taxicab Association. "Fact Sheet on Taxicab Operations in the United States." Lake Forest, September 7, 1973.
[2]Kirby, Ronald F., et al. Para-Transit: Neglected Options for Urban Mobility. Washington, D.C., June 1974.
[3]INTERPLAN estimate of independent taxis in Washington, D.C., Atlanta, Honolulu and small communities.
[4]INTERPLAN estimate of jitneys operating in San Francisco, Los Angeles, Atlantic City, Chicago, Pittsburgh, St. Louis, Anaheim, Miami, and Baton Rouge.



SOURCE: County Business Patterns, 1964-1972 [2].

Figure 2. National trends in taxi employment and firms.

1964 New York City fleet medallions* changed hands privately for as high as $35,000; by 1972 the going rate had fallen to $6,000 [3]. San Francisco jitney permits which normally change hands for about $2,000 have recently been sold for $1,000 [4]. Several of the taxi and jitney operators interviewed in the course of this research** remarked on the increasing costs of gasoline, tires, the vehicles themselves, and wages for drivers, dispatchers and other personnel, and were concerned that as they increased fares to keep up with these rising costs, they were pricing their services out of the market.

In addition, the taxi/jitney industry is also suffering from the competition of improved mass transit services. In its efforts to provide mobility for those without adequate access to transportation facilities and to alleviate critical problems of congestion, air pollution and automotive fuel consumption, the nation has recently been subsidizing the development of mass transit in urban areas. Not only have the frequency and extent of transit services been improved in many cities, but fares have been maintained at pre-inflation levels or even reduced so as to be within reach of low-income users.

A recent study of the impact on the taxi industry of federal capital grants for bus acquisition showed that large grants to communities were often followed by marked decreases in numbers of taxi companies and taxi employment [5]. While this study represents only a preliminary inquiry and caution should be exercised in drawing conclusions from the limited data it presents, it does suggest that subsidy of public transit may negatively affect taxi operations. At any rate, some taxi operators believe this to be so. Table 2, derived from data presented in this study, shows changes in the taxi industry in four cities receiving federal subsidies for more than 50 new buses. The number of companies in 1972 ranged between 18 to 50 percent lower than in the year the grant was received, while reductions in employment ranged between 2 and 31 percent.

Jitney operations may be similarly affected by federal subsidy of mass transit. In San Francisco the major portion of rush-hour jitney ridership

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*City permits to operate taxis; in New York the number of these is fixed.
**See Appendix B for a list of persons contacted for this study.

Table 2. Impact of large Federal capital grants on the taxi industry in selected urban areas.[1]

Urban Area	Year of Grant	Number of Buses Acquired Under the Grant	No. of Taxi Companies			Employment		
			Grant Year	1972	Percent Change	Grant Year	1972	Percent Change
San Diego, CA (San Diego Co.)	1967	100	20	12	-40%	1069	847	-21%
Detroit, MI (Wayne Co.)	1966	151	310	253	-18%	3417	3354	- 2%
Providence, RI (Providence Co.)	1965	147	64	32	-50%	529	387[2]	-27%
Seattle, WA (King Co.)	1968	70	32	24	-25%	992	684	-31%

[1]Data derived from Black (Reference 5).

[2]Item was deleted to prevent disclosure in 1972; this total is for 1971.

is generated by Bay Bridge bus commuters who make the bus/jitney transfer in the vicinity of the Terminal Building. With the opening of rail service under the bay, connecting the East Bay and San Francisco segments of the new BART rapid rail system, it is speculated that many of these riders will no longer find it necessary to transfer. While no data are yet available on the impact of this recent development, local observers believe that this is the major reason for the sharp drop in the selling price of jitney permits.

It is significant that the taxi industry's nationwide organization of operators, the International Taxicab Association, has begun to concern itself with expanding the role of taxis in providing urban transportation services. Task forces have been assigned to study intermodal problems, develop criteria for diversified use vehicles, and review existing regulation of taxi services. Its trade journal, Taxicab Management, and agendas of its meetings are increasingly devoted to discussions of dial-a-ride, jitney, shared taxi and package delivery as new areas into which taxi companies can extend their operations [6].

In February 1974 officers of ITA met with representatives of the U.S. Department of Transportation to discuss the future role of taxis in urban transportation, exploring the possibility of technical assistance in developing computerized dispatching and vehicle location systems, and a diversified use vehicle; in eliminating conflicts between federal, state and local regulation of taxi operations; and in drawing up model ordinances to permit less restrictive modes of operation. ITA was also seeking a regular channel of liaison and exchange of information with DOT, and federal recognition of the taxi industry as an important element of public transit.

In sum, the nation has a valuable resource in taxi and jitney services that currently performs a major role in urban transportation and has potential for an even greater one. These private enterprises are being threatened economically by inflation which is increasingly pricing its services out of reach of its clientele and in some cases by competition with subsidized mass transit. The industry is well aware of its situation and is actively seeking remedies by exploring new types of services and methods of operation, and by promoting a closer relationship with the federal urban transportation program.

3.2.2 Characteristics of the Existing Taxi/Jitney Industry

The following discussion is intended to provide a brief review of the major characteristics of existing taxi and jitney services for those not familiar with the industry or who have not had the opportunity to read the excellent detailed descriptions of these public transportation modes in the recently released Urban Institute report on paratransit [3]. Its purpose is to serve as a background for subsequent discussions of innovative services and operating techniques.

3.2.2.1 TAXIS. Types of Services Provided. With few exceptions, taxis in U.S. urban areas provide what is known as "premium service," that is, exclusive use of the vehicle by one party at a time. The party may consist of a single passenger or a group of riders who have previously arranged to travel together. Sharing of taxis by more than one party is usually prohibited by local ordinance, although this prohibition is often ignored in practice in peak demand situations, such as at regional transit depots during rush hours.

In a few cities, notably Washington, D.C.,* sharing of taxis by more than one party is permitted. Additional passengers may be picked up by a vehicle already occupied by a fare, and the taxi may be rerouted to deliver the second party before the original occupant, delaying the latter's arrival at his destination.

Taxis also perform other services, such as package delivery, but the extent to which these other services are undertaken generally differs with the size of the urban area served. In large cities the demand for such special services is great enough to support independent business operations, and taxi operators tend to confine their activities to premium passenger transport. Taxi operators in small cities, however, frequently seek out additional areas of business in order to make supplemental use of vehicles and drivers when they are not providing regular taxi service. In Santa Barbara, California, for example, these activities have included subscription group-riding for commuters, inter-school transport of students needing special therapy or remedial instruction, delivery of meals-on-wheels, transport of welfare patients to out-clinics, rides to work or home for customers of

*Also Davenport, Iowa; Hicksville, New York; Jacksonville, Florida; and Little Rock, Arkansas.

automobile repair shops whose cars must be left to be serviced, and fixed fare dial-a-ride. In Davenport, Iowa, supplemental services have included home delivery of flowers and ice, privately contracted mail service between post office boxes and business firms, transport to the hospital of walking wounded from local manufacturing plants, and delivery of groceries and other supplies via taxi and motorboat to river barges. The range of services uncovered in the course of this investigation is shown in Table 3.

Table 3. Range of services found to be offered by taxi operators.

1. Premium taxi service
2. Shared taxi service
3. Dial-a-ride
4. Jitney (special vehicles)
5. School bus (special vehicles)
6. Airport bus (special vehicles)
7. Ambulance service (special vehicles)
8. Transport of walking wounded
9. Transport of handicapped in wheelchairs
10. Transport of welfare/elderly for essential trips
11. Interschool transfer of special students
12. Private mail pickup and delivery
13. Telegram delivery
14. Deliveries for merchants (e.g., flowers)
15. Delivery of ice
16. Taxi-motorboat delivery of supplies to river barges
17. Air-taxi package service (Skycab)
18. Meals-on-wheels delivery
19. Transport for customers of auto repair shops

3.2.2.1.1 Vehicles and Equipment. Most taxi operators use ordinary passenger vehicles in the lower price range (e.g., Chevy Novas) that carry a maximum of five passengers in addition to the driver. Often the only modifications to the vehicles are installation of the meter box and provision of identifying markers and paint job.

A lesser number of operators use Checker cabs, which are specially built for taxi service and which can hold 7 passengers comfortably. The extra two

passengers are accommodated on jump seats that fold down from the back of the front seat when needed. Sturdier than regular passenger vehicles, Checker cabs are preferred by some operators, but customers find the ride less comfortable because of the more rigid suspension and hard springing of the seats.

Over 136,000 taxis are licensed for two-way radio use, and only two major cities, Washington, D.C., and New York, operate without them [7].

3.2.2.1.2 Dispatching. Where demand for taxi is high, such as at transit terminals, major hotels and central business districts of large cities, drivers obtain passengers by being approached directly by them at cab stands or by being hailed while driving along the street. In the majority of situations, however, where demand densites are lower, taxis operate primarily through radio dispatching in response to telephoned requests for service.

The usual procedure for delivering premium service requires the telephone answerer to record the address at which the party is to be picked up and the time of the call. This information is passed along to the dispatcher who selects the nearest free driver and instructs him via short-wave radio to go to that address. When the driver has delivered the passenger, he radios the dispatcher to inform him of his new location and availability for another fare.

Under certain circumstances, the dispatcher may send out a general call for drivers to volunteer to make a pick-up. This occurs when the dispatcher cannot locate a free vehicle in the desired area, the address is out of the way and will require a long empty trip, or when the dispatcher is working for an owner-driver cooperative.

Drivers, even when they are employees of the taxi company, do not always respond to radio calls, or they may claim falsely that they are no longer in the vicinity of the call if they do not wish to make that particular pick-up. This is the prime motive behind the taxi industry's desire for a vehicle locating system.

Where shared-riding is offered, the dispatching procedure is more complex. Information must be obtained on addresses of both origin and destination and on the number in the party. The dispatcher must keep in mind the location of vehicles en route between two points as well as those that are free, and whether the occupied vehicles leave room for additional passengers.

If he finds that the optimum vehicle to respond to a call is one already in service, he will radio the driver and instruct him to detour from his present route to pick up, and possibly deliver, the new party before taking the original passenger to his destination.

As far as INTERPLAN has been able to find out, no taxi dispatching services are handled automatically by computer, although computers are used by many companies to record and make analyses of demand distribution and driver performance. The efficiency of taxi operations depends heavily, therefore, on the skill of human dispatchers. A dispatcher needs exceptional ability to hold in his mind a constantly changing dispersion of taxi vehicles throughout the service area and keep track of the sequence of calls for service and the elapsed time between calls and pick-ups. He must make instantaneous judgments to balance waiting times against profitable utilization of vehicles, know how efficiently individual drivers will respond to instructions, and convey these instructions clearly with a minimum expenditure of time.

A good dispatcher can control between 30 and 40 vehicles over periods of three to four hours without a break. During peak rush hours he can dispatch 300 calls per hour for premium service and between 100 and 150 calls per hour under the more complex shared-taxi system [8]. When work loads are heavier than can be handled by a single dispatcher, the service area is divided into sections, with one dispatcher responsible for operations within each section. When a taxi driver moves from one segment to another, he comes under the control of the dispatcher in charge of that segment until he moves out again.

Dispatchers usually work with only the most primitive equipment, frequently put together by someone in the taxi operation. Once he has assigned a call to a driver, the dispatcher hangs the ticket recording the call information on a dispatch board marked with the drivers' numbers. A plywood board with L-shaped hooks is often used for this purpose. On the dispatchers' desk is a map of the city, covered with transparent plastic to protect it from finger smudges and coffee spills. In moments of extreme pressure, some dispatchers use small, color-coded metal pellets or similar markers to denote an exceptional situation, such as a very long trip out to the suburbs. Home-

made moving belts are also used occasionally to carry trip tickets from telephone-answering positions to the dispatch station to eliminate the need to get up and walk the half-dozen steps in between them. These are the devices commonly used, even in fairly large taxi operations, to support the dispatcher and his short-wave radio.

Considering the important function dispatchers perform, their salaries are relatively modest, usually ranging from $4 to $10 per hour. One of the major problems that will have to be overcome if computerized systems are offered as substitutes for human dispatchers is to bring the computer costs down to a level competitive to dispatchers' salaries.

Taxi operators are enthusiastic about computer systems, however. Human dispatchers, being human, and subject to the intense pressures of their occupation, are more than occasionally temperamental. They take strong likes and dislikes to individual drivers, select the most profitable fares for their favorites and punish drivers who have made them angry by letting them stand empty for long periods of the day. It is difficult for the manager of a taxi operation to determine whether poor driver performance is due to the driver's negligence or, as the driver often claims, the workings of the the dispatcher. As one taxi company owner put it, "We want computers so we don't have to operate under the tyranny of our dispatcher."

3.2.2.1.3 Fares. Fares are usually determined by distance traveled, most frequently by meters that measure the exact mileage and calculate the appropriate charge. Generally, there is an initial fare for any trip up to a certain distance and then incremental charges for additonal mileage. In cities where traffic congestion is severe, such as New York, meters may also register elapsed time when the speed of the vehicle falls below a certain point. The final fare is based on a combination of distance travelled and the time over which the passenger had the use of the taxi.

More rarely, cabs do not carry meters, and fares are based on a zonal system, as in Washington, D.C. The city is divided into several geographical areas; the minimum fare is charged for a trip completed within a single zone, while incremental charges are made for crossing the boundary into another zone. In some systems, such as in Davenport, Iowa, the individual zone

fares increase with their distance from the CBD; this is to compensate for dispatching an empty cab for a long trip outside of the principal demand area of the city.

3.2.2.1.4 Labor Force. Most taxis are driven by employees of the companies that own the vehicle. Drivers usually receive around 50 percent of the fares they collect plus the entire amount they receive in tips. The industry is not heavily unionized; where it is organized, it is usually within the Teamsters' Union. Earnings of drivers vary widely, depending on the local labor market and the success of their collective bargaining activity, if any. INTERPLAN's estimate of the general range of employee-driver earnings in mid-1974 is $3 to $8 per hour, including tips, with an average of around $5.

The labor force of the taxi industry tends to be unstable. Since most Americans know how to drive, very little special skill is required to become a taxi driver. Drivers must generally be in good health, have clean driving and criminal records, and be able to pass an examination on street locations and regulations on accident reporting, insurance and fare collection. It is an occupation that attracts college students, moonlighters, retired people, housewives looking for part-time work and transients. Many an owner of a small cab company, in order to have the necessary complement of taxis out on the road, has had to sober up a drunk employee or take over himself for a man who has simply moved on without notice.

3.2.2.1.5 Ownership. In recent years the industry has been experimenting with leasing of taxis to drivers who then function as independent operators. Not only does this attract a more stable labor force, but it offers a number of tax advantages and other economic benefits to both the vehicle owner and the lessee. The most common arrangement is for the owner to provide insurance coverage, repair and maintenance, and dispatching services, and to make bulk purchases of gas and oil which he can resell to the drivers at a lower cost than the going retail price.

The fleet owner is still responsible for meeting the service requirements of operating permits or franchises issued by the local government. He must negotiate with the individual drivers to establish working hours that will insure a sufficient number of taxis for each shift to meet the required level of service.

There are also cooperatives where independent owner-drivers form an association to receive the benefits of radio dispatch services, centralized repair and maintenance facilities, and bulk purchasing of fuel, tires and other equipment, as well as group liability insurance.

Finally, there are a considerable number of owner-drivers operating completely independently. The majority of these are found in free-entry cities—Washington, D.C., Atlanta, and Honolulu—and small urban areas. These drivers are under no obligation to provide services on a regular basis and usually elect to work when returns for their time will be greatest. They may have other employment and work only during rush hours before and after their regular working day. In small towns they may operate another business, such as an auto repair shop, which they can leave in response to a call for taxi service.

3.2.2.1.6 Regulation. Taxis are normally regulated by local Public Utilities or Public Services Commissions which control entry into the market, set fares, and establish standards of vehicle safety and insurance coverage, driver qualifications, and levels of service. Often, enforcement of these regulations is delegated to the Police Department. Regulation of taxis at the state level, as in Maryland and Pennsylvania, is rare, and where states are concerned, their involvement is usually limited. In California, as an example, the State Public Utilities Commission controls taxi services only when they operate beyond the boundaries of the incorporated city which they serve.

Entry controls can take the form of exclusive franchises for service within designated areas, as in Los Angeles until recently;* a fixed number of permits, such as the medallion system in New York City; or an unspecified number of permits. In the latter case the city authority may follow a policy of limiting entry to established operators as long as they appear to be meeting demand for services, or may grant permits to anyone who can comply with standards of vehicle safety, driving skills, and fiscal responsibility in case of accidents, as in Washington, D.C.

There is some evidence to suggest that the last described "free entry" policy yields a greater number of taxis on the road and lower fares than where

*Regulations were revised in 1974 to permit more than one operator to serve an area.

limits are placed on the number of operators permitted to provide services [3]. The taxi owners' association, however, continues to favor entry policies that protect established operators from competition from casual or part-time independent owner-drivers, on the grounds that: (1) the established firm can cross-subsidize, with more profitable operations, the financial losses incurred by providing service for low demand areas and times, thus guaranteeing the universal availability of service; and (2) their considerable business investment precludes their failing to meet the responsibilities of damages incurred through accidents [6]. With regard to the second claim, the casual independent driver may very well declare bankruptcy and go out of the taxi business if he is held responsible for damages beyond those covered by his insurance. However, the growth of illegal "gypsy" cabs in ghetto areas of the larger cities raises doubts as to the validity of the first claim that the large, well-established taxi services are adequately meeting demands in low-income areas.

Three other aspects of regulation are of particular concern in attempting to expand the role for taxis in public transit. Ordinances in most cities prohibit ride-sharing. Many smaller cities do not allow taxis to cruise in search of passengers, or accept fares except at taxi stands or in response to telephoned requests for service. Other regulations restrict taxi service to the boundaries of the city served, precluding an extension of demand-responsive service into the suburbs where it is most needed. Such restrictive regulations can seriously inhibit the development of independent flexicab systems, especially where flexicab systems appear to compete with existing transit operations. However, when flexicab is implemented under the sponsorship of local government with the purpose of improving the entire public transit system, any necessary changes in local regulations can be carried out more quickly and easily. For example, on April 2, 1974, Yellow Cab Company submitted a proposal to initiate the first jitney services in Los Angeles for over 50 years; by August 5, 1974, the city's approval had been obtained and the system was in operation.

3.2.2.2 JITNEYS. Types of Services Provided. Jitneys operate along fixed routes, stopping to pick up and drop off passengers only upon request. Jitneys may stop in the middle of a block in answer to a hail, but more regularly they take on and let off riders at designated curb zones near intersections.

In order to operate profitably, jitney operators usually limit service to high density travel corridors, although it is possible for them to provide fixed-route service to a major facility, such as a shopping center, at some distance from the nearest residential or commercial area.

Riders of jitneys are not easily categorized. In San Francisco they are primarily middle- and upper-income commuters to the CBD and low-income residents of the Mission District. Many of the latter are Spanish-speaking immigrants from Latin America who find the jitney a familiar and more comfortable mode of travel than public transit, inasmuch as many of the drivers are also Spanish-speaking residents of the area. In Atlantic City, on the other hand, ridership is largely made up of tourists who find they can travel more easily by jitney than with their own cars because of the shortage of convenient parking spaces. Another large segment of Atlantic City users is made up of school children, who can purchase books of reduced-fare tickets at their schools.

3.2.2.2.1 Vehicles and Equipment. In years past, vehicles used for jitney service ranged from regular passenger cars, through old Checker cabs with jump seats, to former airport limousines in which several doors open along the sides to provide access to individual rows of seats. More recently vans and small buses have become standard.

Eighty percent of the vehicles used in Atlantic City are IHC Metro buses and the remainder are GMC Step Vans and Dodge, Chevrolet or Willis chassis with Brill-built bodies. All of these have 10 seats facing forward [3]. In San Francisco, 95 percent of jitneys are Dodge vans with Ford and Chevrolet vans making up the rest. These are equipped with 12 seats. Many of the vehicles are old, and none, even when new, offers a very comfortable ride. Current purchase price is $8000 to $10,000.

Two new jitney systems were attempted in 1974 in Los Angeles but were subsequently abandoned. One of the ways in which these systems differed from established jitney operations was the type of vehicle used. The first, a taxi-based system, employed five-passenger taxi vehicles, color-coded and flag-bearing to distinguish them from taxis [9]. If the operation had proved a success, the taxi company has intended to shift to 15- to 18-passenger vans. The second, a bus-based operation, used a 19-passenger bus costing $20,000,

equipped with air conditioning, stereo music, bucket seats, and carpeted floors [10].

3.2.2.2.2 Dispatching. Since jitneys are fixed route services, they have no need for the complex dispatching systems of taxi operations. In San Francisco, a dispatcher arranges for van queueing and regulates headways during off-peak hours as a guard against destructive competition among the drivers. During peak periods, controls are dispensed with and each driver makes as many trips as he can. Drivers pay 50 cents per day for this dispatching service.

In Atlantic City, there is a duty roster which assigns vehicles to shifts. The duty roster rotates assignments each week to allow all the drivers to have a turn at the most profitable shifts.

3.2.2.2.3 Fares. Jitney fare systems resemble those of buses rather than taxis. There are no meters, and the passenger pays a flat fare for all or part of a specified route. The Mission Street route in San Francisco is divided into two segments, and the fare has recently been increased to 25 cents for the first half of the trip and 35 cents for the entire route.

A flat fare of 30 cents is charged in Atlantic City, with reduced rates for school children and senior citizens traveling at off-peak times. These reduced fares are subsidized by the community, which pays the Jitneymen's Association the difference between the reduced and regular fare.

In Los Angeles, the jitney-bus fare was 25 cents, in keeping with the current bus fare and jitney services in other cities. The jitney-taxi system, however, charged a flat fare of one dollar for all or part of its route.

3.2.2.2.4 Labor Force and Ownership. Traditionally, the jitney industry has been owner-driver oriented. Drivers worked full-time or part-time as they wished, providing they kept withing agreed upon hours of service. There were no fleets, and the industry was only loosely organized within local voluntary associations that performed certain cooperative functions for the independent owner-drivers.

In San Francisco and Atlantic City these associations represent the owners in negotiations with local authorities regarding rates and service standards, control destructive competition by regulating hours of work or numbers of tours, and provide other mutually beneficial services. The

Atlantic City Jitneymen's Association, for example, operates a parts and repair shop and makes bulk purchases of gasoline and oil for resale to members.

In Los Angeles, two unsuccessful jitney operations broke with the traditional owner-driver characteristic of the industry. The taxi company leased vehicles for $30 per day to drivers who then kept all of the receipts over that amount. The owner of the bus-based system drove the vehicle himself, employing other drivers only as relief men.

Owner-drivers of traditional jitney services probably earned in the vicinity of $7,000 to $10,000 per year in excess of operating expenses.

3.2.2.2.5 Regulation. Atlantic City jitneys are regulated by the City Department of Revenue and Finance which prescribes the fare, the route and general modes of operation through city ordinances. The number of operating licenses is also limited by ordinance to 190. These are reissued each year for $85 to the previous holder, unless he is disqualified by poor driving, safety, or service performance. These franchises can also be traded privately, however, the current price being estimated at about $3,000.

In addition to the jitney license, an owner-operator must also comply with state requirements for public liability insurance for public conveyers and for omnibus license plates.

San Francisco jitneys are regulated by the City and County Board of Supervisors operating through the San Francisco Commissioner of Police. Annual license fees of $22.50 and public liability insurance are required. Up to 700 jitney licenses are allowed under existing regulations, but in recent years this number has been limited in practice to 120. A $1,500 fee must be paid to the city when a license changes hands; this is in addition to the privately negotiated selling price, currently $1,000. Police regulations also limit the number of passengers to 12, the number of seats available. While this is usually enforced, during a transit strike early in 1974, police overlooked illegal standing passengers, being more seriously occupied with controlling the sudden increase of private cars in the CBD.

Los Angeles jitneys were similarly regulated by local authority, the City Board of Public Utilities and Transportation. Changes in existing regulations were required to permit the operation of the new jitney services. However, these changes were neither so extensive nor difficult to accomplish as is commonly believed.

3.3 EXTENDED USES OF TAXIS AND JITNEYS AND THEIR CHARACTERISTICS

Potential uses of taxis and jitneys extend over a spectrum of public transportation alternatives that range from traditional premium taxi service to fixed-route mass transit via bus. Figure 3 illustrates the relative position along this spectrum of the major categories of these flexicab services.

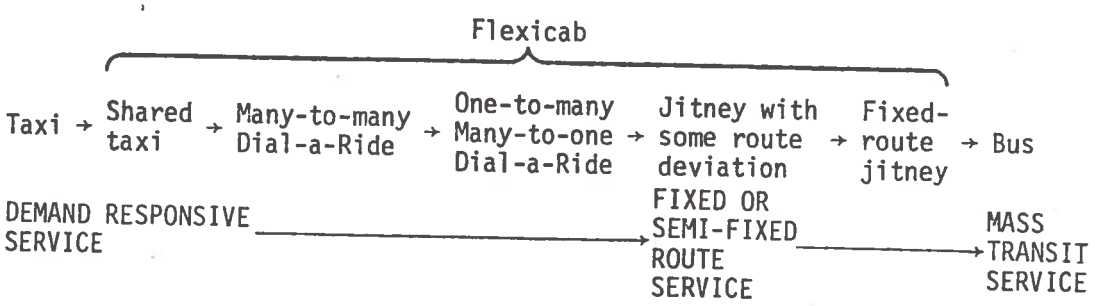

Figure 3. Spectrum of major categories of flexicab services.

Twenty-three types of taxi and jitney services have been identified, some of which are in common use throughout the United States, and others that exist only in concept but have never been attempted. Table 4 lists these services and indicates their location on the flexicab spectrum. Asterisks identify innovations in service that have not previously been implemented.

All of these forms of flexicab service have the potential to meet certain urban transportation needs, often with greater efficiency and social benefit than can be realized through mass transit or private automobiles. Successful implementation of flexicab services, however, depends on selecting the type of service or group of services most appropriate to the specific needs of a given urban transportation environment. The characteristics of a type of flexicab service that generally determine its applicability to a given problem setting are:

- Major socio-economic user groups
- Type of urban environment
- Type of vehicle
- Dispatching technique

Table 4. Extended taxi/jitney services and their relation to the spectrum of major categories of flexicab service.

Specific Forms of Flexicab Service	Spectrum of Major Categories				
	Shared Taxi	Many-to-Many Dial-a-Ride	One-to-Many Many-to-One Dial-a-Ride	Jitney With Some Route Deviation	Fixed-Route Jitney
Demand-Responsive Services					
1. Shared taxi	X				
2. Dial-a-ride/jitney for small cities		X	X	X	X
3. Dial-a-ride for severe weather areas		X	X		
4. Feeder service to mass transit			X		
5. Welfare services for low-income areas		X	X	X	
6. Transport of handicapped in wheelchairs		X	X	X	
7. Inter-school transit for special students			X		
8. Service for retirement complexes				X	
9. Transport of walking wounded	X				
10. Transport for customers of auto repair shops	X	X	X		
Fixed or Semi-Fixed Route Services					
11. Service for intercity terminals			X	X	
12. Jitney between fringe parking and CBD					X
13. CBD circulation minibus					X
14. Jitney to suburban shopping areas				X	X
15. Campus services					X
16. Intra-airport services					X
17.* Late-hour and weekend jitney on bus routes					X
18.* Jitney to reduce peak-hour demand for mass transit					X
Delivery Services					
19. Package delivery for local merchants	X	X	X		
20. Telegram delivery	X	X			
21. Private mail pickup and delivery	X	X			
22. Delivery of meals-on-wheels	X	X			
23. Door-to-door air-taxi delivery	X	X			

*Innovative services not previously implemented.

