Guidebook for Rural Demand-Response Transportation: Measuring, Assessing, and Improving Performance

DETAILS

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TRANSIT COOPERATIVE RESEARCH PROGRAM

TCRP REPORT 136

Guidebook for Rural Demand-Response Transportation: Measuring, Assessing, and Improving Performance

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TRANSIT COOPERATIVE RESEARCH PROGRAM

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 Transportation 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 Academies, 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.

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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.

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FOREWORD

By Dianne Schwager
Staff Officer
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TCRP Report 136: Guidebook for Rural Demand-Response Transportation: Measuring, Assessing, and Improving Performance will be of interest to rural public transportation systems that provide demand-response transit (DRT) services and to the communities they serve. The Guidebook is a resource to assist DRT systems to measure, assess, and improve their performance, focusing on DRT systems in rural areas.

This Guidebook has been prepared under TCRP Project B-31, "Guidebook for Measuring, Assessing, and Improving Performance of Demand-Response Transportation." The research project produced two guidebooks. The first focused on DRT systems in urban areas and was published in 2008 as *TCRP Report 124: Guidebook for Measuring, Assessing, and Improving Performance of Demand-Response Transportation*. This is TCRP Project B-31's second guidebook and, given the important distinctions between DRT in rural and urban areas, it addresses rural DRT.

The research team followed a similar methodology in developing the Guidebook for rural DRT as was followed for the project's first guidebook, which included

- Developing a typology of rural DRT systems based on criteria affecting performance,
- Defining key performance data and a limited set of performance measures for DRT,
- Identifying the various factors that influence DRT performance,
- Collecting performance data from DRT systems representative of the defined categories,
- Identifying actions that rural DRT systems have implemented to improve their performance, and
- Documenting quantitative and qualitative effects on performance from those actions.

While this Guidebook focuses on rural DRT, it shares some similarities with *TCRP Report 124,* the urban Guidebook, particularly with the identification of factors that influence DRT performance and the background discussion on the development of the DRT typology. It is also noted that the rural Guidebook provides only limited information related to Americans with Disabilities Act (ADA) paratransit service because most rural DRT systems do not provide this type of DRT. Those rural systems interested in ADA paratransit and its performance may want to refer to the urban Guidebook for more information.

Improving DRT performance requires an understanding of the characteristics of DRT and the environment within which it operates. Improving performance also requires that

DRT systems measure where they are now and the progress of their performance over time. To do so, DRT systems need consistent data and clearly defined performance measures, which will facilitate their own internal assessment as well as comparisons of performance across the industry. Once DRT systems have assessed their performance and documented where they stand relative to their own service and compared with others, opportunities for improvement can then be considered.

CONTENTS

CHAPTER 1

Introduction

Demand-response transportation (DRT) systems—from large metropolitan services to small, community-based programs—face pressures to improve performance, with increasing demand for service and financial constraints. To improve performance, the characteristics of DRT and the factors that impact performance must be understood. Consistently defined data and clearly defined performance measures are also needed so that DRT performance can be evaluated in a systematic manner. Assessments of DRT performance, both individual system evaluations over time as well as peer comparisons across the industry, will then be more reliable and meaningful.

1.1 Development of Guidebook and Relationship to *TCRP Report 124*

This Guidebook has been prepared under TCRP Project B-31, "Guidebook for Measuring, Assessing, and Improving Performance of Demand-Response Transportation." The stated objective of the research project was to develop a resource that provides guidance for measuring, evaluating, and improving DRT performance with a methodology that recognizes the diversity of DRT services, service areas, and passengers.

The research project has resulted in two guidebooks. The first focused on DRT systems in urban areas and was published in 2008 as *TCRP Report 124: Guidebook for Measuring, Assessing, and Improving Performance of Demand-Response Transportation.* This is TCRP Project B-13's second guidebook and, given the important distinctions between DRT in rural and urban areas, it addresses rural DRT.

Early efforts in the research project established that rural DRT systems have very different characteristics and data-collection issues relative to performance measurement compared with urban DRT systems. The research project's panel then determined that a separate guidebook for rural DRT was needed to adequately address performance measurement and improvement for rural systems.

The research team followed a similar methodology in developing the Guidebook for rural DRT as was followed for the project's first guidebook, which has included

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1.2 Guidebook Organization

The Guidebook has seven chapters. Following this introduction in Chapter 1, Chapters 2 through 4 establish a framework for the Guidebook, with discussion on the diversity of DRT services and definitions of performance data and performance measures. The Rural National Transit Database (NTD) reporting requirements, introduced in 2006, are also discussed in relation to data definitions used for the Guidebook.

Chapters 5 through 7 present the typology of rural DRT systems as well as performance data from more than 20 representative rural systems that provided data and information for the project. Strategies and actions for improving DRT performance are also provided. Readers of the Guidebook who are familiar with performance evaluation may find these latter chapters of the Guidebook more useful.

After this first introductory chapter, the Guidebook includes the following:

- **Chapter 2: Rural DRT and Why Performance Matters** provides a brief background for the Guidebook, with discussion on the differences between rural and urban DRT as well as the broader environment—geographic, demographic, and policy—within which rural DRT operates.
- **Chapter 3: Performance Data for Rural DRT** identifies the key performance data for rural DRT.
- **Chapter 4: Performance Measures for Rural DRT** identifies a limited set of performance measures for rural DRT, building on the data elements discussed in Chapter 3.
- **Chapter 5: Assessing Performance—A Typology of Rural DRT** presents the typology of rural DRT systems, using criteria that influence DRT performance. This chapter also identifies the various factors that influence performance—controllable, uncontrollable, and partially controllable factors.
- **Chapter 6: Performance Data from Representative Systems** provides performance data from more than 20 representative rural DRT systems that participated in the research project, serving as benchmark data for peer comparisons.
- **Chapter 7: Improving Performance** presents policies, procedures, strategies, and practices that can improve DRT performance. The focus of the chapter is those actions taken by the rural systems participating in the research project, along with their quantitative and qualitative experience with those actions.

CHAPTER 2

Rural DRT and Why Performance Matters

Rural DRT is far more diverse than its urban counterpart. There are many more DRT systems operating in rural areas across the country than there are in urban settings. Of the approximate 1,500 rural systems nationwide, the large majority provides demand-response service; there are only about 400 urban DRT systems. Rural DRT covers a wider range of system types compared with urban DRT as characterized by sponsoring organizations, types of services operated, and geographic size of service area, among other attributes.

However, similarly to urban DRT, rural DRT systems are under performance pressures although the pressures may have somewhat different emphasis. Pressures on urban DRT are often related to the growing demand for service and high costs per passenger trip, particularly for ADA paratransit systems, while the issues for rural DRT often relate to funding and the need to stretch limited operating and capital resources. This means that the performance focus in any particular month for a rural DRT system may not be managing ridership demand (as it might be for a large urban ADA paratransit system), but it may well be the ability of the system to keep an aging fleet of vans in road-worthy condition for service each day.

This chapter provides a framework for the Guidebook, providing a brief background on rural DRT and the broader environment—geographic, demographic, policy—within which it operates. This environment must be understood when the performance of rural DRT is addressed.

2.1 Rural DRT—It's Different

DRT is typically defined as public transit that is not traditional fixed-route, fixed-schedule, but rather a service that **responds** in some manner or form to individualized requests or **demand** for transportation service.

The Federal Transit Administration (FTA) has defined DRT as follows:

> Demand-response is a transit mode comprised of passenger cars, vans or small buses operating in response to calls from passengers or their agents to the transit operator, who then dispatches a vehicle to pick up the passengers and transport them to their destinations. A demand-response (DR) operation is characterized by the following:
>
> a. The vehicles do not operate over a fixed-route or on a fixed-schedule except, perhaps, on a temporary basis to satisfy a special need, and

b. Typically, the vehicle may be dispatched to pick up several passengers at different pick-up points before taking them to their respective destinations and may even be interrupted en route to these destinations to pick up other passengers.

However, DRT in rural areas is often more than just a fleet of smaller vehicles operating in response to calls from passengers or their agents. DRT may also provide scheduled service one day each week to and from a distant medical center on an advance reservation basis. DRT may serve outlying communities only on a twice or three times per week basis, with a morning trip into the larger town and a return trip in the afternoon each day of service. Frequently, DRT also provides service for clients of local human service agencies on a contract basis. Rural systems may carry more than passengers. DRT may transport meals to home-bound seniors as part of its transportation mission, and there is at least one rural system that carries bulk mail for the U.S. Postal Service in addition to passengers. (Such non-passenger transportation service is allowable for rural providers through the FTA's Section 5311 Program as long as such service does not reduce the availability of public transportation service.)

DRT may be all of these services in rural communities; yet, the services share a common element of a trip reservation. That reservation may only be made once when an individual books the initial trip for subscription service, or the reservation may be made by a sponsoring human service agency for the rider. However, it is that reservation that makes DRT distinct from traditional fixed-route, fixed-schedule service.

What makes rural DRT distinct from urban DRT is the very broad range of DRT systems and services within the category of "rural." There are many permutations by sponsoring organization, by clientele served, by the range of services provided, by the funding sources used, and by the service areas within which rural systems operate. In terms of a sponsoring organization, for example, rural DRT is provided by political subdivisions, regional entities, transit districts, Councils of Governments (COGs), various single purpose and multi-purpose non-profit human service agencies, and Native American tribal organizations.

In terms of service area, there are rural DRT systems that operate within more than 10,000 square miles, sometimes with rugged terrain and limited roadways and many characterized by different "micro-climates" given the large size and varying elevations that affect daily operations. Many systems serve not just their rural communities and counties, but travel long distances to large urban centers for medical trips, with such trips perhaps requiring an 8- to 10-hr day given the distances to be traveled and time required for riders' appointments.

