TRANSIT COOPERATIVE RESEARCH PROGRAM

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TCRP Report 6

Users' Manual for Assessing Service-Delivery Systems for Rural Passenger Transportation

Transportation Research Board
National Research Council

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Users' Manual for Assessing Service-Delivery Systems for Rural Passenger Transportation

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Subject Area

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The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions,* published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transit Association (APTA), *Transportation 2000,* also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA, the National Academy of Sciences, acting through the Transportation Research Board (TRB), and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time. It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended endusers of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

TCRP REPORT 6

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NOTICE

The project that is the subject of this report was a part of the Transit Cooperative Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the project concerned is appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical advisory panel selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and while they have been accepted as appropriate by the technical panel, they are not necessarily those of the Transportation Research Board, the Transit Development Corporation, the National Research Council, or the Federal Transit Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

Special Notice

The Transportation Research Board, the Transit Development Corporation, the National Research Council, and the Federal Transit Administration (sponsor of the Transit Cooperative Research Program) do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the clarity and completeness of the project reporting.

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FOREWORD

By Staff
Transportation Research Board

This manual will be of interest to agencies engaged in planning, operating, or funding passenger transportation services in rural areas. The manual will assist in designing public transportation services in communities where no systems now exist or in restructuring and improving existing rural transportation. The manual provides detailed methods that allow local planners and operators to identify and analyze transportation services in rural communities.

Under TCRP Project A-2, *Service-Delivery Systems for Rural Public Transportation,* research was undertaken by a team headed by Ecosometrics, Inc. to present an overall plan for conceptualizing alternative transportation systems for rural passenger services. To achieve the project objective, the researchers conducted a comprehensive literature review of current practices. A survey of nearly 200 randomly selected rural public transportation operators, representing all rural public transportation systems in the country, was conducted. The survey collected detailed information on services consumed, services provided, operating and capital costs, sources of funds, and other relevant information. A substantial portion of this information is not available from any other data source.

This manual of recommended methods was developed using these data. The manual includes methods to decide which types and what levels of service to provide and highlights case studies of a variety of successful rural transit operations. Information for contacting specific operators is also provided. Thus, the manual will assist planners and operators in designing and evaluating a wide range of rural passenger transportation service-delivery systems.

Three other products were developed under this project; they are as follows:

- The Rural Transportation Services (RTS) Computer Program. This is a software package that allows the user to identify the characteristics of existing rural transportation systems and the communities that they serve. Information such as operating and performance statistics and financial resources is provided. Users of the program are able to specify their own peer groups, obtain information about systems in those groups, and obtain information for contacting the transit operators they have identified.
- Users' Manual for the Rural Transportation Services Computer Program. This manual describes how to install and operate the RTS computer program.
- Service-Delivery Systems for Rural Passenger Transportation; Final Report. This report provides a description of some of the procedures used and the factors investigated in developing the manual and computer program. Although this report is designed for persons interested in the research process, persons interested in the characteristics and performance of rural transportation systems are encouraged to obtain copies of all of the products of this contract.

Both the computer program and the users' manual for the computer program are available for downloading in the Rural Transportation Assistance Program (RTAP) TAP-IN Bulletin Boards maintained by the Community Transportation Association of America at 202/628-2537. The final report is available on loan through the TCRP, 2101 Constitution Avenue, N.W., Washington, DC 20418.

CONTENTS

ACKNOWLEDGMENTS

The research that produced this manual was performed under TCRP Project A-2 by Ecosometrics, Incorporated and its subcontractors, ATE Management and Service Company, Inc., and Urbitran Associates, Inc.

Jon E. Burkhardt, Vice President of Ecosometrics, Incorporated, was this project's Principal Investigator. He was assisted by Robert J. Hayes, Beth Hamby, Adam T. McGavock, Mark Bower, Fred Fravel, and Linda L. Ryden of Ecosometrics; Andrew J. Mundew and Maxine Marshall of ATE; and Karen Alexander and David Sampson of Urbitran. The authors of thespecific reports and other products of this project are listed with those products. Mr. Burkhardt was the primary author and editor of this manual. Beth Hamby wrote part of Chapter 2 plus the Glossary and the Annotated Bibliography and also created the graphics for this report. Karen Alexander, Andy Mundew, and Fred Fravel wrote initial drafts of the case studies. Statistical tables were prepared by Adam McGavock, and the report was produced by Karen Burkhardt, Linda Ryden, Pat Gaskins, and Mark Bower.

We would like to thank many people for substantial contributions to this report. Our TCRP Project Officer, Stephanie N. Robinson, deserves many thanks for her direction, support, and encouragement throughout the project. We are grateful for the guidance and assistance provided by the members of our Project Panel and those transportation providers and planners who reviewed our works in progress; these persons are listed in Appendix B. We sincerely appreciate the time and consideration given to us by many rural transportation operators, particularly those visited by the research team.

Chapter 1: Rural Passenger Transportation Services

- *Why We Need Rural Passenger Services*
- *Rural Services Now Available*
- *Objectives of This Manual*
- *The Companion Product*
- *What Do the Numbers Mean, Anyway?*
- *A Road Map for Our Journey*

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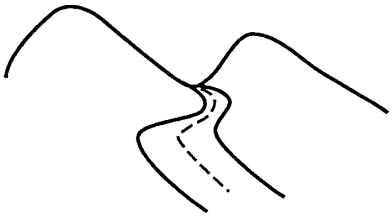
WHY WE NEED RURAL PASSENGER SERVICES

Many rural counties now have excellent all-weather road systems, but some rural residents still remain isolated from the mainstream of modern American society because of their inability to travel. Folks who don't own or drive their own cars face particularly difficult situations because many rural communities lack good public or private transportation alternatives to the automobile. Other folks can't pay the price for transportation services when they are available. Long travel distances required to reach everyday destinations compound the difficulties for people with travel problems who live in the rural countryside and smaller towns. In many rural areas, the availability of an automobile is an important indicator of physical mobility, and the lack of an auto is a proxy measure of isolation.



Communities with large numbers of older persons, families with limited incomes, school-age children, or one-car families often have substantial unmet transportation needs. Compared to the mobile segment of those in rural areas who are able to drive and can afford to maintain reliable private automobiles, those who do not have access to an auto or are not able to drive are at a considerable disadvantage. The social and economic isolation fostered by distances between people and communities is compounded by the expense of traveling. Rural residents without mobility are often unaware of available measures to improve their living conditions or unable to take advantage of those they know about. Their lack of mobility substantially decreases their opportunity to participate in the activities and transactions characteristic of modern society. This lack of opportunity in turn maintains, if not actually produces, many of the cultural and economic problems of rural regions. Thus, the lack of effective transportation services is one of the major problems that hinders the full development of rural America today.

The numbers of rural public transportation systems are growing. As we will show later in this manual, the most effective rural transit systems are those that serve all of their residents, not just members of some particular group. But many rural areas still have no passenger transportation service, and some rural transit operations need to become more effective than they are now.

The following indicators illustrate the restricted public transportation opportunities of many rural areas:

- Of the smallest rural communities, those with 2,500 persons or less,
  - — half of them have no public transportation at all: no taxi, intercity bus, specialized transit, or public transit service.

— Ninety percent of them do not have taxi service; 90 percent do not have intercity bus service; almost 90 percent do not have specialized transit services.

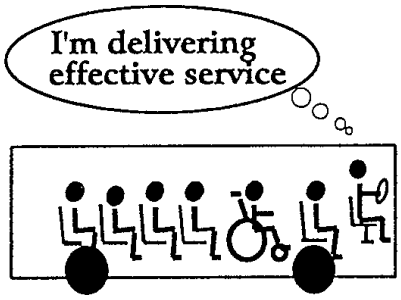
- Of the next largest rural communities, i.e., those places with populations of between 2,500 and 10,000 persons,
  - — one-sixth of them do not have any public transportation services whatsoever,
  - — one-fifth of them do not have taxi services,
  - — three-fifths of them do not have intercity bus services, and
  - — two-thirds of them do not have specialized transit services.

As can be seen, very small communities are not likely to provide the patronage to support, nor the tax base to subsidize, many of the transit services available in larger communities.

RURAL SERVICES NOW AVAILABLE

There are almost 1,200 rural public transportation systems in the United States now funded through the Federal Transit Administration's (FTA) Section 18 Public Transportation for Nonurbanized Areas Program. Federal funding has not dramatically increased since the program's inception, but state governments have increased their funding considerably. Transportation projects funded through FTA's Section 16 program for meeting the special needs of the elderly and disabled also serve many rural areas.

While publicly sponsored rural passenger transportation has become an established service in some rural areas in the United States over the past 20 years, and despite a greater service availability in many areas now, the need to make these services efficient and effective is even greater than before due to serious constraints on public service budgets. Designing service-delivery systems that are closely tailored to the needs and resources of their specific local communities is a key means of increasing efficiency and effectiveness.



The service models and planning methodologies that have been developed for transportation systems in urban areas do not apply to rural areas. The differences between successful rural and small urban transportation systems and their counterparts in large urban areas are enormous. What works well in large urban areas will not work well in rural or small urban areas because of:

- the dispersion of origins and destinations,
- the overall low density of demand,

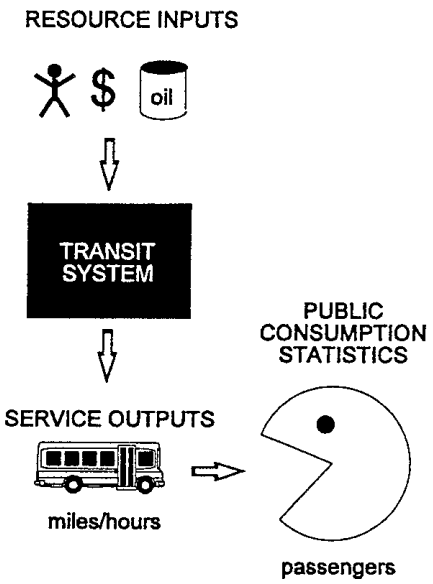
- the different characteristics of the transportation disadvantaged (or transit dependent),
- the nature of the trips demanded, and
- the lifestyles and characteristics of rural and small-urban residents.