- Management background
- Potential labor force
- Potential impact on other public transportation modes
- Current regulatory environment
- Potential for profit-making operation.

Tables 5-8 indicate the major characteristics of each of the 23 flexicab options. Further discussion of these features and examples of the application of individual flexicab options may be found in Appendix C. The common characteristics of extended taxi and jitney services are summarized below.

3.3.1 User Groups and Markets

Flexicab operations characteristically provide specialized transportation services for small groups of riders (see Table 5). The most successful operations provide a number of such services to meet different transportation needs. Flexicab systems can function within extremely limited markets, providing either (1) a full range of services for a selected socio-economic group such as the low-income elderly; (2) a specific service to different types of users, such as door-to-door dial-a-ride in areas subject to severe weather conditions, or (3) a local circulation service for special riders within a restricted service area, as with airport jitney service between airline terminals and parking lots. Demand for flexicab service appears to be highly sensitive to intangible qualities such as attractiveness of vehicles, helpfulness of drivers, availability of individualized services, and special equipment (e.g., wheelchair lifts, package accommodation), and less a function of market characteristics such as population size and density, income level, auto ownership, and other conventional measures.

3.3.2 Vehicles and Dispatching Techniques

Flexicab operations are characterized by the use of easily purchased taxi-type vehicles or small vans and buses (see Table 6). Only one of the 23 flexicab options could make profitable use of a mass transit bus, that of transporting automobile commuters from fringe parking areas to the CBD. In practice, mass transit buses are used to provide other flexicab-type services, such as off-peak CBD circulation, only because the service offers an opportunity to use an otherwise idle vehicle.

Table 5. User and market characteristics of flexicab services.

Forms of Flexicab Service	Major Socio-Economic User Groups						Potential Urban Market				
	Commuters	Business travelers	Housewives & other non-commuters	Low-income and jobseekers	Elderly and handicapped	Students & youths	CBD	Central City	Suburbs	Small City & Environs	Special Service Area
DEMAND-RESPONSIVE SERVICES											
1. Shared taxi	X		X		X	X	X	X	X	X	
2. Dial-a-ride/jitney for small city	X	X	X	X	X	X				X	
3. Dial-a-ride for severe weather areas	X		X	X	X	X		X	X	X	
4. Feeder service to mass transit	X		X						X		
5. Welfare service for low-income areas				X	X	X		X		X	
6. Transport of handicapped in wheel-chairs					X			X	X	X	
7. Inter-school transit for special students						X		X	X	X	
8. Service for retirement complexes					X						Retirement complexes
9. Transport of walking wounded		X						X	X	X	
10. Transport for customers of auto repair shops	X		X					X	X	X	
FIXED OR SEMI-FIXED ROUTE SERVICES											
11. Service for intercity terminals		X						X			
12. Jitney between fringe parking and CBD	X						X				
13. CBD circulation minibus	X	X	X	X	X	X	X			X	
14. Jitney to suburban shopping areas			X		X	X			X		
15. Campus services						X					Campus & adjacent residential areas
16. Intra-airport services		X									Airport
17. Late-hour and weekend jitney on bus routes			X	X		X		X	X	X	
18. Jitney to reduce peak-hour demand for mass transit	X						X	X			
DELIVERY SERVICES											
19. Package delivery for local merchants		X	X				X	X	X		
20. Telegram delivery		X							X		
21. Private mail pickup and delivery		X					X	X	X		
22. Delivery of meals-on-wheels				X	X			X			
23. Door-to-door air-taxi delivery		X					X	X	X		

Table 6. Vehicles and dispatching techniques used by flexicab services.

Forms of Flexicab Service	Appropriate Type of Vehicle					Dispatching Techniques Applicable			
	Passenger Car (5 pass.)	Checker Cab (7-8 pass.)	Small Van (12-15 pass.)	Minibus (18-30 pass.)	Mass Transit Bus (40+ pass.)	Centralized Computerized*	Centralized Manual	Dispatcher on Site	None
DEMAND-RESPONSIVE SERVICES									
1. Shared taxi	X	X				X	X		X
2. Dial-a-ride/jitney for small city			X	X			X		
3. Dial-a-ride for severe weather areas			X	X		X	X		
4. Feeder service for mass transit			X	X			X		**
5. Welfare service for low-income areas	X	X	X	X			X		
6. Transport of handicapped in wheelchairs		X	X				X		X
7. Inter-school transit for special students	X	X	X	X			X		**
8. Service for retirement complexes			X	X				X	
9. Transport of walking wounded	X	X					X		
10. Transport for customers of auto repair shops	X	X					X		
FIXED OR SEMI-FIXED ROUTE SERVICES									
11. Service for intercity terminals	X	X	X					X	
12. Jitney between fringe parking and CBD				X	X			X	
13. CBD circulation minibus				X					X
14. Jitney to suburban shopping areas	X	X	X	X					X
15. Campus services			X	X					X
16. Intra-airport services			X	X					X
17. Late-hour and weekend jitney on bus routes	X	X	X						X
18. Jitney to reduce peak-hour demand for mass transit		X	X	X				X	
DELIVERY SERVICES									
19. Package delivery for local merchants	X	X	X	X		X	X		
20. Telegram delivery	X						X		
21. Private mail pickup and delivery	X								X
22. Delivery of meals-on-wheels	X	X	X			X	X		
23. Door-to-door air-taxi delivery	X	X	X			X	X		

*If size of fleet warrants.
**If subscription only.

Thirteen of the 23 forms of flexicab services identified would require a centralized dispatching capability with two-way radio communication with vehicles on the road. All the fixed- or semi-fixed-route jitney-type services can function independently of such assistance, as can regularly scheduled delivery services. Where intensive jitney services are to be provided, such as along major transportation corridors at peak periods, a dispatcher is required at the point where the route begins to insure proper headway spacing between the vehicles operating over the route.

Only five services would appear to have need of a computerized dispatching system, and then only where the operation is a fairly large one. However, these services include shared taxi and dial-a-ride, which serve the widest markets and could have the most significant impacts on the total urban transportation system.

3.3.3 Management and Labor Force

The taxi industry, with its experience in dispatching and flexible routing services, is particularly suited to providing 19 of the 23 services examined (see Table 7). Management with mass transit experience is considered best suited to two of the services—jitney between fringe parking and CBD, and CBD minibus circulation. Flexicab also offers opportunities for the individual owner-operator of a transit vehicle to provide services to a very limited clientele or in a traditional jitney mode.

The potential labor force of extended taxi/jitney systems is largely determined by the type of management operating the service. Where transit authorities extend their services into the flexicab area, the labor force of the new operations will probably be members of the Amalgamated Transit Union. If taxi companies provide these services, drivers will be either members of the Teamsters' Union or non-unionized. Sixteen flexicab services offer employment opportunities to part-time workers: those who are semi-retired, students, or even people with other regular employment who may operate jitney-type services at off-hours. Some conflict between labor interests could be expected where communities attempted to replace mass transit services with taxi-oriented, demand-responsive and jitney services. Problems could also arise if DOT subsidy of these innovative systems were called for because provisions of the

Table 7. Management and labor characteristics of flexicab services.

Forms of Flexicab Service	Appropriate Management Background			Potential Labor Force Involved				
	Mass Transit	Taxi Company	Individual Owner-Operator	Amalgamated Transit Union	Teamsters Union (taxi)	Non-Unionized Full-Time	Part-time No Other Employment	Part-Time Other Regular Employment
DEMAND-RESPONSIVE SERVICES								
1. Shared taxi		X	X		X	X	X	
2. Dial-a-ride/jitney for small city	X	X		X	X	X	X	
3. Dial-a-ride for severe weather areas	X	X		X	X	X	X	
4. Feeder service to mass transit	X	X	X	X	X		X	X
5. Welfare service for low-income areas	X	X	X	X	X	X	X	
6. Transport of handicapped in wheelchairs		X	X		X	X		X
7. Inter-school transit for special students	X	X	X	X	X	X	X	
8. Service for retirement complexes	X	X	X	X	X	X	X	
9. Transport of walking wounded		X			X	X		
10. Transport for customers of auto repair shops		X			X	X		
FIXED OR SEMI-FIXED ROUTE SERVICES								
11. Service for intercity terminals		X			X	X	X	
12. Jitney between fringe parking and CBD	X			X			X	X
13. CBD circulation minibus	X			X				
14. Jitney to suburban shopping areas	X	X	X	X	X	X	X	
15. Campus services	X		X	X	X		X	
16. Intra-airport services			X	X		X	X	
17. Late-hour and weekend jitney on bus routes		X			X	X	X	X
18. Jitney to reduce peak-hour demand for mass transit		X	X			X	X	X
DELIVERY SERVICES								
19. Package delivery for local merchants		X	X		X	X	X	
20. Telegram delivery		X	X		X	X	X	
21. Private mail pickup and delivery		X	X		X	X		
22. Delivery of meals-on-wheels		X			X	X		
23. Door-to-door air-taxi delivery		X	X		X	X		

Urban Mass Transit Act restricting assistance to public bodies [Section 3(a)] and protecting the interests of mass transit employees [Section 13(c)].*

3.3.4 Impact on Other Modes

Innovative flexicab services are generally complementary to regional mass transit systems, such as rapid rail, commuter rail, and suburb-to-city express bus systems. Only one, shuttle service from peripheral parking lots to CBD, is directly competitive to such systems (see Table 8).

Flexicab is highly competitive, however, to both local short-haul mass transit systems and traditional taxi services, since it provides more convenient, personalized services than the first at a lower cost to the passenger than the second. Only two of the 23 innovative modes promote local mass transit usage: the CBD circulation system, and the peripheral-parking shuttle service, which provides essential public transportation links. Suburban flexicab feeder services could conceivably compete with inadequate line-haul transit in the local service area, but promote bus services at the other end of the commute trip.

3.3.5 Regulatory Environment

Fourteen of the 23 flexicab services were found to be commonly permitted by existing taxi and jitney ordinances (see Table 8). These include all of the package delivery services, those that serve special service areas, such as campuses and airports, and those that provide transport for special user groups, such as the handicapped. However, those flexicab modes that have the greatest potential for improving transit for the general public are often prohibited by local regulations against sharing of taxi vehicles and operating jitney services along fixed or semi-fixed routes. The taxi operators attempting to initiate such services independently where these restrictions are in effect may find it impossible to obtain the necessary operating permits, but if local government is involved in promoting the new services, it can change existing regulations to permit flexicab operations.

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*Under the 1974 National Mass Transportation Act, UMTA will be able to fund para-transit operations more easily and intends to promote this type of service.

Table 8. Potential impact on other modes, current regulatory environment and profitability of flexicab services.

Forms of Flexicab Service	Potential Impact on Other Transportation Modes						Current Regulatory Environment		Profitability	
	Regional Mass Transit		Local Mass Transit		Traditional Taxi Service					
	Promotes	Competes	Promotes	Competes	Promotes	Competes	Prohibitive	Permissive	Can Be Profitable	Requires Subsidy
DEMAND-RESPONSIVE SERVICES										
1. Shared taxi	X			X	X		X*	(X)*	X	
2. Dial-a-ride/jitney for small city						X	X			X
3. Dial-a-ride for severe weather areas	X			X		X	X		X	X
4. Feeder service to mass transit	X		X	X		X		X	X	X
5. Welfare service for low-income areas	X			X		X	X			X
6. Transport of handicapped in wheelchairs								X		X
7. Inter-school transit for special students						X		X		X
8. Service for retirement complexes				X		X		X	X	X
9. Transport of walking wounded						X		X	X	
10. Transport for customers of auto repair shops				X		X		X	X	
FIXED OR SEMI-FIXED ROUTE SERVICES										
11. Service for intercity terminals				X		X	X		X	
12. Jitney between fringe parking and CBD		X			X	X		X	X	X
13. CBD circulation minibus			X			X		X	X	X
14. Jitney to suburban shopping areas				X		X	X		X	X
15. Campus services						X		X		X
16. Intra-airport services						X		X	X	
17. Late-hour and weekend jitney on bus routes	X		X			X	X			X
18. Jitney to reduce peak-hour demand for mass transit	X			X		X	X		X	
DELIVERY SERVICES										
19. Package delivery for local merchants								X	X	
20. Telegram delivery								X	X	
21. Private mail pickup and delivery									X	
22. Delivery of meals-on-wheels								X		X
23. Door-to-door air-taxi delivery								X	X	

*Common practice however.

3.3.6 Profitability

Sixteen of the 23 flexicab services appear to be possible to operate as profit-making ventures by taxi companies or individual owner-drivers (see Table 8). Six of these, however, could provide services at fares within reach of a larger ridership if they were publicly subsidized. Where flexicab services are provided with the purpose of insuring an adequate level of mobility for all members of the community, subsidy is essential.

Shared taxis, service between intercity terminals, intra-airport jitneys, peak-period jitneys on major corridors, and package delivery have all been operated somewhere in the United States as profit-making ventures, and can be expected to provide a similar profit for an adept entrepreneur. Services with welfare functions must be subsidized in order to keep the fare within reach of the clientele it is expected to assist. This can be done either by subsidizing the entire system or by a system of selective subsidy where low-income users of the system are provided with transportation stamps (similar to food stamps), free passes or tokens.

The remaining flexicab options either can be operated by private enterprise with fares set so as to realize a profit, or they can be subsidized by some public body. The regional transit authority, for example, may subsidize a feeder bus service in order to promote use of the system. A small city may elect to provide a flexicab transit system at no- or low-fare to achieve certain social benefits; alternatively, such a system can be offered at a cost to the rider that will provide the operator a profit.

A recent development in flexicab services is the "turn-key" operation where the city contracts with a private taxi company to provide all of the vehicles, dispatching and communications equipment, and drivers and management necessary to the operation of a local demand-responsive public transit system. All fares received are turned over to the city, and the city pays the entrepreneur a prearranged monthly fee for his services, which includes provision for his profit. Three such turn-key services are now successfully in operation in Southern California: Huntington Park operated by All-American Cab Company, and La Mesa and El Cajon operated by Yellow Cab Company of San Diego.

3.4 INNOVATIONS IN FLEXICAB SERVICES

Innovation is the essential ingredient of a successful flexicab operation. It may occasionally take the form of a new type of extended service, but more frequently it is demonstrated in the innovative application of familiar modes, types of vehicles, and operating techniques. Flexicab characteristically provides specialized transportation services for small groups of riders. The challenge lies in identifying their needs and designing services that will meet these needs within the framework of the community's unique transportation setting.

Many of the forms of extended taxi/jitney services described above and in Appendix C are familiar. Some are in common use throughout the United States, especially in smaller urban areas where diversification of taxi operations is essential to supplement the cab company's earnings from passenger transport. Sharing of taxis is less common because of restrictive local regulations, but is well recognized in the taxi industry as an option to premium service. Many well-publicized experiments in demand-responsive public transit have been carried out, but these have been conducted either by mass transit authorities or by research organizations under contract to government agencies rather than by taxi operators. (The only known exceptions to this are the three turn-key services identified above.) Only two of the 23 flexicab services identified, late-hour and weekend substitution of jitneys for buses and use of jitneys to relieve peak demands on mass transit, appear never to have been attempted in this country and will be described more fully below. Here, too, it is not so much the mode or vehicle that is new, but their application to common urban transportation problems.

Two other innovative approaches to flexicab operation appear to warrant more detailed discussion, since they are not widely recognized as available options: "turn-key" operation of flexicab by private taxi companies under contract with local government, and zoning of dial-a-ride services for greater efficiency and less dependence on complex dispatching systems.

3.4.1 Late-Hour and Weekend Jitney on Bus Routes

It is common for transit bus services to be suspended in the evenings and over weekends when demands for public transportation fall below the normal daytime weekday passenger loads. In smaller urban areas and in certain neighborhoods in large urban areas, travel during these hours is possible only for those who have access to private vehicles.

Lack of public transit is a particular hardship for low-income, elderly and young residents who do not drive. It also discourages the use of public transit by those who plan to shop, visit friends, or go to theaters or other places of recreation but who will be staying beyond the time when buses can bring them home.

The limited number of riders during these low-demand periods does not appear to justify the high costs of operating buses. Jitneys, however, can be operated at lower cost along these routes, and their small capacity is particularly suited to the limited demand density. Rather than suspend service entirely, it is possible for a community, or a mass transit authority itself, to contract with a local taxi company to provide off-hour and weekend service along bus routes.

Not only do the lower costs of labor and vehicle operation permit the taxi company to offer this service more economically than the transit operator could, but the social benefits can include reduced fuel consumption, air pollution, and noise. The response of local unionized transit workers to such a proposal is not known, but it is possible that some adjustment in taxi drivers' wages or compensation to bus drivers may have to be negotiated, resulting in higher operating costs.

The taxi company can offer jitney service with either regular taxi vehicles or vans. Radio dispatch communications can be used to start vehicles at appropriate headways, perhaps once every hour. Depending on the length of the route, vehicles may be employed between runs in regular taxi service; should the scheduled vehicle not be able to return to the route in time for the next run, another taxi could be called on to substitute.

3.4.2 Jitney to Reduce Peak-Hour Demand for Mass Transit

Meeting peak demands for mass transit capacity during commuting hours is the major problem of transit operations. The system must be large enough to accommodate intensive use during a few hours of the day; during the remaining hours it is underutilized. It is common, for example, to find that the buses in a fleet are used for only one or two trips a day in addition to peak-period services.

The costs of maintaining a sufficient number of drivers and vehicles to meet peak demands are high, yet these resources cannot be used efficiently. Attempts to economize by reducing the capacity of the system result in such overcrowding of available vehicles that public transit is used only by those commuters who have no other option. Under such conditions reductions in traffic congestion, air pollution or consumption of automotive fuels will not be achieved by offering transit as an alternative to the use of private vehicles.

Jitneys offer a possible solution to this dilemma by providing additional peak commuting capacity and relieving some of the need for mass transit vehicles and labor force to handle peak-period demand. Rather than being viewed by transit authorities as undesirable competition, jitneys should be seen as the providers of welcomed support services. A joint agreement routing jitneys along major travel corridors at peak hours, preferably on streets adjacent to bus routes, would not only improve access to public transportation but also would avoid their adding to traffic congestion on streets already used by mass transit vehicles.

Jitney operators are traditionally self-employed owner-drivers, many of whom work only during high demand hours. It is even possible for people with other regular daytime jobs to drive a few jitney tours during commuter peaks on their way to and from work.

In cities where mass transit is heavily subsidized to permit very low fares, it may be difficult for jitneys to obtain riders at fares high enough to permit them to operate profitably. When operating in this mode, jitneys provide a level of service not very different from mass transit: the route is fixed, and often vehicles may load or unload passengers only at specially designated zones along the route. For this reason, any large discrepancy between bus and jitney fares can be expected to limit jitney ridership. Therefore, transit authorities may find that a small subsidy paid to jitney operators will permit them to offer service at about the same fare as mass transit, but that the total cost of this program would be less than providing the mass transit vehicles and drivers necessary to accommodate peak demands.

In Mexico City, the 5,200 *autos colectivos* or *peséros* that operate along 33 routes in this fashion are viewed by the transportation planning department as an essential element of the total urban transit system. By

supplementing the city's extensive subway and bus systems, they serve public transportation needs that would not otherwise be met. In this country, however, jitney service has been discouraged and operates only in a few cities. Viewed as a possible solution to peak-period travel demands, it may come to play a greater role in urban transportation.

3.4.3 Turn-Key Transit Operations by Taxi Companies

The operation of locally subsidized transit services by taxi companies under contract to city government is a recent development, confined thus far to Southern California. Called a turn-key operation, it offers an opportunity for private, profit-making taxi operators to provide a low-fare public transportation service that supplies essential mobility for those without access to private cars.

Basically, the city elects to provide a transit service (all known examples are versions of dial-a-ride) and subsidizes its operation. It defines the social purposes to be achieved by the proposed service and sets fares, extent of service area, hours of operation, and other service standards in order to achieve these purposes. It then contracts with a local taxi operator to provide service to meet these specifications, paying the operator at a rate that allows him to cover costs and make some profit.

The taxi company takes full responsibility for operating the transit system, obtaining and supervising drivers, maintaining vehicles, supplying fuel, and receiving requests for service and dispatching vehicles in response to them. All fare receipts are credited to the city, and the operator bills the city for his services according to the provisions of the contract, which usually specifies a fixed rate per vehicle-hour or vehicle-mile.

Since local government is eligible in California for state assistance in the acquisition of capital equipment for public transit, the city purchases the vehicles and leases them to the taxi company. Theoretically, federal capital grants should also be available for this purpose, but there has not yet been a case where DOT funding has been used.

The city also maintains responsibility for distributing free passes or chits for individual rides to selected welfare recipients, and for promotion

activities, including the distribution and sale of multiple-ride tickets or passes and advertising. INTERPLAN's observation of these local government promotion programs, however, suggests that they could be made more effective with some professional assistance.

A successful example of a turn-key operation is the El Cajon Express, a dial-a-ride service being offered by the Yellow Cab Company of San Diego to El Cajon, a suburban city of 60,000 population. El Cajon is also served by buses operated by the San Diego Transit District, although the routes are designed primarily to carry passengers into the central city. Initiated in December 1973 as a 24-hour, 7-day-a-week, door-to-door service, the system carries between 225 and 275 passengers per day within the city limits.

The fare is 50 cents for one or more passengers having the same origin and destination. Only tickets purchased previously at banks and savings and loan offices, the Chamber of Commerce, or the City Hall may be used. If the passenger cannot present a ticket, the driver must charge a regular, metered taxi fare. If dial-a-ride passengers wish to go beyond the city limits, they must continue their trip under taxi fare.

Dial-a-ride passengers are picked up only in response to telephoned requests; they may not hail a vehicle en route. Response times are excellent; all but 2 percent of calls are answered within 30 minutes, while pickups within 10 minutes account for 76 percent of calls. Drivers are permitted to assist in loading and unloading of packages and personal effects of passengers when requested.

The city is credited with all dial-a-ride fares collected and billed by Yellow Cab at the rate of 80 cents per live-mile of operation. Annual city subsidy of the operation, in excess of farebox receipts, amounts to $120,000.

A major advantage of turn-key arrangements is that through them taxi companies are able to offer demand-responsive services at considerably lower cost than mass transit operators because of lower wage scales and vehicle operating expenses. The arrangement which Huntington Park, California, an incorporated city within Los Angeles, has with the locally based All-American Cab Company is a good example. All-American was awarded the city's contract for dial-a-ride for $8.25 per vehicle-hour, compared to the Southern California Rapid Transit District's bid of $23.50. While the taxi

industry opinion generally agrees that $11 per vehicle-hour would be a more realistic rate for this taxi-based service, the higher rate would still be less than half that required to support the bus-based operation.

3.4.4 Zoning for More Efficient Dial-a-Ride Operation

The single most difficult task of a demand-responsive operation is the scheduling and routing of vehicles so that they are deployed in the most efficient manner possible. When the dispatching function is centralized and vehicles operate totally under its control, the information processing task is enormous. For each service request, information must be obtained on the customer's name, the address of origin, address of destination, number in the party, and if service is not required immediately, when it is desired. The dispatcher, human or electronic, must then select the optimum vehicle to respond to the call, plot a new route for it that is coordinated with its other current assignments, and transmit new instructions to the driver. The dispatcher must then also receive confirmation of the passenger's pick-up and delivery and record the completion of the order. Computer technology in dispatching is improving, but automated systems have yet to prove sufficiently reliable and economical for broad application. Both computerized and manually operated systems become overloaded at periods of peak demand.

Zoning of dial-a-ride operations offers a feasible solution to this problem by permitting a mixed demand-responsive and fixed-route form of operation. Probably the best example of this less recognized hybrid form of operation is the Regina Dial-a-Bus system. Under this system, vehicles are not dispatched in response to individual calls throughout the service area. Instead, the service area is divided into zones of 1 to 2 square miles and dial-a-bus vehicles make a tour through the zone at intervals of 20 minutes, picking up at their doors all passengers who have asked for service. During peak periods, vehicles alternate 30-minute tours so that service is available every 15 minutes.

The tour begins and ends at a zonal depot where line-haul buses going to other parts of the city are scheduled to meet the dial-a-bus vehicles so that riders can transfer easily. Riders destined for other addresses within the dial-a-bus zone are dropped off before the bus returns to the depot. Sixty percent transfer to the line-haul buses.

Over 40 percent of the dial-a-ride passengers are regular subscribers being picked up at the same time every working day. On the peak-period runs these regular users account for 80 percent or more of total passengers. This preponderance of subscribers reduces the dependence of the system on dispatching services, which can otherwise become frequently overwhelmed during peak-demand periods.

In the Regina system each driver going on duty is provided with a series of printed lists of names and addresses of regular subscribers, one list for each 20- or 30-minute tour. Each list is organized to indicate an efficient route through the zone. Just before he leaves the depot for a tour, the driver will receive and acknowledge by two-way radio the names and addresses of unscheduled passengers who have just called for service. The bus driver will then insert these new calls in his printed list where they can be most efficiently handled.

Because the zones are small and each driver operates within a single zone, drivers become so familiar with addresses and street configurations that they can design their own optimum routes without the assistance of a centralized dispatching system. The dispatcher's functions are to take telephone requests for service, relay them to the drivers, and see that the dial-a-ride tours are on schedule so that connections to the line-haul system are met. In the last-mentioned role, the dispatcher acts more like a jitney dispatcher than a dial-a-ride dispatcher.

Computer dispatching is not necessary under this system. In Regina the only use made of electronic data processing is to update the subscriber list when new names are added or regular riders cancel service. The dial-a-bus system does not even own any data-processing equipment but contracts with a local insurance company to process the data and provide them with the printout schedules in time for the early morning commuter runs.

4. APPLICATION OF FLEXICAB SYSTEMS TO THREE REPRESENTATIVE URBAN TRANSPORTATION SETTINGS

4.1 INTRODUCTION

Flexicab services are potentially applicable to a wide range of urban transportation settings. They can be designed to meet public transportation needs in cities of all sizes and can contribute to urban mobility either in conjunction with existing mass transit operations or as the sole means of public transportation.

To illustrate the applicability of flexicab to widely different urban transportation settings, three hypothetical innovative systems have been designed, each representing a flexicab solution to the transportation problem of a city of a different population size group and with a different level of transit service, and each being typical of many existing U.S. urban areas. The examples selected are:

a. An urban area of 51,000 population with no existing public transportation and with demand densities too low to support mass transit. (Examples: Auburn, Maine; Normal, Indiana; Sherman, Texas; and Napa, California.)

b. An urban area of 190,000 population in which a limited bus system operates on a few, widely dispersed routes but offers no service between 7 p.m. and 6 a.m. or on Sundays. (Examples: Charleston, South Carolina; Green Bay, Wisconsin; Galveston, Texas; and Pensacola, Florida.)

c. An urban area of 2 million population where public transit is provided primarily by buses, but which also is served by a commuter rail route and a partially completed regionwide rapid rail system. (Examples: Pittsburgh, Pennsylvania; St. Louis, Missouri; Baltimore, Maryland; and Minneapolis-St. Paul, Minnesota.)