2.2 The Rural Transit Environment

Rural America composes 75% of the country's land area, but just 17% of the population (*1*). This translates to approximately 50 million people living in Census-defined rural areas. More than 70% of rural counties gained some population between 1990 and 2000, with most of this growth due to migration into rural areas. These trends varied across the country, however. Population gains were seen in those parts of the country with either mild climates, proximity to growing metropolitan areas, scenic landscapes, or two or three of these attributes—for example, the Pacific Northwest and Southern Highlands including western North Carolina and eastern Tennessee, among other parts of the country; there were no gains seen in the vast Great Plains (*1*).

From the perspective of counties, 74% have less than 50,000 population and 24% have less than 10,000, with the Midwest and the South characterized as the most rural regions in the United States (*2*). The population growth that occurred was still below that of metropolitan areas. According to demographic researchers, the limited gains in rural population and migration slowed by the late 1990s and this slowdown has continued into the 2000s (*1*).

The migration patterns, however, continue to "age" rural America, with rural areas gaining population in the over-age 50 groups. This is coupled with a general out-migration of young adults to urban areas, who are seeking social and economic advantages they see beyond their rural communities (*3*).

With these trends, the rural population tends to be older and in the most rural counties, along with central urban areas, poorer, compared with urban areas. Rural poverty can be more difficult to address, with the physical and social isolation typical in rural settings. With fewer transportation resources and the longer distances that must be traveled, it is more difficult for the rural poor to access the public services that are needed to help address poverty (*1*).

Access to health care is also a critical need in rural areas, where the problem may be as basic as the availability of healthcare facilities and providers. Rural counties that lack an urban area have roughly one-fourth the number of doctors per 100,000 population as do urban counties, and small rural counties have just one-sixth as many medical specialists per 100,000 population as do the metropolitan areas. Moreover, access to the medical care that is available is made more difficult because of the distances involved (*1*).

Rural transit operates within this environment, serving predominately those population groups who lack private transportation options. The mission of rural transit is often to provide, for those who depend on transit, the needed connections to medical services, grocery and retail stores, social services, employment, community college, and more. These services and facilities often require long trips and ongoing resources to sustain—resources that are often strained and stretched. It is a tall order.

What We Know About Rural Transit

Given the diversity of the country's rural areas, it is not surprising that rural transit and, specifically, rural DRT are often quite different from their urban counterparts. A recent survey effort by the National Rural Transit Assistance Program (RTAP) and the Community Transportation Association of America (CTAA) has identified more than 1,480 rural transit systems in the country (*4*). With information provided by respondents to the survey, various characteristics of rural transit emerged.

Almost half of the organizations providing rural transit are local governments such as cities and counties (49%); not quite one-third (31%) are non-profits; 11% are transit authorities; 7% are provided by "other" entities such as regional planning agencies and university transit systems; and a very small 1% are provided by Native American tribal organizations.

The survey showed that many rural transit systems provide more than one type of transit service. The vast majority (89%) provide demand-response service. Somewhat less than one-third (31%) provide fixed-route service, and 18% provide route or point deviation services.

More than two-thirds of the rural systems operate transit services directly, with their own staff. About 13% use a contractor, and 17% have a combination of directly operated and contracted service. A small 1% indicated they are brokers, where the transit entity distributes trips to various service providers.

Regarding their service area, the largest proportion (43%) is county-based, another almost one-forth (23%) serves multi-county areas, and one-fifth operates predominately in a single town or small city. About 9% operates in a multi-town area, which in some cases would be similar to a county-based service.

In terms of their vehicle fleets, the largest proportion of rural transit agencies operate fleets of fewer than ten vehicles (43%), and about one-third (34%) have vehicle fleets of 10 to 25 vehicles. Another 11% have larger fleets of 26 to 50 vehicles, and 10% operate 51 to 100 vehicles. A small 2% have fleets larger than 100 vehicles. The survey findings estimate that there are more than 32,000 vehicles used for rural transit although it is acknowledged that this is likely overstated.[1]

In terms of staff, the survey data indicate that the average rural system has 25.5 employees (full-time employees[FTEs]). More than 90% of rural systems have fewer than 50 employees. Regarding finances, somewhat over half of the rural systems (57%) reported total annual operating revenues of less than $500,000.

What About Rural DRT?

For a closer look at rural systems that operate demand-response only or demand-response in addition to route deviation and/or fixed-route, sample data from TCRP Project F-12 (published as *TCRP Report 127)*, which focused on rural and small urban transit systems, can be reviewed.[2] From the total survey respondent database for that study, data on rural systems that provide only demand-response service or demand-response in addition to fixed-route/route deviation can be extracted.[3]

Information from this dataset shows that rural DRT generally shares the characteristics found for all rural transit through the RTAP/CTAA survey referenced above, as would be expected since the large majority of rural transit systems operate some demand-response service. However, for some characteristics, the sampled TCRP data provide a more detailed look at rural DRT.

Regarding service area, the TCRP survey data show that rural DRT systems are most frequently operated at the county level, with the next most frequent at the multi-county level, followed by the municipal level (see Table 2-1). This is similar to overall rural transit.

The fleet size information also shows that rural DRT is quite similar to all rural transit. The average fleet size for rural DRT systems, based on the TCRP sample data, is 22.5; the average for overall rural transit systems, according to the RTAP/CTAA survey, is 21.9. The vast majority—more than 75%—of rural DRT and of general rural transit systems have 25 or fewer vehicles in their fleet.

In terms of type of organization, rural DRT services tend more frequently to be provided by non-profit agencies than is the case for all rural transit where government agencies are the most frequent provider. The TCRP survey data, which is more finely grained than that of the National RTAP/CTAA data, show that the most common type of rural DRT provider is a private, non-

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[1] By comparison, the 2007 Rural NTD estimates the total rural transit fleet at about 18,500 vehicles; however, this is somewhat understated as not all rural systems are represented in the database.

[2] TCRP Project F-12 was published in 2008 as *TCRP Report 127: Employee Compensation Guidelines for Transit Providers in Rural and Small Urban Areas.* The project was conducted by the KFH Group, Inc.

[3] Of the TCRP F-12 study's total of 367 survey respondents, which represented 45 states, 200 are rural demand-response providers.

Table 2-1. Percentage distribution of rural DRT systems by service-area type.*

Service-Area Type	Percentage of Total
Single municipal area	15%
Multi-town area	9%
Single county	44%
Multi-county	32%
Indian tribal reservation	<1%
Totals	100%

**Source: Survey data collected for TCRP Project F-12.*

profit multi-purpose agency, with the second most common type a department of county government (see Table 2-2).

2.3 What Does All This Mean for Rural DRT Performance Assessment?

Information and data about the general rural environment, rural transit, and rural DRT suggest that the assessment of rural DRT performance should be approached with acknowledgment of several "truths." These include the great diversity among rural systems and the fact that the mission of the rural transit agency can have a strong influence on performance. Where a rural DRT system transports riders 100 miles round-trip to a medical facility because its mission is one to serve the life-sustaining needs of community residents who lack private transportation, productivity will be low.

Additionally, while less "truth" than fact, rural DRT performance assessment must also recognize that data collection resources and practices can influence performance reports, particularly regarding mode-specific service for multi-modal rural systems, and that cost performance data may not be comprehensive, particularly where the rural transit agency is part of a larger organization.

Table 2-2. Percentage distribution of rural DRT systems by organization/agency type.

Organization/ Agency Type	Percentage Distribution
Department of County Government	19%
Department of City Government	15%
Private, Non-Profit—Transportation Only	16%
Private, Non-Profit—Multi-Purpose	32%
Transit Authority	12%
Private, For-Profit	1%
Other	5%
Totals	100%

**Source: Survey data collected for TCRP Project F-12.*

This is not to disparage the significant efforts made by rural transit systems to collect and report performance data; yet, as described by the research project's panel overseeing the development of this Guidebook, "historically, data collection and reporting have not been rigorous among DRT systems."

Regarding data collection and reporting, from the standpoint of assessing the performance of rural DRT as opposed to general rural transit, what must be recognized is that operating data for DRT is often combined with data for other modes, particularly route deviation. This becomes a challenge when trying to evaluate DRT as a distinct mode.

A related challenge—again where rural transit systems operate more than just demand-response—is that operating costs are often not allocated to the different modes. This makes it difficult to assess the cost-related performance of rural DRT. For example, if the rural transit system operates both demand-response and route deviation (also called deviated fixed-route and flex route), the differences in cost per passenger trip are difficult to know unless the costs are allocated to the two distinct modes. For example, assume a fictitious rural transit system that operates both DR and route deviation for a total annual cost of $800,000 and 20,000 annual vehicle-hours, distributed between the modes 75%–25%, as shown in Table 2-3.

Based on total system data, the cost per passenger trip is calculated to be $10.67, irrespective of mode, as shown on the top half of Table 2-3. However, a more nuanced evaluation would allocate costs to the two modes, with the result that the operating cost for the demand-response service is $625,000 and $175,000 for route deviation, as shown in the bottom half of the table. With the two separate costs and with operating data segregated by mode, it can be determined that the cost per vehicle-hour and cost per passenger trip vary by mode.

In fact, for this fictitious system, the cost per route deviation passenger is 12% higher than for a demand-response passenger. With a higher productivity on demand-response as compared with route deviation (4 versus 3 passenger trips/hour), the cost per passenger trip is less on demand-response even though the cost per hour is more. This more detailed assessment of cost performance data might suggest that the rural transit system take a closer look at its route deviation service.