Proportionally, rural areas still contain more persons who are aged, disabled, and low income than urban areas.

Despite the obvious needs, no detailed methodology has ever been produced to assess service-delivery systems for rural passenger transportation systems. This manual fills that void.

OBJECTIVES OF THIS MANUAL

This manual is one of two products designed to help you to design, evaluate, and improve rural transportation services for your community. Funded through the Transit Cooperative Research Program, this manual provides information about rural transportation service options, how often they are being used and where, and their performance results in those communities. At the moment, all systems included in the data files are those funded through the Section 18 program of the U. S. Department of Transportation, Federal Transit Administration. (We know that there are other good transportation services now operating in rural communities, and hope that a future version of these products will include systems funded through FTA's Section 16 program plus operations funded through the various agencies of the U. S. Department of Health and Human Services, plus other specialized services.) Case studies of exemplary systems are included, and the appendices include statistics on most of the Section 18-funded rural transit systems now operating in the United States, with comparisons by service types and by region. Contact information for 1,100 systems is also included.



The other product is the Rural Transportation Services computer program, an easy to use database program that enables you to view information of interest to you about rural public transportation services that are currently operating in the United States. The program, described in Appendix A, provides you with detailed information about the public transportation services that now operate in rural communities and about those communities.

These products are intended as tools to help you

1) **design** public transportation services in rural communities where none now exist, and

2) **restructure and improve** rural public transportation services where they do exist.

You can compare communities to each other and their transportation services to each other, and **YOU get to choose how to make the comparisons.** You'll see which services are most efficient in which types of communities and, in the end, you'll get the names, phone numbers, and addresses of the folks who run these systems so you can contact them directly and find out how their experiences can help you.

While each of these products is designed so that it may be used alone, you will probably get the greatest benefit from using this manual and the companion computer program together. Persons without the necessary computer hardware or software may wish to enlist the assistance of regional or state transportation planners for the computer operations.

If service planning was a truly easy task, we wouldn't need to spend lots of time, energy, and money doing it. While these products will make your job easier and your choices more enlightened, you will still need to put real work into creating plans, testing and evaluating them, revising them, presenting them to appropriate community leaders, and revising them again based on community inputs and operating experiences. This manual, and the companion computer program, were designed to give you as much information as possible about what other folks are doing in other rural communities and with what results. That kind of information will be a powerful tool to aid your efforts to create the best transportation service for your own community. Like any other tool, the more you use it, the better feeling you will have for its benefits and the more benefits you will obtain.

Let's get started.

Background

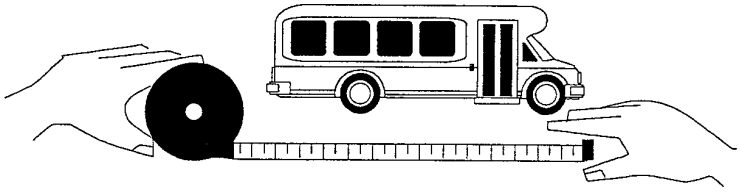
In late 1992, the **Transit Cooperative Research Program (TCRP)** announced a research project statement entitled ***"Service Delivery Systems for Rural Passenger Transportation."*** The problem statement in that announcement states, in part,

"...it is difficult for rural transportation providers and planners to design and evaluate an effective and cost-efficient service-delivery system....no generally accepted set of methodologies or guidelines are available to assist rural transportation providers and planners.

"Because of the complexities in providing transit service in rural areas, transportation providers and planners must have

credible methodologies and guidelines for designing and evaluating delivery systems for existing, expanded, and reduced rural transit services. These tools must be in a format adaptable for use by rural transportation providers and planners under a wide range of conditions, which include terrain and geographic constraints; demographic and socioeconomic characteristics; and economic and market forces...

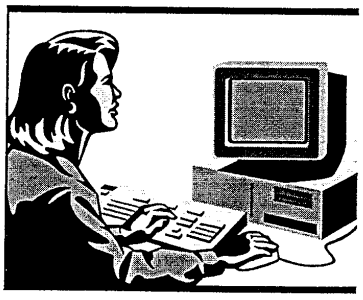
"The objective of this research project is to develop a manual of recommended methodologies for use by transportation providers and planners in designing and evaluating a wide range of rural passenger-transportation service delivery systems...."



TCRP authorized Ecosometrics, Incorporated and its subcontractors, ATE Management and Service Company, Inc. and Urbitran Associates, Inc., to begin work on this project in May 1993. The work plan for this project included a mail survey of rural transit operations funded by FTA's Section 18 program (200 of whom provided detailed information for this project), visits to selected rural transportation operations, and reviews by a TCRP Project Panel and by rural transportation providers and planners of the materials produced. (See Appendix B.)

THE COMPANION PRODUCT

The companion product to this manual, the Rural Transportation Services computer program, is designed to be an advanced software tool that will be extremely useful to transportation system operators, planners, and analysts. Its users will need no programming skills whatsoever to be able to access the information in this program about communities and the rural public transportation systems that now exist in them.



This program is designed to allow you to review detailed information about localities and the public transportation systems that have been created to serve the rural portions of those localities. You may begin using the program by starting with either community or transportation system information. Information about the localities is from U. S. Census Bureau data tapes for the 1990 Census. The rural transportation operators in this data file are those

funded by the U. S. Department of Transportation through the Federal Transit Administration's Section 18 program, "Formula Grant Program for Areas other than Urbanized Areas." The database in the Rural Transportation Services computer program provides general information on 1,100 of the 1,200 Section 18 systems now operating in the United States, plus detailed information on 200 of those systems.

More information on the computer program is provided in Appendix A.

WHAT DO THE NUMBERS MEAN, ANYWAY?

What good is all this information? What can it do to help you?

We think that the information available through this manual and the Rural Transportation Services computer program can provide great benefits to the planners and operators of rural transportation systems. Perhaps the greatest value is that you can use the information provided by those who are now operating rural transit systems to provide you with "benchmarks" that you can use to assess your system's characteristics and performance against those of other systems. Seen in this light, this manual and the computer program are two of many tools you should have to answer some very important questions: "How am I doing?" "Am I doing a good job or am I in trouble?" "What do I do next?" Thus, the data available to you through these two sources can provide lots of support in your monitoring and evaluation activities, whether you do these activities for your own internal management, for reports to your funding sources, or reports to your Board of Directors.

Similarly, for persons interested in starting rural transportation services where none now exist, these data can tell you what solutions others have used and with what results. You can see what kinds of services are being used in areas that are similar to yours, what they cost, and how many persons they serve.

Many persons in rural areas have a healthy skepticism about "fancy numbers" and a high regard for common sense solutions. We believe in those virtues, too, and we're not suggesting that they be abandoned just for the release of new service data. This manual and the computer program tell you what other folks say that they are doing: for a variety of reasons, what they do may not quite apply in your community. Then again, what they say that they are doing may not have been reported in quite the fashion we would have liked. Indeed, there are some figures that look to be "too good to be true" among the reports that are included in the our database. But one of

the beauties of this data file is that it gives you the **names and phone numbers** of folks to contact when you see information that interests you.

The data reported here were gathered in 1994, which means that some systems were reporting the results of their fiscal year ending June 30, 1993. Especially when dealing with cost figures, it is important to realize that the passage of time may have affected the reliability of prior reports.

You may want to design a service-delivery pattern for your rural community, which no one else has ever tried, or you may want to be the best of a certain type of service provider. In either case, the information in these files tells you what other rural transportation providers report for their systems, and that information should be of fundamental importance to your efforts to plan new transportation services or improve existing ones.

A ROAD MAP FOR OUR JOURNEY

Where do we go from here? We suggest that you consider the following sequence of steps as your process or methodology for planning or assessing rural transportation services:

1. Review the service types that are available.
2. Establish local goals, objectives, and needs based on your community and its profile.
3. Select and tailor services to reflect community needs.
4. Estimate the volume of service anticipated.
5. Evaluate available resources and forecast funding and service costs.
6. Refer to other sources for help in refining the service design.

First, we'll explore some basic service definitions in Chapter 2 and look at some examples. Chapter 3 will examine the issues to be considered when deciding which type of service to select. We'll look at local goals and objectives, the advantages and disadvantages of various service types, taking advantage of community characteristics, how much service to offer, how much service you can afford, and special considerations about service types and combinations of types.

Chapter 4 looks at examples of rural transit operations that are successfully tailored to local circumstances and conditions. Chapter 5 presents in-depth numerical details of the various service types (and that information is expanded further in the Appendices). The last chapter presents a quick list of sources of assistance in planning and evaluating rural transportation systems.

Our journey might be compared to the process of peeling an onion. We will start with more general information first, and will then proceed to deeper levels and pick up more of the details. Some readers may find enough information in the first three or four chapters, which present a basic overview of service types and some examples. Others will want to delve into the detailed statistical information about the relative performance levels of the different service types that is provided in Chapter 5 and the Appendices. For persons interested in customized perspectives of how the service types fit into communities of various characteristics, we recommend that you use the Rural Transportation Services computer program to generate unique peer comparisons.