Flexicab systems can be designed to perform more than one function; a number of different types of service can be incorporated into a single operation. In fact, providing a variety of services offers the flexicab operator the opportunity to maximize the use of his vehicles, drivers, and dispatching services throughout the day and to reduce the costs of providing any one type of service. Creative flexicab management will seek out unmet transportation needs and will design services that will respond to these needs in a way that complements taxi-based services already offered.

There is no standard optimum design for a flexicab system. Each urban area has its own unique pattern of travel demands, derived from land use patterns, the road network structure, and the locations of community facilities, such as hospitals, government offices, and shopping and recreation centers.

The successful flexicab system will offer a range of services designed to match specific local travel needs. Appendix E, reproduced from the dial-a-bus manual prepared by the Canadian government, discusses available techniques for estimating market demand which may be applied to any type of flexicab service.

The hypothetical flexicab systems presented here are designed to meet the particular needs of their individual service areas. Certain specific characteristics have been attributed to each hypothetical urban area. These include the geographic distribution of its population; the age, income, and ethnic characteristics of its population; its economic base and economic activity patterns; and the location of selected social, cultural and recreational facilities that create travel demands.

The details in these examples are largely derived from actual urban areas, but simplifications have been made in order to focus on selected transportation needs. Conditions have sometimes been generalized so that the hypothetical situations will be recognizable to more taxi operators and local officials in other urban areas.

Each example begins with a summary of selected population and economic characteristics and of the area's physical features. A map of the hypothetical area is provided as an aid to identifying transportation resources and problems. The taxi service and mass transit system, if any, are then described as they existed prior to flexicab. This description is followed by a more detailed discussion of the flexicab system itself, its origins, and its present form.

In each example, the discussion of the origins of the flexicab system focuses on the initial attempts to implement flexicab services. It describes how support and cooperation were gained from local government and transit authorities, how essential changes in taxi regulations were achieved, and how new franchises, operating permits, and subsidies were obtained. Typical errors made by the hypothetical taxi operator in his initial selection of service areas, fares, or operating techniques are also revealed, as well as the ways in which these errors had to be corrected before the flexicab system could be successful. These errors were suggested by the real experiences of taxi operators in their first attempts to implement flexicab services. It is hoped that their examination here may assist some future operators to avoid them.

Each of the flexicab services offered is described in detail, including clientele, methods of operation, types of vehicles and other equipment used, fares, and special features. Typical operating costs are presented. Special attention is given to describing the integration of the different services and the complementary effects of improved utilization of labor force and equipment. The combined results of all services offered are then presented, including comparisons of the net income of the former taxi service with that of the new flexicab operation, and an account of the social and environmental benefits to the community. Bases for the data presented for each example are described in Appendix D; numbered references in parentheses, e.g., (D-1), direct the reader to numbered paragraphs in that appendix.

It is hoped that these hypothetical case histories will convey to taxi operators and representatives of local government how innovative flexicab services can help to solve some of our pressing urban transportation needs.

4.2 FLEXICAB AS THE SOLE MEANS OF PUBLIC TRANSPORTATION IN A SMALL URBAN AREA

4.2.1 The Setting

The urban area hypothesized for this example of the application of flexicab has a population of 51,000 and demand densities too low to support a mass transit service. Auto and truck ownership is nearly one for every two persons in the area. Parking in the CBD is often difficult to find, and peak-period traffic congestion is a problem on the major city streets and freeway access roads, However, over one-third of the residents of the area are unable to drive private automobiles because of age, income, state of health, or inclination, and the community needs some form of public transportation. This need is met by a multifaceted flexicab service operated for profit by a private entrepreneur.

The area centers around a city of 33,000 that functions primarily as a market town for a sizable agricultural region. An additional 18,000 people live in unincorporated areas surrounding the city, with over half of these clustered in a village about 5 miles from the city limits.

Most jobs in the area are related directly or indirectly to agriculture. Local crops are both highly seasonal and labor intensive, which results in extreme fluctuations in employment and significant movements of transient agricultural workers. There are two large food-processing plants that rely heavily on housewives and students as a labor force during peak packing seasons. The

city's function as a market center supports a substantial retail and service industry as well as many government offices. The only major source of jobs that is not oriented to agriculture is a plant manufacturing aviation-related electronic components at a recently developed industrial park adjacent to the airport, southwest of the city.

Average family income in the area is high, but nearly 20 percent of the local population lives at or below the poverty level. Most of the low-income population belongs to the area's principal minority group, which makes up the bulk of the unskilled agricultural work force. Low-income residential areas are located in the village and in the northern section of the city, where there is a subsidized housing project.

Figure 4 shows the configuration of the area and the location of selected facilities that generate travel demands. The central business district is located on Main Street, a broad, heavily traveled road that was formerly a segment of the major north-south state highway. A recently constructed freeway now bypasses the city to the east. Access from the freeway to downtown is provided by another heavily used road that crosses Main Street in the CBD and continues west to the village. A third access road south of the city limits connects the freeway to the airport and the new industrial development.

Interregional passenger transport is available by air and bus. The buses perform no local transportation function, however, as they are routed along the freeway and make only one stop, at the downtown bus depot. A railroad spur line carries produce from the area to a mainline track, but does not offer passenger service. School buses carry students from all sections of the area to its only high school, located on Main Street just south of the CBD. These buses are subsidized by state education funds, and are not used for any purpose other than transporting school children.

Community facilities that generate significant travel demands include:

a. The city government offices and the recreation center, located adjacent to the CBD
b. The city hospital on First Avenue near the freeway
c. The community college immediately southeast of the city

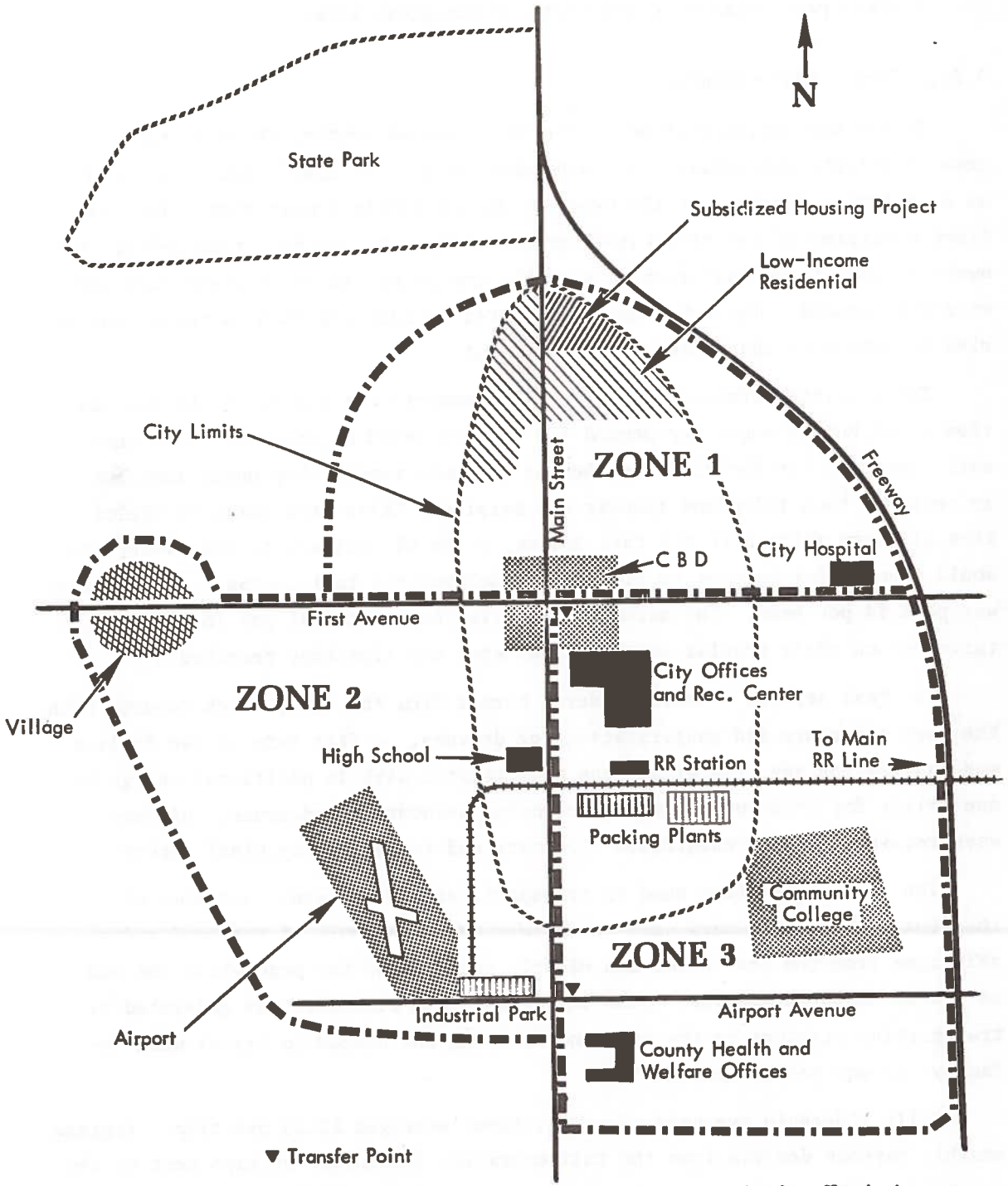

Figure 4. Configuration of an urban area of 51,000 population showing flexicab zones.

d. The county health and welfare offices, recently relocated from the city center to new buildings constructed on county land south of the city limits

e. A state park located to the north of the urban area.

4.2.2 Former Taxi Resource

Before the implementation of the new flexicab system, those without access to private automobiles were dependent on a local taxi service operated as a part-time business by the owner of an automobile repair shop. The taxi fleet consisted of two five-passenger vehicles, with one full-time driver; the owner or one of the four mechancis in his employ providing supplementary service when needed. The vehicles were painted to identify them as taxis, but carried no meters or short-wave radio equipment.

Taxis neither cruised in search of passengers nor parked at the bus station or at hotels where the demand for service would be expected to be greatest. Instead, the vehicles remained at the auto repair shop until sent out in response to a telephone request for service. Calls were taken by the office girl and relayed to the taxi driver, or in his absence to the owner, who would then select someone to pick up and deliver the taxi customer. The driver was paid $4 per hour. The mechanics received no additional pay for driving taxis beyond their regular salaries, but kept any tips they received.

The taxi service operated under a permit from the city, which covered both the fare structure and qualifications of drivers. A flat fare of two dollars was charged for any trip within the city limits, with an additional charge of one dollar for trips out to the surrounding unincorporated areas. Drivers were required to hold chauffeurs' licenses and to have no criminal record.

The taxis were often used to transport, without charge, customers of the repair shop whose cars were being serviced. The bulk of the paid ridership came from the low-income and elderly segments of the population who had no access to an automobile. Some additional paid ridership was generated by transporting visitors to the city and children who needed to travel when the family car was not available.

Daily ridership averaged 43 trips; fares averaged $2.20 per trip. Average monthly revenue derived from the taxi operation (exclusive of tips kept by the

drivers) was $2,838. Monthly operating costs came to $2,547, covering driver's wages and benefits, vehicle replacement and repairs, fuel and tires, and insurance. Relief drivers' wages and dispatching costs were absorbed by the auto repair operation, leaving an annual net income from the taxi business of $3,500 [D-1].

4.2.3 The Flexicab System

4.2.3.1 ORIGIN OF THE SYSTEM. When the country health and welfare offices were relocated south of the city, there was a significant increase in the use of taxis for trips between the new facility and the low-income residential area north of the CBD, and the need for low fare public transportation was brought to the attention of the city council. Bids were obtained from transit operators for a communitywide system, the lowest of which was $22 per vehicle-hour for a three-route bus system with 45-minute headways during weekdays and Saturdays but no evening or Sunday service [D-2]. Ridership of the proposed system was estimated at 500 per day. At the 25-cent fare selected by the city council as appropriate for a service directed toward low-income users, total daily revenues would be $125, while daily costs would be $858, producing an annual deficit of $229,429 to be covered by the city (see Table 9).

The taxi operator then offered to provide a combined jitney and dial-a-ride system, using 10-passenger vans and taxi vehicles, at a cost to the city of $11 per vehicle-hour. At 500 passengers per day, this system would require an annual subsidy of only $163,155. However, the taxi owner estimated that his higher quality of service would attract twice as many passengers as the bus service, especially among the elderly, if the city permitted him to charge the same 25-cent fare. Daily revenues would then be $250, while costs to the city would be only $572. Even with the addition of Sunday service, the annual deficit of the larger flexicab operation would be $117,500, or about half the cost to the city of the bus system [D-3]. Table 9 shows how the two bus and taxi estimates compare.

The city council has contracted with the taxi operator to operate this innovative public transit service for an experimental two-year period.* In addition to the combined jitney and dial-a-ride service, the taxi operator offers premium taxi service by telephone request and has sought out a number of

*Under the provisions of the 1974 National Mass Transportation Act, the city could apply to UMTA for all or part of the subsidy required ($117,530 in this case).

Table 9. Comparison of bus and flexicab public transit systems proposed for a small urban area.

	Bus System	Flexicab System	
COST TO CITY			
Rate per vehicle-hour	$22	$11	
Number of vehicles in operation	3 buses	{3 vans full time 2 taxis half-time	
Hours of service per day	13	13	
Days of operation per year	313	365	
Annual cost of contract for public transit service	$268,554	$208,780	
ESTIMATED REVENUES FROM FARES			
Passengers per day	500	500	1,000
Fare	$.25	$.25	$.25
Days of operation per year	313	365	365
Annual revenue	$39,125	$45,625	$91,250
NET COST TO CITY	$229,429	$163,155	$117,530
Flexicab system as percent of bus system in cost to city.		71.1%	51.2%

new markets for compatible services. These are integrated into a single system that makes maximum use of his drivers and vehicles.

4.2.3.2 TYPES OF SERVICES OFFERED. The present flexicab system now offers six types of service designed to meet a full range of local transportation needs.

4.2.3.2.1 Basic Jitney and Dial-a-Ride Transit Service. This service, subsidized by city funds, provides essential mobility for those without access to private automobiles. It also offers an alternative means of commuting to those who would otherwise drive to work, thus reducing demands for CBD parking and relieving some of the peak-period traffic congestion [D-4].

The service area extends beyond the city limits to include the community college, the airport and industrial park, the hospital, and the unincorporated village five miles west of the city. It is divided into three zones: Zone 1 covers the portion of the city north of First Avenue, including the low-income residential area and the city hospital; Zone 2 extends west of Main Street and serves the village and the airport-industrial park area; and Zone 3, east of Main Street, includes the city offices and recreation center, the food-processing plants, the community college, and the county health and welfare offices.

Every half-hour a van makes a tour through each zone, stopping at the addresses of people who have previously arranged to be picked up, but also taking on other passengers hailing them en route. These tours begin and end at one of the two transfer points located on Main Street, one in the CBD at First Avenue and the other south of the city limits at Airport Avenue. Vehicles then travel the length of Main Street between the two transfer points in a fixed route mode, returning to their zone in time for the next dial-a-ride tour. Occasionally the two taxis are used for out-of-the-way pickups or when vans are temporarily out of service. At these times taxi vehicles carry flags indicating that they are dial-a-ride vehicles. Drivers are permitted to leave their vehicles to help elderly and handicapped passengers to and from the door and with packages. Ridership currently averages 1,000 per day.

Many of the riders are regular users, with standing orders for service so they do not need to telephone each time they wish to be picked up. These standing orders are recorded on magnetic tape in the data processing center operated by the community college. When the flexicab office receives requests for new regular service and changes in pickup time or cancellation, it records these on standardized data input forms and delivers these to the computer center at the end of the day. Each morning an updated computer listing of subscribers' names, addresses and destinations is picked up by the flexicab office in time for the first run.

The computer listings are organized by zone and time intervals corresponding to each of the half-hour tours, and are arranged within these groups for the most efficient sequence of operation. The appropriate set of listings is given to each driver at the beginning of his shift. Just before the driver starts, and while he is en route, he radios the dispatcher to find out if any additional calls for pick-up have been received. If so, he records the names, addresses, and destinations of these new passengers on the computer listing, inserting them between his regular stops where they can be most efficiently handled. Familiarity with the service area permits the driver to design his own optimum routing, and no costly computerized dispatching system is necessary.

Costs to the former taxi owner of operating this basic transit service amount to $194,000 per year, allowing him a profit of $15,000 out of the $209,000 he receives from the city. His costs are broken down as follows:

Table 10. Flexicab operating costs in a small urban area.

Manager-dispatcher (including benefits)	$ 30,000
Drivers (including benefits)	102,300
Vehicle replacement (3-year life)	8,000
Vehicle maintenance	13,000
Gas, oil, tires	20,100
Radio equipment (10-year life)	500
Insurance	4,500
License fees	800
Rent, phone, office equipment, miscellaneous	7,200
Legal, accounting and computer services	8,000
	$194,400

[See D-5].

4.2.3.2.2 Additional Flexicab Services. In order to improve his earnings from the city-subsidized transit service, the flexicab operator sought out additional business that would permit him to maximize the use of his equipment and personnel. These included a continuation of premium taxi service, and specialized passenger and goods transport services for the business community and public agencies in the area.

Premium taxi service is carried out by the two taxi vehicles during the time they are not being used to back up jitney and dial-a-ride service. The premium fare has been increased to $2.75 for in-city trips and $3.25 for those outside the city limits. All-night service has been added, with dispatching handled by an answering service which the flexicab company has provided with a two-way radio for contacting vehicles. Over half of the fares are generated at night after the city-sponsored dial-a-ride/jitney service has ceased operating. Patronage of the premium service has declined, but still averages 23 trips per day and produces an annual revenue of $25,000.

The operator can afford to service this limited market for premium taxi service only because many of the operating costs are already accounted for in the facilities and equipment essential to basic flexicab transit service: vehicle replacement and maintenance; daytime dispatch service and radio equipment; insurance and license fees; and management and office support. The only additional costs are drivers' wages, night dispatch services, and fuel, amounting to $21,000 per year. Therefore net income derived from the premium taxi operation averages nearly $4,000 per year. More importantly, the community is now provided with 24-hour public transportation [D-6].

The flexicab operator also provides special-purpose transportation under contractual arrangements with the business community, service organizations, and local public agencies. Most of these are scheduled in the evening hours when the city-subsidized jitney and dial-a-ride system is not operating.

The city council feels that the essential public transit needs of those without access to private cars is adequately met by daytime service, when trips to medical facilities, welfare agencies, shopping and various public facilities can be accomplished. The inclusion of Sunday public transit also makes possible attendance at church, visits, and access to movie theaters and restaurants. This, the council believes, is the maximum level of public transportation service the city can afford to subsidize; if there are demands for public transit outside of these daytime hours, they must be funded from other sources.

The CBD Merchants Association contracts with the flexicab operator to continue daytime service from 7 p.m. to 10 p.m. every Friday evening and during the two weeks before Christmas, when stores remain open until 9 p.m. The association pays a higher rate than the city to cover the additional cost of time-and-a-half wages, or $15 per vehicle-hour, providing the flexicab operator with an annual gross revenue of $10,000. Fares collected are deducted from charges to the Merchants Association. The flexicab operator's additional operating costs include wages for his drivers, dispatcher-manager and telephone-clerical worker, and vehicle-related costs. This evening shoppers' service adds another $2,700 to the net income of the flexicab operation [D-7].

The community college, the city recreation department, and local service organizations also sponsor occasional evening public transit service to encourage attendance at theater performances, art festivals, rodeos and other public affairs. These are also billed out at $15 per vehicle-hour and net the flexicab owner an additional $1,200 per year [D-8].

During the peak packing season, the processing plants operate 24 hours a day with three shifts. Since many of their temporary workers are housewives and students without their own cars, the flexicab operator saw a potential need for offhours public transit to serve those changing shifts at midnight. Under contract with plant management, he operates a subscription commuting service, picking up people who will begin work at 12 and taking home those who have just finished their shifts.

He hires college students for $15 for a two-hour shift between 11 p.m. and 1 a.m., the equivalent of the minimum wage for a four-hour half-day's employment. They first pick up subscription passengers at their homes and drive them to the plant, carrying a total of 60 riders on two half-hour runs. Then they complete two subsequent tours for employees leaving the plants.

Parking space is in extremely short supply at the packing plants, and management encourages the use of the subscription service, even by those who have their own cars, by staggering work hours over the 11:00-1:00 period and by subsidizing this service at no cost to their employees. They pay the flexicab owner a basic fee of $2,500 for the work involved in organizing and scheduling the subscription service and an additional 75 cents per day for each rider.

During the 10 weeks that the packing plants are on 24-hour operation, the scription service provides 7,200 rides. It costs the flexicab operator 52 cents in drivers' wages and vehicle costs to carry each passenger. In addition, it costs him $1700 to schedule the service, using staff and equipment at the computer center of the community college. Net profit on this service is approximately $2500 [D-9].

The flexicab operator also provides a variety of special delivery services for the hospital, local government, and the business community. Most of these are handled by drivers on their regular routes, but where immediate delivery is requested, the backup vehicle will be utilized for a special trip. Services for the hospital include picking up perishable drugs and special equipment at the airport, and urgently needed medical records from the offices of local doctors. Interoffice mail for the city and between the city and county buildings is exclusively handled by flexicab. The electronics components manufacturers contract for pickup and delivery of mail at two-hour intervals, a level of service the U.S. Post Office is unable to provide. Flexicab is also used by local merchants for deliveries of flowers, candy, liquor, prescriptions, and other goods in lieu of operating their own delivery services. The delivery service does not add significantly to basic operating expenses, and grosses an average $75 per day, 6 days a week. Net profit to the operator is $6400 per year [D-10].

In summary, by combining a number of transportation services within an integrated flexicab system the operator has not only provided a much needed public service to the community, but has also created a successful business. Net annual

earnings from the combined operations are given in the table below.

Table 11. Flexicab company annual earnings in a hypothetical small urban area.

City-subsidized jitney/dial-a-ride service	$15,000
Premium taxi service	4,000
Evening shoppers service	2,800
Special events evening service	1,300
Subscription service during peak-packing season	2,500
Delivery services	6,200
TOTAL	$31,800

In seeking out additional markets for his operation and designing services responsive to the special requirements of these markets, the flexicab operator has maximized the utilization of his labor force, vehicles and managerial skills. He has nearly doubled his profits over the level earned from the original city-subsidized service, and has multiplied by nearly ten times the earnings of his former marginal taxi business.

4.3 FLEXICAB AS A SUPPLEMENT TO A LIMITED MASS TRANSIT SYSTEM IN A MEDIUM-SIZE URBAN AREA

4.3.1 The Setting

The medium-size urban area hypothesized for this example of the application of flexicab is a community of 190,000 population served by a bus system that operates only on a few widely dispersed routes and discontinues service between 7 p.m. and 6 a.m. and all day Sunday. Since nearly one-third of the area's residents have no access to private vehicles and the few bus routes lie beyond comfortable walking distance for many of them, flexicab is used to supplement the spatial and temporal coverage of public transit service. Flexicab was selected for this function because it could provide a higher level of service at less cost than would be required to expand the mass transit system to meet these demands.

The population of the area is almost evenly divided between the central city and the adjacent unincorporated areas. The built-up area extends along a narrow shelf of land between a mountain range and the ocean. The economic

base is fairly diversified. There is some agricultural production of citrus, avocados and poultry, but light manufacture of small machine and automotive parts and electronic equipment is a far more important source of jobs. Because of the city's location and favorable climate, the tourist industry also employs a large segment of the labor force in motels, restaurants, recreation facilities, and vistor-oriented retail establishments. A major campus of the state university system, located north of the city, is not only a significant generator of employment in itself but has also attracted a number of research organizations to the area.

Family income is somewhat higher than the state average. This is due partly to the highly trained personnel required by some of the specialized manufacturing firms, research organizations, and the university, and partly to the area's attraction of well-to-do retired people. However, 16 percent of the residents have incomes below the poverty level. Many are non-English speaking immigrants who supply much of the area's unskilled labor force; others are the not-so-well-to-do retired who live on social security benefits and tiny pensions. The low-income residential areas are located both within the city and in the unincorporated areas.

Figure 5 shows the configuration of this medium-size urban area, the location of selected facilities that generate travel demands, and the routes of the bus transit service. The dominant transportation feature of this area is a north-south freeway paralleling the coastline. Cross-traffic is accommodated by overpasses in the unincorporated areas and by underpasses within the city limits. The main street of the city, along which the CBD is located, intersects the freeway at right angles. The western extremity of Main Street leads directly onto a pier where restaurants, shops, and other tourist attractions have been constructed. Adjacent to the pier are the city's public beach and boat harbor, as well as motels catering to vacationers. Parking accommodations in the CBD are limited. The extreme north-south orientation of the city and the limited number of options in through-routes create moderate peak-period congestion on the freeway and access roads.

South of the CBD is located the city's industrial area, surrounded by low-income housing. City and county offices are concentrated in the southeast corner of the CBD. The city high school lies just south of the local government complex within the low-income housing area.