But for many rural systems, it may be difficult to collect and calculate the more comprehensive operating and performance data that would allow for more detailed and instructive assessments. This may be due to the transit system's staff resources and available technology that can facilitate data collection. Where the rural system is a part of a larger organization, for example, it may be difficult to obtain the data that would show the proportionate costs that should be allocated to the different modes.

Table 2-3. Example of multi-modal rural transit system performance data.

Annual Performance Data Based on *Total* System Data				
Total Operating Costs	**Total Vehicle Hours**	**Total Passenger Trips**	**Operating Cost/ Vehicle Hour**	**Operating Cost/ Passenger Trip**
$800,000	20,000	75,000	$40.00	$10.67

Annual Performance Data Based on System Data *Allocated by the System's Two Modes*									
Operating Costs		**Vehicle Hours**		**Passenger Trips**		**Operating Cost/Vehicle Hour**		**Operating Cost/ Passenger Trip**	
Total DR Cost	Total Rt Dev Cost	Total DR Veh. Hrs	Total Rt Dev Veh. Hrs	Total DR Pass. Trips	Total Rt Dev Pass. Trips	Op. Cost/ DR Veh. Hr	Op. Cost/ Rt Dev Veh. Hr	Op. Cost/ DR Pass. Trip	Op. Cost/ Rt Dev Pass. Trip
$625,000	$175,000	15,000	5,000	60,000	15,000	$41.67	$35.00	$10.42	$11.67

Beyond these "truths" and facts about rural DRT, there are a variety of factors that influence performance day-to-day. This may include the considerable deadhead time and miles required because of a large service area, or it may be policies and procedures related to no-shows. Some of these the rural DRT system can control, at least partially; others, it cannot.

It is thus important to understand the context of rural transit and specifically rural DRT when assessing performance. This Guidebook attempts to provide that context. More importantly, the Guidebook provides *how-to resources* for rural DRT performance measurement. What are the key data that should be used? How are the data elements defined, and what data are used for what measures? Once the performance data are calculated, then what? These are the same resources provided for urban DRT systems in the companion guidebook, *TCRP Report 124.*

As in *TCRP Report 124,* this Guidebook provides sample data from representative DRT systems around the country, providing reference points for rural DRT systems assessing their own performance. The Guidebook also provides information gleaned from these sampled systems about actions and strategies that they have used to improve their own performance. Again, these can serve as reference points for other DRT systems interested in considering performance improvements.

While the nuts and bolts of performance assessment—data collection, reporting, and measuring data over time and perhaps against other systems—may seem just another task in an already too long list of to-dos for rural transit managers, DRT performance does matter. It needs to be reported so that the manager can demonstrate to the community—the system's riders as well as its staff—what the system has accomplished. It needs to be assessed so that the system can build on what works and then try and fix what could work better. Reporting and assessing performance also matter so that the case can be made to local, state, and federal leaders and policymakers that rural transit is well-deserving of continued financial support.

CHAPTER 3

Performance Data for Rural DRT

Measuring and assessing rural DRT performance require that performance data be identified and defined. This is an important step that will help improve consistency in data definitions and reporting. Particularly at rural transit systems there may be limited administrative staff for data collection tasks, and these tasks may be burdensome without technology tools such as a computer-assisted scheduling/dispatch (CASD) system. Data on DRT may be intermingled with data for other service modes, such as route deviation, but consistent data reporting practices are needed for assessing rural DRT performance. This chapter identifies key performance data for rural DRT systems and also reviews other data elements that are often collected for performance assessment purposes.

3.1 Performance Data—Which Data Elements Are Particularly Important?

This Guidebook's companion guidebook on urban DRT systems, *TCRP Report 124,* identified a long list of data elements that DRT systems can consider for data collection and assessment purposes. This list was then distilled to six key data elements for performance assessment, in keeping with the research project's objective of selecting a limited number of performance data elements and measures.

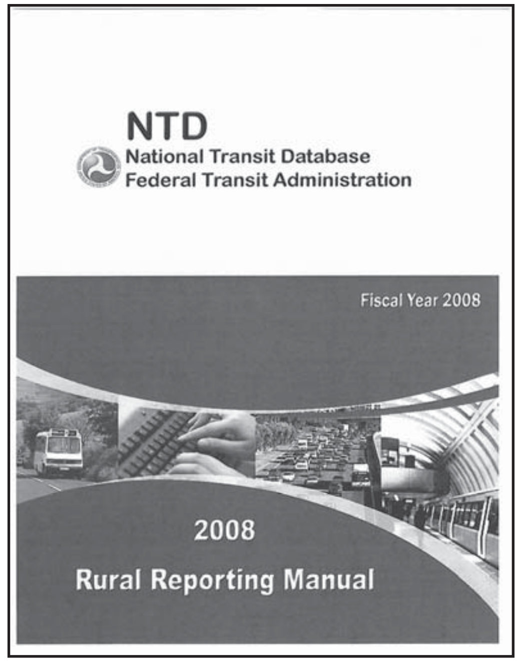
For rural DRT systems, a similar set of six data elements is used for this Guidebook as the key data for performance assessment purposes:

- Vehicle-hours,
- Vehicle-miles,
- Passenger trips,
- Total operating expense,
- Accidents/safety incidents, and
- On-time trips

In addition to these data elements, a number of others are identified and discussed in this chapter. These additional data elements and related performance measures provide rural DRT systems with additional resources for assessing their performance.

3.2 Performance Data for Rural DRT—Now There Is NTD

With the Rural NTD established in 2006 for transit systems operating in rural areas, transit managers at the nation's rural systems must now comply with specific federal reporting requirements. NTD reporting has been a staple for urban transit systems since the 1970s, and adoption of standardized reporting for rural systems in 2006 is a positive progression.



The NTD reporting requirements can help standardize data, data definitions, and data reporting practices for rural systems. Over time, the national database will provide a large reservoir of rural transit information that can be useful in assessing performance trends over time and providing peer information that an individual transit system can use for reviewing its own performance.

However, it should be noted that some aspects of the federal transit reporting system have evolved over the years, and in some cases, continue to evolve. Take the NTD definitions related to safety, for example. These data elements have been revised several times over the years for urban reporters. Such is the case for Rural NTD as well, even over its short history. Certain data elements included in its 2006 inaugural year have been revised since then. For this Guidebook, some of the NTD definitions are used and, in other cases, not, as is discussed in the following section.

3.3 Key Performance Data for Rural DRT Performance Assessment

The key performance data used for this Guidebook and their definitions are identified below.

Vehicle-Hours

Vehicle-hours measure the time from when the DRT vehicle leaves the garage (or other starting location) to go into service until the time that the DRT vehicle pulls in after completing service—"pull-out to pull-in." Vehicle-hours therefore include deadhead time needed to travel to the first pick-up location and from the last drop-off location back to the garage. Vehicle-hours do not include any charter service, vehicle operator training, or vehicle maintenance testing. Vehicle-hours also do not include any scheduled time off for the operator such as a formal lunch break.

While the urban NTD reporting program requires transit agencies to report *vehicle-hours* (as well as vehicle revenue hours), Rural NTD does not ask for "vehicle-hours." Rather, Rural NTD asks systems to report *vehicle revenue hours.* The standard definition for vehicle revenue hours is the time from first passenger pick-up to last passenger drop-off, not including any deadhead time, or any charter service, vehicle operator training, vehicle maintenance testing, or scheduled operator time off such as a formal lunch break.

However, somewhat confusingly, the NTD's *2008 Rural Reporting Manual* (the current manual at the time this Guidebook was developed) defines vehicle revenue hours for the DRT mode (and only for the DRT mode) as the time from when the vehicles pull-out to go into revenue service to the time they pull-in from revenue service. In other words, *vehicle revenue hours* for rural DRT are defined the same way as *vehicle-hours* are typically defined, which is pull-out to pull-in.

For this Guidebook, it was determined that the appropriate data element for rural DRT would be *vehicle-hours,* and it is defined as "pull-out to pull-in," minus any scheduled time off for the operator.

Data Collection for Vehicle-Hours

Vehicle-hours data are obtained from vehicle operator logs. These logs, also called "manifests," should be configured so that the operators report the actual times that they leave the garage or other starting location (e.g., their home if they take the vehicle home with them at night) and the time that they return at the end of their driving shift, referred to as "pull-in."

The log should also be configured so that the operators report their scheduled time off, such as lunch breaks, both the starting and ending time of their break (if they have such a break), or any other time that they are formally not providing or available to provide transportation. This does not include the time it might take for an operator to quickly grab something to eat when traveling between pick-up and drop-off points.

Any scheduled time off, when the operator is not providing or available to provide transportation, needs to be deducted to determine total vehicle-hours. For example, an operator may have a driving assignment in the morning hours and then once back at the garage, that operator is assigned other duties in the office such as answering the phone and taking trip reservations before another driving assignment in the afternoon. The logs must be designed so that these data are collected, and reporting practices must ensure that this time that the operator spends in the office is not included in vehicle-hours.

Vehicle-hours, then, include all the time from pull-out to pull-in, minus scheduled time off or time that the operator is assigned to other, non-driving duties. Vehicle-hours do not cover transportation activities such as exclusive school bus service and charter service.

If **volunteers** are used to provide DRT service, their time is counted as vehicle-hours, using the same definition—the time from garage (or other storage location) pull-out to garage pull-in, exclusive of any scheduled time off. If a volunteer driver accompanies the passenger to an appointment as part of the trip (e.g., a medical appointment), the time spent at the appointment is counted in the same way as scheduled time off; in other words, it is not counted as part of vehicle-hours. Where volunteers are used, the DRT system's reporting forms should be developed so that data on the volunteers' vehicle-hours are captured. These hours would then be added to the vehicle-hours provided by paid drivers.