The bad news is that neither assessing existing rural service-delivery systems nor planning new ones is a cookbook operation. There is no simple abstract formula nor one great planning model that will create a uniquely best answer regarding transportation services for a particular rural community. The good news is that there are at least several good answers for each community, and these can be tailored to the specific goals and constraints of the community. Furthermore, some solutions are demonstrably better than others, and some are demonstrably worse. So although we can't offer simple or unique answers, this manual will improve your ability to design and operate rural transportation services that are appropriate for your particular locality.

Chapter 2: Potential Service Options

- *The Components of Transportation Service Options and Strategies*
- *Real-World Examples of Service Types*
- *An Overall Framework of Service Options*
- *Examples of Innovative Service Designs*
- *Summary*

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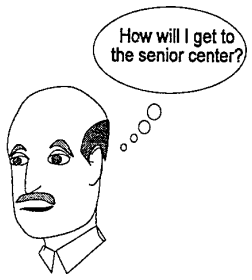
THE COMPONENTS OF TRANSPORTATION SERVICE OPTIONS AND STRATEGIES

There are many possible transportation service options for rural communities. As some options will be more appropriate in particular communities than other options, it is important that you understand the full range of service types that are available.

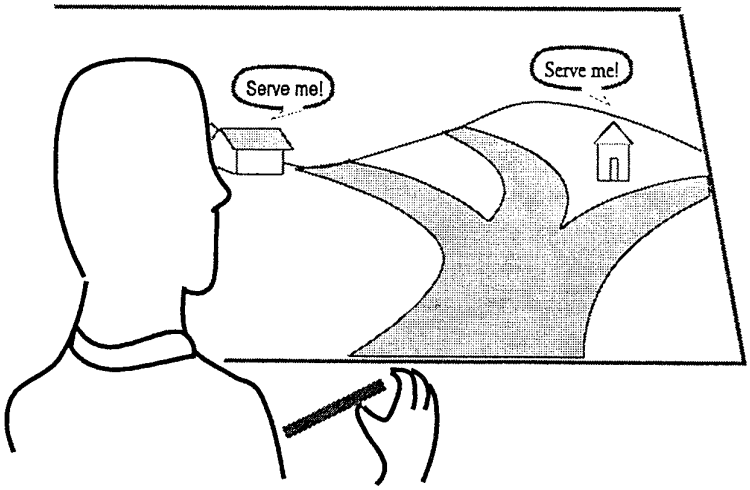
While transportation services may be characterized by a large number of dimensions (ownership, clientele, operational features, vehicles, administration, means of access, and many others), when we are talking about service strategies, there is just one extremely important question: How do potential passengers access the transportation services?

It's been said that the three major operational strategies that bring the transit vehicle to the customer are 1) routing, 2) scheduling, and 3) stop location. (A really good reference on these issues is NCHRP Report 209, "*Market Opportunity Analysis for Short-Range Public Transportation Planning*," by Frederick J. Wegmann and others, published by the Transportation Research Board in 1979. The routing and scheduling definitions listed below are from this reference.) Routing and scheduling may be thought of as the where and when of service patterns or their spatial and temporal dimensions. Stop location is another kind of descriptor of geographic or spatial dimensions.



Where: The Spatial Dimensions of Transportation Services

Routing, the spatial path of the vehicles, directly determines the accessibility of the transit system to potential customer and the degree to which the desired destinations are serviced. If routing alone is considered, the closer the routing corresponds to the local pattern of origins and destinations, the more accessible the service will be. Basic routing strategies are

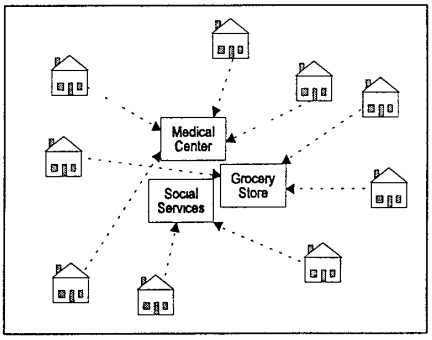


1. ***Fixed-Route Service.*** The transit vehicle travels a preestablished route. Passengers are picked up or dropped off at predesignated locations along the route.

2. ***Route-Deviation Service.*** A vehicle travels a basic fixed-route, picking up or dropping off passengers anywhere along the route. On request, and, perhaps, with additional charge, the vehicle will deviate a few blocks from the fixed-route to pick up or deliver a passenger.

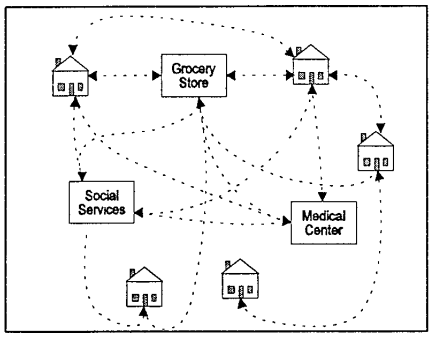
3. ***Point-Deviation Service.*** A vehicle stops at specified checkpoints (shopping centers, industrial parks, etc.) at specified times, but travels a flexible route between these points to serve specific customer requests for doorstep pickup or delivery.

4. ***Many-to-Few Service.*** Origin points may be anywhere in a defined service area, but destinations are limited to a few activity centers. Conversely, for a return trip, origins are limited whereas destinations are areawide. The vehicle travels a flexible route between origin and destination points to serve specific customer requests.



Many-to-Few Service

5. ***Many-to-Many Service.*** Service is provided to all origins and destinations within a defined service area. Service is not provided outside the service area. The vehicle travels a flexible route between the origin and destination points to serve specific customer requests for doorstep pickup and delivery.



Many-to-Many Service

Looking at these spatial service options as a spectrum, it could be said that they range, starting from fixed-route services, from services specified by the transportation provider to those specified by the transportation consumer, or from relatively fixed services with few choices to relatively flexible services with many choices (from the consumer's point of view).

When: The Temporal Dimensions of Transportation Services

Scheduling defines the times at which transit vehicles will be available to specific customers for transportation service. Basic scheduling strategies are

1. ***Fixed-Schedule.*** Customers board a vehicle at specified times. The schedule is established by the transportation agency.

2. ***Flexible Fixed-Schedule.*** Customers board a vehicle at specified times established in advance by the customers. Schedule changes are permitted with short notice to reflect changing circumstances.

3. ***Advance Request.*** Service is requested for a single trip to occur at a specific time, perhaps 24 to 48 hours after the request. The customer has control of the pickup time within a specified arrival window with the advance request option, but must know complete trip details in advance. (As this is not always possible, this requirement constrains the responsiveness of the service.)

4. ***Immediate Request.*** Service is requested through a central control or dispatcher for a single trip to be made as soon as possible. Requests are generally made by telephone. The responsiveness of this option is affected by the availability of a telephone, the availability of a vehicle to make the trip, and the availability of space in the vehicle. This is the most responsive service possible except for the personal automobile.

Looking at these temporal service options as a continuum or a spectrum, as we did for the spatial options, it can again be said that they range, starting from fixed-schedule services, from services specified by the transportation provider to those specified by the transportation consumer, or from relatively fixed services with few choices to relatively flexible services with many choices (from the consumer's point of view).

REAL-WORLD EXAMPLES OF SERVICE TYPES

Framework

An automobile provides services with almost unlimited flexibility in routing and scheduling, being able to access nearly any point served by the road network at nearly any time desired by the driver. But this is private transportation, not public transportation service. All public transportation options are less flexible in scheduling and in routing than a private auto.

Table 2-1 breaks down the spectrum of service options or strategies from least flexible to most flexible in terms of system predetermination in routing and scheduling. The options are grouped into four primary categories, two of which have subcategories. Each is described below. At the end of this chapter we will review some real-world examples, many of which utilize more than one or a hybrid of these options.

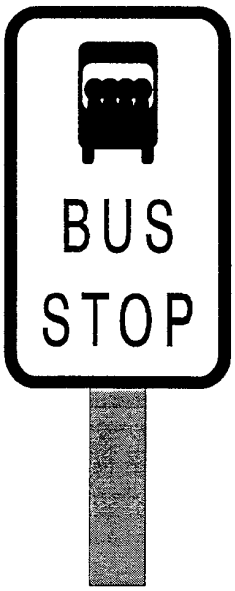
Table 2-1

RELATIVE FLEXIBILITY OF SERVICE OPTIONS

Service Options or Strategies	Typical Examples	Degree of Routing Flexibility	Degree of Scheduling Flexibility
Fixed-Route, Fixed Schedule	Traditional Bus Service	No Flexibility	No Flexibility
Fixed-Route, Flexible Schedule	Jitney	No Flexibility	Limited Flexibility
Flexible Route, Fixed Schedule	Flexible Bus Services		
Route Deviation		Limited Flexibility	No Flexibility
Point Deviation		Some Flexibility	Limited Flexibility
Flexible Route, Flexible Schedule	Demand-Responsive Paratransit Services		
Subscription Service		Some Flexibility	Considerable Flex
Advanced Reservation		Considerable Flex	Considerable Flex.
Real-Time Schedule		Considerable Flex	Considerable Flex
No Specific Routes or Schedules	Taxi Service		
Advanced Reservation		Considerable Flex.	Considerable Flex.
Real-Time Scheduling		Unlimited Flexibility	Unlimited Flexibility

Service Options

Fixed-Route, Fixed-Schedule Service



The term traditional or "conventional" mass transit service refers to fixed-route, fixed-schedule service. Commuter bus and intercity bus also fall into this category, and they are sometimes excellent options for rural areas. Commuter service can be effective for areas outside of urban employment centers, while intercity service is often needed when the community is far away from major medical facilities. Both of these types of service are needed in a specific direction at a specific time of day. Fixed-route, fixed-schedule service can also be effective within the community during the mid-day for shopping and personal business types of trips. Small cities and communities with seasonal tourist attractions may find frequent all-day service linking a remote parking facility with the destinations useful for alleviating traffic congestion and parking problems.