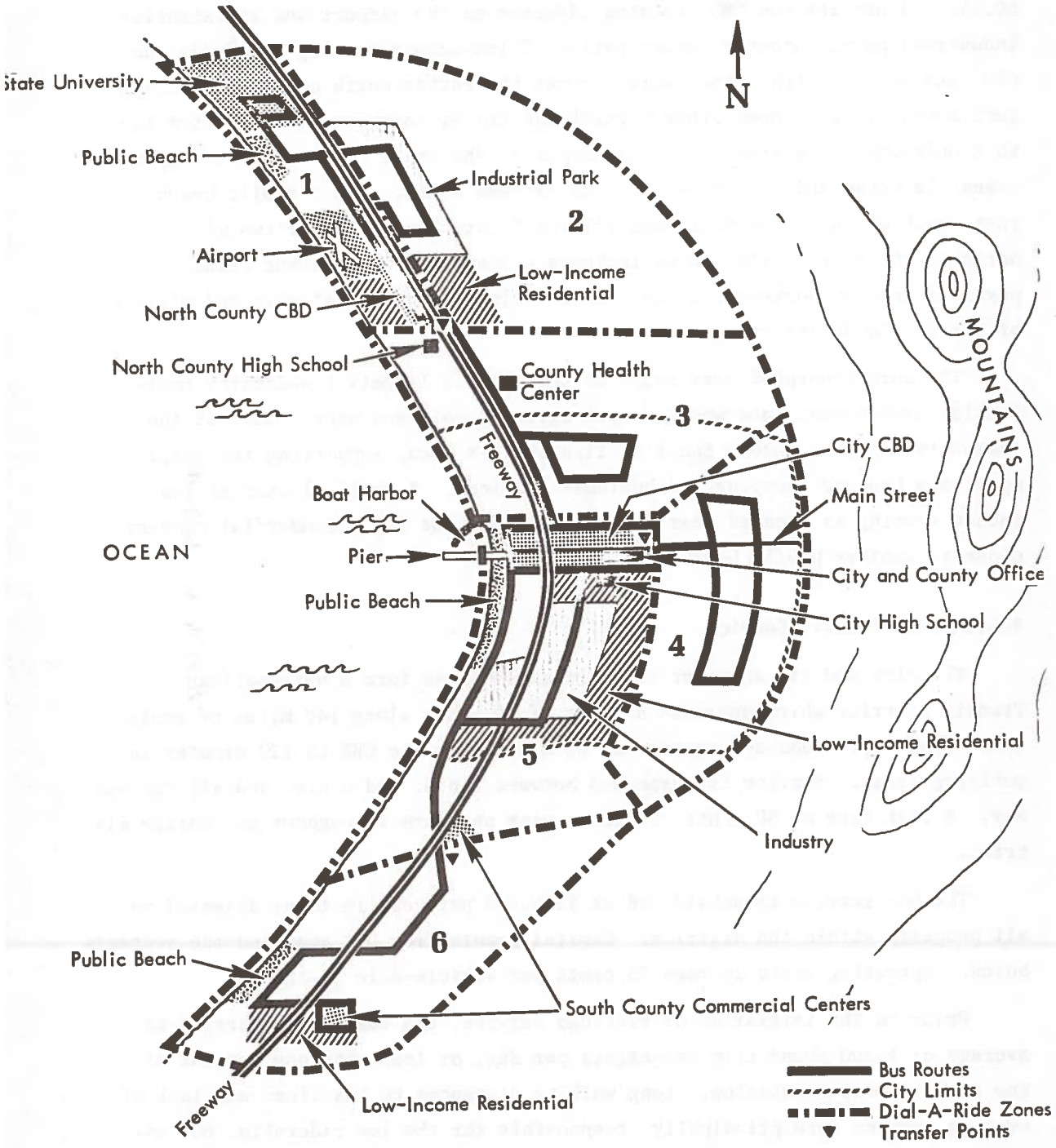

Figure 5. Configuration of a hypothetical urban area of 190,000 population showing flexicab zones.

The unincorporated area north of the city holds a population of nearly 60,000 and has its own CBD, located adjacent to the airport and an extensive industrial park. Another concentration of low-income housing surrounds the CBD, and another high school which serves the entire north county area lies just south of it. Three other significant travel generators are located in this unincorporated area: (1) the campus of the state university, lying between the ocean and the freeway to the extreme north; (2) a public beach just south of the university; and (3) the County Health Center two miles north of the city limits, which includes a hospital, out-patient clinic, physical therapy workshop, mental health clinic, and laboratories and offices of the Public Health Department.

The unincorporated area south of the city is largely low-density residential development interspersed with agricultural land uses. Most of the community's higher income families live in this area, supporting two small complexes housing shopping and business services. A small cluster of low-income housing is located near the southern-most of these commercial centers, close to another public beach.

4.3.2 Mass Transit Service

The city and its adjacent unincorporated areas form a Metropolitan Transit District which operates a fleet of 10 buses along 140 miles of route (see Figure 5). Headways range from 20 minutes in the CBD to 120 minutes in outlying areas. Service is suspended between 7 p.m. and 6 a.m. and all day Sunday. A flat fare of 30 cents carries a user anywhere throughout the entire district.

The bus service is subsidized at $365,000 per year in taxes assessed on all property within the district. Capital grants from DOT supplied the system's buses. Operating costs average 75 cents per vehicle-mile [D-11].

Prior to the initiation of flexicab service, the bus system carried an average of 1,300 round-trip passengers per day, or less than one percent of the area's total population. Long walking distances to bus lines and lack of evening service were principally responsible for the low ridership, but experiments with new routes and extended service hours did not yield sufficient ridership to convince the transit district management that these services

should be offered on a permanent basis. There is some question as to whether the experiments were adequately promoted or carried out over a long enough period to develop their potential ridership. However, the transit district did not believe that the heavily automobile-oriented property owners in the area would be willing to subsidize the high costs of permanent additional services.

4.3.3 Former Taxi Resource

Before the implementation of the new flexicab system the area was served by a successful taxi service that carried nearly as many passengers per year as the bus system. The taxi company operated under an exclusive franchise with the city which permitted shared riding, but prohibited cruising. The company was required under its contract with the city to maintain an adequate level of service or lose its exclusive franchise. This was specifically defined as less than 25 trips per driver per day; when demands exceeded this amount, the operator had to add another vehicle and driver to the system or the city would permit another operator to offer taxi service.

The fleet consisted of 35 passenger vehicles equipped with meters and two-way radios. The entire fleet was converted to use natural gas as fuel by the company's own maintenance shop. The company employed 72 drivers, 3 dispatchers, 2 office workers, and 3 mechanics, with the owner serving as the manager.

Taxis operated 24 hours a day, making an average of 450,000 trips per year. Average ridership was nearly two passengers per trip. Fares were 60 cents for the first .2 mile and 10 cents for each additional .2 mile. The average fare was $1.70. No additional charge was made for extra passengers in one party or shared use by two parties. Ride-sharing usually occurred when two parties started at the same point of origin with the vehicle continuing the trip beyond the first party's destination to that of the second; the driver decided which to drop off first and what share of the total fare each should pay. Gross annual income from the taxi service was $765,000. Annual operating expenses were as given in the table below. Net profits from the taxi operation were $45,000 per year.

Taxis carried about 1,200 round-trip passengers per day, compared to 1,300 for the bus system. A large portion of taxi customers were elderly

Table 12. Taxicab company annual operating expenses prior to initiation of flexicab service in a medium-size urban area.

Wages for drivers, dispatchers, mechanics	$470,000
Vehicle replacement	24,000
Rent of office and shop	24,000
Fuel, tires, parts, repair	130,000
Insurance	27,000
Promotion	5,000
Management (owner)	40,000
TOTAL	$720,000

women who prefer the door-to-door convenience and need assistance with packages. Many of these customers also found the walk to bus lines beyond their capacity and the bus service too slow and infrequent to meet their needs. Unaccompanied children traveling to and from music lessons, orthodontist appointments, and school on rainy days made up another sizable group of users [D-12].

4.3.4 The Flexicab System

4.3.4.1 ORIGIN OF THE SYSTEM. The taxi operator recognized that much of his business was derived from the inadequacies of the local bus service. However, as his costs of operating increased under the pressure of inflation, he saw that his rates would have to be raised beyond reach of many of his passengers, especially the elderly living on small fixed incomes. After some investigation the taxi owner concluded that he could operate a dial-a-ride service as an adjunct to his regular taxi business. He received from the city council permission to operate a separate dial-a-ride service within the city limits at a flat fare of 60 cents a rider, exactly double the amount of the bus fare. He purchased two 10-passenger vans, briefly advertised the availability of his new service, and began dial-a-ride operations.

In his first month of operation he averaged 50 to 60 passengers per day. By the end of the third month he was carrying nearly 180 per day. At that point the growth in ridership leveled off. Farebox receipts were $108 per day, while operating costs included drivers' wages of $80, fuel and repairs costs of $10, and amortization of the two vans at $10 per day. Only by absorb-

ing the dispatching and management costs in the taxi operation could the dial-a-ride service show a profit of $8 per day.

What was wrong? First of all, the system was too small to function effectively. By restricting service to the city limits, where buses were more frequently and widely available than in the outlying area, the operator had excluded the greater portion of his total potential market. By trying to serve the entire city with only two vans, the operation required drivers to make long route deviations, which often resulted in hour-long rides for passengers who might have made the same trip in 10 minutes by taxi or private automobile. Even when taxi vehicles were drafted into dial-a-ride service when vans were too busy or too far out of the way to respond to a call, the problem of extreme route deviation was not solved. Routing was left to the discretion of the drivers who tended to take passengers to their destination in the order that they entered the vehicles rather than select the most efficient over-all route. While both the drivers and the dispatchers were much more experienced with scheduling and routing demand-responsive services than mass transit personnel would have been, they still had a good deal to learn in how to cope with the complexities of the different origins and destinations of as many as ten passengers.

Nor was the level of service provided by the dial-a-ride system, even aside from the long travel times, satisfactory to the elderly women passengers who had previously used taxis. Dial-a-ride drivers were not permitted to leave the van to accompany them to the door after dark or to carry heavy bags of groceries into the kitchen. Many of these riders returned to the use of taxis, in spite of increased fares, in order to enjoy these extra services.

Last but not least, the new dial-a-ride service was not adequately promoted. Many residents of the city did not know the service existed even after 6 months of operation. Even so, the two vehicles were each carrying an average of 7 passengers per hour, and with the distances to be covered throughout the city, it would have been difficult for the operator to increase his ridership substantially without adding more vehicles. If each additional vehicle could have brought in only $8 per day in net profit, the dial-a-ride system would have continued to be a marginal operation.

With this knowledge gained from his initial experiment with dial-a-ride services, the taxi operator set about designing and implementing the existing successful flexicab system [D-13].

4.3.4.2 TYPES OF SERVICES OFFERED. The new flexicab system operates as a profit-making private enterprise which includes contractual agreements with the transit district and city and county governments. Basically, it continues to offer dial-a-ride, but the service is now integrated with the bus system instead of competing with it and is partially subsidized by local agencies for the benefit of low-income riders and others who have no alternative to public transit.

4.3.4.2.1 Integration with Bus Services. Flexicab now serves to extend public transit into areas not reached by bus routes, and substitutes for bus service in the evenings and on Sundays. During the day the service area is divided into six dial-a-ride zones (see Figure 5), each served by two taxi-company vehicles. Passengers may transfer to transit district buses or to other dial-a-ride zones at three transfer points, located at the north county CBD, the east corner of the city CBD, and a south county commercial center. Dial-a-ride fare has been increased from 60 cents to one dollar, but transfers to the bus system or other dial-a-ride zones are free. Passengers changing vehicles take transfer tickets from automatic dispensing machines as they exit the first vehicle and present them to the driver of the next vehicle.

Ridership of the bus system has increased from 1,300 round-trip passengers per day to nearly 6,000, or slightly more than 3 percent of the area's total population, and is expected to continue to grow. Not only has the dial-a-ride service provided access to areas not served by the buses, it also has permitted the transit district to utilize new buses, acquired under a second DOT capital grant, on its original routes, thus reducing headways and making the service more attractive to users.

Because of its improved efficiency of operation, the transit district has been able to absorb some of the costs of the integrated system. It permits all holders of dial-a-ride transfers to ride free of charge on its buses and redeems bus-riders' transfers from the taxi company for 30 cents each. The taxi company, in turn, charges holders of bus transfers only 70 cents to continue their trips by dial-a-ride, and redeems the remainder of the regular one dollar fare from the transit district.

Each dial-a-ride zone is served by two ten-passenger vans which tour the zone once every 20 minutes, arriving back at the transfer point in time to meet transit district buses and dial-a-ride vans from other zones. During peak commuting hours or at any time when a request for service cannot conveniently be met by one of the vans, taxis are used. Drivers are permitted to leave vehicles to help elderly and handicapped passengers with boarding at any time, but are allowed to carry packages into the house only during offpeak runs.

Subscription riding is encouraged by a reduced fare of 12 rides for ten dollars, since it permits routing of the tours to be largely planned in advance. Data processing facilities at the university produce updated listing of names, addresses, and destinations of subscribers each morning, similar to those used in the small urban area system already described. Here, too, the drivers plan their own routes. Information about new requests, received via two-way radio at the start of each tour, is inserted on the printed list of subscription riders. Vans have all been converted to natural gas [D-14].

After 7 p.m. and on Sundays when transit service is suspended, the dial-a-ride tours cease, and only one van is on duty in each zone to respond to any calls for service. Another four vans take over the principal transit district bus routes and run until midnight on one-hour headways. The same fare structure applies as during the day: 30 cents for fixed route rides and one dollar for dial-a-ride service, with the same transfer arrangements. The transit district contracts with the taxi company to provide this jitney-type evening and Sunday service at $9 per vehicle-hour, about one-third of what it would cost to run their own buses over these routes. Any farebox receipts are credited to the transit district. Ridership during these off-hours is limited, and the ten-passenger vans are well able to meet the demand. The availability of continued transit service through the evening promotes additional use of daytime bus service, since riders know they will be able to ride the substitute-bus home after 7 p.m. [D-15].

Daytime dial-a-ride vehicles average 3.5 riders per 20-minute tour over 13 hours of service, carrying an average of 1,600 passengers per day throughout the system. Farebox receipts, including transfer compensation paid by the transit district, less discounts for subscribers (30 percent of total

ridership) amount to $1,540 per day. Operating 313 days per year, the daytime dial-a-ride service has an annual revenue of $482,000.

Evening and Sunday dial-a-ride service generates only an average of 6 passengers per hour for each of the six vans remaining in operation. Operating five hours, Monday through Saturday, and 18 hours on Sunday, this service yields gross weekly receipts of $1,730. Evening and Sunday jitney service along bus routes, subsidized at $9 per vehicle-hour by the transit district, earns another $1,730 per week. Costs of operating the combined dial-a-ride and jitney services are shown in Table 13 [D-16].

Table 13. Flexicab operating expenses in a medium-size urban area.

Manager and dispatchers (including benefits)	$76,000
Drivers (including benefits)	369,000
Vehicle replacement (3-year life)	22,000
Vehicle maintenance	31,000
Fuel (natural gas), oil, tires	24,000
Radio equipment (10-year life)	1,000
Insurance	12,000
License Fees	2,000
Rent, phone, office equipment, miscellaneous	15,000
Legal, accounting, computer services	16,000
	$568,000

Improvements in bus and dial-a-ride service have reduced taxi ridership by 70 percent, but the average taxi fare has risen to $2.00. Expenses per passenger carried have also increased by 17 percent. Gross annual earnings of $270,000, offset by costs of $253,000, still provide the taxi company owner with an annual net income of $17,000 from taxi service [D-17].

Net annual earnings from the combined services orfered within the flexicab system are summarized in Table 14.

4.3.4.2.2 Subsidy of Low-Income Ridership. When the owner of the taxi company approached the city and county governments for permission to operate his expanded dial-a-ride service, government authorities were concerned that the proposed one dollar fare would place the service beyond reach of those who were most urgently in need of it. Their first thought was to subsidize the entire

Table 14. Flexicab company net annual earnings in a medium-size urban area.

	Revenue	Operating Costs	Net Earnings
Daytime dial-a-ride service	$482,000		
Evening and Sunday dial-a-ride service	90,000	$568,000	$94,000
Evening and Sunday jitney service	90,000		
Taxi service	270,000	253,000	17,000
TOTAL	$932,000	$821,000	$111,000

operation, using public funds to compensate the taxi company for the difference between the regular 30-cent fare charged by the transit district and the revenue required by the taxi company to operate at a profit. The taxing authority of the transit district, they reasoned, could be used to raise the additional funds.

The transit district, however, objected strongly to this proposal, on the grounds that its recent studies had indicated that the automobile-oriented property owners in the area would not agree to such a sizable increase in taxes to support transit. Moreover, it said, the majority of families living in the lower density residential areas, who would benefit most from the proposed service, could well afford the one-dollar fare and were not in need of public assistance.

It was decided that selective subsidization of the dial-a-ride service was the best answer. An increase of only one cent per $100 assessed valuation was made on property within the transit district, and this additional revenue was used to purchase blocks of dial-a-ride tickets from the taxi company at the regular rates.

City and county agencies in contact with low-income residents of the area distribute the tickets according to the needs of their clientele. Individual tickets are provided when appointments are made by the county health center; subscription books are provided by the county welfare department to cover trips to its office and essential errands such as grocery shopping. The employment service gives tickets to those going out on job

interviews or starting work at places of employment that they would otherwise be unable to reach. The city recreation department distributes still other tickets where needed to both senior citizen and young people. Even the school system supplies emergency transportation with dial-a-ride tickets.

Still in its experimental stages, this system of selective subsidization of transit appears to be working well. First, there is no stigma attached to the use of the tickets, since they are identical to those used by the regular subscribers. Second, the relatively lower cost of subsidizing transit permits the city and county to be generous in their interpretation of need, and many low-income people are for the first time able to participate in community activities and visit community facilities that were formerly beyond their reach. There is also the possibility that increases in ridership of the dial-a-ride system from subsidized fares will permit the operator to offer blocks of tickets to local government at a lower rate in the future [D-18].

In summary, by modifying the original dial-a-ride service to a more efficient mode of operation by zone, and by integrating it with the existing transit system rather than attempting to compete, the taxi owner has provided a much needed public transportation service for the community. Moreover, he has secured his investment in the taxi company, which he feared was threatened by the rising costs of operating, and has doubled his former earnings by expanding into new flexicab areas of service.

4.4 FLEXICAB AS A PROMOTER OF MASS TRANSIT USE IN A LARGE URBAN AREA

4.4.1 The Setting

The urban area hypothesized for this example has a population of 2 million, of which 900,000 reside within a central medium density city. Secondary population concentrations in the area include a city of nearly 300,000 to the north of the central city and three smaller cities of 100,000 each. The remaining population of 500,000 is distributed among unincorporated suburban and rural areas.

This urban area has traditionally been heavily oriented to the use of private automobiles and has one of the finest urban freeway systems in the nation. Only 3 percent of total trips are made by public transit. Buses are

the principal mode of public transportation, but the area is also served by a commuter rail line running between the second largest city to the central city and continuing south to one of the smaller incorporated areas. The commuter trains pass through several suburban residential areas along this route.

A recently formed areawide transit district has absorbed all of the former independent bus operations into a single integrated service and is also in the process of constructing a regional rapid rail system. Only one segment of the rail system has been completed, a line that runs east and west from the CBD, currently providing service to two major residential areas of the city. Figure 6 shows the general configuration of the area, its transportation infrastructure, and selected important generators of travel needs.

Nearly 30 percent of the area's population has incomes below poverty level. Most of these low-income families belong to minority groups living in low-income neighborhoods in the older part of the city. Residents of these neighborhoods who are employed work principally in the industrial area just north of the city. Other low-income residential areas are located in the unincorporated areas adjacent to the industrial concentration.

In an effort to reverse the deterioration of the central city, a major urban renewal program is being carried out. New high-rise offices, retail complexes, and a civic center are attracting more people to the CBD. The existing road system is unable to accommodate the traffic that has been generated. Congestion is severe in the downtown streets and on the freeways leading into the CBD, and air pollution frequently reaches critical levels. The city has decided against devoting any additional CBD land to roadways or parking facilities and is looking elsewhere for solutions.

Although some effort has been made to incorporate high-rise residential development in the CBD renewal program, this type of housing could accommodate only a fraction of those who work downtown. Some 97 percent of the CBD labor force would still need to commute to work. Increased use of mass transit appears to be the only reasonable solution. But the problem is urgent, and mass transit systems, even those using buses on existing roadways, can require years to reach full service levels.

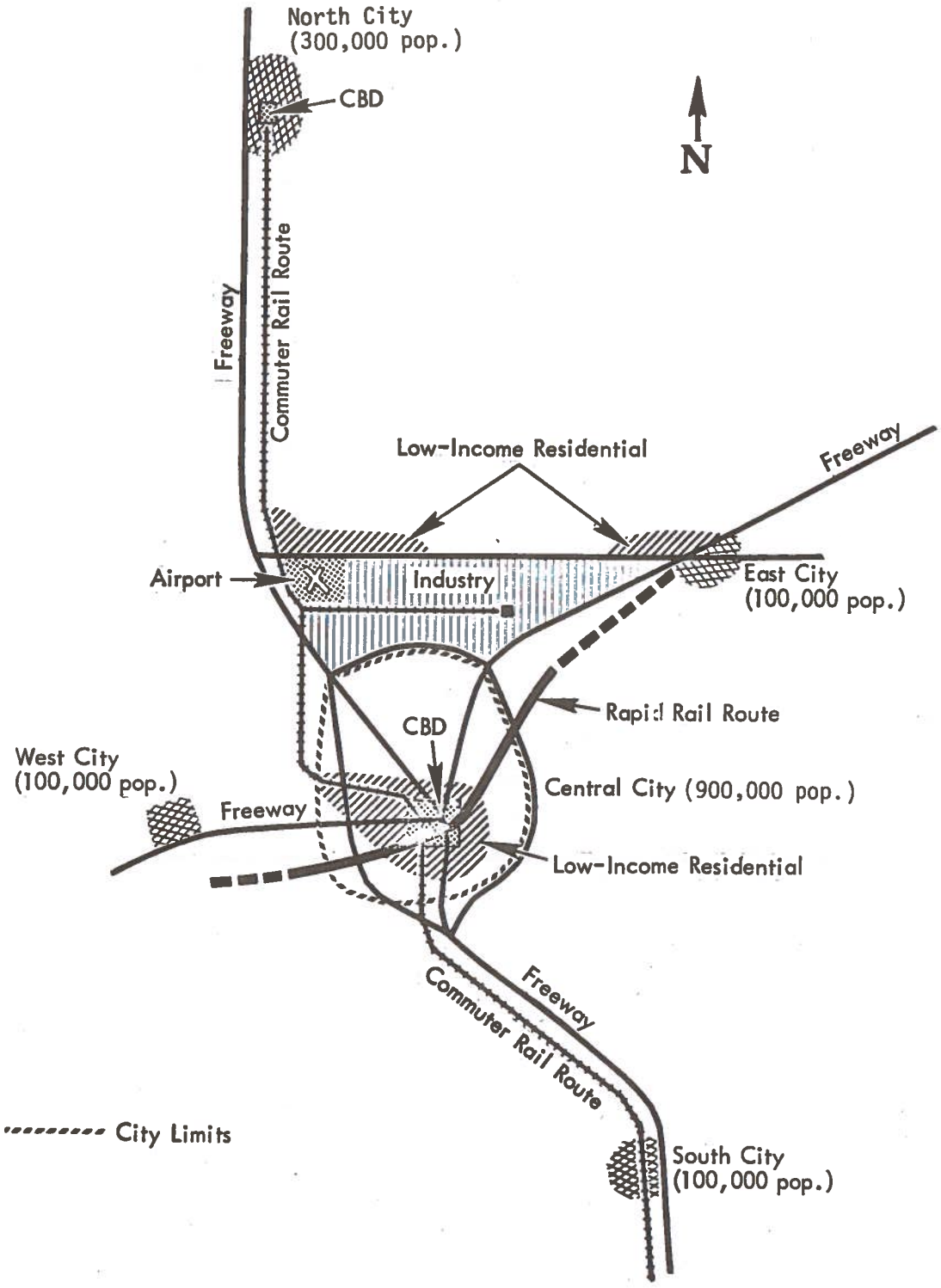

Figure 6. Configuration of an urban area of 2 million population showing rail line routes.

4.4.2 Mass Transit: Existing System and Future Plans

The transit district operates a fleet of 400 buses on more than 50 routes throughout the area, carrying an average of 25 million passengers annually, or about 34,000 round-trip passengers per day. Express services, utilizing the freeway system, carry commuters to the CBD and other job locations from all important residential areas, and local services are provided within all four cities, as well as in some of the higher density suburban areas. Service along major routes is frequent, but in outlying areas headways are often as much as one hour. A zonal fare system is utilized with fares running 25 cents to $1.25 depending on the distance traveled. All in-city travel is 25 cents and transfers are free. An annual deficit of $6 million is covered by taxes assessed on property within the transit district [D-19].

The transit district is also responsible for the planning and construction of the new rapid rail system, of which an initial 11-mile portion is already in operation. This system carries 9,000 round-trip passengers per day. The fare has been set at a flat 25 cents to promote ridership, but when the system is extended beyond the city limits, a graduated fare similar to that used by the buses will be established. Thus far, the system has cost nearly $1 billion in construction and capital equipment, largely paid for by DOT grants. Its operating deficit in the first year of operation was nearly $3 million. This and the local contributions to capital costs are paid for by a special tax assessment on property [D-19].

The commuter rail system carries 13,000 round-trip passengers per day, most of whom travel from suburban stations to work in the CBD. Trains run every 20 minutes during peak periods and once an hour otherwise. Fares range from 60 cents to $1.50, higher than the bus fare for short trips but roughly comparable to it for longer ones. The railroad company claims to be losing $1 million per year in operating the commuter service [D-19].

Long-range public transit plans for the area call for the extension of the rapid rail system to all urban concentrations, thereby replacing the existing express bus and commuter rail service. Not only will this eliminate a large portion of the buses that now aggravate congestion problems in the CBD, but it is also hoped that the improved service will attract enough new ridership to reduce the number of private vehicles entering the area by as much as 20 percent.

However, the rapid rail system will not be complete for another 12 years, and traffic congestion and air pollution problems require more immediate solutions. Existing mass transit ridership is low, primarily due to lack of access in the middle-to-low density suburban areas and lack of convenient CBD circulation services. Also, commuter peak travel seriously overloads the existing bus capacity, which discourages many potential riders from using the system. However, the transit district is reluctant to invest in upgrading a bus system that is scheduled to be replaced.

4.4.3 Former Taxi Resource

Before entering into flexicab operations, the taxi company ran a fleet of nearly 400 vehicles within the central city. Taxis equipped with two-way radios and meters and driven by employees of the company provided only premium service, in accordance with local taxi regulations.

In the year prior to the development of flexicab services, the company grossed over $8.3 million in fares, but operating costs of nearly $55 per vehicle per day left it with a net profit of only $331,000. The rising cost of vehible replacement, communications equipment, rent, fuel, and labor had necessitated a rate increase, and the number of passengers carried annually had dropped 11 percent from the previous year. Company management was convinced that any further rate increase would discourage still more taxi users and that the only solution was to expand into new areas that permitted more efficient utilization of equipment and manpower [D-20].

4.4.4 The Flexicab System

4.4.4.1 ORIGIN OF THE SYSTEM. The taxi company identified three potential markets for its extended taxi services:

a. Providing convenient access to mass transit in middle-to-low density areas;
b. Improving circulation in the CBD; and
c. Relieving some of the peak demand for mass transit during commuting hours.

Experiments in each market area were designed and the taxi company approached local governments to obtain the necessary permits and make contractual arrangements to begin service. South City was offered a turn-key dial-a-ride system to provide both internal circulation and access to express bus routes and to the

commuter rail station. Central City was asked to revise taxi regulations to permit ride-sharing and the operation of flat-fare, fixed-route jitney services in the CBD and along major travel corridors.

The initial reaction of the transit district to the entry of the taxi company into public transit was that their market was being threatened by competition. Since the public transit agency had only recently been formed and many of its management personnel had formerly worked in privately owned transit companies, this instinctive reaction might have been anticipated. The transit district demanded that South City open the proposed dial-a-ride service to competitive bidding and submitted its own offer. This offer, at nearly three times the cost of the taxi bid, was rejected in favor of the private company's proposal.

The transit district then bitterly opposed any changes in taxi regulations that would permit the operation of shared cabs and jitney service in Central City. The city, however, concerned with finding some immediate solution to its critical traffic congestion and air pollution problems, was willing to experiment and overrode transit district objections. To the surprise of most of the parties concerned, the city did not, as was generally believed, have any "anti-jitney" ordinances on its books. The only legal changes necessary to implement the proposed jitney operation were to permit sharing of taxi vehicles by passengers boarding and leaving vehicles at different points and to establish a new flat-fare structure for service along a fixed route. These changes in regulations were carried out within a few weeks of the city's decision to experiment with jitney services.