If **taxis** are used to provide some of the rural transit system's demand-response service, the time that the taxi is transporting the system's passengers should also be included in the DRT system's count of vehicle-hours. The agreement with the taxi provider should include requirements that the company provide data showing the elapsed time for the trips provided per the arrangement with the rural transit system. Since taxi companies are more accustomed to dealing with miles rather than hours, this may require some emphasis to ensure the time data are provided.

Vehicle-Miles

Vehicle-miles include the miles from when the DRT vehicle leaves the garage (or other starting location) to go into service until the time that the DRT vehicle pulls in after completing service—"pull-out to pull-in." Vehicle-miles include deadhead miles needed to travel to the first pick-up location and from the last drop-off location, but do not include any miles for charter service, vehicle operator training, or vehicle maintenance testing.

Vehicle-miles, therefore, correspond to vehicle-hours; they are the miles traveled while the DRT vehicle is accumulating vehicle-hours. Vehicle-miles should also include the miles of any personal vehicles used in DRT service, such as by volunteers who use their own cars, and the miles of any taxicabs that provide DRT service for the transit agency.

It is noted that Rural NTD does not ask for vehicle-mile data, but rather *vehicle revenue miles,* defined by Rural NTD as the miles traveled by the vehicles when in revenue service.

Data Collection for Vehicle-Miles

Vehicle-miles data are obtained from vehicle operator logs. These logs should be configured so that the operators report odometer readings when leaving the garage or other starting location (e.g., their home if they take the vehicle home with them at night) and the time that they return at the end of their driving shift.

The log should also be configured so that any miles operated during formal lunch breaks or any other time that they are formally not providing or available to provide transportation are tracked. These miles, traveled when the operator is not providing or available to provide transportation, need to be deducted to determine total vehicle-miles. Vehicle-miles data do not include any miles traveled for exclusive school bus service or charter service.

If **volunteers** are used to provide DRT service, their distances traveled are counted as vehicle-miles, using the same definition—the miles traveled from garage (or other storage location) pull-out to garage pull-in, exclusive of any scheduled time off.

If **taxis** are used to provide some of the rural transit system's demand-response service, the miles that the taxis accumulate when transporting the system's passengers should also be included in the count of vehicle-miles. The agreement with the taxi provider should include requirements that the company provide data on the miles of all trips provided on behalf of the DRT system as well as time.

Potential Issues When Reporting Vehicle-Hours and Vehicle-Miles

Regarding the reporting of hours and miles data, there are several possible errors that may be made by transit systems. These include the following:

- **Use of operator pay hours for revenue or vehicle-hour data.** Some DRT systems mistakenly compute vehicle-hour or revenue hour data from operator time records—that is, they report the time as the sum of operator pay hours. This is not correct. For vehicle-hours, the time includes only the time from vehicle pull-out to vehicle pull-in, minus scheduled breaks, and it does not include such time as that provided to operators for pre-trip or post-trip inspections.
- **Estimation of hours and miles data.** NTD requires the direct recording of hours and miles data. Experience with urban NTD reporting has found that some reporters incorrectly assume that estimated values can be reported, but this is not the case.
- **Incorrect treatment of lunches and breaks.** Some transit systems do not subtract out scheduled lunches and breaks from vehicle-hours; therefore, these systems overstate their hours data.
- **Incorrect calculation of total vehicle-miles.** Transit agencies may calculate total vehicle-miles by simply subtracting their vehicles' starting odometer reading at the beginning of the year from the odometer readings at the end of the year. This is not correct and leads to an over-reporting of vehicle-miles. By using year-start and year-end odometer readings, the mileage figure will include such miles as those needed for vehicle operator training, maintenance testing and other maintenance needs, and possibly charter or other purposes. These latter miles are not included for NTD reporting purposes.

Passenger Trips

The data element *passenger trips* is also called *ridership.* NTD uses the term *unlinked passenger trips* or *regular unlinked passenger trips* according to the Rural NTD manual. The Rural NTD has added an additional term for passenger trips: *sponsored unlinked passenger trips,* which is defined as DRT trips that are paid in part or in whole by a third-party such as a human service agency or Medicaid agency.

This Guidebook uses the term *passenger trips.* The data element is a count of the number of passengers who board the DRT vehicle, with passengers counted each time they board a DRT vehicle. If a passenger travels with children or a Personal Care Attendant (PCA), these other riders are also counted as passenger trips. Total passenger trips is the sum of what Rural NTD refers to as regular unlinked passenger trips and sponsored unlinked passenger trips.

Passenger trips should also include the count of any passenger trips provided by taxicabs if taxis are used for the DRT service. Additionally, passenger trips provided by volunteers should be included in the total DRT passenger trip count.

Data Collection for Passenger Trips

Passenger trip data are obtained from driver logs, which should be designed so that vehicle operators record the number of passengers boarding at each pick-up location. For volunteer services, reporting forms should be developed that will capture passenger counts.

PCAs and companions are counted as passengers on DRT as long as they are not employees of the transit system. Attendants and companions are included regardless of whether they are fare-paying passengers.

Transit system employees are not counted as passengers if they are performing work duties that require traveling on the vehicles and are being paid while traveling. Examples of these work duties include observing vehicle operations and serving as an on-board aide or assistant for the passengers. However, transit system employees are counted as passengers if they are traveling for personal reasons including commuting to and from work.

There can be inconsistent reporting of passenger trips by DRT systems, with common problems being

- **Counting only round trips.** Some DRT systems only count round trips of passengers in their total count of passenger trips, so when a rider is transported, for example, to the senior center and then back home, the transit system might count one passenger trip. This is not correct. That rider should be counted each time she boards the vehicle; in this example, two passenger trips should be counted.
- **Incorrect definition of passengers.** Some DRT systems incorrectly define passengers in one of the following manners: all fare-paying passengers, ADA-certified riders only, all persons boarding not including children, and all persons boarding not including PCAs and companions. This also is not correct. Each person who boards the vehicle, including someone who rides for free, a PCA, a companion, or a child, is defined as a passenger.

Total Operating Expense

Total operating expenses or total operating costs include those costs needed to operate and administer transit services day to day. These costs include salaries and wages, fringe benefits, materials and supplies, insurance, taxes, and outside services such as cleaning and utilities. These are the costs used for the day-to-day expense of operating and maintaining vehicles; maintaining other equipment, buildings and grounds; and general administration costs including marketing and customer support, finance and procurement, planning and service development, and legal costs.

Total operating costs also include equipment lease and rental costs. Operating costs include depreciation of capital and the interest paid on loans for capital purchases. Importantly, operating costs exclude the purchase of capital such as vehicles, equipment, or facilities.

As defined by Rural NTD, operating costs include the costs to operate "sponsored" transit programs and services such as those provided for client-specific or categorical programs—for example, Meals-on-Wheels, sheltered workshops, independent living centers, and any social service agency programs. The Rural NTD, however, does not ask reporters for operating costs by mode. Rather, Rural NTD asks for the annual operating expenses for *all* the rural transit services operated, including DRT. Thus, rural transit systems do not need to allocate costs by mode for federal reporting purposes.

For purposes of this Guidebook and performance assessment, however, it is important that the operating costs be separated by transit mode, when the rural agency operates more than just DRT. Most transit expenses are known as direct expenses and can be associated on a one-on-one basis with a specific transit mode. Examples include operator labor and fuel costs. However, some expenses, known as indirect or shared expenses, cannot be directly associated since they support several modes. The majority of these costs, often called "overhead costs," are administrative such as accounting and planning. These costs must be allocated on a reasonable basis to the individual transit modes. There are a number of transit references that can be consulted on cost allocation and these are listed in References in this Guidebook.

Data Collection for Total Operating Costs

The transit system's accounting system records and reports operating expenses. It is important that all operating expenses are included. For example, if the rural DRT system contracts for service and the contractor obtains fuel from the city or county yard, the costs for the fuel should be included as part of operating costs.

If the transit system purchases transit services and the contractor provides vehicles, it needs to ensure that the contractor provides cost data that are separated into operating and capital costs. This requirement should be explicitly stated in the contract to make it clear to the operator before service starts.

Where there are problems with DRT system reporting of operating expenses, it is often related to two issues:

1. **Poor cost allocation of joint expenses.** Transit systems that operate more than one mode or type of service must allocate certain shared expenses such as the administrative costs and shared building expenses. Some transit systems may not use reasonable allocation procedures or use procedures that should be updated.
2. **Inclusion of capital charges in purchased transportation costs.** While contracting for service is less common for rural DRT systems than for urban DRT, there may be cases where the DRT service contractor provides the vehicles. The contractor may charge one unit cost per hour or per trip that includes both the operating costs associated with vehicle operations and maintenance and the capital cost associated with providing the vehicle. Where this is the case, the transit system should require the contractor to report in its monthly invoice the portions of the invoiced costs that are capital and operating so that operating costs can be accurately reported.

Accidents

Data on accidents and other safety-related incidents are important for all transit systems to collect and assess. Transit systems may have different procedures related to how accidents and safety incidents are formally reported, and most systems differentiate between preventable and non-preventable accidents. For purposes of this Guidebook as well as for *TCRP Report 124,* it was decided that the NTD definitions should be used for safety data since they provide standard definitions.

Rural NTD requires the collection and reporting of three types of safety data: reportable incidents, fatalities, and injuries. Per NTD, these are defined as follows:

1. **Reportable incident:** The existence of one or more of the following conditions constitutes a reportable incident: a fatality, injuries requiring immediate medical attention away from the scene for one or more persons, or property damage equal to or exceeding $25,000. A

reportable incident must be related to the operation of *revenue* service and not associated with unrelated tasks. The following types of incidents are not reportable to the NTD:
   - Mechanical,
   - Industrial, or
   - Administrative work orders.
2. **Fatality:** A transit-caused death confirmed within 30 days of a transit incident.
3. **Injury:** The definition of injury requires immediate medical attention away from the scene of the accident. This means that injured people who receive treatment at the accident scene are not counted toward the definition of an injury. It also means that injured people who delay receiving treatment after the accident are also not counted.