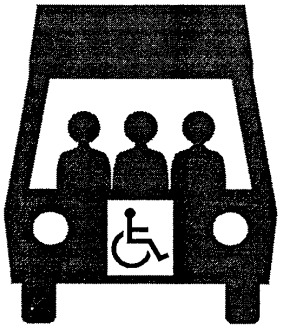
Fixed routes can take on a number of spatial characteristics. Broad categories of routes include radial routes, loop routes, and circulators. Adding the dimension of coordinated timing to multiple routes can create a pulse system.

Fixed-Route, Flexible Schedule Service

Jitney service comes to mind when one refers to fixed-route, flexible schedule service. For rural areas, this type of service is only really useful in communities with seasonal tourist attractions because of the high densities of trip demands need to justify typical service frequencies. High-frequency service linking a remote parking facility with the destinations is useful for alleviating traffic congestion and parking problems. Other trip purposes would require a much lower frequency of service, making jitney service less appropriate than other options.

Fixed-Route, Flexible Scheduling Service

This category of service often best meets the needs of a rural community and is becoming more widespread in urban areas as well with innovations for fixed-route operators to comply with the complementary paratransit provision of the Americans with Disabilities Act (ADA). Two subcategories are found in this category: route deviation and point deviation.



Route Deviation. In route-deviation service, buses travel along a prescribed route at scheduled times and maintain scheduled checkpoint stops. Nonscheduled stops will be accommodated within the deviations. The bus may leave and return to the route to pick up requests for demand-responsive trips near the route (Figure 2-1).

Passengers may call in advance for route deviation, or may access the system at predetermined route stops. The limited geographic area where the bus may travel off the route is known as the route deviation corridor.

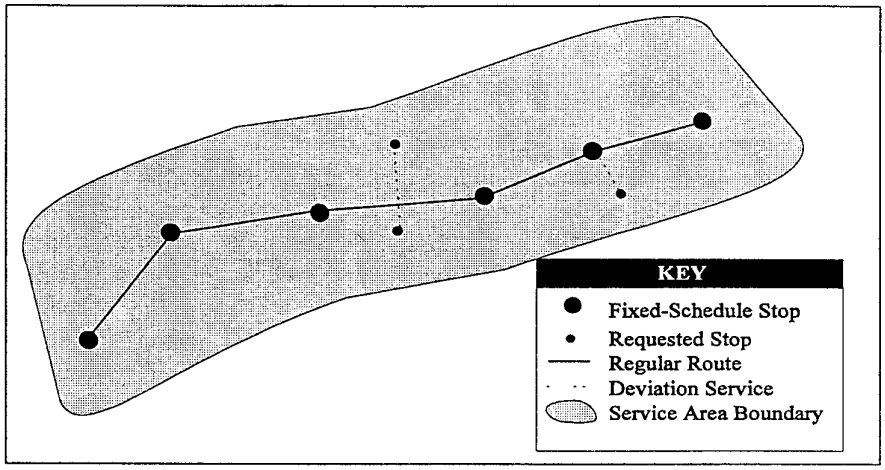


Figure 2-1: ROUTE DEVIATION

Point Deviation. In point-deviation service, fixed stops (points) are established on a predetermined time schedule, but the vehicle may follow any route needed to pick up individuals along the way and make it to the fixed points on schedule (Figure 2-2).

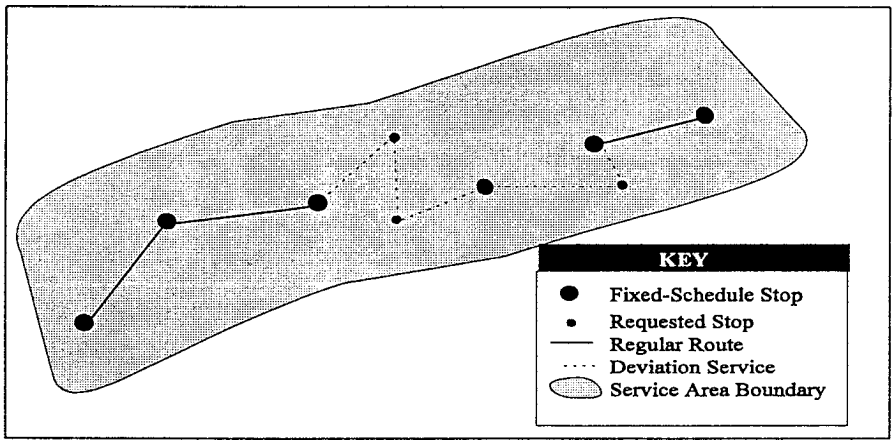
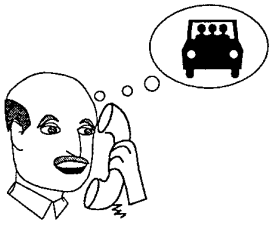


Figure 2-2: POINT DEVIATION

Demand-Responsive Service



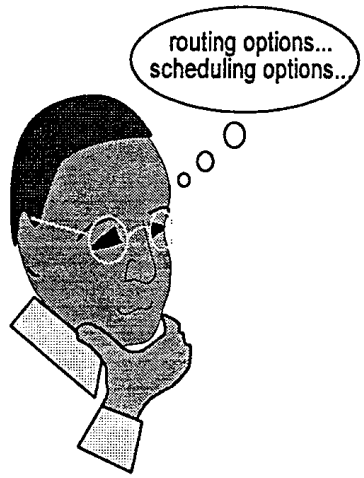
Demand-responsive service is activated based upon passenger requests. Usually passengers call the scheduler or dispatcher and request a ride for a particular date and time. A trip is scheduled for that passenger, the trip may also be canceled by the passenger. Demand-responsive service may operate on a curb-to-curb or door-to-door basis. Trips may be scheduled on an advanced reservation basis (typically, at least one day in advance) or in "real-time" (for pick-up

as soon as a vehicle can get there). Usually smaller vehicles are used to provide demand-responsive service. There are three subcategories for this type of service. In order of flexibility (from least flexible to most flexible), they are described as follows:

Subscription. When a passenger or group of passengers requests a repetitive ride (such as a daily or weekly service on an ongoing basis), trips are often scheduled on a subscription or "standing order" basis. The passenger makes a single initial trip request, and the transit system automatically schedules them for their trip(s) each day or week. A transit system may sometimes limit peak-hour service to subscription trips only (although this is not permitted in the case of ADA complementary paratransit).

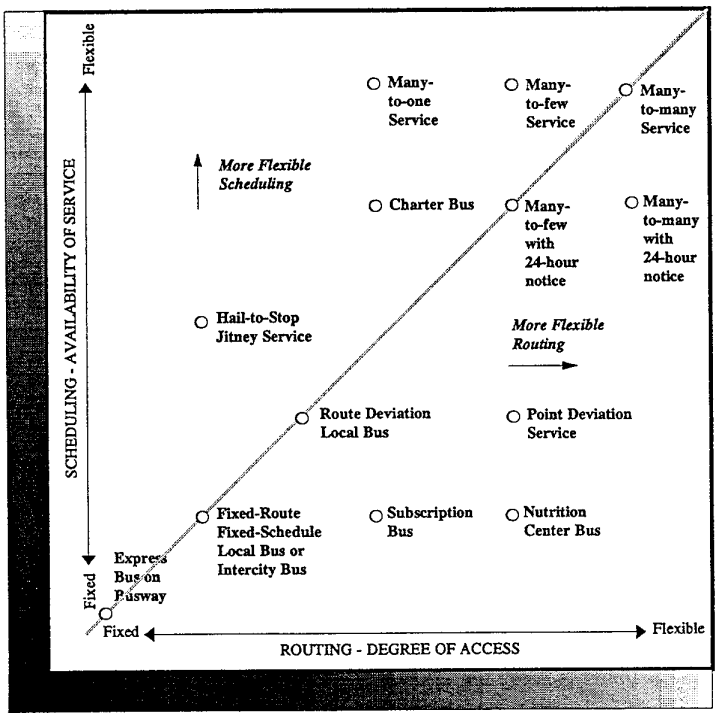
Advanced Reservation. If passengers call ahead and reserve a ride for a particular date and time in the future, this is called advanced reservation service. The transit system may set limits on the minimum and maximum advanced reservation times before the requested trip. In the case of ADA complementary paratransit, a transit system must allow eligible riders to schedule trips as much as 14 days in advance and as little as one day in advance.

Real-Time Scheduling. In real-time scheduling, also known as dial-a-ride service, passengers call and request demand-responsive trips just before the trip is needed. This type of scheduling is most convenient for passengers, but most costly for a transit system to implement as a large fleet of vehicles and drivers is needed to ensure all trip requests are met. This type of scheduling is most frequently used by taxi services.



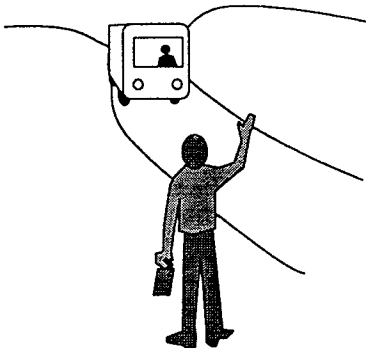
AN OVERALL FRAMEWORK OF SERVICE OPTIONS

The most useful way to understand alternative transportation service options for a specific community is to simultaneously consider the range of **routing options** from fixed to very flexible and the range of **scheduling options** from fixed to very flexible. This kind of schema was previously proposed by Wegmann. Figure 2-3 shows Wegmann's interpretation of the range of services that could be provided if the transportation service vehicles were buses. While the most highly fixed options — for example, express bus on exclusive busway — do not apply in the rural communities, other service options on this figure are more applicable to rural areas, including fixed-route, fixed-schedule systems, subscription buses, point deviation services, many origins to few destinations with a 24-hour advance request for a trip, and many-to-many services by taxis within small towns. All of these are possible and, indeed, common within rural communities in the United States.