Having lost the battle to block jitney service, the transit district then proceeded to redeploy its buses so as to flood the CBD and jitney corridors with public transit competition to the new taxi company services [D-21].

While the taxi company's South City dial-a-ride service proved successful and taxi-sharing improved revenues per vehicle-hour, the jitney service failed for lack of ridership. One factor contributing to this failure, aside from competing bus services, was the flat fare of one dollar which the taxi company believed was necessary to operate at a profit; the level of service offered by the jitneys was not sufficiently different from that of the 25-cent bus ride to attract and hold regular users, except for the

15-minute period of highest commuting demand when buses were severely overcrowded.

Meanwhile, however, the transit district discovered that ridership of their express buses serving South City had shown a marked increase since the initiation of the dial-a-ride system. Overall ridership on routes coming into the CBD had also improved with the greater availability of the less costly shared-ride taxi service. Finally, the presence of the jitneys during the extreme peak commuting periods had absorbed some of the intense demand for bus capacity and had resulted in a more smoothly flowing transit operation. The transit district began to recognize that flexicab services might in fact benefit its mass transit services rather than detract from them.

Meetings between the taxi company and the transit district led finally to an integration of the two systems. The transit district encouraged communities in the area to contract with the taxi company for dial-a-ride services that would feed passengers to their existing line-haul buses and the future rapid rail system. It also removed some of its larger buses from CBD circulation, allocating them to improving service along its express routes, and partially subsidized the taxi company's peak-period jitney operation so that it could offer its service at a reduced fare.

4.4.4.2 TYPES OF SERVICES OFFERED. The taxi company now provides four types of service within an integrated flexicab system: shared-ride and premium taxi throughout its original service area; dial-a-ride systems for the smaller communities; and jitney services along major transportation corridors in the central city.

4.4.4.2.1 Shared-Ride and Premium Taxi Services. Taxis are now normally operated in a shared-ride mode on a reduced rate schedule that assumes an average occupancy of two fares per vehicle. Fares are charged according to a zonal system rather than by meter. Each party pays the full amount of the fare for its trip regardless of whether it has had exclusive use of the taxi or has shared it with other parties. Any passenger who enters an empty cab may request premium service. He is charged an extra fee of one dollar for exclusive occupancy of the vehicle and to avoid the risk that his trip will be interrupted to pick up or deliver another party.

Average taxi fare is down from $2.85 to $2.65 and annual ridership has increased from 2.9 million to 3.6 million, 90 percent of which is in the shared-ride mode. Annual receipts from fares have grown to $9.5 million. Greater needs for dispatching service under shared mode operations and generally higher costs of operation due to inflation have increased costs per vehicle per day to $64. Vehicle occupancy, however, has improved, permitting a reduction in the size of the fleet to 379 vehicles. Annual operating costs of $8.86 million leave the company with a net profit from the new taxi system of $687,000 [D-22].

4.4.4.2.2 Dial-a-Ride System. The taxi company now operates four dial-a-ride systems for communities outside the central city. They are turn-key operations carried out under contract with local government. All operating functions are performed by the taxi company: vehicle maintenance, hiring of drivers, scheduling, and dispatching. The company also provides insurance and purchases fuel, tires and other supplies necessary to keep the vehicles in operation. The city supplies the vehicles, which it can obtain under federal and state capital grants as a public agency. The city also prescribes the fare schedule, hours of operation, and level and types of services to be provided, such as response times and assistance in boarding and carrying packages for elderly and handicapped riders.

In the initial experiment in South City, local government also handled the distribution of passes and subscription tickets and public information. However, the taxi company found that city personnel had no experience in advertising and ticket-selling, and the system almost failed in the beginning through inadequate promotion. Taxi management now performs these functions as well.

All fares collected are credited to the cities, and the cities are billed at $10.60 per vehicle-hour by the taxi company. Vehicle replacement cost amounts to 4 percent of the total operating costs of the dial-a-ride system. Therefore the flexicab operator is able to offer his services at this reduced rate to cities that supply their own vehicles.

Dispatching and management supervision of the dial-a-ride systems are incorporated into the company's basic taxi operation. At peak periods a special dial-a-ride dispatch station is manned at the central dispatching facility, but at other hours calls are handled by the regular taxi dispatchers.

Costs to the taxi company of operating the turn-key services average $9.80 per vehicle-hour, including additional management and dispatching functions. Vehicle-hours of operation for the four turn-key systems (16 vehicles, 13 hours per day, 313 days per year) total 65,100. Annual net income from dial-a-ride amounts to approximately $51,000 [D-23].

4.4.4.2.3 Jitney Services. Jitneys no longer operate on streets served by buses, but are routed along adjacent streets. This modified approach not only provides a more accessible total public transportation system, but also eliminates the severe obstruction to traffic flow that was observed when both buses and jitneys were loading and unloading passengers along the same routes.

A more personalized service, preferred by many users, is provided by the jitneys than by the buses. Jitneys will stop at any point along the route upon request, except at rush hours when traffic conditions require that they stop only at designated loading zones. However, because of their smaller passenger loads, they frequently run two or three blocks without loading or unloading and will complete their run in less time than a bus on a parallel route.

Twelve-passenger vans are used. The vans are purchased by the taxi company and leased to drivers who operate as independent entrepreneurs. The company permits drivers to work only part-time if they wish, and many operate only during peak commuting hours. This flexibility allows the number of vehicles competing for business to vary between high and low demand periods. Dispatchers, stationed at the CBD ends of the routes or at the highest demand points of routes that do not come into the CBD, regulate headways during off-peak hours. At peak-demand periods no control is exercised over headways, and drivers are encouraged to make as many trips as possible, usually three per hour.

Fares have been reduced from one dollar to 50 cents, or twice the amount of the in-city bus fare. The transit district pays each driver who works a route from 7 to 9 a.m. and 4 to 6 p.m. a subsidy of $3 per trip, or an equivalent of 25 cents each for 12 passengers. Initially an attempt was made to keep an exact count of the number of passengers carried, but this proved to be difficult, as it required riders to purchase tickets which then had to be collected by the driver and turned in to the taxi company. A sampling of ridership during these hours showed that jitneys averaged about 12 passengers per trip;

therefore the fixed subsidy rate of $3 was agreed upon by the transit district and jitney drivers.

Four hundred jitneys are now in operation, carrying an equivalent of 34,000 round-trip passengers per day. Over 80 percent of these are commuters traveling during peak hours. Drivers lease vehicles from the taxi company at $25 per day, which includes maintenance and insurance. Fuel, which is excluded from the fee, may be purchased from the taxi company at a reduced rate. Drivers earn between $55 and $160 per day, depending on the number of hours worked, including the subsidy received from the transit district of peak-period trips. Drivers' costs average $30 per day for the leased vehicle, fuel, and dispatching services, leaving them with a net income of $25 to $130 per day.

The taxi company receives an average of $8,000 per day from jitney leasing; fuel is sold at cost. Annual receipts amount to nearly $3 million. Costs of the leasing operation are given in the table below. Net income from jitney leasing is $230,000 [D-24].

Table 15. Annual operating expenses of a jitney-leasing operation in a large urban area.

Vehicle replacement (2-year life)	$1,100,000
Maintenance and repair	1,200,000
Insurance	360,000
Management of leasing operation	100,000
TOTAL	$2,760,000

4.4.4.3 RESULTS OF FLEXICAB IMPLEMENTATION. Annual net income resulting from the entire flexicab system is given in the table below.

Table 16. Flexicab company net annual earnings in a large urban area.

Shared-ride and premium taxi services	$687,000
Dial-a-ride systems	51,000
Jitney services (leasing)	230,000
TOTAL	$968,000

This represents over three times the annual net earnings of $292,000 for the former taxi operation.

Moreover, transit ridership has grown, and it has been demonstrated that improvements in the quality of service can be effective in luring some commuters away from using private vehicles. Peak-period traffic congestion in downtown streets and on freeways leading to the CBD has been somewhat reduced, and the effect of improved traffic flow is beginning to show up as modest gains in air quality.

Perhaps the most important result is that these benefits are being realized now rather than 12 years from now when the new rapid rail system would be completed, because they result from flexicab transit services that could be implemented in a very short period of time.

5. RECOMMENDATIONS FOR FURTHER RESEARCH AND POLICY DEVELOPMENT

INTERPLAN suggests that the application of flexicab services to urban transportation problems would be encouraged by further research and policy development. Eight recommendations are made for specific tasks that would serve to improve flexicab technology, implementation, and the regulatory environment.

5.1 RESEARCH ON IMPACTS OF JITNEY OPERATIONS

It is commonly believed that jitneys provide undesirable competition to mass transit systems and add to problems of traffic congestion on city streets. Only a very few cities in the United States permit their operation; in the rest, jitneys are specifically banned.

It is INTERPLAN's belief that jitneys can, on the contrary, be of benefit to mass transit by providing some of the peak-period capacity required at commuting hours. This could relieve transit authorities of the need to provide vehicles and drivers used to meet demand during peak periods but underutilized for the remainder of the day. It is also believed that operating jitneys on streets parallel to those used by mass transit vehicles avoids aggravating traffic congestion and makes public transit more accessible.

To verify these assumptions and, hence, to resolve the question of potential competition with transit services, a study of existing jitney operations, both in this country and abroad, is recommended, focusing on the impacts of jitneys on mass transit operations and their effect on traffic congestion.

5.2 DEMONSTRATION OF SUBSIDIZING PEAK-PERIOD JITNEY OPERATION

Should the results of the investigation described above prove favorable, it is recommended that DOT fund a demonstration in which jitney operators are subsidized to provide peak-period commuter services.

Many jitney operators work only part-time and prefer those hours when demands are highest, e.g., commuter peaks. Since mass transit fares are usually low due to subsidization, it is difficult for jitneys to obtain riders when they charge fares high enough to allow them a profit. A subsidy for peak-

period operation would attract many part-time drivers, even some who have other regular day-time employment but would run a few jitney tours before and after work.

The demonstration should be monitored for its effect on overall public transit ridership as well as on mass transit efficiency and traffic congestion.

5.3 CONTINUED DEVELOPMENT OF COMPUTER DISPATCHING SYSTEMS

Current efforts toward developing computerized dispatching systems should be continued, with special emphasis on low-cost, simple-to-operate, and reliable systems suited to flexicab operations. The taxi industry would welcome such an alternative to its present dependence on human dispatchers. However, to be of use to the industry the system must be competitive, in terms of cost, ease of supervision, and reliability, with the manual dispatching techniques that are currently available.

5.4 DESIGN OF A FLEXICAB VEHICLE

There is a need for an attractive, low-cost vehicle with a comfortable ride that can be utilized for a full range of flexicab services. It should be easily modifiable by the operator to suit his own particular needs, and should be suited for use in both passenger and goods transport. For example, the vehicle could permit the operator to rearrange passenger seating or remove it to allow more room for packages, according to the use to which the vehicle is being put at any one time.

Low fuel consumption and low maintenance are also essential features. Consideration should also be given to the possible utilization of alternative fuels such as natural gas.

The vehicle should provide a comfortable ride, approximating as closely as possible the comfort of a private automobile. No vans currently available meet this specification. Doors and steps should be designed to accommodate elderly and handicapped riders, and the option of a wheelchair lift or ramp should be available. There should also be convenient places for riders to place their packages. Some consideration might also be given providing optional facilities for bicycle transport.

It is suggested that initially a survey be made of taxi, jitney, and dial-a-ride operations to obtain specific suggestions on the characteristics and special features that would be desirable in an improved flexicab vehicle.

5.5 TECHNIQUES FOR DEMAND ESTIMATION

Flexicab systems must be designed according to estimates of potential demand for services, which will determine the number of vehicles and drivers needed, the frequency and length of service, and the size of the service area and of zones which can meet the service standards of the proposed system.

A simple, reliable low-cost, technique of estimating demand that can be used even by relatively unsophisticated potential operators in small communities is urgently needed. Methods currently available are either imprecise or too costly for most communities to undertake (see Appendix E). New services can fail because of inaccurate demand forecasts. Underestimating the potential ridership can result in a system too small to meet actual demands, such as in Fairfax City, Virginia, and Santa Clara County, California. Overestimating demand can result in selecting fare schedules which are too high, such as occurred in Yellow Cab Company's attempt to operate jitneys in Los Angeles. More reliable techniques of forecasting ridership could reduce the possibilities for such situations.

5.6 RECOMMENDATIONS FOR FLEXICAB REGULATION

A survey of existing state and local regulations would reveal where these frequently offer impediments to the implementation of flexicab service. A report directed at legislators and policy makers in state and local governments could, first, point out implementation problems created by certain common types of regulation and, second, suggest model ordinances that could replace existing ones.

The model ordinances should provide for controls essential to safeguarding the public and assuring the reliability and adequacy of flexicab services to meet local public transit needs. However, they should also offer operators enough latitude with regard to service areas, fare schedules, and modes of operation that flexicab experimentation will be encouraged.

5.7 DOT CAPITAL ASSISTANCE FOR FLEXICAB

It is possible within existing DOT legislation and operating procedures to provide capital grants to local governments and transit districts for the purchase of vehicles and equipment for turn-key flexicab transit operations. Up to this time, however, only state funds have been directed to this purpose. The use of turn-key taxi-based services, especially in small urban areas, could be increased by the availability of such funding from DOT.

5.8 INFORMATION DISSEMINATION PROGRAM

Several recent innovations in public transit applicable to flexicab operation are not known to many taxi operators and officials of local governments. These innovations include new modes and methods of operation, alternatives in subsidizing services, and technological developments. As more experiments in flexicab are made and research and development projects are completed, more options in procedures and tools for implementing flexicab systems will be available.

There is a need for a continuous information program directed specifically at those who must carry out flexicab implementation. DOT has access to information that would be of value to operators and local government, but this information does not now reach this audience effectively and promptly. A multifaceted information service could be developed to include a periodical describing new developments in the field, reprints of reports on experiments of broad application, and field trips, seminars, and workshops for representatives of local government and the taxi industry.

An effective DOT program of information dissemination could be instrumental in developing flexicab systems in urban areas throughout the nation and contribute substantially to solving current transportation and environmental problems.

6. REFERENCES

1. Wells, John D. et al. (Institute for Defense Analyses). Economic Characteristics of the Urban Public Transportation Industry. Prepared for the U.S. Department of Transportation, Assistant Secretary for Policy and International Affairs, February 1972.

2. U.S., Department of Commerce, Bureau of the Census. County Business Patterns. Annual reports, 1964 through 1972.

3. Kirby, Ronald F. et al. (The Urban Institute). Para-Transit: Neglected Options for Urban Mobility (PB 234 320). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration and the Federal Highway Administration. Springfield, Va.: NTIS, June 1974.

4. Willis, David K. "San Francisco's Jitneys: Current Status and Future Prospects" (Draft). Berkeley, Calif.: University of California, Graduate School of Public Policy, 31 May 1973.

5. Black, William R. Intermodal Impacts: Federal Public Transit Programs and the Taxi Industry. Research Paper Series No. 2. Bloomington, Indiana: University of Indiana, Center for Urban and Regional Analysis, 1974.

6. Samuels, Robert. "Samuels Reviews Taxicab Industry Regulations." Reprinted from a three-part article in Taxicab Management, n.d.

7. International Taxicab Association. "Fact Sheet on Taxicab Operations in the United States." Lake Forest, Ill., 7 September 1973.

8. Heathington, Kenneth W. et al. An Organizational and Environmental Review of Two Privately Owned Shared Ride Taxi Systems (Draft). Knoxville, Tenn.: University of Tennessee, Transportation Research Center, June 1974.

9. Baker, Erwin. "Cab Firm Offers Jitney Plan." Los Angeles Times, 3 April 1974.

10. Hebert, Ray. "Jitneys are Back—And L.A. Has 'Em." Los Angeles Times, 2 August 1974.

11. "Trouble in Mass Transit." Consumer Reports, March 1975.

APPENDIX A
BIBLIOGRAPHY

Altshuler, Alan, and Thomas Melone. Site Selection for a Dial-a-Ride Demonstration (PB 199 405). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration. Springfield, Va.: NTIS, March 1971.

Arrillaga, Bert, and George E. Mouchahoir. Demand-Responsive Transportation System Planning Guidelines (MTR-6659). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration. McLean, Va.: The Mitre Corporation, April 1974.

Baker, Erwin. "Cab Firm Offers Jitney Plan." Los Angeles Times, 3 April 1974.

Beeler, Ed. "Dial-A-Ride Begins Soon." El Cajon Californian, 22 March 1974.

Beesley, M. E. "Regulation of Taxis." The Economic Journal 83 (1973): 150-172.

Black, William R. Intermodal Impacts: Federal Public Transit Programs and the Taxi Industry. Research Paper Series No. 2. Bloomington, Indiana: University of Indiana, Center for Urban and Regional Analysis, 1974.

Bloomington (Indiana), City Council. "An Ordinance to Regulate and License 'Jitneys'" (Ordinance No. 71-49). 18 November 1971.

Bohnett, William. "An Annotated Bibliography on Taxicabs." n.p., n.d.

Bradley, Tom (Mayor of Los Angeles). "Remarks before the Subcommittee on Los Angeles Regional Transportation, Assembly Committee on Transportation." Los Angeles, 1 August 1973.

_____. "Remarks by Mayor Tom Bradley, City of Los Angeles, before the Subcommittee on Transportation of the Senate Public Works Committee." Los Angeles, 25 May 1974.

Brown, Terrence A. Economic Analysis of the Taxicab Industry in Pennsylvania: Demand and Cost. Middletown, Penn.: Pennsylvania State University, Office of University Research, August 1973.

Canada, Telebus Demonstration Project Steering Committee. Operations Report of the Telebus Demonstration Project (PB 219 014). Springfield, Va.: NTIS, June 1972.

_____. Financial and Economic Analysis of the Regina Telebus Demonstration Project (PB 219 015). Springfield, Va.: NTIS, June 1972.

_____. Regina Telebus Study: Summary Report (PB 225 315). Springfield, Va.: NTIS, November 1972.

_____. Regina Telebus Study: Transportation Data Report (PB 225 314). Springfield, Va.: NTIS, February 1973.

_____. Regina Telebus Study: The Impact of Telebus (PB 225 313). Springfield, Va.: NTIS, March 1973.

Canada, Transportation Development Agency, and L'Ecole Polytechnique de Montreal. Dial-A-Bus Manual. 2 vols. Montreal, Canada, January and March 1974.

Carpinteria (California), City Council. Ordinance No. 55, Section 6624, "Taxicabs." 22 July 1968.

Control Data Corporation, and the International Taxicab Association. A Framework for Uniform Reporting of Taxicab Statistics. Prepared for the U.S. Department of Transportation, Assistant Secretary for Policy, Plans and International Affairs, November 1973.

Cornett, Bob. "Many Benefits in Door-to-Door Rides." El Cajon Californian, 25 October 1973.

Cruz, Manny. "Grand Experiment Set in Taxi Transportation." The Weekly Review and Inland Empire Advertiser (El Cajon, California), 29 November 1973.

Curry, James P. "Providing Transportation for Persons with Limited Mobility." Transit for the Poor, the Aged, and the Disadvantaged. Highway Research Record 403. Washington, D.C.: Highway Research Board, 1972, pp. 47-48.

Eckert, Ross D., and George W. Hilton. "The Jitneys." The Journal of Law and Economics, October 1972, pp. 293-325.

The Economist. "Not so Hansom Cabs." 13 April 1974, pp. 100-101

Eisen, Jack. "Calls Clog Dial-a-Bus Start in Fairfax City." Washington Post, 3 June 1974.

El Cajon Californian, "El Cajon Express Should be Funded" (editorial). 4 December 1973.

El Cajon Californian, "Success of Taxis Improves." 5 December 1973.

Engineering News Record, "New Systems Won't Make Decisions Any Easier." 25 January 1973.

Environmental Design Group, Inc. Plan to Improve Transportation Services for the Elderly in Orange, Seminole and Osceola Counties (PB 230 992). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration. Springfield, Va.: NTIS, June 1973.

Falcocchio, John C.; Lewis J. Pignataro; and Edmund J. Cantilli. "Modal Choices and Travel Attributes of Inner City Poor." Transit for the Poor, the Aged, and the Disadvantaged. Highway Research Record 403. Washington, D.C.: Highway Research Board, 1972, pp. 6-17.

Greyshock, Donald G. Dial-A-Ride: Personalized Door-to-Door Transportation. A proposal presented by All American Cab Company to the City of Huntington Park, California. 11 June 1973.

Heathington, Kenneth W. "Demand-Responsive Transportation Systems." Paper presented at the CalTrans course "Public Transportation State of the Art," March 1974, Sacramento, California.

Heathington, Kenneth W.; Gilbert T. Satterly, Jr.; and William L. Grecco. "Public Transportation for Small Urban Areas." Public Transportation for Small and Medium Sized Cities. Highway Research Record 419. Washington, D.C.: Highway Research Board, 1972.

Heathington, Kenneth W. et al. An Analysis of Two Shared-Ride Taxi Systems: Executive Summary (Draft). Knoxville, Tenn.: University of Tennessee, Transportation Research Center, August 1973.

_____. "An Example of Demand Responsive Transportation Systems in the Private Sector." Paper presented at the 53rd Annual Meeting of the Highway Research Board, January 1974, Cambridge, Mass.

_____. An Organizational and Environmental Review of Two Privately Owned Shared Ride Taxi Systems (Draft). Knoxville, Tenn.: University of Tennessee, Transportation Research Center, June 1974.

Hebert, Ray. "Proposed Jitney Fleet for L.A. Draws Fire." Los Angeles Times, 10 February 1974.

_____. "Jitneys are Back—And L.A. Has 'Em." Los Angeles Times, 2 August 1974.

Hedges, Charles A. "Let's Attack the Real Urban Transportation Problem." Paper presented at the 53rd Annual Meeting of the Highway Research Board, January 1974, Cambridge, Mass.

Highway Research Board. Demand-Responsive Transportation Systems. Special Report 136. Washington, D.C., 1973.

_____. Public Transportation Research Needs. Special Report 137. Washington, D.C., 1973.

Hilton, George W. Federal Transit Subsidies: Urban Mass Transportation Assistance Program. Washington, D.C.: American Enterprise Institute for Public Policy Research, June 1974.

Hines, J. Michael, and David W. Sloan. Legal Analysis of Transportation Regulation and Innovation: The Dial-a-Ride (PB 199 407). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration. Springfield, Va.: NTIS, March 1971.

International Taxicab Association. "Fact Sheet on Taxicab Operations in the United States." Lake Forest, Ill., 7 September 1973.

_____. "Diversified Use Vehicle." Lake Forest, IL, 9 November 1973.

_____. "A Proposal for a Research Contract to Analyze Regulations and Regulatory Agencies Governing Taxicab Operations in the U.S." Memorandum to the U.S. Department of Transportation. Lake Forest, IL, 2 April 1974.

_____. "A Proposal to Gather and Analyze Economic and Statistical Information Pertaining to the Taxicab Industry." Memorandum to the U.S. Department of Transportation, Urban Mass Transportation Administration. Lake Forest, IL, 2 April 1974.

International Taxicab Association. Cab Research Report, No. 165. Lake Forest, IL, 10 May 1974.

International Trail. "Jersey Jitney's Changing Profile." 35 (1965): 4-5.

Kamrass, Murray; Howard Margolis; and Sandra F. Ugel. State of Urban Mass Transportation Research, Development and Demonstration. Vol. V: New Systems (P-848). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration. Arlington, Va.: Institute for Defense Analyses, March 1972.

Kates, Peat, Marwick & Co. Regina Telebus Feasibility Study (PB 200 860). Prepared for the City of Regina Transit System; the Saskatchewan Department of Highways and Transportation; and the Canadian Ministry of Transport. Springfield, Va.: NTIS, June 1971.

Kernodle, James R. (Yellow Cab Company of California). Letter to R. W. Russell, Board of Public Utilities and Transportation, City of Los Angeles, requesting approval of six new jitney routes in Los Angeles. 1 April 1974.

Kirby, Ronald F. et al. (The Urban Institute). Para-Transit: Neglected Options for Urban Mobility (PB 234 320). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration and the Federal Highway Administration. Springfield, Va.: NTIS, June 1974.

La France Transportation Systems. "Jitney Bus Routes." Map and route descriptions of eight new jitney bus services. Los Angeles, n.d.

Lee, Bumjung; John D. Falcocchio; and Edmund J. Cantilli. "Taxicab Usage in New York City Poverty Areas." Transit for the Poor, the Aged, and the Disadvantaged. Highway Research Record 403. Washington, D.C.: Highway Research Board, 1972, pp. 1-5.

LEX Systems, Inc. Santa Clara County Transit District Integrated Demand-Responsive/Express Bus System: Report on Requirements and Preliminary System Design. Menlo Park, Calif., October 1973.

_____. Demand-Responsive and Integrated Transit Systems. Menlo Park, Calif., 1974.

LEX Systems, Inc., and DAVE Systems, Inc. Implementation and Operation of a Demand Responsive Public Transportation System (Haddonfield Dial-A-Ride) (UMTA-NJ-06-0002-74-3). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration, and the State of New Jersey, Department of Transportation, March 1974.

_____. Summary of a Report Covering the Implementation and Operation of a Demand Responsive Public Transportation System (Haddonfield Dial-A-Ride) (UMTA-NJ-06-0002-74-2). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration, and the State of New Jersey, Department of Transportation, March 1974.

"50¢ Dial-A-Ride Starts Saturday." Life News (La Mesa, Calif.), 27 March 1974.

Los Angeles. "City Charter. Article XX: Department of Public Utilities and Transportation invests the Board of Public Utilities and Transportation with authority over the operation of vehicles for hire, regardless of form of transportation (Section 212[2])." n.d.

_____. Amendments to Article I, Chapter 7 and 80.66.1 of the Los Angeles Municipal Code regarding taxicabs: Ordinance No. 141,670, 10 March 1971; Ordinance No. 142,214, 9 July 1971; Ordinance No. 143, 859, 14 September 1972; Ordinance No. 146,267, 25 July 1974.

Los Angeles, Board of Public Utilities and Transportation. "Board Order No. 226" (regarding regulation of taxis). 5 November 1970.

_____. "Summary of Procedure for Handling Franchise Applications." 16 July 1973.

_____"Departmental Staff Report on Proposed Master Plan for Taxicab Service in the City of Los Angeles." 30 January 1974.

_____. "Departmental Staff Report: Application of Frederick W. LaFrance, dba La France Transportation Systems, for Jitney Motor Bus Permits." 2 April 1974.

_____. "Departmental Staff Report: Application of Yellow Cab Company of California for 'Hail-A-Ride' Jitney Bus Service." 24 June 1974.

Maryland, Montgomery County, Department of Transportation. Transit Improvement Program (TRIP) for Montgomery County, Maryland. May 1974.

Metropolitan, "Printed Routings Personalize Rochester Dial-a-Bus Service." May/June 1974, pp. 13-14.