Data Collection for NTD Safety Data

The data on accidents is collected as part of the claims management function. Specific reports should be prepared on a routine basis to document the events that meet the accident criteria. Since DRT systems typically collect data on all safety-related incidents and accidents regardless of NTD reporting thresholds, DRT managers have essentially two sets of data on safety incidents.

It is important to note that the NTD definition is event-oriented and goes beyond measuring injuries to passengers and includes events related to property damage. Since each reportable safety incident is an event, there can be more than one "result" from that event. For example, there may be an accident with property damage exceeding the dollar threshold and also with three passenger injuries meeting the NTD definition of injury. This would be counted as one reportable incident, and additionally there would be three injuries reported. There may be an accident with limited property damage yet with two passenger injuries meeting the reporting definitions. As with the first example, one reportable incident would be tallied, and additionally two injuries would be reported.

Several issues may be problematic with collection of the NTD safety data:

- **Definition of injury.** According to NTD, an injury requires immediate medical attention away from the accident scene. Immediate medical attention includes, but is not limited to, transport to the hospital by ambulance. If an individual is transported immediately from the incident scene to a hospital or physician's office by another type of emergency vehicle, by passenger vehicle, or through other means of transport, this is also considered an injury. An individual seeking medical care several hours after an incident or in the days following an incident is not considered to have received immediate medical attention. In cases that are less clear-cut, reporters can apply their judgment in determining whether the injury sustained caused the individual to immediately seek medical attention.

  The medical attention received must be at a location other than the location at which the incident happened. The purpose is to exclude incidents that only require minor first aid or assistance at the scene, but this distinction is not supposed to be burdensome for the transit provider. The NTD does not require the system to follow-up with each person to see if they received medical attention at the hospital.
- **Definition of fatality.** A fatality is a transit-caused death that occurs within 30 days of a transit incident. If death occurs after 30 days, it is classified as an injury.
- **Accident must involve a transit vehicle or happen on transit-controlled property.** This means that the accident occurs in an environment under the direct control of the transit system. For DRT systems, this definition typically limits the counting of accidents to those involving transit vehicles since most DRT systems do not own or control other transit facilities used by passengers such as stations, buildings, or shelters.

On-Time Trips

On-time trips are those trips where the DRT vehicle arrives at the scheduled pick-up location within the DRT system's definition of *on-time.* Some rural DRT systems measure their on-time performance at the drop-off end, so an on-time trip is one that gets the rider to his or her destination by the promised time. Often, DRT systems provide a "window of time" within which the vehicle's arrival is defined as on-time. A 30-min window at the pick-up end is typical for many urban and some rural DRT as well, but variations are used, including windows from 15 to 60 min.

Some rural systems determine that they are on-time if the vehicle arrives anytime before the scheduled pick-up time. Thus, there is no window of time—any time before the scheduled pick-up time is on-time. However, while many rural DRT provide their riders either a specific pick-up time or a window of time for the pick-up and many have their operators report arrival times at scheduled locations on their manifests, the majority do not use the data formally or routinely to report on-time performance. This is a data element, however, that is important for performance-assessment purposes. Trip timeliness is perhaps the single most important measure of service quality from the DRT rider's perspective and provides an assessment of the DRT system's reliability.

Data Collection for On-Time Trips

While data collection and reporting of on-time trips may not be routinely done by rural DRT systems, it need not be burdensome. DRT systems should ensure that operators record on their manifests the time that they arrive at the pick-up location (not the time the rider boards, but the time when they have pulled up to the scheduled location). They should also record the time when they arrive at the drop-off location (again, the time once they have pulled up at the destination).

Alternatively, some DRT systems have their operators call in on the radio their arrival and drop-off times. In such cases, the dispatcher maintains the records and should ensure that the data are reported on the schedules so that comparisons can be made of the actual times versus the scheduled times.

For those rural DRT systems that have Mobile Data Terminals (MDTs) in their vehicles, the pick-up and drop-off times can be reported electronically, via MDT, which greatly eases the data reporting effort. If the transit system has Automatic Vehicle Location (AVL) technology, this will enable the system to "see" where the vehicles are, and operator-reported data on trip timeliness can be verified.

There are several issues with the reporting of on-time trips from a data reporting perspective, including

- **The definition of on-time varies.** Since there are different ways that on-time is defined, reported data on timeliness have somewhat different meanings. If a rural system defines on-time using a 45-min window and 90% of its trips are measured as on-time, can this be compared with a system with a 30-min on-time window and 90% on-time trips? Not really. What is more important is that the rural DRT systems have defined on-time and that they measure timeliness on a routine basis, allowing internal comparisons over time.
- **On time at the pick-up or the drop-off end.** While DRT systems typically focus on measuring on-time performance at the pick-up end, timely service at the drop-off end may be more important for the passenger, particularly for a time-sensitive trip such as to work or a medical appointment. It is recommended that DRT systems monitor on-time performance at the drop-off end for those trips that are time sensitive.

  It is important to note that DRT systems need to schedule riders' trips based on *either* the desired pick-up time *or* the desired drop-off time; a DRT system cannot schedule a rider's trip with both a requested pick-up time *and* requested drop-off time, given that both computerized and manual scheduling procedures must have some degree of flexibility for scheduling purposes. Riders must choose which end of the trip to focus on when requesting their trips. When riders have time-sensitive trips, the DRT system is better able to provide a timely arrival when riders accept a DRT system-determined pick-up time that is based on meeting the appointment time. Otherwise, riders may face late arrivals for appointments as they may not allow adequate time for DRT shared-ride service.

- **Self-reporting bias.** For most rural DRT systems, the on-time data are recorded by vehicle operators on their trip manifests. There may be tendency for some operators to "round" the pick-up times to better fit within the on-time window or to make their arrivals seem timelier. Use of MDTs/AVL can help with the reporting of accurate data. The AVL data can be used to verify operators' locations at specified times, providing a check on operator reporting and specifically on-time performance data. Some DRT systems have been surprised to learn their "true" on-time performance once they have transitioned from operator reporting via manifest to MDTs/AVL. Differences of more than 5 to 10 percentage points for on-time performance are not uncommon once a DRT system transitions from manual reporting to MDTs/AVL.

3.4 Other Performance Data for Rural DRT Performance Assessment

In addition to the six data elements discussed above, there are other data elements that are useful for DRT systems to collect and report. These are identified below.

Revenue-Hours

While the Rural NTD does not require the collection or reporting of revenue-hours for rural DRT systems,[1] this is a useful data element that some rural DRT systems already collect. Revenue-hours are defined as all time from the point of the first passenger pick-up to the last passenger drop-off, as long as the DRT vehicle does not return to the dispatching point (the transit agency's garage or other designated location where the operator is waiting for a passenger trip assignment), minus scheduled time off such as driver lunch breaks.

It is noted that, for DRT service, there may be periods of time when there are no passengers riding or when the vehicle is stopped before proceeding to the next pick-up. This time is considered revenue time as long as the vehicle operator does not return to the dispatching point. Scheduled time off is typically a lunch break, but this does not include the time it might take for an operator to quickly grab something to eat when traveling between pick-up and drop-off points.

Data Collection for Revenue Hours

Revenue-hours data are obtained from vehicle operator logs. These logs, also called "manifests," should be configured so that the operators report the actual times that they go into and out of revenue service. This is in addition to reporting the times that they leave the garage or other starting location (e.g., their home if they take the vehicle home with them at night) and the time that they return at the end of their driving shift, referred to as pull-in. The difference between vehicle-hours and revenue-hours is deadhead time.

[1] As explained earlier in this chapter, Rural NTD asks reporters to report "vehicle revenue hours," but defines this data element, for the DRT mode only, as the time the vehicles pull-out to go into revenue service to the time they pull-in from revenue service, which is the definition typically used for vehicle-hours, not revenue-hours.

The log should also be configured so that the operators report their scheduled time off such as lunch breaks, both the starting and ending time of their break (if they have such a break), or any other time that they are formally not providing or available to provide transportation.

Scheduled Trips

Scheduled trips are those trips that are placed onto vehicle schedules for transportation service. Some DRT systems accept trip reservations for trips up to 2 weeks, and sometimes even longer, in advance. Others have a shorter advance reservation time period, accepting trips no more than 1 week or several days in advance. If the DRT system provides ADA paratransit service, it must accept trip reservations on a next-day basis. That is, an ADA-eligible rider should be able to make a trip reservation for tomorrow up to the close of the DRT system's office hours today.

Some DRT systems provide immediate response service, accepting trips from riders on the same day of desired travel or even just 1 hour or less before a desired trip. Those DRT systems that are advance reservation will often accept a same-day trip request for an urgent trip or when they have available capacity. All of these trips are scheduled trips.

Data Collection for Scheduled Trips

This data element is collected by the DRT system call-takers and schedulers. For those systems that have a CASD system, this data element is calculated automatically by the system.

Completed Trips

Completed trips are those trips where a passenger is transported from an origin to a destination. A completed trip may carry more than one passenger if there are two or more passengers traveling from the same origin to the same destination. Completed trips are a subset of scheduled trips, as some trips will be cancelled and some (hopefully not too many!) will be no-shows.