Source: Adapted from Wegmann, et. al., *Market Opportunity Analysis for Short-Range Public Transportation Planning.*

Figure 2-3: RURAL TRANSPORTATION SERVICE OPTIONS



We can make this framework even more useful if we also consider the relative flexibility of the origins and destinations of each trip. Table 2-2 adds the third dimension of origins and destinations, along with the consideration of their degree of flexibility, to the two dimensions of routes and schedules, and provides real-world examples of services currently in use. From the passenger's point of view, the most restricted kind of services are those with fixed routes, fixed schedules, fixed origins, and fixed destinations. Obvious examples of services in this category include commuter buses, city buses, school buses, and intercity buses, as they start at predetermined origins and predetermined times and arrive at specific destinations at predetermined times. The decisions about origins, destinations, routes, and schedules are made by the system's operators, not the passengers.

If these modes are used, but passengers are allowed to "flag down" a passing vehicle and to board it, this opens up some flexibility with respect to trip origins (but only along the predetermined already existing routes of service). If passengers are to be allowed to board and alight at any points of their own choosing along a service route, this is what is known as jitney service.

Table 2-2: EXAMPLES OF POTENTIAL SERVICE OPTIONS FOR RURAL PASSENGER TRANSPORTATION SYSTEMS

		SCHEDULES				
		Fixed Schedules		Flexible Schedules		
		Origins			Origins	
	Destinations	Fixed Origins	Flexible Origins	Destinations	Fixed Origins	Flexible Origins
Fixed-Routes	Fixed Destinations	• *Commuter Bus* • *City Bus* • *School Bus* • *Subscription** • *Intercity Bus*	• *Scheduled Demand Activated** • *Intercity Bus with Flag Stops*	Fixed Destinations	• *Hotel to Airport Shuttles*	• *Home to Airport Shuttles*
	Flexible Destinations			Flexible Destinations	• *Route Deviation*	• *Jitney* • *Patterned Demand-Responsive*
Flexible Routes	Fixed Destinations	• *Point Deviation* • *Carpool and Vanpools**	• *Nutrition Center Bus**	Fixed Destinations		• *Human Service Agency**
	Flexible Destinations	• *Airport Limo (To Town)**	• *Shared-Ride Taxi**	Flexible Destinations	• *Delivery Service (from a store)**	• *Taxi** • *Charter* • *For Hire Delivery*

**These modes usually offer door-to-door services.*

Transportation services for nutrition centers serving the elderly pick up different persons on a day-to-day or even trip-by-trip basis, making their routes and origins flexible, even though they will most often arrive at their destinations (the nutrition centers) at predetermined times. The most flexible service possible is that typified by taxi operations — and some rural transportation systems — that will pick up passengers at any time and anywhere within the service area and deliver them to any destination within the service area.[1]

Rural transportation systems can use this table by first addressing the issue of how much choice the individual passenger will be allowed. If the system's routes and schedules are to be predetermined by the operator, the passenger has little choice; that decision suggests that certain specific fixed-route and/or fixed-schedule transportation modes will be used. If passengers are to have a great deal of latitude about where and when they travel, other modes will be required for service.

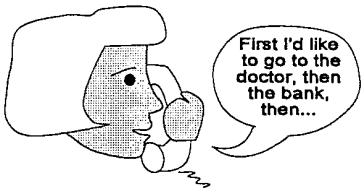
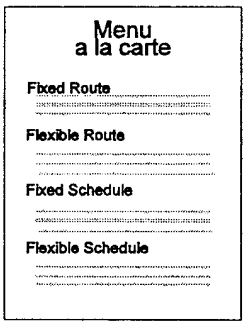


Table 2-2 still focuses on public passenger transportation services; driving one's own car still provides the ultimate flexibility in routing and scheduling, and similar options (such as rental cars) are close behind in flexibility. Although the consumer's flexibility is a good starting point for designing rural public passenger transportation services, it certainly is not the only criterion, as we will discuss later in detail.

The way to use Table 2-2 is as follows. If, for example, the service planned is to be fixed-route and fixed-schedule, then, if the origins and destinations are also both fixed, we see that we are talking about services that look like the typical city bus or school bus. (These are the most strictly defined services shown in the upper left-hand corner of the table; the other end of the diagonal of the matrix (in the lower right-hand corner) shows the most flexible services, of which the taxi is the best example.) If, on the other hand, we desire flexible schedules on a fixed-route with flexible origins and destinations, this is more like a classical jitney service.



[1] "Pure" taxi service — anytime, anywhere service on an exclusive ride basis — is expensive to provide, particularly in low-density rural area. Allowing passengers ultimate flexibility in routing and scheduling their trips produces per-trip operating costs, which exceed the levels which most rural residents will pay. Tradeoffs between flexibility and cost-effectiveness will be discussed later.

The Table should be used to develop some idea about the kind of service to be provided. For example, most people think that transportation for the elderly to nutrition programs should involve pickup and return to the individual's house. This means that the origins of the trips will change from day to day as different persons go to get meals, but the schedule will have to be about the same every day to get to the meal site (which is a fixed, specific destination) on time.

The point is to **tailor the service to the needs of the area.** While many planners recognize this objective, few innovate with the service design to produce a uniquely appropriate solution. There are many possible options, as is shown in Table 2-3. The technique for success is to clearly identify needs and objectives so that a preferred option can be chosen.

Table 2-3

LIST OF POSSIBLE SERVICE OPTIONS FOR RURAL TRANSPORTATION OPERATORS

Services with fixed routes and schedules might look like

- city bus services
- school bus services
- intercity bus services

Services with flexible routes and fixed schedules might look like

- point deviation transit operations
- some carpools and vanpools
- limo services from airports to downtown
- nutrition center buses
- shared ride taxis

Services with fixed routes and flexible schedules might look like

- hotel to airport shuttles
- home to airport shuttles
- jitneys
- patterned demand-responsive transit services

Services with flexible routes and flexible schedules might look like

- store-owned delivery services
- human service agency services
- taxi services
- charter services

Nothing says that rural transportation systems have to be either fixed-route or demand-responsive, and, in fact, the most successful systems are hybrids of these two extreme patterns. For example, a system called "scheduled demand-activated service" is one that typically runs a fixed-route but only stops at certain places if called in advance by the passenger desiring the trip. Another possibility is the point deviation system — such as that in Merrill, Wisconsin — where the vehicle arrives at certain "checkpoints" at scheduled times, but the route in between those points may include deviations for door-to-door pickups and deliveries. The key point to understand is that **there are many possible options for service.**

EXAMPLES OF INNOVATIVE SERVICE DESIGNS

The Central Vermont Transportation Association, Inc. (CVTA), based in Montpelier, Vermont, provides Section 18-subsidized public transportation services in all of Washington County and parts of Orange County. As the State Capitol, Montpelier attracts many workers and tourists as well as transportation-dependent persons needing access to essential goods and services. The variety of services operated by CVTA reflect these needs:

- **Fixed-Route, Fixed-Schedule Bus Service** between Montpelier and the nearby town of Barre, operated on weekdays between 6:00 a.m. and 6:00 p.m. and on Saturdays between 9:00 and 5:00 p.m. The bus travels back and forth along a major commercial corridor, stopping at several points along the way. At both ends, the bus makes a small loop within the towns.

- **Fixed-Route, Fixed-Schedule Shuttle Service** is also operated within the downtown Montpelier area. This service is operated on 10-minute headways between 7:00 a.m. and 5:00 p.m. weekdays, and makes a loop which changes depending upon the time of day.

- **Route-Deviation Service** is operated between Barre, Montpelier, and a nearby regional medical center on weekdays between 7:30 a.m. and 4:30 p.m. This route is actually a hybrid of fixed-route and demand-responsive service. Fixed-route service is operated between each of the cities and the hospital area. Door-to-door demand-responsive service is operated within the two cities at the beginning of each run and through the medical center area at the end of the run.

- **Subscription Service** is operated throughout Washington County to local community services between 9:00 a.m. and 3:00 p.m. on weekdays, providing service in different areas on different days. The core ridership of this service, which is open to the public, is made up of seniors going to meal sites located in four communities.

- **Demand-Responsive Service** is operated to transport Medicaid recipients to medical appointments, among other eligible social service clients and trip purposes. The hours of availability of this service are not set, as the bulk of this service is provided by volunteer drivers. CVTA maintains a pool of about 50 volunteer drivers who are reimbursed for their mileage.

In addition to operating the variety of services described above, CVTA acts as a brokerage for carpools, vanpools, and Medicaid trips that can be made on either the existing routes or the demand-responsive services.

Chenango County, New York

TC Transit (formerly Town & Country Transit) is operated by Opportunities for Chenango (OFC) in Norwich, New York. OFC is a community action agency providing a number of social services to the residents of Chenango County, including transportation. As the County's Section 18 operator, TC Transit serves the general public as well as agency clients. The transportation service types operated are as follows:

- **Fixed-Route, Fixed-Schedule Service.** For the most part, its fixed-routes have developed out of agency client transportation subscription patterns; however, the routes have been fixed and opened to the general public. Fixed stops were established and published, and route and schedule information is available. Agency clients continue to be identified as such for agency billing, but routes do not change on days when individuals do not ride as door-to-door stops are not made. These routes bring residents from five general areas of the County (South, West, North, Northeast, and Southeast) into Norwich in the morning and return them during the afternoon. During the midday, the routes tend to terminate in the outlying communities where local demand-responsive service is provided. Fixed-route service is also operated within the City of Norwich, on 1-hour headways between 9:30 a.m. and 5:30 p.m.