Mexico City, Direccion General de Ingenieria de Transito y Transportes. Transporte Publico. 1973.

_____. Rutas de Transportes Colectivo (Peseros). 1974.

Miller, N. Craig, and John C. Goodnight. "Policies and Procedures for Planning Transit Systems in Small Urban Areas." Transit Planning and Development. Highway Research Record 449. Washington, D.C.: Highway Research Board, 1973, pp. 14-20.

Mitchell, Matt. "Ridership Rate Surprise: El Cajon Express Taxi Cabs." El Cajon Californian, 21 December 1973.

Mitchell Research Associates. Feasibility of Dial-A-Ride for the City of La Mesa, California (No. 148073). San Diego, January 1974.

Motor Vehicle Manufacturers Association of the United States. "Statement of Franklin M. Kreml before the House Public Works Subcommittee on Transportation." News release. Detroit, Mich., 10 April 1974.

Neilson, Gordon K., and William K. Fowler. "Relation Between Transit Ridership and Walking Distance in a Low-Density Florida Retirement Area." Transit for the Poor, the Aged, and the Disadvantaged. Highway Research Record 403. Washington, D.C.: Highway Research Board, 1972, pp. 26-34.

Olsen, Charles E., and Philip G. Kuehl. The Taxicab Industry of Washington, D.C.: Regulatory Perspectives. Prepared for the District of Columbia. Washington, D.C., April 1974.

R. L. Banks and Associates, Inc,; Stanford Research Institute; and Real Estate Research Corporation. Study and Evaluation of Urban Mass Transportation Regulation and Regulatory Bodies (PB 211 077, 211 078). 2 vols. Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration. Springfield, Va.: NTIS, May 1972.

Rappaport, Carl S. "Policy Analysis: An Urban Transportation Example." Paper presented at the 1974 National Conference on Public Administration, 6 May 1974.

Rebibo, Kathy K. et al. Summary of an Automated Scheduling System for Demand Responsive Public Transportation. Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration. Washington, D.C.: The Mitre Corporation, March 1974.

Ronis, Leonard. "The Capacity of Urban Mass Transit to Handle the Increased Load of Passengers Resulting from Lower Supplies of Gasoline." Statement in behalf of the American Transit Association before the Senate Public Works Committee, Transportation Subcommittee, 11 December 1973.

Saltzman, Arthur, and Richard J. Solomon. "Jitney Operations in the United States." Transit Planning and Development. Highway Research Record 449. Washington, D.C.: Highway Research Board, 1973, pp. 63-73.

Samuels, Robert. "Samuels Reviews Taxicab Industry Regulations." Reprinted from a three-part article in Taxicab Management, n.d.

San Francisco Jitney Owners Association. Jitney Owners and Drivers Rules and Regulations. n.d.

Sweeny, John. "Taxi Transit Setup Called Big Success." San Diego Union, 8 December 1973.

Taxicab Management, "The Merits and Feasibility of 'Dial-a-Ride' Concepts." February 1974, p. 8.

U.S., Department of Commerce, Bureau of the Census. County Business Patterns. 1951 through 1972.

U.S., Department of Transportation, Office of the Secretary. 1972 National Transportation Report: Present Status—Future Alternatives. July 1972.

_____. "Request for Proposal No. DOT-UT-40020: A Low-Pollution Para-Transit Vehicle." 1 May 1974.

U.S. Department of Transportation, Transportation Systems Center. Demand-Responsive Transportation: State-of-the-Art Overview. Office of the Secretary, and the Urban Mass Transportation Administration, n.d.

U.S., Department of Transportation, Urban Mass Transportation Administration. "Meeting with Officers of the International Taxicab Association." Internal memorandum. 14 February 1974.

Vidich, Charles. "Union Taxis and Gypsy Cabbies." Society, July/August 1973, pp. 43-49.

Ward, Jerry D., and Norman G. Paulhus, Jr. Suburbanization and Its Implications for Urban Transportation Systems. U.S. Department of Transportation, Office of the Assistant Secretary for Systems Development and Technology, November 1973.

Wells, John D. et al. (Institute for Defense Analyses). Economic Characteristics of the Urban Public Transportation Industry. Prepared for the U.S. Department of Transportation, Assistant Secretary for Policy and International Affairs, February 1972.

Willis, David K. "San Francisco's Jitneys: Current Status and Future Prospects" (Draft). Berkeley, Calif.: University of California, Graduate School of Public Policy, 31 May 1973.

Wohl, Martin. "Public Transportation Pricing, Financing and Subsidy Principles." Traffic Quarterly 27 (1973):619-634.

Zachar, John A., and Edward A. Beimborn. The Urban Taxicab Industry in Wisconsin: An Inventory and Examination of Regulatory Policies (PB 231 433). Prepared for the U.S. Department of Transportation, Urban Mass Transportation Administration. Springfield, Va.: NTIS, February 1974.

APPENDIX B
ORGANIZATIONS VISITED AND INDIVIDUALS INTERVIEWED

SHARED TAXI OPERATIONS

Orange and White Systems, Hicksville, New York
- Mr. Charles Meyerson, President
- Mr. Stanley Hirsch, Vice President

Royal Cab Company, Davenport, Iowa
- Mr. Robert C. Cheray, President

Public Service Commission, Washington, D.C.
- Mr. Louis Deeny

Police Department, Washington, D.C.
- Mr. Charles E. Morgan, Chief, Public Vehicles Division.

DIAL-A-RIDE SYSTEMS: BUS OPERATED

Haddonfield Dial-A-Ride Demonstration Project, Haddonfield, New Jersey
- Col. John Kerkering, Project Manager
- Dr. Lawrence I. Schneider, LEX Systems, Inc.
- Mr. Richard Scott, DAVE Systems, Inc.
- Mr. Harry Juliano, DAVE Systems, Inc.

Regina Transit System, Regina, Saskatchewan, Canada
- Mr. Gordon Robbins, General Manager, Telebus Services
- Mr. Lloyd Scott, Assistant Manager, Telebus Services

Santa Clara County Transit District, San Jose, California
- Mr. Louis L. Davis, President, LEX Systems, Inc.

DIAL-A-RIDE SYSTEMS: TAXI OPERATED

All-American Cab Company, Huntington Park, California
- Mr. Donald G. Greyshock, President

City Manager's Office, El Cajon, California
- Mr. Frank N. Mannen, Administrative Analyst

City Manager's Office, La Mesa, California
- Mr. Michael W. Huse, Administrative Assistant-Operations

Yellow Cab Company, San Diego, California
- Mr. Norman Bryant, General Manager
- Mr. William Hilton, President

Yellow Cab Company, Santa Barbara, California
Mr. M. Ernest Parks, President.

JITNEY OPERATIONS

Jitneymens Association, Atlantic City, New Jersey
Mr. Sidney Bergman, President

Jitney Owners Association, San Francisco, California
Mr. Louis Kritikakos, Vice President

Police Department, City and County of San Francisco, California
Officer Morris Martindale, Taxi Detail

Direccion General de Ingenieria de Transito y Transportes, Departmento del Distrito Federal, Mexico City, D.F., Mexico
Ing. Angel Alceda Hernandez, Chief, Office of Transportation

Direccion General de Policia y Transito del Distrito Federal, Mexico City, D.F., Mexico
Mayor Eduardo Cardenas Pineda, Chief, Office of Control of Public Services

Yellow Cab Company, Los Angeles, California
Mr. John M. Corsello, Assistant to the Executive Vice President

Southern California Rapid Transit District, Los Angeles, California
Mr. Peter G. Drake

Mayor's Office, City of Los Angeles, California
Mr. Norman Emerson, Executive Assistant to the Mayor
Mr. Graham O. Smith, Research Associate

Department of Public Utilities and Transportation, City of Los Angeles, California
Mr. David B. Talcott, Senior Civil Engineer Assistant.

INTERNATIONAL TAXICAB ASSOCIATION

Mr. Richard Gallegher, Executive Director, Lake Forest, Illinois

Mr. Robert E. Samuels, President, Yellow Cab Company, Chicago, Illinois

Mr. John H. Davidson, Vice President-General Manager, Yellow Cab Company of Kansas City, Inc. (now with Yellow Cab Company in Los Angeles)

Mr. Richard Gaylen, President, Valley Checker Cab Company, Van Nuys, California

U.S. DEPARTMENT OF TRANSPORTATION, URBAN MASS TRANSPORTATION ADMINISTRATION

Mr. Robert H. McManus, Associate Administrator, Office of Transit Planning

Mr. Theodore A. Munter, Assistant Chief Counsel, Program Division

Mr. Ronald Fisher, Office of Transit Planning

Mr. Jim Yu, Office of Program Planning.

U.S. DEPARTMENT OF LABOR

Mr. Lari F. Yud, Special Assistant for Urban Mass Transportation

Mr. James Perlmutter, Industrial Relations Specialist.

APPENDIX C
DETAILED DESCRIPTION OF EXTENDED TAXI AND JITNEY SERVICES

DEMAND-RESPONSIVE SERVICES

Shared Taxi

DEFINITION. Two or more parties traveling between different origin and/or destination points use the taxi simultaneously. Meters measuring distance, and occasionally time, or zonal systems determine the amount of the fare. Depending on the practice established by the operator, each party pays the full fare he would be charged with exclusive use of the vehicle, or parties share the single fare.

EXAMPLES. Washington, D.C.; Hicksville, New York; Davenport, Iowa; Jacksonville, Florida; Little Rock, Arkansas.

MAJOR USERS. Upper income groups, especially non-drivers, commuters traveling to and from mass transit depots, or within CBDs where parking is difficult; also low income, elderly, handicapped and the young for essential trips. Use is more widespread than with premium (one party) service because of lower cost.

MARKET ENVIRONMENT. Universally applicable to CBDs and central cities of major metropolitan areas, as well as suburbs and small cities, where it may serve as the only means of public transportation.

VEHICLES. Regular taxi vehicles are used, either five-passenger sedans or Checker Cabs, accommodating 7-8 passengers.

DISPATCHING. In Washington, D.C., many taxis operate in shared mode without dispatching assistance; they cruise the streets and respond to hails, picking up second parties if they are traveling in a direction compatible to the route of the initial passenger. Shared taxi operations in small cities are controlled by centralized dispatching systems because demand densities are too low to permit cruising. Computerized dispatch is highly desirable even for relatively small fleets, since information needs include address of pick-up, address of delivery, time of call, time service desired (if pre-arranged), and number of people in the party.

MANAGEMENT. Individual owner-drivers can operate in a non-dispatched shared-taxi mode. Otherwise the service requires the experience and facilities of established taxi operators.

LABOR. Part-time and full-time individual owner-drivers can operate non-dispatched services. Dispatched systems usually rely on full-time drivers, organized within the Teamsters Union or non-unionized, but may also employ some part-time drivers.

IMPACTS ON OTHER MODES. Shared taxi services do not compete with regional transportation systems, but rather promote their use by providing a connecting link between home and the transit depot. In Hicksville, for example, the heaviest use of shared taxis is by Long Island Rail Road commuters. However, making shared taxi services available can diminish demand for premium service because of its lower cost to the user. Shared cabs are also highly competitive to local mass transit, especially where transit service is poor and fares are high.

REGULATORY ENVIRONMENT. Sharing of taxis is illegal in most cities in the United States, and local ordinances would have to be changed before this flexicab mode could be implemented.

PROFITABILITY. All shared taxi services currently in operation are being operated at a profit. Their lower cost per passenger provides them with a larger market than premium service, and it is expected that they will continue to be profitable even as increased rates shrink the demand for premium service.

Dial-a-Ride/Jitney for Small Cities

DEFINITION. These can be dial-a-ride systems or combined demand-responsive and fixed-route systems that provide the sole means of public transportation in communities too small or too dispersed to support a mass transit system. Different vehicles may be used for dial-a-ride and jitney portions of the operations, or the same vehicles may provide demand-responsive service in residential areas, switching to the jitney mode (fixed route) in the downtown area.

EXAMPLES. Batavia, New York and Ann Arbor, Michigan.

MAJOR USERS. All groups of non-drivers and drivers whose cars are not available. Ease of parking in such communities encourages the use of private vehicles over the transit service.

MARKET ENVIRONMENT. Can be implemented in small urban areas and suburban communities of major urban areas.

VEHICLES. In combined services, small vans carrying 12 to 15 passengers are most appropriate for the demand-responsive portion as well as most jitney routes. Some jitney services on more heavily traveled routes may be sufficient to justify minibuses of 18 to 30 passengers, but these vehicles are too large for demand-responsive service. Dispersal of vehicles to meet demands throughout the community is more easily accomplished when the vehicles are interchangeable for either mode. Five-passenger taxi vehicles are used in El Cajon and La Mesa, where operators provide only dial-a-ride services.

DISPATCHING. Dispatching capability is essential for the demand-responsive portion of the service. Although the amount of information to be processed for each service request is the same as with shared taxi, the need for a computerized dispatching system is not so great because of the lighter overall demand for service.

MANAGEMENT. The older, combined dial-a-ride/jitney services in Batavia and Ann Arbor are operated by transit-oriented managements. The newer, exclusively dial-a-ride systems of El Cajon and La Mesa are operated by the Yellow Cab Company of San Diego under contract to the local governments. Taxi operators appear to have an advantage over former transit people in being more familiar with dispatching and flexible routing procedures.

LABOR. The transit-oriented systems tend to use drivers affiliated with the Amalgamated Transit Workers Union, while taxi-oriented systems use former taxi drivers who either belong to the Teamsters Union or are not organized. These services offer employment opportunity for both full-time and part-time drivers.

IMPACT ON OTHER MODES. Small city dial-a-ride/jitney systems are highly competitive to local mass transit services. When the new system is publicly implemented, redundant transit services are usually abandoned, and unless population size and density increase remarkably, they are not likely to be reinstated once the more personalized services are in operation. The innovative system is also highly competitive to existing premium taxi services; it is only when a passenger cannot tolerate the delays in being picked up or indirectly routed to his destination that he will choose the more expensive mode of transportation. The higher the level of service provided by the dial-a-ride system, the lower will be the demand for taxi service.

REGULATORY ENVIRONMENT. The private operation of dial-a-ride and jitney services is commonly prohibited or restricted by local or state ordinances where they compete for riders within the service area of an existing public transit service. Where no such service exists, or where the city itself seeks to replace an unsatisfactory mass transit system with a more flexible system, local ordinances present very little problem. There may, however, be conflicts with state regulations if the new service is also to operate outside of the city limits. In California, for example, a privately operated dial-a-ride or jitney service is currently not permitted under state PUC regulation to generate more than two percent of its revenue outside of the city it has a permit to serve. This means that the service areas of these innovative modes must be restricted to the city proper and cannot respond to needs in residential areas that lie beyond the city limits. Since dial-a-ride is especially suited to low density residential neighborhoods, efforts are being made to change this regulation.

PROFITABILITY. All of the dial-a-ride/jitney services that currently provide the sole means of public transit in small urban areas are subsidized. Bus-oriented systems tend to require greater subsidies because of higher labor costs, the larger vehicles that are usually employed, and the need to develop a new capability in dispatching and flexible routing. Taxi-based systems operate at lower cost.

Dial-A-Ride for Severe Weather Areas

DEFINITION. Door-to-door demand-responsive services can be provided for urban areas that suffer extremes in weather conditions which make it very unpleasant for people to wait on the streets for mass transit vehicles and occasionally make it hazardous for people who own cars to drive them. They can be operated exclusively as dial-a-ride systems or in conjunction with mass transit.

EXAMPLES. Regina, Saskatchewan.

MAJOR USERS. In addition to the normal users of public transit--those without cars or unable to drive--these systems also carry people who choose to leave their cars at home. The system must be able to tolerate extreme fluctuations in ridership occasioned by sudden changes in the weather. Seasonal variations in demand are also more extreme than would occur in more clement areas. Experience in Regina indicates that significant demands exist even in high-income residential areas. Services are so reliable that even pre-school age children travel alone.

MARKET ENVIRONMENT. Except for heavily concentrated central business districts, where mass transit service can be provided within very short headways, these demand-responsive services are feasible in all kinds of market areas--large and small cities, as well as suburbs.

VEHICLES. Smaller vans (12-15 passengers) are preferred over those of higher capacity because of greater maneuverability in the winding streets and cul-de-sacs of residential areas and because it is difficult to provide prompt and relatively direct service for a larger number of riders. Reliability and safety of operation under extreme weather conditions are primary vehicle requirements.

DISPATCHING. A dispatching system is essential for demand-responsive service. The degree to which a computerized system is necessary depends on the percentage of irregular and spontaneous demands compared to pre-arranged, regular demands. Ridership of the Regina system is heavily oriented to subscribers, for example, and has no need for computerized dispatching capability.

MANAGEMENT. Where the system operates solely as a demand-responsive service, taxi experience would be preferred. However, when dial-a-ride and mass transit are to be operated as a single integrated system, coordination of the two parts of the system may be better under a transit-oriented management, as in Regina.

LABOR. The selection of employees is likely to reflect management background. Taxi management will use former taxi drivers, while bus-oriented management will select and retrain bus operators for the new service.

IMPACTS ON OTHER MODES. Where integrated with mass transit, the dial-a-ride service will improve ridership of the other mode. Otherwise, a separate demand-responsive system would be extremely competitive with mass transit, especially in residential areas and in severe weather conditions. This service would also be competitive to premium taxi operations.

REGULATORY ENVIRONMENT. The same regulatory problems apply here as with small city demand-responsive systems.

PROFITABILITY. Under certain conditions a taxi company might profitably extend its services into this area, putting on extra drivers and utilizing every available vehicle for group riding at times when extreme weather conditions prevail. Systems currently operated, however, are subsidized.

Feeder Service to Mass Transit

DEFINITION. Dial-a-ride systems in low- to medium-density residential areas are designed to carry users of mass transit systems between home and transit depots. They are used primarily in conjunction with rail systems where stops are far apart. Ridership of the combined service can be encouraged by a joint fare system and coordinated scheduling, as in the case of AC Transit and BART in Contra Costa County, California.

EXAMPLES. Haddonfield, New Jersey; Hicksville, New York; Contra Costa County, California.

MAJOR USERS. Commuters to the central city of large metropolitan areas are the principal users of feeder systems. These systems eliminate the need

to provide all-day parking facilities at commuter stations and may permit the commuter's family to do with one less car. Shopping and entertainment trips to the city also generate significant demands.

MARKET ENVIRONMENT. Primarily suburban residential areas.

VEHICLES. Small vans carrying 12 to 15 passengers appear to function best in residential areas.

DISPATCHING. Preponderance of regular commuters permits pre-scheduling of runs and should reduce the per passenger work-load for dispatching services. Computerized systems could be useful, but not so essential as for systems designed primarily for intra-community services.

MANAGEMENT. Local taxi operators can provide this service under contract to local government or the regional transportation system. The great differences between dial-a-ride and regional mass transit systems argue against attempting to operate both systems with the same management personnel.

LABOR. Heavy peak-period demands provide an excellent employment opportunity for part-time drivers.

IMPACTS ON OTHER MODES. This type of service can be highly effective in promoting the use of the regional transit system. It would be competitive to existing local bus systems and may reduce emergency trips to the transit depot via taxi.

REGULATORY ENVIRONMENT. If the service is initiated privately by a local taxi company, ordinances would have to be changed to permit group riding, and some opposition could be expected from any local transit operator. Implementation would probably be easier if the service is initiated by the regional transit system itself, especially where the system is closely tied to a region-wide overall transportation authority. Where the new system is sponsored by local government, new ordinances can easily be enacted and a competing public bus system simply phased out.

PROFITABILITY. A demand-responsive feeder system could be operated profitably as part of a local taxi business. However, such a service may also be subsidized by the regional transit system to promote ridership

or by local government to provide mobility within the community for residents without their own means of transportation.

Welfare Service for Low-Income Areas

DEFINITION. These services are designed to meet the transportation needs of low-income areas where local mass transit is inadequate. Dial-a-ride, jitney or combined modes can be used. Access to health and welfare facilities is always provided. Some services also provide transportation to work where available jobs are inaccessible without a private automobile. Systems may serve to carry low-income residents to points at which they may transfer to local mass transit, or they may operate a parallel, independent service.

EXAMPLES. Buffalo, New York; Columbus, Ohio; Anchorage, Alaska; Hartford, Connecticut; St. Petersburg, Florida.

MAJOR USERS. Users are primarily the unemployed and the elderly and handicapped recipients of welfare assistance. Less frequently, the systems are used for commuting by low-income persons employed at out-of-the-way manufacturing plants. Services are also designed to provide mobility to the young residents of low-income areas who have no other means of transportation to community facilities. Often, residents of the area have insufficient command of English to use regular public transit.

MARKET ENVIRONMENT. Low-income residential areas in central cities.

VEHICLES. Usually small vans suited to demand-responsive applications. They are often provided with curb-level steps, handrails and other safety features for use by the elderly and handicapped. Passenger vehicles can also be used.

DISPATCHING. Taxi-type dispatching services are necessary to handle spontaneous demands for service with dial-a-ride operations. Many door-to-door trips can be pre-arranged, and the driver simply given a printed list of passengers' names, addresses and destinations. Jitney-type services can be operated with on-site dispatching to insure proper headways or without dispatching control.

MANAGEMENT. These systems are frequently managed by local agencies concerned with welfare in low-income areas. In small cities this agency may

turn over the actual operation of the service to the local taxi company. Since these trips can usually be scheduled outside of peak-demand times for taxi services, they offer a good business opportunity.

LABOR. Unless the service has been subcontracted to an existing taxi company, drivers will be recruited from the neighborhood, since it provides work for those who would otherwise be unemployed. Where many residents have only limited skills in English, using local drivers can be especially helpful.

IMPACTS ON OTHER MODES. Since these systems are implemented where regular public transit services are inadequate, they have little impact on existing transit systems. Some taxi trips may be replaced, since often taxis are the only form of vehicular transportation available to many low-income persons.

REGULATORY ENVIRONMENT. These systems normally do not conflict with other public transportation services, and are usually sponsored by government. There appears to be little difficulty in their being implemented under existing regulations.

PROFITABILITY. Many welfare-oriented transportation systems for low-income neighborhoods in the United States have been implemented under the federally assisted Model Cities Program. Others are funded by local government as part of a community effort to improve living conditions of low-income groups. Fare are kept low or omitted entirely so as to provide the maximum mobility for those who would otherwise be unable to travel. When operation is subcontracted to a local taxi company, fares are sometimes paid by tokens or coupons provided at no charge to passengers making essential trips. The taxi operator then turns these in to the local agency and receives payment for his services in an amount covering his actual costs plus a small profit. Subsidization of some form is always required for the operation of these services.

Transport of the Handicapped in Wheelchairs

DEFINITION. Special services to provide mobility for users dependent on wheelchairs.

EXAMPLES. Santa Barbara, California.

MAJOR USERS. Handicapped in wheelchairs.

MARKET ENVIRONMENT. All types of urban areas.

VEHICLES. Vans or Checker Cabs especially fitted with wheelchair lifts, handrails and other safety features, such as restraints that hold the wheelchair as well as the rider in case of sharp stops and turns.

DISPATCHING. Demand-responsive dispatch facilities.

MANAGEMENT. Normally a private company operating a related business, such as an ambulance service or a taxi service.

LABOR. Drivers employed by operator for regular service. However, physical strength and tact are both necessary in performing this service, and the operator will generally select particular drivers to answer these calls.

IMPACT ON OTHER MODES. This service is not competitive with other modes of mass transit and regular taxi operations. In fact, it can relieve the local transit system from the need to equip vehicles for use by the handicapped in wheelchairs.

REGULATORY ENVIRONMENT. No problems.

PROFITABILITY. These services are generally subsidized by local government, but can also be undertaken by large health facilities, or non-profit service organizations. The operator usually contracts with the sponsoring organization to provide these services at a low fare for which he is compensated at a rate that allows him a profit.

Inter-School Transit for Special Students

DEFINITION. Public school systems often find it more practical to concentrate certain types of facilities at one location. Students in need of these special facilities are transported during school hours to these locations for physical therapy, computer and language training, and so forth.

EXAMPLES. Santa Barbara, California.

MAJOR USERS. School children, usually only a few at each pick-up point.

MARKET ENVIRONMENT. School districts in all sizes of cities and suburban areas.

VEHICLES. Taxis or small vans are most suited to the transport of the small number of students at each scattered location. Where the local taxi operator provides the service, he will use vehicles that happen to be free from his other services. School buses can also be used if the trips will be completed before the end of the school day.

MANAGEMENT. Sponsored by the school system and subcontracted to a local carrier, frequently a local taxi company.

LABOR. Regular drivers of the local carrier, with some selectivity to use those who get along with children.

IMPACTS ON OTHER MODES. None.

REGULATORY ENVIRONMENT. No problems because it is a privately contracted service.

PROFITABILITY. Provides an opportunity to the local carrier for additional use of vehicles and drivers in low-demand periods. Contractual agreements compensate the operator for his services, including profit.

Service for Retirement Complexes

DEFINITION. Services tailored to meet the needs of residents of retirement complexes for access to downtown shopping and recreation.

EXAMPLES. Portland, Oregon.

MAJOR USERS. Elderly, usually middle-income retired. Many are women who do not drive.

MARKET ENVIRONMENT. Any size of city or suburb where the residential complex is located at some distance from the downtown area.

VEHICLES. Depending on the size of the complex, vehicles can range from passenger cars to minibuses. Age of the users makes ground-level access and handrails essential; package accommodation is desirable.

DISPATCHING. Normally, these systems are operated on a fixed route and schedule, but they can be modified to provide door-to-door service. In the

latter instance, taxi-type dispatching services are needed, but on a small scale.

MANAGEMENT. The small scale of the operation provides opportunities for self-employed owner-drivers. This service could also be a logical extension of local taxi service.

LABOR. Owner-drivers, part-time or full-time relief drivers, or employees of participating taxi companies.

IMPACTS ON OTHER MODES. These special services are implemented only where other modes of public transportation are not convenient and premium taxi service is too expensive. They are not significantly competitive with either of the alternative modes.

REGULATORY ENVIRONMENT. Service is usually either contracted for by an association representing residents' interests, or provided as a service by the management of the retirement complex. Regulatory problems do not normally arise.

PROFITABILITY. The operator is able to provide this service at a profit, either by charging a fare in excess of his costs, or by being subsidized by the residents' association or management of the retirement complex. Again, this presents a good opportunity for a taxi company, especially when its premium rates are too high for frequent use by this group of potential riders.

Transport of Walking Wounded

DEFINITION. Walking wounded are persons injured and needing hospital attention, but not so severely hurt that they need ambulance service. It is common practice in most industries to assign one of the injured person's co-workers to drive him to the hospital, thus losing the output of both people. Taxi companies contract with plants to provide transportation for walking wounded so that a co-worker need not be called upon for the trip to the hospital.

EXAMPLES. Davenport, Iowa.

MAJOR USERS. Employees of local industries.

MARKET ENVIRONMENT. Industrial developments of all sizes of cities and their environs.

VEHICLES. Taxis.

DISPATCHING. Uses taxi-type dispatching methods.

MANAGEMENT. Taxi company or cooperative.