Data Collection for Completed Trips

Data on completed trips are collected by vehicle operators, who report the data on their manifests. Some DRT systems that operate as immediate response may have the operators call in their passenger counts via the radio as the passengers are picked up and dropped off—"plus one at 1429 Elm St. . . . minus one at 2021 Elm St.," and so forth. In this case, the count of completed trips is handled by the dispatchers. Or for the rural DRT systems that have MDTs and a CASD system, passenger data can be collected electronically.

No-Shows

A no-show is defined as a failure of a rider to show up for a scheduled trip at the scheduled time and location, when the vehicle has arrived in a timely manner (according to the DRT system's definition of on-time), and when the rider has not cancelled the trip in advance. Should a rider cancel the trip when the vehicle arrives ("cancel at the door") or if a rider cancels the trip "late" (with late cancel defined in different ways by DRT systems), then those, too, are typically counted as no-shows. DRT systems may differentiate between no-shows and late cancels, but since a late cancellation often has the same negative effect on DRT service, the two data elements are usually counted and assessed together.

Data Collection for No-Show Trips

No-shows are reported by vehicle operators. Late cancels are reported by dispatchers or call-takers. Regarding the reporting of no-shows, some DRT systems require that vehicle operators obtain approval from a dispatcher before marking a passenger a no-show. This allows the dispatcher the opportunity to try and telephone the passenger so that the trip might be provided, and it also provides a level of supervision over the vehicle operator.

Late Cancellations

A late cancellation is a trip cancellation that is made shortly before the vehicle is scheduled to arrive. The exact time that a cancellation becomes a *late cancellation* rather than just a *cancellation* is a matter of DRT policy and should take into account the degree to which the scheduling/dispatch function can "re-use" the space newly created by the cancellation. For a rural DRT system that must travel long distances between pick-ups and drop-offs, a late cancellation may be one that is made less than 3 or 4 hours before the scheduled trip, or some rural systems may require cancellations the day before the scheduled trip.

On the other hand, if the rural system operates predominately within a small community, a late cancellation may be one made with less than 1 hour's notice. However the DRT system defines a late cancellation, the system must ensure that its riders and the community understand the definition as well as why it is so important to cancel unneeded trips in as timely a manner as possible.

For rural DRT systems that provide ADA paratransit service, it should be noted that the FTA has commented that a late cancellation for purposes of rider sanctions should be the operational equivalent of a no-show.

Data Collection for Late Cancellations

Trip cancellation data are reported by the dispatchers or other DRT system staff that work in the dispatch office.

Missed Trips

A missed trip is defined as a failure of the vehicle to show up for a scheduled trip. A missed trip can also be defined to include a trip that arrives so late that the passenger is no longer there for the trip or declines to take the trip. In both cases, the trip is not completed. This more expansive definition of a missed trip is recommended.

Some DRT systems use the term *vehicle no-show* instead of missed trip. There may also be confusion with the term "missed trip" since some DRT systems combine missed trips and late trips together for purposes of contractor monitoring or for other reasons. They are not the same operationally: a missed trip results with an incompleted passenger trip because of vehicle operator or other DRT system error, whereas a late trip, no matter how late, results in a completed trip.

Data Collection for Missed Trips

Data on missed trips are obtained from vehicle operator records or dispatcher data. Rural DRT systems may not routinely collect data on missed trips, but it should be monitored if missed trips become problematic.

Trip Denials

A trip denial is a DRT trip that is requested by a passenger, but that the DRT system is not able to provide typically because capacity is not available at the passenger's requested time. For those rural DRT systems that provide ADA paratransit, the definition of denials is considerably more complicated, and the reader is referred to *TCRP Report 124.*

It can be useful for a DRT system to collect trip denial data as it provides hard evidence of limited capacity, at least during the times when trips are denied. These data may be useful when the

DRT system is trying to make a case that added capacity is needed, or it could suggest that schedules for vehicle operators should be reviewed to ensure that the operators' shifts match ridership demand patterns.

Data Collection for Trip Denials

Data on trip denials are captured during the trip reservation process by call-takers or schedulers.

Trip Length

Trip length is the distance measured in miles from the passenger pick-up to drop-off location. The cumulative sum of all passengers' trip lengths is referred to as passenger-miles and is a NTD data element required for urban reporters.

While rural transit systems do not have to report trip length data for NTD purposes, it is useful data that rural DRT systems may want to assess on a sampled basis. It is particularly useful where a rural system wants to track and monitor the longer distance trips that it may serve and to assess the impacts of those long trips on its performance. In such cases, the DRT system should collect, report, and monitor trip length data.

Data Collection for Trip Length

One approach would be to have the vehicle operators record odometer readings at each pick-up and drop-off location for a sampled time period—for example, a 1-week period several times per year—which would provide the trip lengths of the sampled passenger trips.

Another approach to data collection would be to use an FTA-developed procedure that is designed for urban reporters to meet passenger mile reporting, as described in the FTA Circular *C 2710.2A Sampling Procedures for Obtaining Demand Response (DR) System Operating Data Required under the Section 15 Reporting System* (available at www.ntdprogram.gov). While these procedures are designed to meet FTA's defined statistical accuracy levels for urban reporters, a rural system does not have these requirements and could use the procedures for a time period it determined appropriate—for example, a sampled month twice per year.

Travel Time

Travel time is the time that the passenger spends on-board the vehicle from time of boarding to arrival time at the destination. Travel time is a useful data element, providing data to help measure both the degree to which the scheduling function has grouped similar passenger trips for greater efficiency and service quality from the passengers' perspective. Travel time is also important to monitor for ADA paratransit systems. Under the regulations concerning capacity constraints, systems must not have substantial numbers of trips with excessive travel times.

Data Collection for Travel Time

Data on travel time are recorded by vehicle operators through their manifests or through MDTs. The time at both pick-up and drop-off locations is needed to determine travel time.

Complaints

For a transit system, a complaint is an expression of dissatisfaction by a passenger or the passenger's representative over some aspect of service. Transit systems typically monitor complaints that are related to service and those complaints over which they have day-to-day control. Some transit systems refer to these as "valid complaints." Transit systems may or may not record complaints that are related to matters of policy—for example, the operating days or hours. Nonetheless, such information may be useful over time. If a DRT system repeatedly hears complaints from its riders and the community that there is no weekend service, the transit system may want to consider whether it could expand its service days.

Data Collection for Complaints

Transit system staff can collect complaint information in varying ways: by letter, by telephone call, and via e-mail. Use of all these methods will facilitate passenger feedback. Where the DRT service is contracted, complaints are typically directed to the public entity sponsor. Complaint data should be summarized on a routine basis and assessed internally rather than compared with other DRT systems, given the range in how complaints are defined and handled across DRT systems.

3.5 Rural DRT—Performance Data to Measure Transit Impact

In addition to the more traditional performance data used to assess DRT service, less traditional data elements may also be used particularly if there is an interest in incorporating social values in DRT performance assessment. Such data elements recognize that rural transit often serves predominately those who depend on transit and that the more traditional data elements such as passenger trips and vehicle-miles do not necessarily capture the role of rural transit in improving the quality of life for rural residents. These data elements might include, for example, the number of riders transported to congregate meal sites for a nutritious meal or the number of rural residents able to access improved health care because of rural transit.

Such less traditional data relate to the *impact* of rural transit, and can be used for *impact measures* that weigh the results of rural transit. The impact or result of rural transit might be measured, for example, by assessing the economic impact of ensuring access to employment for a specific number of residents who previously had received welfare. The types of impact data that a rural DRT system might want to collect depend upon what it wants to measure. If there is a local interest in improving transportation for lower income seniors, then data collection should target how the rural DRT system is improving seniors' access within the community and the results of that access such as total number of trips to the senior center, total number of trips to the grocery store, and so forth.

This Guidebook does not suggest any specific data elements for measuring transit impact since such data and resulting measures are more properly determined at the local level, based on the particular community issues with which the rural transit system is involved.

CHAPTER 4

Performance Measures for Rural DRT

The research underlying this TCRP project identified more than 60 different performance measures that have been used to evaluate DRT service, with 16 or so measures used more commonly. But one does not need a litany of measures to capture the important aspects of DRT performance, and six measures have been selected as the key measures for the Guidebook, given that one of the objectives of the project was to select a *limited* number of measures.

4.1 Key Performance Measures for Assessing Rural DRT

The six measures selected for the Guidebook for assessing rural DRT performance are identified in Table 4-1 and discussed in this section. Depending on the results of those measures, a rural DRT system may need to delve deeper into certain aspects of its operations, examining more detailed data and assessing additional measures to address questions or questionable performance.

Importantly, rural DRT systems must consider the extent to which their mission influences their day-to-day performance. When a rural system is tasked with serving the needs of riders who are transit-dependent, its DRT service will often include lengthy trips for critical purposes with limited opportunity for shared-riding. Its performance measures will then reflect lower productivity and higher cost per passenger trip than might otherwise be the case.

Passenger Trips per Vehicle-Hour

Passenger trips per vehicle-hour measures the productivity of a DRT system. Many consider productivity to be the most important single measure of DRT performance, assessing the system's effectiveness.

As a performance measure, productivity captures the ability of the DRT system to schedule and serve passenger trips with similar origins, destinations, and time parameters, using the least number of in-service vehicles and hours. This is the essence of shared-ride, public DRT service.

> productivity = total passenger trips ÷ total vehicle-hours

However, there are various important factors that affect the ability of a DRT system to be productive: the size of the service area; the distribution of residential areas and destination areas; and the patterns of riders' trips, including the extent of group trips. Particularly for rural DRT systems, large service areas with dispersed trip patterns make it harder to effectively schedule two or more riders on the same vehicle; this will result in a lower productivity. The extent to which the rural DRT system serves pre-scheduled group trips will also impact productivity, such as group trips to the senior center or other frequented destination. If there are limited group trips—that is, few opportunities to schedule riders on the same

Table 4-1. Six key DRT performance measures selected for Guidebook.