- ***Subscription Service.*** For agencies with door-to-door client transportation needs, subscription routes continue to be operated under contract to the agencies. These routes may change on days when individual clients are not riding and as individuals are added to or removed from the ridership.

- ***Demand-Responsive Service.*** In different communities on different days of the week, local demand-responsive service is provided during the midday (10:00 a.m. to 2:00 p.m.). Requests for this service must be made at least a day in advance.

In addition, demand-responsive service is provided for Medicaid recipients traveling to and from medical appointments. The service hours for this service are flexible to the needs of the riders who may need to access medical facilities outside of Chenango County.

TC Transit is exploring coordination of home meal delivery with passenger transportation using specially equipped vehicles. This could prove to be a unique method of delivering both people to services and services to people, making rural transportation doubly effective.

Gatlinburg, Tennessee

Gatlinburg is a small community in the Smoky Mountains in Eastern Tennessee. During the summer, the area serves a large number of tourists. A jitney shuttle service was implemented using trolley buses to alleviate traffic congestion and provide visitors easier access to the area. The buses follow two long routes (10 and 6 miles) and circulate among parking lots, hotels, and downtown, along 15-20 minute headways.

Gray's Harbor County, Washington

Gray's Harbor County, a coastal community in the Pacific Northwest, lies southwest of Seattle, Washington. In the mid-1970s, Gray's Harbor Transportation Authority operated a "roving dial-a-ride" service, which is a hybrid of route deviation and demand-responsive services, in addition to fixed-route service. Four buses were assigned to specific communities that they served by "roving" along specific routes several times a day. Upon request, a bus would deviate from the route to provide door-to-door service. Between route runs, the vehicles were used to provide pure demand-responsive service. The routes were timed to connect with the system's fixed-routes, which provided access to the nearby urban area, and with the ferry operated by Gray's Harbor Transit Authority during the summer. After about 2 years of operation, the demand-responsive element of the system was dropped, although route-deviation service continued to be provided.

Merrill, Wisconsin

Merrill, a small community in North Central Wisconsin, has been the subject of a number of reports and case studies in the rural transportation literature. In 1975, an innovative point-deviation bus system, the Merrill-Go-Round, began operations in the community. Two small buses run at half-hour headways, serving specific scheduled checkpoints but also providing door-to-door service upon request. The path of the checkpoints is fairly linear, but time is scheduled between the checkpoints to allow for deviations, so that most of the town is in the potential service area.

Winona, Minnesota

The Winona Transit System began operating in 1977, providing fixed-route service to the communities of Winona and Goodview along the Mississippi River. Three buses followed a figure eight loop, which intersected in downtown Winona, a college town. Midday route-deviation, door-to-door service was available for elderly and disabled riders. A peak-hour shuttle service was also implemented for college students.

Arrowhead Transit, Minnesota

Six counties in Minnesota are served by Arrowhead Transit. Fixed routes are scheduled for different parts of each county on different days of the week. However, would-be passengers must call in advance to indicate that they will be riding that day. A minimum of five scheduled passenger trips are required for operation of the route; if the requests fall short of this, the route is canceled for that day and the requested rides are provided by volunteer drivers using their own autos. A route scheduler and volunteer dispatcher ("area caller") are based in each county. The service area for volunteer trips is limited to 2 miles on either side of the regular route.

SUMMARY

This chapter has described the service options — the choices — that are available to rural transportation operators. The next chapter describes how to decide which of these options makes sense in your community.

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Chapter 3: Which Service Type? How to Decide

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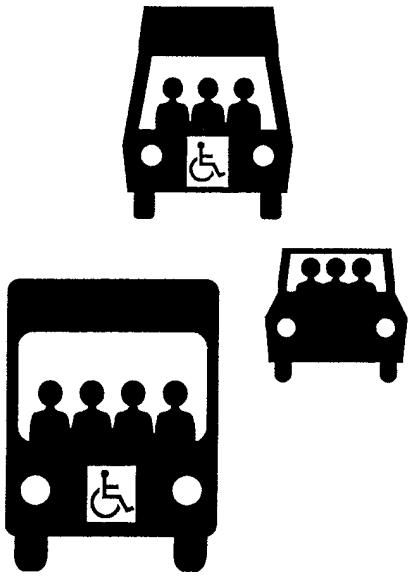
Statistical and anecdotal data show that nearly all rural transit services are used and appreciated in their communities. This suggests that there may be no unique match between a particular community and a particular service type, which means that there may be several acceptable service options for your community. On the other hand, there may be one or two options from the group of possible choices which offer the highest probability of cost-effective service. This chapter discusses what you should take into account when reconfiguring an existing rural passenger transportation service or when starting a new one.



THE FIRST STEPS IN SERVICE DECISIONS

The very first step in determining what type or types of transportation service would be most appropriate for your community is to determine (perhaps with your Advisory Committee) how much choice you feel that the customer should have in determining where they can go and when they can ride. You need to address the following questions:

- Will we pick up riders anywhere in the entire county? Will we take them anywhere in the entire county? If not, what portion of the county will we serve?
- When will we provide rides? Will it be all 24 hours in a day or only during some hours? Will we provide trips 7 days a week or less?
- Where do we stand on the spectrum between providing unlimited services and providing very limited services?

Once basic questions like these have been addressed, the consequences of the decisions can be identified. After determining the consequences, it may be necessary to change the service specifications a bit. (This is what is known as an "iterative" planning process, which means that you do it over and over again until you get the results that you really want.)

It is possible that what you would like the services to be may not be as important in your locality as other factors, such as how much they will cost. In general, very responsive unlimited services are attractive to lots of people and cost a lot; services that are very limited in terms of where they go and when they are available do not attract as many riders but they do not cost as much. The relative importance of each of these factors is something that needs to be determined by the political decision makers in each community. The materials in this book will show you what other folks have determined is appropriate for their communities and how you can use that information to determine what is best for where you live.

ADVANTAGES AND DISADVANTAGES OF VARIOUS SERVICE TYPES

Each service type performs well in some circumstances and not so well in others. This section looks at the advantages and disadvantages of the following service options:

- fixed route, fixed schedule,
- fixed route, flexible schedule,
- flexible route, fixed schedule (including route deviation and point deviation services), and
- three types of demand-responsive services
  - subscription,
  - advanced reservation, and
  - real time scheduling.

Fixed Route, Fixed Schedule

This option often works well in situations where

- the area is more densely settled,
- the demand for trips is high,
- trips are generally destined to one particular area (like a downtown), or
- type patterns are similar on a day-to-day basis (or, best of all, on an hour-to-hour basis, but this is rare).

This option does not work particularly well where

- the service area has a low population density, or
- trip patterns are variable and not very predictable.

If your service area is:	Densely populated
And your trip patterns are:	Predictable
And your origins and destinations:	Are similar from day to day
Then a good choice would be:	**Fixed Route, Fixed Schedule**

Fixed Route, Flexible Schedule

This option works well in areas with high levels of demand along a particular corridor or route. It does not work well in areas where origins and destinations are highly dispersed, nor in areas of lower density.

This particular option has very little applicability for rural transit systems. Its only usage would be within certain urban portions of rural areas, like downtowns of small rural centers. However, even in these small towns, there are probably better service choices.

Variable Route, Fixed Schedule

Route deviation and point deviation are the two subchoices within this option. Route deviation is the more frequently used of the two.

Route deviation services work well where

- the deviations are a relatively small part of the overall demand and the overall running time of the route,
- the majority of the riders are not highly time-sensitive,
- door-to-door service is important to some but not all passengers, or
- there are other positive reasons for providing services that are more like fixed route than demand-responsive options.

Route deviation services do not typically work well where

- most of the trips are time sensitive, and
- some sort of basic route structures is not desirable for this community.

While **point deviation services** share many of the same advantages and disadvantages of route deviation services, point deviation services are more like demand-responsive operations. Route deviation service would be preferred where passengers would be waiting along the route to be picked up without advance notice to the system, and point deviation would be preferred when a service needed to be more highly responsive to changing or variable demands. Point deviation services may be preferable to route deviation services in rural areas because the routes

between checkpoints can be flexible, allowing the driver more routing options for maintaining the schedule, and requests for service can be negotiated or deferred so that the schedule is maintained.

If your service area is:	Sparsely populated
And your trip patterns are:	Similar on a day-to-day basis
And your origins and destinations:	Vary from day-to-day
Then a good choice would be:	**Flexible Route, Fixed Schedule**

Demand-Responsive Service Types

Subscription Services

Subscription services work well where

- travelers are relatively clustered around the same origins and destinations,
- the demand for trips is once or twice a day (not all day long),
- the same persons take the same trips (that is, the same origins and destinations at the same times) on a frequent, regular basis, but the level of demand is not high enough to justify fixed route, fixed schedule service, and
- travel demand densities are relatively low.

Subscription services do not work particularly well where trip patterns are not regular and predictable.