LABOR. Taxi drivers.

IMPACTS ON OTHER MODES. None; replaces use of private automobiles.

REGULATORY ENVIRONMENT. No problems.

PROFITABILITY. Comparable to premium taxi service. Employers pay the fare.

Transport for Customers of Auto Repair Shops

DEFINITION. Auto repair shops commonly provide transportation to work or home to customers who must leave their cars for extensive repair work. Using mechanic employees to provide these services is expensive and results in losses of productivity. Auto shops can arrange with local taxi companies to carry on these transportation services for them. The customer is given a coupon, signed by the owner or manager of the repair shop, the taxi driver records the fare when the customer is delivered to his destination, and the customer signs the coupon to indicate that he has received the service. Coupons are redeemed by the auto shop for full value of the fares. Tips given by customers to the taxi drivers are kept by them as usual.

EXAMPLES. Santa Barbara, California.

MAJOR USERS. Commuters to work and those not normally employed who usually drive.

MARKET ENVIRONMENT. Can be used in any type of community, except CBDs with good, frequent public transit and low-income residential areas of cities where automobile ownership is rare.

VEHICLES. Taxis.

DISPATCHING. Uses taxi dispatching system.

MANAGEMENT. Taxi company or cooperative.

LABOR. Taxi drivers.

IMPACTS ON OTHER MODES. None; replaces use of private automobile.

REGULATORY ENVIRONMENT. No problems.

PROFITABILITY. Comparable to premium taxi service.

FIXED OR SEMI-FIXED ROUTE SERVICES

Service for Intercity Terminals

DEFINITION. Fixed-route or modified fixed-route (optional stops) services for passengers traveling to or between intercity rail, bus or air terminals.

EXAMPLES. Extinct Parmalee System, Chicago, Illinois; airport limousine services in all major cities.

MAJOR USERS. Intercity travelers.

MARKET ENVIRONMENT. Large cities.

VEHICLES. Taxis, limousines or vans with adequate accommodation for passengers' luggage are easier to manipulate through city streets. Large buses function well when demand densities are high and a portion of the trip is made on freeways, especially to air terminals.

DISPATCHING. Reliability of service is of primary importance, and usually requires dispatchers on-site at major stops along the run. Route deviations are sometimes handled via two-way radio, which can also be used to pre-order taxi services for individuals wishing to travel beyond the fixed-route service, as in Kansas City.

MANAGEMENT. This service may be operated by an association of individual owner-drivers, by a taxi company, or by private or public bus operators.

LABOR. Open to full-time or part-time drivers. Services are provided by vehicle owners or employees of taxi or bus operations, depending on the management.

IMPACTS ON OTHER MODES. This service impacts only on taxi services, which provide the only practical alternative means of transportation for a

traveler with luggage. Public transit does not normally attempt to provide service to or between intercity terminals.

REGULATORY ENVIRONMENT. These services are usually provided by holders of exclusive franchises from local government.

PROFITABILITY. Operators undertake these services as profit-making activities.

Jitney Between Fringe Parking and CBD

DEFINITION. Shuttle service for automobile commuters between fringe parking lots and their final downtown destinations. Reduces CBD traffic congestion and permits higher economic use of downtown land area. Vehicles may all follow a single route, or they may be dispatched to different downtown locations.

EXAMPLES. Seattle, Washington.

MAJOR USERS. Commuters and other traveling to the CBD for shopping, business errands, and entertainment.

MARKET ENVIRONMENT. Medium and large central cities of metropolitan areas.

VEHICLES. Large-capacity vehicles are needed for commuters at peak-periods. Mass transit buses or minibuses can be used.

DISPATCHING. On-site dispatching at peak periods should be provided, especially where vehicles are destined for different downtown locations.

MANAGEMENT. This service is appropriate for management by a mass transit operator, but it could also be carried out by small private companies under contract to local government. The peak-period demand would probably conflict with regular taxi service, but could be operated as a separate business venture under taxi management.

LABOR. Would reflect type of management in being either bus drivers or employees of small private companies. The heavy peak demands at either end of the work day make this a good opportunity for part-time workers.

IMPACTS ON OTHER MODES. This service is competitive to regional mass transit in that it encourages commuters to use their own cars for trips from the suburbs. It also competes with use of regular mass transit services within the city if operated by another entity. However, this additional service might relieve the local transit system of some of its peak demands for vehicles and drivers, and thus reduce its overall cost of operation. Reduction of downtown congestion would also permit the more efficient operation of transit buses.

REGULATORY ENVIRONMENT. There would be no problem if the service was operated as a part of the mass transit system or under contract to local government. If a private entrepreneur attempted it on his own, however, he would probably be prevented by anti-jitney ordinances.

PROFITABILITY. These services could be operated at a profit, especially if part-time drivers could be employed, even without local subsidization. Normally, however, these services are sponsored by local government as a part of their efforts to improve the CBD environment.

CBD Circulation Minibus

DEFINITION. Fixed-route public transportation at frequent intervals with frequent stops to provide access between points in downtown business and commercial establishments.

EXAMPLES. Salem, Oregon; Los Angeles, California.

MAJOR USERS. People who work in the downtown area, especially during the noon hour, and people on shopping trips.

MARKET ENVIRONMENT. CBD circulation systems can be useful even in relatively small cities where the commercial area is long and narrow. Distance between stores of more than three blocks can be enough to discourage walking from one to the other, especially when the shopper is carrying heavy or awkward packages or is accompanied by small children. They are even more necessary in large CBDs where traffic is congested and parking space is difficult to find.

VEHICLES. Minibuses are preferred for this service because they can maneuver more easily in and out of the traffic flow than larger buses, and they do not contribute as much to traffic congestion and air pollution. They are also less expensive to operate. However, the timing of this service permits the use of the part of the regular bus fleet otherwise used only for peak-period commuting. Therefore it is common to see full-size buses used for downtown circulation systems. Jitney vans carrying 12-15 passengers can also be used.

DISPATCHING. Dispatching services are not needed for this fixed-route, regularly scheduled service.

MANAGEMENT. The local bus company is best able to carry out this function because of the similarity to regular bus service and because it has vehicles and drivers available. It is possible, however, for a taxi company or private individuals to offer this type of service as a jitney operation.

LABOR. Full-time bus drivers or jitney operators.

IMPACT ON OTHER MODES. Conflicts could occur where both public transit and private jitneys were simultaneously attempting to provide CBD circulation without prior arrangement to serve different routes.

REGULATORY ENVIRONMENT. Jitney services would require changes in public transit ordinances in most urban areas. Opposition to this from the local mass transit operator could be expected unless cooperative agreements had previously been made. No problems would occur if the transit operation itself provided this additional service.

PROFITABILITY. CBD circulation services are often underwritten by local retailers to promote business, as is the case in Salem, Oregon. The city itself may also finance the service, sometimes in conjunction with a program of fringe parking and shuttle service, to relieve downtown traffic congestion and promote increased commercial activity in the CBD.

Jitney to Suburban Shopping Areas

DEFINITION. Fixed-route service between residential developments and major shopping areas in suburban communities. The commercial area may be a freeway-oriented shopping center accessible only by private automobile.

EXAMPLES. Davenport, Iowa; Rochester, New York.

MAJOR USERS. Housewives and others not regularly employed are the major users. Those below driving age and those who cannot afford cars also use the service. Some may commute to sales jobs at the center.

MARKET ENVIRONMENT. Low-density suburban areas without other forms of public transit.

VEHICLES. Vans and small buses carrying up to 30 passengers are adequate for the normal moderate demand. There should be accommodation for packages.

DISPATCHING. No special dispatching capability is required.

MANAGEMENT. Private small operators, such as local taxi companies or owner-drivers, can best function in this area. The jitney service may be an off-peak adjunct to a demand-responsive system that carries commuters at peak periods.

LABOR. Since the demands for this service continue throughout the day, drivers will usually work full-time or for most of the normal work-day. They may also be the same drivers used for commuter-oriented services offered by the same company.

IMPACT ON OTHER MODES. None.

REGULATORY ENVIRONMENT. Local ordinances will usually have to be changed to permit jitney operations. There may be additional difficulties with state regulations if the service area is unincorporated.

PROFITABILITY. Long hours, small passenger loads and relative long distances would make it difficult to realize a profit out of this operation alone. It may, however, help an operator who also provides commuter services keep his vehicles and drivers employed during the hours between commuter peaks. Owners of stores in the shopping center may also find it profitable to subsidize the service so that their establishments are accessible to more customers.

Campus Services

DEFINITION. Fixed-route service between classrooms and student residences, possibly extending beyond the campus proper into an adjacent urban

area, providing access to retail, entertainment and community facilities. Schedules should correspond to intervals at which classes begin.

EXAMPLES. University of California at Santa Cruz and at Davis; University of Texas at Austin.

MAJOR USERS. Students would be the principal user group, but instructors and staff may also make use of the service, as well as visitors to the campus.

MARKET ENVIRONMENT. Campus and adjacent residential and commercial areas.

VEHICLES. Vans and small buses appear to function best, but full-size buses can also be used. Accommodation for bicycles would be useful when student residential areas are beyond easy biking from the campus but students need bikes to travel between classes. Book racks are also needed.

DISPATCHING. Not necessary.

MANAGEMENT. Student unions or enterprising private groups of students could provide this service. The local taxi company might undertake it, but only as a separate operation.

LABOR. Part-time student drivers are usually available and would seem to be a good choice for this type of work.

IMPACTS ON OTHER MODES. None

REGULATORY ENVIRONMENT. Services within the campus proper would fall under the jurisdiction of the educational institution. Where services were extended into an adjacent community, a permit to operate would be required from the local government.

PROFITABILITY. This service could be offered as a modest profit-making venture, but some subsidy is preferable so that fares can be kept within reach of the student riders. The subsidy might take the form of vehicle acquisition by the institution or the student body, or both capital and operating expenses might be subsidized. Service operations might be subcontracted to a private operator, perhaps the local taxi company.

Intra-Airport Services

DEFINITION. Shuttle services between airlines and between airport parking lots and passenger depots.

EXAMPLES. Los Angeles, California; Kansas City, Kansas; New York City.

MAJOR USERS. Airline passengers.

MARKET ENVIRONMENT. Large airports serving major metropolitan areas.

VEHICLES. Small buses, especially equipped with wide doorways and racks to accommodate passengers carrying luggage. Taxis can also be used.

DISPATCHING. Needed only to keep reliable headways.

MANAGEMENT. Most common is the small private transit company. However, taxis can also be utilized in a shared-ride mode, as a part of their regular airport access services.

LABOR. Usually non-union bus drivers, but may also be taxi drivers if the company offers this service.

IMPACTS ON OTHER MODES. None.

REGULATORY ENVIRONMENT. Airport grounds are normally under the jurisdiction of a special authority that may grant franchises or permission to operate these services.

PROFITABILITY. Intra-airport services are usually operated as profit-making businesses by private entrepreneurs.

Late-Hour and Weekend Jitney on Bus Routes*

DEFINITION. At low-demand times, such as early morning, late evening and over weekends, when ridership is not sufficient to justify the use of mass transit buses, jitneys are used to provide public services along the bus routes. The jitneys run at fairly long but regular intervals, stopping only when hailed.

EXAMPLES. None.

MAJOR USERS. Regular riders will be commuters whose work schedules begin or end at times when bus services are not provided. Elderly persons and

*Innovative service not previously implemented.

those under driving age without access to private transportation will also use the service, especially over weekends for visiting and trips to church and recreational facilities.

MARKET ENVIRONMENT. Residential areas in large and small cities and suburban areas where bus services are curtailed at night and on weekends.

VEHICLES. Passenger vehicles or small vans are most efficient because ridership is low.

DISPATCHING. To insure regular headways, services should be controlled by a dispatcher. If the service is operated by a taxi company, radio facilities can be used. Otherwise an on-site dispatcher, possibly one of the drivers, would take this responsibility.

MANAGEMENT. This type of service can be provided by the local taxi company or by jitney operators assigned to specific routes. The taxi operator has the advantage of being able to employ his night shift vehicles more fully between calls for taxi service and can quickly substitute one vehicle for another if the jitney-route driver is away on a taxi call.

LABOR. Taxi drivers or owner-drivers of jitneys and their relief men. This type of flexicab service provides special opportunities to part-time drivers, such as students and those holding other regular-hour employment. There may be some objection by the bus drivers' union to turning this service over to unaffiliated drivers.

IMPACTS ON OTHER MODES. Local bus services should benefit from increased ridership, since transit passengers can be guaranteed a means of getting home again if they are out later than regular bus hours or must start out in the mornings before bus service is available. Some reduction in demand for taxi service could be expected, especially among the elderly on weekends, but most users of the new service would not normally take taxis, and their fares would represent increases in overall revenue.

REGULATORY ENVIRONMENT. If undertaken under an agreement with the local mass transit operator, existing regulations governing the transit service might be extended to the new service. If undertaken privately, changes in anti-jitney ordinances would be necessary.

PROFITABILITY. Since no experiments in this type of flexicab operation were discovered, estimates of profitability can only be speculative. Owner-operators of jitneys make only modest profit on high-density travel routes, and it would seem unlikely that they would profit from this low-demand type of service. Taxi operators may find it more feasible to provide the service because they would have a certain number of vehicles on the road at these hours and would be able to make more intensive use of them. It is highly probable, however, that some community subsidy would be required.

Jitney to Reduce Peak-Hour Demand for Mass Transit*

DEFINITION. Jitney services provided at peak commuter hours on or parallel to heavily used mass transit routes.

EXAMPLES. None.

MAJOR USERS. Commuters, especially those traveling short distances or to points between rapid rail transit stations.

MARKET ENVIRONMENT. Central cities of large metropolitan areas, usually in or near the CBD.

VEHICLES. Small vans carrying 12 to 15 passengers are most appropriate. Passenger vehicles can be used, but may not be so efficient as the higher capacity vehicles and would contribute more to congestion, air pollution and fuel consumption. Larger buses would have more difficulty in moving in and out of traffic flow to make the frequent stops called for by this type of service.

DISPATCHING. Peak-period jitney services are provided without dispatching assistance.

MANAGEMENT. Owner-drivers or leasors of jitney vehicles. This mode appears to offer a good opportunity for taxi companies to extend their operations.

LABOR. Self-employed owners or leasors of vehicles. The short periods of peak demand offer a good opportunity for part-time work. These services may even be carried out by a driver on his way to and from another regular-

*Innovative service not previously implemented.

hour job, operating as a sort of professional carpool. He may even have regular riders who are destined for the same downtown location.

IMPACTS ON OTHER MODES. Regional rapid rail systems that terminate in the central city should benefit from jitney commuter services, since jitneys can provide local shuttle services based at the rail stops for people whose final destinations are beyond convenient walking distance. Jitneys would then be competing with local bus services, but this competition may actually be of benefit to the bus system because it reduces extreme peak demands for vehicles and drivers. Taxis in CBDs are usually operating at maximum capacity during peak periods; competition from jitneys at these times would probably not affect their overall ridership.

REGULATORY ENVIRONMENT. Anti-jitney ordinances in effect in most cities would have to be changed to permit jitney operation.

PROFITABILITY. Existing jitney services offered in the U.S. and abroad do operate at a profit. However, if jitneys are to offer supplemental peak-hour transit service, transit operators may find it desirable to offer a small subsidy in order to insure that enough jitney drivers are attracted to carry a significant number of passengers.

DELIVERY SERVICES

Package Delivery for Local Merchants

DEFINITION. Where rapid delivery is desired but the volume of deliveries is too small to warrant operation of its own delivery van, a retailer will contract for delivery services. In large cities, there is usually sufficient demand for such services to support a specialized delivery business. In small cities or suburban areas, these services will usually be provided by the local taxi operator under a contract to the retailer.

EXAMPLES. Davenport, Iowa.

MAJOR USERS. Retail establishments.

MARKET ENVIRONMENT. Small cities and suburbs.

VEHICLES. Taxis can be used for many of these deliveries, but vans are especially useful when large items must be carried or when seasonal volume is high. Improvement of package carrying capacity for multi-purpose taxi-related services is needed.

DISPATCHING. Pickup times can be regularly scheduled, but usually service is on a demand basis, requiring regular taxi dispatching operations.

MANAGEMENT. This type of service is a practical extension of taxi operations. Speed of service and reliability are essential, as in other taxi operations. Deliveries can be made during low demand periods and can sometimes be combined with passenger services to the same neighborhood.

LABOR. Taxi drivers.

IMPACTS ON OTHER MODES. None.

REGULATORY ENVIRONMENT. No problems.

PROFITABILITY. Some taxi companies charge an extra delivery fee in addition to the premium fare to compensate for the driver's having to leave his vehicle to complete the delivery. Other companies, interested in developing delivery services to keep their vehicles and drivers employed at slack times, will offer more attractive rates. All delivery services are operated for profit. Types of products utilizing rapid delivery include: flowers, candy, other perishable food products, ice, liquor and drugs.

Telegram Delivery

DEFINITION. Delivery of printed telegrams to addressees under contract to local Western Union offices. Message has usually been received previously by telephone, so these confirmation copies need not normally be delivered immediately.

EXAMPLES. Santa Barbara, California.

MAJOR USERS. Telegraph offices.

MARKET ENVIRONMENT. Small cities and suburban communities where volume of business does not justify in-house delivery capability.

VEHICLES. Taxis.

DISPATCHING. Regular taxi dispatch system is used.

MANAGEMENT. Taxi company.

LABOR. Taxi drivers.

IMPACTS ON OTHER MODES. None.

PROFITABILITY. This service is always carried out as a profit-making adjunct to normal taxi operations.

Private Mail Pickup and Delivery

DEFINITION. As public mail service has become slower, less frequent and less reliable in recent years, many business firms have found it necessary to supplement mail delivery by other means. This is especially true of firms operating in small cities or in suburban locations outside of major cities. Rather than using an employee to make supplementary trips to the post office, some business firms contract with local taxi companies to provide this service for them. On regularly scheduled tours or in response to special requests, taxi drivers take mail to the post office or pick up mail from post office boxes and deliver it to the business establishment.

EXAMPLES. Davenport, Iowa.

MAJOR USERS. Business firms.

MARKET ENVIRONMENT. All areas where public mail services are not sufficient to meet business needs, especially in small cities and suburbs.

VEHICLES. Taxis; vans may be used if the taxi company undertakes this extended service on a large scale, or sizable packages are involved.

DISPATCHING. Dispatching capability is needed in order to respond to special (unscheduled) demands.

MANAGEMENT. This is another practical extension of taxi services to utilize vehicles and drivers at non-peak hours of service.

LABOR. Taxi drivers. Business firms feel more assured when one particular driver is permanently assigned to the job, especially where valuable packages or large checks are among the mail being delivered.

IMPACTS ON OTHER MODES. None.

MARKET ENVIRONMENT. No problems.

PROFITABILITY. This type of flexicab service is only undertaken as a profit-making venture.

Delivery of Meals-on-Wheels

DEFINITION. Hot meals prepared by a welfare agency or service organization are delivered to low-income elderly or bedridden recipients who are not able to cook for themselves. Delivery is frequently carried out by volunteers, but in some instances this part of the operation is subcontracted to a local taxi company.

EXAMPLES. Santa Barbara, California.

MAJOR USERS. Elderly and bedridden, usually residents of low-income areas.

MARKET ENVIRONMENT. Primarily small cities and their environs.

VEHICLES. Vans are preferred to passenger-type taxi vehicles because of greater capacity and more convenient doorways.

DISPATCHING. Prearranged delivery schedules do not require regular taxi dispatching capability.

MANAGEMENT. Taxi operator.

LABOR. Taxi drivers.

IMPACTS ON OTHER MODES. None.

REGULATORY ENVIRONMENT. No problems.

PROFITABILITY. Since the recipients of the means are generally of low to moderate income, the program must be subsidized. The subsidy may be provided by the welfare or service organization, in which case it may be possible for the taxi company to provide this service at a profit. However, the taxi company may undertake to carry out the service at cost or as a public service, absorbing the operating costs.

Door-to-Door Air-Taxi Delivery

DEFINITION. A combined taxi and airline delivery service for packages that must be delivered more quickly than by other types of air mail or freight service. Cooperative operating agreements between taxi companies in various cities and air freight or airline companies permits the package to be picked

up by a taxi in the city of origin; delivered to the air terminal; flown between cities as passenger luggage rather than air cargo; and picked up by taxi at the airport in the destination city and delivered directly to the adressee. Materials shipped include half-life drugs, computer tapes, government forms or documents due by absolute deadlines, ad campaign material, films, research reports, and blueprints that would otherwise have to be hand-carried by a courier.

EXAMPLES. Skycab, American Parcel Service in all major cities.

MAJOR USERS. Business firms.

MARKET ENVIRONMENT. All sizes of cities and environs served by airlines.

VEHICLES. Taxis.

DISPATCHING. Taxi dispatching capability.

MANAGEMENT. Taxi companies for local delivery; air freight or specialized air carriers for intercity service.

LABOR. Taxi drivers (for surface transport segment).

IMPACTS ON OTHER MODES. None.

REGULATORY ENVIRONMENT. Permissive.

PROFITABILITY. This type of extended taxi service provides another profitable area of business for existing taxi companies.

APPENDIX D

BASES OF DATA PRESENTED IN HYPOTHETICAL EXAMPLES OF FLEXICAB APPLICATION

Items are numbered to correspond to references in the text of Section 4.

EXAMPLE 1: FLEXICAB AS THE SOLE MEANS OF PUBLIC TRANSIT IN A SMALL URBAN AREA

(1) Former Taxi Resource

Monthly revenue:

43 trips/day x $2.20 average fare x 30 days/mo. = $2,838

Monthly costs:

Vehicles	2 5-passenger cabs
Vehicle replacement	5 yrs.
Original cost of vehicle	$3,800
Average length of trip	5 mi.
Fuel consumption	12 mpg
Fuel cost	57¢/gal.
Oil consumption	5 qts./mo.
Oil cost	60¢/qt.
Tire replacement (2 vehicles)	5 sets/yr.
Tire cost/set (retreads)	$52/set
Insurance	$75/mo./vehicle
Legal and accounting costs	1% of gross
Miscellaneous expenses	1/2% of gross
Drivers' wages	$4/hr.

Vehicle replacement (2 vehicles x $3,800 ÷ 5 yrs. ÷ 12 mo.)	$ 127
Fuel (43 trips x 5 mi. x 30 days ÷ 12 mpg x 57¢)	$ 306
Oil (5 qts. x 60¢)	$ 3
Tires (5 sets x $52 ÷ 12 mo.)	$ 22
Insurance (2 vehicles x $75)	$ 150

Drivers' wages ($4 x 13 hrs. x 30 days)	$1560
Payroll taxes	$ 71
Workmens' compensation	$ 138
Maintenance (own repair shop)	$ 25
Repair shop rent and phone	--
Legal and accounting (1% x $3,000)	$ 30
Miscellaneous (1/2% x $3,000)	$ 15
Telephone answering service for evenings and weekends	$ 100
Total monthly operating cost	$2,547

Annual Profit:

Monthly revenue	$2,838
Monthly costs	2,547
Monthly profit	$ 291
	x12
Annual profit	$3,492

(2) The Proposed Bus System

The transit operator's bid of $22 per vehicle-hour is derived from the bid of Southern California Rapid Transit District to the City of Huntington Park. SCRTD's bid of $23.50 was reduced slightly to reflect a lower wage scale in the smaller community used as the example in the text. Ridership of 500 per day represents one percent of the area's population, a reasonable estimate for a new line-haul system at this level of service.

Daily revenue	
(500 passengers x 25¢ fare)	$ 125
Annual revenue	
(313 days (365 less 52 Sundays) x $125)	$39,125
Annual costs to the city of providing the bus service would be:	
3 vehicles x 13 hrs./day x 313 days/yr. x $22/vehicle-hr.	$268,554

The annual deficit of operating costs over revenue would be:

Annual revenue	$ 39,125
Annual costs	268,554
Annual deficit	$229,429

(3) The Flexicab System: Revenues and Cost to City

Revenue from the flexicab system based on an average of 500 and 1,000 passengers per day, including Sundays, would be:

500 x 25¢ = $125/day x 365 days = $45,625/yr.

1,000 x 25¢ = $250/day x 365 days = $91,250/yr.

Costs to the city would be based on using 3 vehicles full-time plus 2 vehicles half-time, or an equivalent of 4 full-time vehicles for 365 days per year:

4 vehicles x 13 hrs./day x $11/vehicle-hr.
= $572/day x 365 days = $208,780/yr.

Deficits to be covered by the city would then be:

500 passengers/day: $572-$125 = $447 x 365 days = $163,555

1,000 passengers/day: $572-$250 = $322 x 365 days = $117,530

Net cost to the city of the flexicab system as a percent of the proposed bus system would be:

500 flexicab passengers/day: $163,555 ÷ $229,429 = 71.1%

1,000 flexicab passengers/day: $117,530 ÷ $229,429 = 51.2%

(4) Model for Flexicab Jitney/Dial-a-Ride Service

The combined jitney/dial-a-ride service described here is modeled primarily on the Regina Dial-a-Ride Bus system, which operates regularly scheduled tours within zones and transfers passengers to the line-haul services with access to other zones. The assumption that most riders are regular users and the technique for computer printing of pick-ups for each tour also come from the Regina system. Regina drivers also plan their own routes to accommodate last-minute additional requests for service, as described in the hypothetical

example in Section 4.

(5) Flexicab Operating Costs

It is assumed in Table 10 that the manager functions as the principal dispatcher, earning a salary of $26,000 per year. The dispatcher's relief periods, taken at low-demand times, are covered by relief drivers. An additional $4,000 per year is budgeted for benefits (i.e., workmen's compensation, health insurance, payroll taxes) and for vacation replacement of the manager-dispatcher.

Drivers are paid $4 per hour. The system requires 18,890 driver-hours per year, or the equivalent of 4 operating 13 hours for 365 days per year, resulting in direct wages of $75,920. A full-time mechanic at $10,400 per year is included. An additional $16,000 is budgeted for benefits.

Vehicle replacement is based on a three-year life for the three Dodge vans ($5,500 new) and for the two taxi vehicles ($3,800 new). Replacement of $24,100 in vehicles every three years results in an annual replacement cost of $8,033.

Vehicle maintenance is estimated roughly on the basis of $50 per week for each of the 5 vehicles in the fleet ($50 x 52 x 5 = $13,000). The salary of the mechanic is included under drivers' wages above.

The estimates for gas, oil and tires assume an average of 900 miles per day for the total system. This is based on 10 mi./tour x 2 tours/hr. x 13 hrs. for each of the 3 vans, or substitute taxi vehicle when a van is out of service, plus an additional 110 mi./day for the emergency pick-ups by taxis that insure a high level of service. On the basis of 10 mpg and 57¢/gallon, annual fuel costs amount to $18,725. Oil at 60¢/quart, consumed at a rate of one quart/1000 miles, comes to $197. Twenty sets of retreated tires at $60/set of four would cost $1,200. Annual expenditures would then amount to:

Gas	$18,725
Oil	197
Tires	1,200
Total	$20,122

Radio equipment costs are assumed to run $1,500 for the dispatcher's site and $650 for each of the 5 vehicles in the fleet, or a total of $4,750. A 10-year life is normal for such equipment, implying an annual cost of $475.