1.	Passenger Trips per Vehicle-Hour
2.	Operating Cost per Vehicle-Hour
3.	Operating Cost per Vehicle-Mile
4.	Operating Cost per Passenger Trip
5.	Safety Incidents per 100,000 Vehicle-Miles
6.	On-Time Performance

vehicle at the same time for travel to a common destination—this will also mean a lower productivity.

Other factors that impact productivity include the level of no-shows and late cancellations, scheduling efficiency, dispatcher skills, and ability to schedule trips in real-time, vehicle operator experience and familiarly with the service area and their passengers' trip-making patterns, and the operating environment including the roadway network and geographic barriers that impact that network.

The type of DRT service—particularly whether it functions as ADA paratransit—also affects productivity because ADA regulations have effective limits on the flexibility that a DRT system has to maximize shared riding. This also may mean a lower productivity. Some of these are examples of *uncontrollable* factors affecting the performance of DRT systems. Such factors impacting DRT performance are discussed in more detail in Chapter 5.

From a DRT performance perspective, the emphasis on productivity stems in great part from the fact that small changes in productivity can be very cost effective. Larger changes can be even more cost effective.

The productivity measure can be calculated with either *revenue-hours* or *vehicle-hours* in the denominator. For this Guidebook on rural DRT, the measure uses *vehicle-hours,* in keeping with one of the project's objectives to use NTD data definitions.

To the extent that vehicle-hours are generally fixed, at least in the short run, while revenue-hours occur only during passenger service, using vehicle-hours to measure productivity may provide a better indication of how well vehicle resources are being used over the course of a day, week, or month (*5*).

However, in the guidebook for urban DRT (*TCRP Report 124),* the productivity measure uses revenue-hours as the denominator. Direct comparisons, then, between productivity data included in *TCRP Report 124* and that included in this Guidebook for rural systems are not valid since deadhead time is included in the measure for rural DRT systems. In some cases, deadhead can be a significant proportion of vehicle-hours.

For those rural DRT systems that collect revenue-hours data, productivity can be calculated using revenue-hours. Use of revenue-hours for measuring productivity has generally been used for demand-response transportation where revenue-hour data are available. Revenue-hours are typically used for measuring fixed-route productivity as well. Moreover, since revenue-hours are less than vehicle-hours, the productivity figure will be higher when revenue-hours are used as the numerator in the measure—passenger trips—is divided by a smaller number.

Productivity is sometimes measured as *passenger trips per mile.* Given the low passenger volumes on DRT relative to mileage, this ratio usually results in a number less than 1. Such resulting numbers are not particularly logical given that an actual passenger trip is not less than 1; passenger trips per hour is an easier number to visualize.

Performance Considerations

If a rural DRT system has a lower performance on *passenger trips per vehicle-hour* than desired, it should look to various possible reasons, only some of which the system can affect:

- A large service area, where passenger trips are lengthy;
- Low density of passengers within the service area;
- System policies that allow riders to travel to destinations beyond the primary service area, for example, service to a distant medical facility;
- Significant deadhead time, related to service area size and long-distance trips;
- Service policies and scheduling practices that facilitate individualized trip-making ("one-to-one" trips rather than "few-to-one" or "many-to-one" trips);
- Limited dispatch control that lacks the tools to manage service operations and respond to changes on a real-time basis;
- High rates of no-shows and late cancellations;
- Scheduled vehicle-hours that are not aligned with ridership demand; and
- Less-than-reliable vehicles, with excess breakdowns, requiring replacement service to be deployed.

Operating Cost per Vehicle-Hour

Operating cost per hour is a key cost efficiency measure, assessing the financial resources needed to produce a unit of service, defined for this measure as an hour of service. What does it cost the DRT system to put service on the street? This measure, however, does not evaluate *use* of the DRT service; because of this, it should be assessed in conjunction with the measure passenger trips per vehicle-hour or other ridership use measures.

Similarly to the productivity measure, practices vary as to whether the measure uses *revenue-hours* or *vehicle-hours* in the denominator. Since the productivity measure has used vehicle-hours, this measure also used vehicle-hours.

operating cost per vehicle-hour = total operating cost ÷ total vehicle-hours

Performance Considerations

The elements in this measure are (1) the DRT operating costs, with the major components of costs related to staff labor and vehicle operations and their maintenance and (2) the amount of DRT service provided as measured by vehicle-hours. For a rural DRT system, deadhead time may have a significant impact on operating costs if large amounts of time are needed to travel to and from pick-up and drop-off locations at the start and end of passenger service.

There are various reasons that a DRT system's performance on operating cost per vehicle-hour may not meet objectives, including

- Costs for labor, particularly vehicle operators, since these compose the largest share of transit staff;
- Costs for maintenance from an older fleet, from problem vehicles, from accidents, and from fuel costs;
- High costs for administration or other overhead;
- High proportion of paid hours for vehicle operators related to vehicle-hours of service—that is, a significant proportion of operator pay–hours that is attributed for cost items other than providing passenger service (e.g., administrative efforts);
- High fringe benefits costs for items such as vacation, sick leave, family leave, and medical benefits;

- Costs for significant amounts of deadhead time because of service-area size and/or long-distance trips; and
- Inefficient number of vehicle-hours, resulting from a poor service design or from scheduling practices.

Labor is a major cost center. For the transit industry in general, labor including fringe benefits may account for up to 70% to 80% of total operating costs, with the majority of employees working in vehicle operations and vehicle maintenance. The labor rates paid to vehicle operators and mechanics are somewhat controllable, but will depend on the local job market and wages paid for similar positions at competing organizations. For some DRT systems, the rates may be influenced by a labor contract.

Maintenance is an important functional cost center. Based on NTD data for the transit industry in general, vehicle maintenance may account for up to 20% of operating expenses. DRT management has some control over this factor, but costs will also depend on the type of vehicles, their age, and the vehicles' operating conditions—the latter of which is influenced by service-area characteristics and weather.

Operating Cost per Vehicle-Mile

Operating cost per mile is another service efficiency measure often used for performance assessments, either in addition to or instead of operating cost per hour. While cost per hour is often the more important measure because the largest proportion of costs (wages and salaries) is paid on an hourly basis, the measure operating cost per vehicle-mile is included for rural DRT systems since rural systems with limited data reporting practices are more likely to report vehicle-mile data than vehicle-hour data.

operating cost per vehicle-mile = total operating cost ÷ total vehicle-hours

As a cost efficiency measure, operating cost per vehicle-mile assesses the financial resources needed for the rural system to produce "vehicle-miles." Similarly to the related measure, operating cost per vehicle-hour, this measure does not evaluate the use of those vehicle-miles, so the measure should be assessed along with measures of DRT utilization.

Performance Considerations

Factors that influence the operating cost per vehicle-mile measure for DRT include the operating costs as well as number of miles operated, which is influenced by the average speed of service and deadhead requirements, among other factors. Reasons that a rural DRT system may have a relatively high operating cost per vehicle-mile include some of the same as listed above for the measure operating cost per vehicle-hour:

- Relatively high operating costs stemming from high costs for labor, maintenance, and/or administration;
- Costs for significant amount of deadhead miles because of service-area size and/or long-distance trips; and
- Low average operating speed, which could result from a number of factors, including excess dwell times at riders' pick-up and drop-off locations or other factors which slow down service—for example, weather-related factors such as fog or poor road conditions. While the primary cost factor is the hourly operating cost, the measure cost per vehicle-mile is impacted because the costs are spread over a smaller number of miles.

For urban DRT systems, high operating cost per vehicle-mile may result in part from excess traffic congestion, which slows down average operating speed, but this is less a factor in rural areas.

Operating Cost per Passenger Trip

Operating cost per passenger trip is a critical cost-effectiveness measure. It combines elements of the first two measures—*operating cost* per vehicle-hour and *passenger trips* per vehicle-hour, relating productivity to the hourly operating cost.

> operating cost per passenger trip = total operating cost ÷ total passenger trips

As a composite measure, a DRT system may have low operating costs but if productivity is also low, the operating cost per passenger trip may be relatively high. Conversely, a DRT system may have a relatively high cost on a vehicle-hour basis, but if its productivity is high, the cost per passenger trip may be low.

Performance Considerations

A key element of this measure is productivity. Efforts to improve the cost per passenger trip measure should first focus on increasing the number of passenger trips served within given resources. Reasons that a DRT system might show high operating cost per passenger trip include:

- High operating costs:
  - Costs for labor, particularly vehicle operators;
  - Costs for maintenance from an older fleet, from problem vehicles, from accidents, and from fuel costs, and
  - High administrative costs.
- Low productivity:
  - Large service area where passenger trips are lengthy;
  - Low density of passengers within the service area;
  - System policies that allow riders to travel to destinations beyond the primary service area;
  - Significant deadhead time related to service-area size and long-distance trips;
  - Service policies and scheduling practices that facilitate individualized trip-making (“one-to-one” trips rather than “few-to-one” or “many-to-one” trips);
  - Limited dispatch control that lacks the tools to manage service operations and respond to changes on a real-time basis;
  - High rates of no-shows and late cancellations; and
  - Scheduled vehicle-hours that are not aligned with ridership demand.

Safety Incidents per 100,000 Vehicle-Miles

Safety needs to be a primary concern for all transit systems, including DRT. Rural DRT systems should track and monitor their safety record and make adjustments as needed to ensure safe operations. As a performance measure, the safety incident rate can be seen as one that incorporates an assessment of both service operations as well as passenger service quality. The safety of the DRT system may not be an attribute that passengers consider each day that they ride the DRT system, but safety is a dimension of customer service quality.