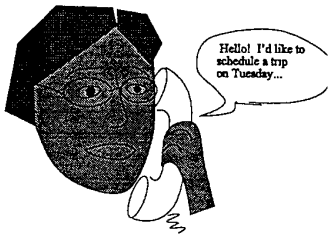
If your service area is:	Densely or Sparsely populated
And your trip patterns are:	Unpredictable
And your origins and destinations:	Vary from day-to-day
Then a good choice would be:	**Demand-Responsive Service**

Subscription services are seldom offered alone; the most common pattern is for subscription services to be offered in conjunction with other demand-responsive options. Subscription services can create an especially effective "back-bone" for shared ride demand-responsive services.

Advanced Reservation

Advanced reservation services are particularly useful where

- the trips are not taken on a regular pattern (such as those on subscription services),
- ride sharing is used to reduce the cost per trip for each passenger, or
- overall demand levels are low and trip origins are dispersed,

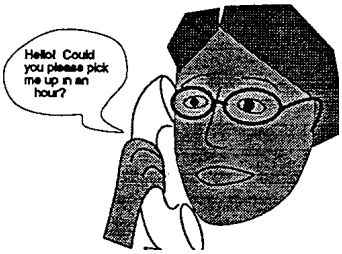


but advanced reservation services do not work particularly well in situations where there are immediate needs for service and where cost is not a strong consideration for the passenger.

Real-Time Scheduling

Real-time scheduling works well where

- highly personalized services are appropriate,
- service needs are immediate,
- door-to-door services are desired,
- origins and destinations are variable and do not necessarily fit any preestablished patterns, and
- demand densities are not very low and trip distances are not very long.



The disadvantages of real-time scheduling are primarily the opposite of its advantages: it is relatively costly, demand-specific, and resource (labor and capital) intensive. All vehicles in service must be radio-equipped in order to use this option.

Summary

As can be seen, all of these service types have distinct advantages and disadvantages. Each, therefore, has circumstances to which it is well suited and other circumstances where it would not be the top choice.

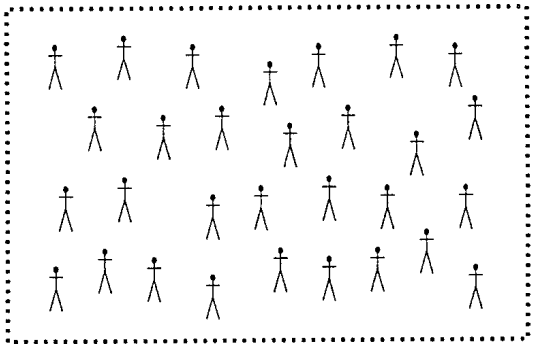
TAKING ADVANTAGE OF COMMUNITY CHARACTERISTICS

There are different types of rural communities, and the community type will help determine which transportation service option or options might be most appropriate. The most significant community characteristics in terms of transportation options are settlement patterns, employment and service patterns, and demand density.

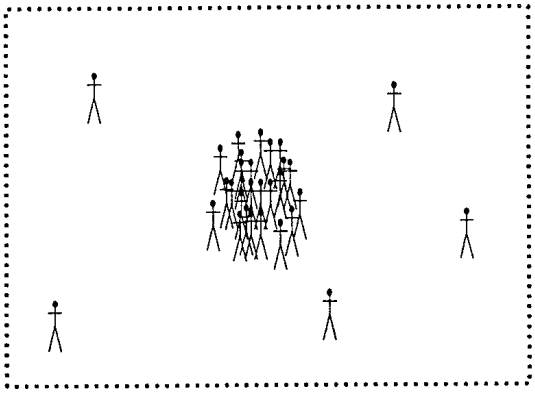
Settlement Patterns

Two rural communities of 30,000 persons may be vastly different in terms of their potential transportation options due to their settlement patterns. The first consideration is that of the degree of concentration versus the degree of dispersion of the places where people live, which can be considered the usual origins of most trips. If 30,000 people are spread relatively evenly throughout one county of 300 square miles, as we find in many Midwestern farming areas, some sort of demand-responsive service would probably be most attractive. Advanced reservations would help the transportation system cluster trips at certain times and thereby improve system productivity.

Is your community populated like this ...?



... or more like this?



On the other hand, if another county had 25,000 people living within one small city of ten square miles and 5,000 more persons living throughout the remainder of the 290 square miles, different service options would be better. First of all, it is possible that different services would be provided to those living inside and outside of the small city. Outside of town, there could be demand activated advance reservation routes running into town. Within town, there could be fixed route services, route deviations, or real-time scheduling. (The latter would be most appropriate where local politicians had decided to support a high level of service.)

Different spatial patterns of this small city would help to decide which transportation service options would be best. If the settlement pattern basically resembled a circle or a square, demand-responsive options

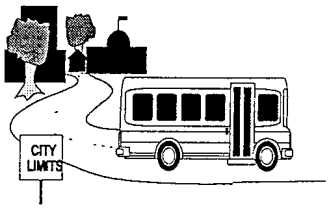
might get the nod. If the city had developed in a linear fashion along a river or within a valley, fixed route service types might be logical.

Employment and Service Patterns

The locations of employment sites, human service agencies, and business and personal services — usually the destinations of trips — also strongly influence the appropriateness of potential transportation service options. The influences are similar to those exerted by housing patterns — if the patterns are dispersed and spread out, low frequency demand-responsive services would probably be preferred, while highly concentrated destinations could be served by more highly routed and scheduled services.

Whether or not the transportation system serves work trips (and the proportion of all of its trips that are work trips) will make a big difference in service options. Work-oriented transit services can provide relatively high frequency services on relatively fixed routes (at least for the employment origins and destinations), as shown by one of our case studies in Chapter 4. Systems without a significant proportion of work trips (that is, less than 10% of their trips) will tend more often to serve other trip types with demand-responsive services.

It should be noted that, in some rural communities, employment concentrations are not located where service concentrations are located. Mining and manufacturing are two examples of larger types of employers not usually located within the towns where banks, stores, and public services are found. In such a situation, employment-related transit services may well differ from service-oriented transit services.



Demand Density

The number of trips within certain geographic areas and within specified time periods is an important consideration with respect to service types. The higher the demand for trips, the more like fixed routes and schedules the services can be. Lower demand densities suggest demand-responsive services, which may not be as frequent as even every day at the lowest end of the scale, are more appropriate.

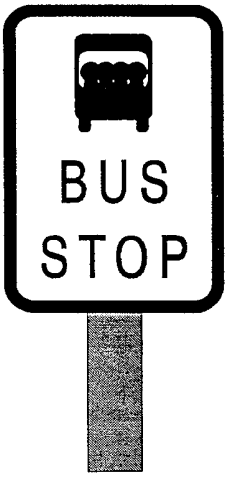
CONSIDERATIONS IN TAILORING SERVICES TO PARTICULAR COMMUNITIES

In designing and redesigning service options, several other variables should also be considered. The most important of these are user access, service combinations and transformations, and service zones.

User Access

How will (or, how do) your passengers get to your service? Some persons walk to bus stops, travel on the vehicle, and then walk to their final destination. Others are picked up at the curb in front of their house, others are picked up at their front door, and some drivers go into riders'

homes to assist them out of the house and onto the vehicle. Your choices include providing one or several of these access types to your passengers. Generally, the choices as listed above range from system-oriented to user-oriented, with system-oriented services focusing on fixed-route options, and user-oriented services focusing on more demand-responsive operations.

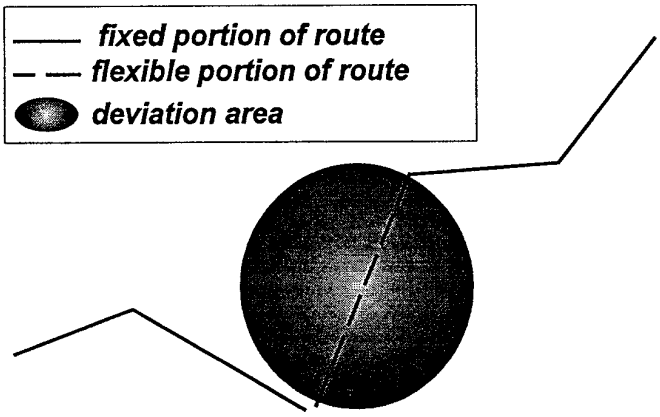


Service Combinations and Transformations

Half of today's current rural transportation operations provide more than one form of service. The most frequent combination is fixed route plus demand-responsive.

There are many ways to combine services. One is to offer several types of service at all times. Another is to offer different types of service at different times of the day. For example, some systems will provide a kind of fixed-route subscription service early in the morning and late at night to serve work trips and agency trips, and will then provide demand-responsive services during midday periods.

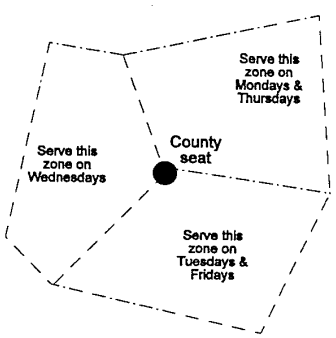
Another strategy is to provide one type of services for part of a trip and another service type elsewhere. A good example of this is the situation in which a vehicle will circulate in a neighborhood to pick up passengers, then will travel some distance without picking up additional passengers, and will then distribute the passengers to their various destinations at the other end of the trip. Some commuter services operate in this fashion. If one vehicle performs the service, it is a circulator/line haul/circulator operation; if two or more vehicles are involved, one will be doing feeder service and another will be doing line haul services.



Yet another strategy is to let services change over time. A service that starts out as a subscription operation may be transformed into a fixed route operation if the demand is large enough and stable enough over a long period of time.

Service Zones

Service zones offer another way to create a variety of services. If a zonal pattern is established, it might be possible to provide 24-hour advance reservation service outside of town and fixed route service in town. Dividing a low-density county into several zones would allow services in some zones on certain days of the week and services in other zones on the other days of the week. Some systems been able to provide more frequent service by using a "timed transfer system" at a central transfer point or at the boundaries of the zones, so that a person will ride a certain distance on one vehicle and then transfer to another vehicle to complete the trip.