Insurance at $75 per month for each of the 5 vehicles amounts to $4,500 per year.

License plates for the 5 vehicles cost an estimated $840 per year, about $200 per van and $120 per taxi.

Rent of $250 per month, or $3,000 per year, is considered adequate in a city of this size to provide a facility for dispatching and managing the system. Phone costs will probably amount to nearly as much as rent, around $2,500 per year. $1,000 is allocated for annual replacement of office equipment, and $700 is budgeted for supplies and miscellaneous expenditures.

Legal and accounting services are estimated as 1 percent of gross receipts from all flexicab operations, or roughly $2,800, while computer services provided by the city college could be expected to amount to about $450 per month, or $5,400.

Many of these detailed cost figures are also used as the basis for estimating operating expenses for other dial-a-ride services of the three hypothetical flexicab systems.

(6) Premium Taxi Service

The average number of trips per day is assumed to have dropped from 43 to 23 with the implementation of the subsidized flexicab service, since many former taxi trips were made during the day and are now being made using the city-subsidized service.

Annual revenue:

23 trips/day x 365 days x $3/av. fare = $25,185

Annual operating costs:

Drivers' wages: Since the night work load is so light, college students can be used as drivers. They work for a $2/hr. minimum wage, plus benefits and tips, and sleep and study between calls. An average of 4 hours/day of daytime drivers is logged to premium taxi service at $4/hr. for drivers' wages. Total wage costs to

the flexicab operator are:

(11 hrs. x $2) + (4 hrs. x $4) + $5 benefits
= $43/day x 365 = $15,695/yr.

The cost of dispatch services during the day is absorbed by the flexicab operation; night dispatching by the answering service costs $10/day, or $3,650/yr.

The expenses of vehicle replacement, maintenance, license fees, radio and insurance have already been charged to the basic flexicab operation. Costs of gas, oil, and tires are based on an average trip length of 5 miles, or a total of 41,975 miles per year:

Gas (41,975 ÷ 12 mpg x 57¢)	$1,994
Oil (41,975 ÷ 1000 mi./qt. x 60¢)	25
Tires (1 extra set/yr. x $60/set)	60
Total	$2,079

In summary, total annual operating costs are:

Drivers' wages	$15,695
Night dispatching	3,650
Gas, oil and tires	2,079
Total	$21,424

Annual net income:

Revenue	$25,185
Cost	21,424
Net income	$ 3,761

(7) Evening Shoppers' Service

Annual operating costs:

Subsidy by Merchants Association	$15/vehicle-hr.
Days per year (52 Fridays + 12 additional days at Christmas)	64 days/yr.
Hours of operation (7-10 p.m. x 64 days)	192 hrs./yr.
Wages at time-and-a-half:	
Dispatcher	$7/hr.
Telephone clerical	$5/hr.
Driver	$6/hr.

Daily mileage (based on the ratio of 900 mi./day for 13 hrs./day for shoppers' service, less 10% for reduced night-time ridership)	187 mi./day
Annual mileage (187 mi./day x 64 days)	11,968 mi./yr.
Annual wage costs (one dispatcher, one telephone-clerical, 3 regular and one half-time relief driver: $7 + $5 + (3-1/2 x $6) = $33/hr. x 3 hrs. x 64 days/hr.)	$6,336
Annual vehicle-related costs (based on the ratio of costs of gas, oil, tires and vehicle replacement of $28,100 for regular daytime service for 328,500 mi./yr. x 11,968 mi./yr. for shoppers' service)	$1,024
Total operating costs ($6,336 + $1,024)	$7,360
Annual revenues ($15/vehicle-hr. x 192 hrs./yr. x 3-1/2 vehicles)	$10,080
Annual net earings:	
Revenue	$10,080
Cost	7,360
Net earnings	$ 2,720

(8) Special Events Evening Service

Annual net earnings:

Hours of operation (24 theater performances at 2 hrs./night, plus 8 all-evening rodeos, festivals, etc. at 5 hrs./night) 88 hrs./yr.

Same revenue and operating costs/hr. as for shoppers' service.

Earnings calculation, based on $2,720 net earnings for shoppers' service:

$$\$2,720 \times \frac{88 \text{ hrs./yr. for special service}}{192 \text{ hrs./yr. for shoppers' service}} = \$1,247$$

(9) Subscription Service to Packing Plants

Wages	$15/day/driver plus 15% for benefits
Vehicles	3 vans
Passengers/vehicle	10 pass.
Passengers/run	30 pass.

Runs/shift		2 runs
Shifts/night		2 shifts
Peak packing season		10 wks./yr.
Operation during peak season		7 days/wk. 40 mi./day/veh.
Computer and clerical service		$1,700/yr.
Subsidy from packing plants		75¢/passenger
Fee for administration from packing plants		$2,500
Annual revenue:		
No. of passengers (3 vehicles x 10 pass./ vehicle x 2 runs/shift x 2 shifts/night x 6 nights/week x 10 weeks)		7,200
Annual subsidy (75¢/passenger x 7,200 passengers)		$5,400
Administration fee		$2,500
Total annual revenue		$7,900
Operating costs:		
Drivers' wages (3 x $15/day x 60 days)		$2,700
15% for benefits		$ 405
Total wages		$3,105
Vehicle costs		
Annual mileage (40 mi./day/vehicle x 3 vehicles x 60 days)		7,200 mi./yr.
Vehicle costs (calculated as before)		$616
Wages & vehicle costs ($3,105 + $616)		$3,721
Wages & Veh. cost/rider ($3,721 ÷ 7,200 riders		52¢
Computer and clerical costs		$1,700
Total costs ($3,721 + $1,700)		$5,421
Annual profit		
Revenue	$7,900	
Costs	5,421	
Profit	$2,479	

(10) Special Delivery Services

These are the types of supplementary services carried out by taxi operators in small cities such as Santa Barbara, Calfiornia, and Davenport, Iowa, and would be appropriate for this hypothetical community.

Driver and vehicle	1 full-time equivalent
Hours of operation	8 hrs./day, 6 days/week
Wages (including 15% benefits)	$4.60/hr.
Vehicle costs	$2.20/hr.
Operating costs ($4.60 + $2.20)	$6.80/hr.
Daily revenue	$75/day
Annual Profit	
Revenue ($75/day x 313 days)	$23,475
Costs ($6.80 x 8 hrs./day x 313 days)	17,027
Profit	$ 6,448

EXAMPLE 2: FLEXICAB AS A SUPPLEMENT TO A LIMITED MASS TRANSIT SYSTEM IN A MEDIUM-SIZE URBAN AREA

(11) Mass Transit System

The hypothetical bus system is based roughly on the system operating in Santa Barbara, California in 1972. Headways, fares, subsidy required, ridership, and operating costs per vehicle-mile are typical of line-haul systems of this size.

(12) Former Taxi Resource

The former taxi operation hypothesized for this example is derived largely from the 1972 experience of the Yellow Cab Company of Santa Barbara, California, prior to its experiment with dial-a-ride service. Operating cost data were supplied directly by the company, rather than derived as in Example 1, but have been modified to reflect current prices and wage levels and the type of operation postulated for this example. Fare costs reflect the use of natural gas at 15¢ per gallon.

(13) The Flexicab System

The initial flexicab operation is taken from the experience of Yellow Cab Company of Santa Barbara with an experimental dial-a-ride service. Ridership and operating cost data approximate those of the actual system, although 12-passenger rather than 10-passenger vans were used, and several regular taxi drivers shared dial-a-ride assignments rather than a few being permanently assigned to the job. Criticisms of the system are INTERPLAN's, but are based in part on information supplied by the company. Mr. Ernest Parks, President of Yellow Cab Company, was very generous not only with information about his own operations, but also in spending several hours reviewing INTERPLAN's hypothetical systems and suggesting changes to increase their realism.

(14) Integrating Bus and Dial-a-Ride

The concept of integrating demand-responsive and line-haul bus services is borrowed from Regina, but the idea of a bus operator's subcontracting with a taxi company for dial-a-ride feeder services is an INTERPLAN invention. The ridership postulated for the combined system-- 3 percent of the area's population-- has actually been achieved in Regina.

(15) Jitney as Bus Substitute

Operation of jitneys as substitutes for buses is also an INTERPLAN invention. The operating arrangements are hypothetical but believed feasible, and the ridership and fares are thought to be reasonable speculations.

(16) Revenues and Costs of the Flexicab System

Day-time dial-a-ride service revenues:

Average no. riders/tour	3.5 riders
Tours/hour	3 tours
Hrs./day	13 hours
Days per year (no service on Sundays)	313 days
Zones	6 zones
Vehicles/zone	2 vehicles

Full fare	$1
Discounted subscription fare (20% off)	80¢
Discounts	Apply to 30% of fares
Passengers/year (3.5 av. riders/tour x 3 tours/hr. x 13 hrs. x 6 zones x 2 veh./ zone) = 1,638 passengers/day x 313 days/ yr.)	512,694/yr.
Discounted fares (1,638 passengers/day x 30%)	491/day
Regular fares (1,638 - 491)	1,147/day
1,147 passengers at $1 regular fare	$1,147
491 passengers at 80¢ discounted fare	$ 393
Total daily farebox revenue	$1,540
Annual revenue ($1,540 x 313 days/yr.)	$482,020

Evening and Sunday dial-a-ride service revenues:

Passengers/hour/zone	6 pass.
Vehicles/zone	1 veh.
Zones	6 zones
Hrs./week (5 hrs./day x 6 days/week + 18 hrs. Sunday)	48 hrs.
Fare (no subscribers at off-hours)	$1
Weekly revenue (6 passengers/hr./zone x 1 vehicle/zone x 6 zones x 48 hrs./week x $1 fare)	$1,728
Annual revenue ($1,728 x 52)	$89,856

Jitney service revenues:

Subsidy from transit district	$9/veh. hr.
Hours of operation	48 hrs./wk.
Vehicles	4 veh.
Weekly revenue ($9/veh./hr x 48 hrs./ week x 4 veh.)	$1,728
Annual revenue ($1,728 x 52)	$89,856
Total annual revenue, daytime and evening, dial-a-ride and jitney ($482,020 + $89,856 + $89,856)	$661,732

Combined dial-a-ride and jitney operating expenses:

Annual salary of manager, including benefits			$30,000
Annual salary of dispatcher, including benefits			$12,000
Dispatchers			3 persons
Vacation replacement for manager and dispatchers			$10,000
Total driver hours/year			
Weekdays:	13 hrs. x 12 veh. x 313 days/yr.	=	48,828
Evenings:	5 hrs. x 10 veh. x 313 days/yr.	=	15,650
Sundays:	18 hrs. x 10 veh. x 52 week/yr.	=	9,360
			73,838 hrs./yr.
Drivers' wages, including benefits			$5/hr.
Vehicles			12 veh.
Vehicle cost			$5,500
Maintenance per vehicle			$50/wk.
Average use of vehicle			400 mi./day
Natural gas fuel			15¢/gal.
Average consumption of fuel			12 mpg
Average consumption of oil			2.5 qts./veh./mo.
Cost of oil			60¢/quart
Sets of tires			2.5/veh./yr.
Cost of retread tires			$52/set
Cost of two-way radio			$650/veh.
Cost of dispatch center radio			$1500/station
Insurance			$80/veh./mo.
License fee			$200/veh./yr.
Computer services			$500/mo.
Rent			$500/mo.
Telephone			$500/mo.
Legal and accounting services			1.5% gross revenue

Wages and benefits		
Manager, including benefits	$30,000	
3 dispatchers, including benefits	36,000	
Vacation replacements	10,000	
Drivers (73,838 hrs./yr. x $5/hr.)	369,190	
Total wages and benefits	$445,190	
Vehicle replacement (12 veh. x $5,500 ÷ 3 yrs.)		$22,000
Vehicle maintenance ($50/veh./wk. x 12 veh. x 52 wks.)		$31,200
Fuel, oil and tires:		
Natural gas (400 mi./day x 12 veh. ÷ 12 mpg x 15¢/gal. x 365)		$21,900
Oil (2.5 qts./mo. x 12 veh. x 60¢/gal. x 12)		$ 216
Tires (2.5 sets/yr. x 12 veh. x $52/set)		$ 1,560
		$23,676
Radio equipment (12 veh. x $650 plus 3 stations x $1,500)		$12,300
Annual radio equipment cost ($12,300 ÷ 10 yrs.)		$ 1,230
Insurance ($80/mo. x 12 veh. x 12)		$11,520
License fees ($200 x 12 veh.)		$ 2,400
Rent ($500/mo. x 12)		$ 6,000
Phone ($500/mo. x 12)		6,000
Office equipment and miscellaneous		3,000
Total		$15,000
Legal and accounting (1.5% of $662,000)		$ 9,930
Computer ($500/mo. x 12)		6,000
Total		$15,930

(17) Premium Taxi Service

Revenue

Trips/yr. with former service	450,000 trips
Reduction under competing flexicab service	70%
Average fare	$2

Former annual operating costs		$720,000
Increase in operating costs/passenger		17%
Passengers/trip		2 passengers
Revenue (450,000 trips x 30% of former use x $2)		$270,000
Operating costs, former operation:		
Passengers/yr. (450,000 trips x 2 pass./ trip)		900,000 pass.
Cost/pass. ($720,000 ÷ 900,000)		$0.80
Operating costs, new operation:		
Pass./yr. (900,000 x 30%)		270,000 pass.
Costs/passenger ($0.80 x 1.17)		$0.936
Annual operating costs (270,000 pass. x $0.936)		$252,720
Net profit, new operation:		
Revenue	$270,000	
Operating costs	252,720	
Net profit	$ 17,280	

(18) Subsidy of Low-Income Ridership

The subsidy program described is an INTERPLAN invention, which to our knowledge has never been attempted. It was drawn up so as to keep tax increases to a minimum and incur no loss for the new flexicab operator while offering essential transportation to those in the community who cannot afford the relatively high cost of the personalized transit services. INTERPLAN also believes it is essential to provide subsidized transportation so that it carries no stigma; therefore, the use of regular dial-a-ride tickets is suggested.

EXAMPLE 3: FLEXICAB AS A PROMOTER OF MASS TRANSIT USE IN A LARGE URBAN AREA

(19) Mass Transit System

The bus system is patterned roughly on the AC Transit District service operating in and around Oakland, California, scaled down to fit the population of the hypothetical urban area. Daily round-trip passengers on the imaginary system amount to 1.7 percent of the area's 2 million population.

The rapid rail system is an INTERPLAN invention. Some of its characteristics are taken from the BART system in the San Francisco-Oakland metropolitan area. Ridership amounts to 0.45 percent of the area's population.

The commuter rail system approximates the Southern Pacific Railway service from San Jose to San Francisco. Ridership, fares, and operating deficit are close to those in effect in 1973. The hypothetical system carries 0.65 percent of the area's population, yielding a total daily round-trip transit ridership of 2.8 percent of the 2 million population of the area.

(20) Former Taxi Resource

The former taxi operation is assumed to have had an exclusive franchise for service within the city of 900,000 population. The 400 vehicles in the fleet provide a ratio of 0.44 taxis per 1,000 population, considered to be fairly representative of cities of this size range where entry is restricted (median licenses per 1,000 population for all cities is 0.57).

Revenue:

Vehicles in fleet	400 veh.
Average no. fares/day	20 fares
Average fare	$2.85
Annual revenue (400 x 20 x $2.85 x 365)	$8,322,000

Operating costs of premium taxi operation in the medium-sized city are $0.936 per passenger, or $1.87 per trip. Of this 65% is wages, while 35% is other costs. Wages in the large city are assumed to run 50% higher (e.g. $6/hr. for drivers as opposed to $4/hr. in the medium-sized town). Some of the operating costs, such as rent, legal and accounting services and advertising are assumed to be higher in the large city, but are offset in part by savings in bulk purchasing of fuel, vehicles, and other equipment and supplies made possible by the size of the larger operation. It is assumed, therefore, that costs other than wages would be 40% higher overall. Thus:

Wages/trip ($1.87/trip x 65% x 1.5)	$ 1.82
Other costs/trip ($1.87 x 35% x 1.4)	.92
Total costs per trip	$ 2.74
per vehicle/day ($2.74 x 20)	$54.80
fleet/yr. ($54.80 x 400 x 365)	$8,000,800

Net profit:	
Annual revenue	$8,332,000
Annual operating costs	8,000,800
Annual net profit	$ 331,200

(21) Origins of the Flexicab System

The hypothetical original jitney operation described here is closely patterned on the experiences of Yellow Cab Company and La France Transportation Systems in attempting to initiate jitney services in Los Angeles in 1974. The Southern California Rapid Transit District strongly opposed the move, and when overruled by the City Council and Board of Utilities and Transportation, it did apparently expand its routes so as to compete with one of the new jitney services. Yellow Cab Company operated through leasing and charged a $1 fare, as in the hypothetical example. The evaluation of the causes of failure reflects INTERPLAN's opinion, but a representative of the Yellow Cab Company has since stated that he believes a 25-cent fare and subsidized operation are essential to successful operation. Acceptance by the transit district and the coordination of jitney and bus services is an INTERPLAN invention, but is believed to be feasible.

(22) New Taxi Service

No data were found for a taxi operation's change from premium to shared mode; hypothetical data were selected as reasonable for this example.

Passengers/yr.		3.6 million pass.
Average taxi fare		$2.65
Operating costs		$64/veh./day
Vehicles in the fleet		379 veh.
Annual revenue (3,600,000 pass. x $2.65 av. fare)		$9,540,000
Annual operating costs ($64 x 379 veh. x 365)		$8,853,440
Net profit:		
Annual revenue	$9,540,000	
Annual operating costs	8,853,440	
Annual net profit	$ 686,560	

(23) Dial-A-Ride Systems

The four systems hypothesized for this example are taken from turn-key services now operated in three California cities: Huntington Park, El Cajon, and La Mesa. The rate of $10.60/hr. is slight lower than the $11.00 rate generally considered appropriate by knowledgeable taxi operators, but was selected to demonstrate the effect of having vehicles provided by the community rather than by the operator. It is assumed that wage scales in these suburban communities are the same as those in the small city described in Example 1 (e.g., $4/hr. for driver's wages); this may not be true where the community is near enough to a large city to reflect its higher wage scale. It is assumed that overall operating costs per vehicle-hour are identical to those in the small city system, less vehicle replacement costs.

Small city system (Example 1):	
Annual operating costs	$194,400
Vehicle replacement costs per year	8,000
Operating costs net of vehicle replacement	$186,400
Annual vehicle hours	18,980 veh.-hr.
Suburban dial-a-ride services:	
Number of systems	4 systems
Vehicles per system	4 vehicles
Hours of operation (no night or Sun. service)	13 hrs./day 313 days/yr.
Annual vehicle-hours for total of 4 systems (4 x 4 veh. x 13 hrs. x 313 days)	65,104 veh.-hrs./yr.
Subsidy from communities	$10.60/veh.-hr.
Revenue:	
(60,104 hrs. x $10.60/hr.)	$690,102
Annual operating costs:	
($186,400 ÷ 18,980 veh.-hrs. x 65,104 hrs.)	$639,378
Net profit:	
Annual revenue	$690,102
Annual operating costs	639,378
Annual net profit	$ 50,724

(24) Jitney Services

The subsidy arrangements for jitney operations are invented. Leasing arrangements approximate those used in Los Angeles, while drivers' earnings are extrapolated from the information on San Francisco and Atlantic City jitney services where similar low fares are used. Operating costs are derived from data developed for the preceding examples.

Operating costs:

Jitney vehicles	400 veh.
Fare	50¢
Daily round-trip passengers	34,000 pass.
Ridership in peak hours	80% total
Daily peak commuting hrs.	4 hrs.
Trips driven	3 trips/hr.
Peak ridership	12 riders/trip
Off peak ridership	4 riders/trip
Leasing cost to driver	$25/day
Average cost to driver of fuel and dispatching	$5/day
Subsidy to drivers for peak service	$3/trip
New vehicle cost	$5,500
Vehicle life	2 yrs.
Maintenance and repair	$3,000/veh./yr.
Insurance	$900/veh./yr.
Annual management cost of leasing operation	$100,000

Drivers' earnings; morning peak operation only

Fares (2 hrs. x 3 trips/hr. x 12 passengers/trip x 50¢ fare)	$36
Subsidies (6 trips x $3/trip)	18
Daily gross earnings	$54
Expenses ($25 veh. leasing + $2 fuel & dispatching)	27
Net earnings ($54 - $27)	$27

Drivers' earnings, full-day operation:

Gross peak-hour earnings (fare & subsidy), 4 hrs. ($54 x 2)	$108
Off-peak earnings (9 hrs. x 3 trips x 4 pass. x 50¢)	54
Daily gross earnings	$162
Expenses ($25 lease of veh. + $7 fuel & dispatching)	32
Daily net earnings ($162 - $32)	$130

Flexicab revenue from leasing:

Mon.-Fri. (400 veh. x 5 days x 52)	104,000 veh.-days
Sat. (250 veh. x 1 day x 42)	13,000
Sun. (50 veh. x 1 day x 52)	2,600
Total leases/year	119,600 veh.-days
Annual revenue (119,600 x $25)	$2,990,000

Flexicab cost of leasing:

Vehicle replacement ($5,500 x 400 veh. ÷ 2 yrs.)	$1,100,000
Maintenance and repair ($3,000 x 400 veh.)	1,200,000
Insurance ($75/mo. x 12 x 400 veh.)	360,000
Management	100,000
Total leasing costs	$2,760,000

Annual net profit to flexicab company for leasing operation:

Annual revenue	$2,990,000
Annual cost	2,760,000
Annual net profit	$ 230,000

APPENDIX E
METHODS OF ESTIMATING DEMAND*

176 Four techniques of arriving at demand estimates will be described in the following paragraphs. The first two only produce rough estimates but do not necessitate extensive research efforts.

Extrapolation from Conventional Transit Utilization Data on Site

177 When an existing system is to be replaced in part or in whole by Dial-a-Bus service, a record of the existing transit ridership should be obtained. This is fairly easy to estimate if a record does not already exist. The size and distribution of demand can then be estimated for the new service. It is fairly safe to assume that ridership will be at least equal to that of conventional public transit. From recent D.A.B. applications it is also possible to forecast an increase. There is evidence that transit users will continue to use D.A.B. instead of the old transit service, because of the higher quality service offered. Also, past studies have shown that transit users are insensitive to some extent to a reasonable premium that may be charged for the D.A.B. service.[44]

178 In evaluating information derived from conventional public transit sources, one must bear in mind that its applicability will be related to the function of existing fixed-routes within the service area. If D.A.B. operates in competition with conventional systems, then the data will have to be used cautiously and the quantities of new and diverted riders calculated separately. Theoretically speaking, taxi and limousine companies could provide information on specific trips, such as those to and from the airport. Unfortunately, this is usually difficult to obtain. In places with no transit system at all, comparisons can be made with cities of similar size, structure, and urban development.

Inference from Other D.A.B. Projects

179 The experience of D.A.B. systems already in operation will be of great importance to the project manager. Indeed, circumstances may compel municipalities to use results from elsewhere as approximations in forecasting local demand. When this is the case, the following limitations of such an option should be borne in mind:

(a) It is essential that similar conditions exist in both sites, particularly with respect to population densities, family income auto ownership and transit usage.

(b) If the service areas are characterized by nearly identical socio-economic patterns and transportation situations, extrapolation may be justifiable. Otherwise, modifications will be necessary.

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44 Economic Consideration for Dial-a-Ride, Report No.USC TR-70-11, Urban System Laboratory, M.I.T. Cambridge, Mass., March 1971.

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*Reproduced from Dial-A-Bus Manual, Volume II, Transportation Development Agency, Canada (pp. 50-52).

180 Ridership experience per day per 1000 residents varies between 15 and 56 for seven D.A.B. systems (refer to Table 6, Part 1, preceding). For design purposes,an average figure of 26 trips per day per 1000 residents can be used as a first approximation or potential ridership. The highest ridership attained (56 in Regina) can be used as a possible figure only in similar areas. If there is an existing transit system, the current route ridership data can be related to population and residence characteristics within half a block on either side of each route, and the relationships thus developed can be applied to D.A.B. areas under evaluation.

181 Even where data cannot usefully be applied directly to an untried service area, it can be beneficial to study the estimation methodology employed and modified by D.A.B. operators. The Peoria and Decatur Premium Special experiment,[45] showed that there appeared to be a mathematical relationship between size of specific classifications of work force at the traffic generator in the area served, and potential ridership of a high-quality bus service. These calculations held nearly true for seven out of eight separately identifiable employment situations experimented with in both these cities, and the formula predicted the very low level of viable routes which were experienced in the independent Flint project. The formula is:

$$D_1 = \frac{(E_1)^2}{P_1}; \quad D_2 = \frac{(E_2)^2}{P_2}; \quad \text{etc., where:}$$

D_1 = Demand for the high-quality bus service under consideration.

E_1 = Employment figures according to certain census categories, for a specific urban area served.

P_1 = Total number of workers in the urban area to be served by the buses.

182 It should be noted that it might be necessary to apply a multiplier to the results to adjust them to local conditions and to the influence of time. (A more urbanized and congested area may warrant a multiplier of more than unity.)

Diversion Curves

183 Diversion curves are the most common method used to forecast demand for transit services. They represent a quick and easy way to obtain estimates of transit usage. Diversion curves take the form of a graphical display of the percentage of trips attracted to public transit as compared with the automobile, as a function of their travel time ratio, fare ratio, level of service ratio, and other parameters, considered one at a time. These curves can also be stratified for riders from different socio-economic groups. As D.A.B. is a relatively new system, it is questionable whether diversion curves can be used to estimate its demand.However, the existing curves for conventional transit may be used as proxies for D.A.B., provided that the curves are adjusted for site data and the increased level of service.

Mathematical Models

184 There are numerous classifications of modal split models used to determine transit ridership. They can be abstract versus mode-specific, deterministic versus stochastic,demographic versus behavioural. It is not the intention here to discuss these at length. The abstract versus mode-

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45 University of Illinois: Mass Transportation Demonstration Projects, III., Mtd. 3,4, P. 96

specific models as well as the demographic versus the behavioural apprpach are discussed in Part 5, Appendices, following. For modal split models of urban travel, the most widely applied method is regression.The regression model expresses the relationship between the dependent variable (the demand) and the independent variables (time, cost service level,socio-economic factors).Such models have two major deficiencies; their data are too gross to be useful in planning specific low-patronage routes, and their predictions are usually drawn from historical data and therefore are weak in providing for changes in quality of service, social objectives, etc. Cities interested in developing demand forecasts using mathematical models should appoint consultants or a team of technical people to investigate this problem.

CONCLUSION

185 All the known methods of predicting D.A.B. demand appear to be imprecise or expensive, or both. No optimal method exists at present. The approach to the modelling question, therefore, depends upon:

(a) Quality of existing data.

(b) Budget Available.

(c) Size of the planned system.

(d) Precision required for the forecast.

APPENDIX F

REPORT OF INVENTIONS

In accordance with requirements set forth in DOT-TST-72-1, INTERPLAN has reviewed this report and finds that no patentable innovation, discovery, improvement or invention has been made in the course of this study.