Summary

The importance of these multiple service strategies is that they allow you to very closely approximate the travel needs of your clientele by providing some services at different times and places and to different clients. Whether a very large or very small operation, these multiple service strategies can be an effective means of increasing the cost-effectiveness of your system.

OVERALL PERSPECTIVES ON SERVICE OPTIONS

What does this all mean? Keeping in mind our original observation that many different service types are possible in any given community, there still are some overall considerations that are worth noting.

Demand-responsive services of one form or another are now being offered by the vast majority of rural public transportation operations. As shown in the graphic below, almost 90 percent of today's rural transportation operations that are funded by Section 18 provide some demand-responsive services. Thirty-four percent of such services are demand-responsive only, another 31 percent provide demand-responsive services in conjunction with fixed route and other services, and another 22 percent are providing demand-responsive and other services (but not fixed-route services). Among those services responsive to specific customer demands, **subscription services** are useful where there is some regularity to ridership patterns. Standing orders or subscriptions also provide a nucleus of riders needed to establish shared ride demand-responsive operations, which provide flexible trips at a relatively low level of cost. As driver wages are a major component of overall system costs, the more riders served by each driver, the more cost-effective is the entire operation.

Fixed route services are most useful where densities are higher and people are likely to walk to and from the bus stops to their destinations. These services work better where origins and destinations are concentrated rather than dispersed. Because of the provisions of the Americans with Disabilities Act, public transit services can no longer be provided solely by fixed route and schedule operations (unless these are commuter routes), but must be augmented by complementary

paratransit services (which are, in effect, advance reservation demand-responsive services). (Services provided by private, non-profit organizations are exempted from this requirement.)

Route deviation services (which are not required by the ADA law to provide complementary paratransit operations) are useful where most of the riders have some flexibility in their schedules that allow for the deviations without being seen as a decrease in service quality. A number of rural transit operations which formerly offered fixed route and fixed schedule services have switched to offering route deviation services as a means of complying with the ADA and offering more personalized services to their riders.

Advanced reservation services are also useful in promoting shared ride operations. They serve situations in which trips are somewhat predictable in advance but are not regular enough to warrant subscriptions or standing orders. Many rural transit operations provide both subscription and advance reservation services.

Real-time scheduling services, which closely resemble taxi operations, are not frequently provided by rural transit operators as a stand-alone service type, but a number of rural transit operators will try to fit last-minute callers into currently scheduled vehicle trips that are nominally subscription or advance reservation services as a means of increasing the cost-effectiveness of the service. Still, real-time scheduling offers a higher than usual level of service, and some communities have opted for this more responsive and more costly option within limited geographic areas.

HOW MUCH SERVICE SHOULD YOU OFFER?

One way of figuring out what is appropriate for your community is to look at what other folks are doing in their communities. In reviewing the experiences of others with specific service delivery patterns, there are two main questions: What's out there? and What works? While Chapters 4 and 5 will examine in depth the performances of Section 18-funded systems across the country, this section summarizes some of the highlights in some of those chapters.

One way of answering the "How much?" question is to examine results from some of the most productive and cost-effective systems (such as those described in the case studies in Chapters 4 and in the statistical information provided in Chapter 5). Ranges of experience for these systems are shown in Table 3-1, and it can be easily seen that the ranges are wide indeed: for some of the smallest ranges, the largest case is nine or ten times as large as the smallest case, and other ranges are even larger. So there is still a wide element of choice available in rural transit operations, even among the most cost-effective and productive ones.

Table 3-1

RURAL TRANSPORTATION SERVICE BENCHMARKS: HIGH PERFORMANCE SYSTEMS

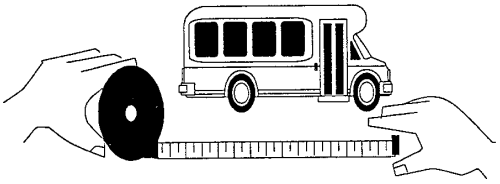
Service Factors	Ranges
Population Served:	6,000 - 62,000
Area Served (sq. miles)	5 - 3,000
Vehicles:	1 - 34
Square Miles/Vehicle:	1 - 650
Persons Served/Vehicle:	650 - 7,200
Miles/Vehicle/Year:	11,500 - 29,000
Trips/Year:	8,200 - 210,000
Trips/Person/Year:	0.85 - 9
Trips/Vehicle/Year:	4,200 - 13,500

Looking at the results from these systems as benchmarks, some suggestions emerge:

- ***Population and Area Served*:** These figures suggest upper and lower limits to the question of how large a service area should be chosen. Below 5,000 persons, the best strategy may be to combine forces with adjoining areas to create a service base which is large enough to support the facilities and personnel required to provide even basic services. Above 60,000 persons, perhaps some strategy should be found to divide the service area into discrete units. The smallest area shown represents the city limits of a small town, while the largest is the size of a west Texas county. Again, if the service area you are considering exceeds 3,000 square miles, you should probably consider dividing the area into separate transit operations.

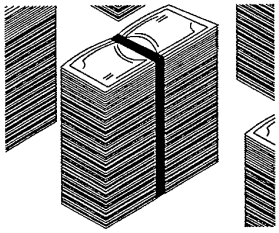
- ***Persons Served and Square Miles per Vehicle*:** These figures are good indicators of the number of vehicles required for service. Not less than 650 persons per vehicle nor more than 7,000 persons per vehicle is an excellent rule of thumb for initial fleet planning. Similarly, it would probably not be wise to consider serving much more than 700 square miles per vehicle without some compelling reason to do so.

- ***Trips per Person and per Vehicle per Year*:** These figures show the results that cost-effective systems are obtaining when they offer services. At less than one trip per year for all persons in your service area, you should probably be making improvements to attract more riders. At the other end of the spectrum, it may not be wise to expect more than nine trips per year for each person in your service area. For each vehicle in service, you should be getting at least 4,000 trips per year, but you probably will not get more than 14,000 trips per year. These figures will be useful in making cost and budget estimates.



HOW MUCH SERVICE CAN YOU AFFORD?

The difference between transportation services that we want to provide and the services that actually are provided often relates to the funds available for those services. Table 3-2 looks at the cost results from both the high-performance case studies described in Chapter 4 and the national sample of systems that is described in detail in Chapter 5. The following rules of thumb regarding cost factors have emerged from their experiences:



- ***Cost per trip:*** You should budget between $1.50 and $9.70 per trip that you plan to serve. For example, if your service area population is 30,000 and you expect that the average trip rate will be 5 trips per person per year, or 150,000 annual trips on your system, you will probably need between $225,000 and $1,455,000 annually to operate this service. Yes, this is a huge range, but that is the range of actual experiences. Average costs per trips were about $5.65.

- ***Annual budget*:** The annual budget for the eight high-performance operations ranged from $25,000 to over $1.3 million. The $25,000 figure at the low end looks like an excellent rule of thumb as the "entry level price" for a minimal rural public transportation operation.

- ***Cost per vehicle:*** Cost per vehicle among these systems ranged from $16,500 to $50,000. The one-bus systems were clustered around $25,000 per vehicle per year, supporting the rule of thumb noted above. The tables in Appendix D describing the national sample also support this figure.

- **Cost per hour:** Based on the national sample, it will probably cost you between $6 and $48 for every vehicle hour of service you provide. The average figure was about $27 per hour.

- ***Cost per mile*:** It will probably cost you between $0.40 and $4.50 for every vehicle mile of service you provide. The average was $2.35.

- ***Cost per person served per year:*** The cost-effective systems examined spent between $3.00 and $30 per person per year to deliver their services. This is a relatively concise and powerful figure for planning practices; looking again at a hypothetical service area population of 30,000 persons, between $90,000 and $900,000 would be required annually to provide rural public transportation services. At the low end, not even one trip per day would be provided to most parts of the area, while quite extensive services could be provided at the upper end of the expenditures.

Table 3-2

RURAL TRANSPORTATION SERVICE BENCHMARKS: COST FACTORS FROM THE NATIONAL SAMPLE

Cost Factors	Ranges
$/Trip	$1.50 - $9.70
$/Hour	$6 - $48
$/Mile	$0.40 - $4.50
$/Vehicle/Year	$16,500 - $50,000
$/Person Served/Year*	$3.00 - $30.00

*Figures from the sample of high-performance case studies.

These ranges (representing one standard deviation, which means that the range represents about the middle two-thirds of all systems) are extremely broad, again demonstrating that a wide variety of systems have been implemented in rural areas across this country. So the good news is that you have lots of options that could provide good service for you. The bad news is that there is no one simple, cookbook answer to questions like "Which service?" and "How much of it?" for any one community.

SUMMARY

This chapter has begun the process of providing more and more detailed information for your consideration. You should now have a firm grasp of the service options that may be best for you, depending on the specific needs and goals of your community. The importance of tailoring services to local demographic, geographic, financial, and political

opportunities and constraints has been stressed. We've given you some broad outlines of services typically produced and resources typically consumed by the various service types, and will expand on those issues in later chapters.

Even more detailed information is coming next, as we delve deeper into the details of rural transportation system design and performance. The next chapter describes a number of case studies in depth. We will be particularly interested in uncovering those factors which seem to make a particular service design especially appropriate for a particular community. Chapter 5 will provide you with more statistical details about the specific service options and the levels of performance they tend to achieve. The last chapter looks at other sources of advice and assistance that you may wish to consider in deciding how to reconfigure existing services or to design new ones.