Calculation

Given the different ways the DRT systems define and measure safety and their accident rates, it was determined that the Guidebook use the NTD definitions to assess safety. As described in Chapter 3, these are very specific definitions.

The performance measure uses the sum of NTD safety incidents, which is a required Rural NTD data element, divided by 100,000 vehicle-miles. The measure compares the raw number of

NTD safety incidents with the miles traveled by the system, which places the raw number into the perspective of miles traveled by the system.

> safety incidents per 100,000 vehicle-miles = [(NTD reportable safety incidents) ÷ (total vehicle-miles)] x 100,000

However, since the reporting thresholds for NTD safety incidents are relatively high (e.g., for a property damage incident, the reporting threshold is $25,000 worth of damage), rural systems should monitor safety incidents of all types and distinguish between preventable and non-preventable accidents, without regard to a pre-determined dollar threshold. When assessing this more detailed safety data, comparisons over time for the individual rural system will likely be more meaningful than comparisons to peer systems since individual system definitions of accidents and preventable versus non-preventable vary.

Performance Considerations

A DRT system's performance on safety can be improved by ensuring that vehicle operators are well trained, vehicles are well maintained, and operating policies and procedures support safe operations day to day. Lower than expected or desired performance on safety may result from a variety of reasons:

- Limited vehicle operator training and/or retraining;
- Inexperienced vehicle operators;
- Vehicle issues such as the vehicle type or design and their condition;
- Scheduling practices that result in a system speed that forces vehicle operators to rush, which then increases opportunities for accidents;
- Environmental factors such as bad weather; and
- The system's commitment to safety and efforts to communicate that commitment to all its employees.

On-Time Performance

> on-time performance = (total on-time trips, including no-shows) ÷ (total completed trips + no-shows + missed trips)

On-time performance is an important measure of service quality from a DRT rider's perspective. On-time performance measures the reliability of the system: does the vehicle arrive for the pick-up when it was promised? While this measure may get more attention at urban DRT systems that operate ADA paratransit, it is important for all DRT systems. Rural systems should routinely monitor and assess their on-time performance.

On-time performance may also be important at the drop-off end. In fact, timeliness at the destination end may be more important for riders with time-sensitive trips such as to work or medical appointments. DRT systems should consider assessing on-time performance at the drop-off end for time-sensitive trips, those with a pre-determined "appointment" time. This would be a separate assessment since only those trips with an appointment time would be included for this assessment. However, even if a DRT system schedules a rider's trip to ensure timeliness at the destination, the system needs to give the rider a pick-up time (or time window) so that the rider can be ready when the vehicle arrives.

As discussed in the last chapter, the definition of "on-time trips" varies among DRT systems. Data collection also varies although most rural systems use vehicle operator-reported data from operators' manifests.

Calculation

On-time performance can be calculated based on data for all trips (which may require more data processing time unless the system has MDTs) or on a sample of trips. For a rural system that provides general public or specialized service, calculation of the measure on a sampled basis, for example, based on one week during the month or even on one sample day in the month is adequate (*6*). The sample day or sample week should be chosen randomly to avoid bias in the results.

To calculate the measure, the following data elements are needed for the time period being addressed, a full month or a sampled day or week: the number of trips on-time (based on however the rural system defines "on-time") and the total number of completed trips, plus no-shows (assuming those trips have arrived on-time!) as well as missed trips, should there be any. (A trip labeled as a no-show that in fact was a late trip where the rider did not travel should be classified as a missed trip, rather than a no-show.)

Regarding the assessment of on-time performance in relation to no-shows, rural DRT systems should make efforts to ensure that no-shows are in fact "legitimate" no-shows—that is, the vehicle operators have arrived on-time for the scheduled pick-up even though the rider does not show. There are cases where a vehicle operator may claim that a rider was a no-show, but the operator was not at the rider's pick-up location when the claim is made. DRT systems might consider procedures to ensure that vehicle operators wait at scheduled pick-up locations for the prescribed waiting period, such as having operators contact dispatch at arrivals, and that dispatch try and contact riders when they do not appear for a trip to avoid no-show trips. If a DRT system has AVL technology, dispatch can check on a vehicle's location to verify an operator's whereabouts if there are questions related to no-shows.

Performance Considerations

DRT systems can look to a number of factors that can impact on-time performance, including

- Vehicle operator schedules that are not adequately prepared or that overbook trips so that vehicle operators cannot maintain the schedule;
- Incorrect information on schedules so that vehicle operators do not have the proper information for timely service (bad addresses, lack of details on just where to pick up the passenger such as a back door, a side street, etc.);
- Staffing issues such as no back-up operators (such back-up vehicle operators are often referred to as the "extra board"), inexperience, or an inadequate number of operators;
- Vehicle breakdowns or road calls resulting from vehicle design issues or maintenance practices that do not keep vehicles in good working order;
- Limited dispatch practices to make real-time changes to tackle service problems and help vehicle operators who are running late;
- Passengers' habits (e.g., excessive dwell time because passengers are not ready to board upon vehicle arrival, use of wrong mobility aide, etc.).

4.2 Additional Performance Measures

In addition to the six performance measures discussed in the preceding section, there are others that are used by DRT systems to monitor their service. Some of these can be thought of as interim measures in that they assess a specific aspect of DRT service that affects efficiency, effectiveness, or service quality.

No-Show/Late Cancellation Rate

Generally the no-show and late cancellation rate measures the percent of scheduled trips that are not completed due to passenger no-shows and late cancellations. The Guidebook recommends that this be calculated as the sum

no-show/late cancellation rate =
(total no-shows + total late cancellations) ÷
total number of scheduled trips

of passenger no-shows and late cancelled trips (with late cancellations defined differently by DRT systems) divided by the total number of scheduled trips. The denominator—number of scheduled trips—is the total of the trips that are placed onto vehicle schedules for service, as defined in Chapter 3.

It is noted that the no-show/late cancel rate can be considered an interim measure, monitored because of the important affect that no-shows and late cancellations have on productivity and operating costs. They are combined together for performance measurement purposes as they have a similar negative impact on DRT operations: for most DRT systems, they represent lost resources with adverse impacts on productivity.

In an effort to minimize the negative impacts of no-shows and late cancellations, most DRT systems have adopted policies addressing no-shows and late cancellations. There is considerable variation among these policies, but broadly they all establish penalties for passengers who repeatedly cancel their trips with little notice or fail to appear for their scheduled trips. Implementation and enforcement of such policies can significantly reduce the occurrences of no-shows and late cancellations; this is discussed in detail in Chapter 7.

Complaint Rate

In addition to monitoring and responding to complaints, some DRT systems measure and report their rate of complaints by comparing the number of complaints received to service provided, such as total service complaints per 1,000 passenger trips. The denominator may be total passenger trips completed or it may be total trips scheduled. Rather than passenger trips, some DRT systems compare complaints to revenue-hours of service provided.

complaints per 1,000 passenger trips =
(total valid complaints ÷ total passenger trips) x 1,000

or

complaints per 1,000 revenue-hours =
(total valid complaints ÷ total revenue-hours) x 1,000

The complaint rate can be monitored over time as an indicator of customer satisfaction. It is important that DRT systems maintain a consistently defined measure so that trends and comparisons from month-to-month or year-to-year are meaningful over time. If the calculation method is modified, it should be clearly noted on any trend line comparison to ensure proper assessment.

Some systems have established a standard related to complaints—for example, the DRT system should have no more than *x complaints per 1,000 passenger trips.* Such a standard may be included in a contract document for a contracted DRT operator, with associated incentives and liquidated damages.

Average Passenger Trip Length

average passenger trip length =
total passenger miles ÷ total number of passenger trips

The size of the DRT system service area, distribution of riders' origins and destinations, and degree of shared riding will affect the average passenger trip length. This can be a useful measure for a DRT system to monitor as it has an important affect on system productivity, with longer trip lengths having a negative affect on productivity. The average trip length can be measured on a sampling basis over time, and any changes assessed to monitor the impact of trip length on service operations and especially on productivity.

In particular, rural DRT systems that serve more than an insignificant number of longer distance trips may want to routinely collect and report average trip length data to monitor trends over time and to compare any changes in related performance measures such as productivity. Additionally, if a rural system collects average trip length data by type of trip and by trip sponsor (e.g., non-emergency Medicaid trips), the system can better understand the performance impacts of those specific trips on its systemwide performance.

Average Travel Time

> average travel time =
> total passengers' travel time ÷
> total number of passenger trips

Average travel time is computed as the sum of all passengers' travel times divided by the total number of passenger trips.

This is not a measure that is routinely reported by DRT systems, but it is useful, indicating both the degree of shared riding and service quality for the passengers. One of the premises of DRT is the grouping of passengers with similar trip patterns—ride sharing—to maximize productivity. If passengers' travel times are short comparable with travel by private vehicle, it indicates that the scheduling function has not achieved much ride-sharing. On the other hand, if many passengers' travel times are long, it may indicate too much ride-sharing and passengers may be overly inconvenienced with long on-board times to reach their destinations. Balancing ride-sharing with passenger travel times is a key objective of the scheduling function.

4.3 Transit-Impact Performance Measures

Chapter 3 introduced transit-impact-related performance data in addition to the more standard DRT data elements such as passenger trips and vehicle-hours and -miles. These less traditional data elements (e.g., the number of seniors transported to congregate meal sites) can be used for transit-impact performance measures. Since rural transit often serves predominately those who are dependent on transit, a rural DRT system may want to capture its impact in improving the quality of life for those rural residents who rely on DRT service.

The performance measures that assess the more qualitative aspects of rural DRT service and that might be appropriate for a particular system will depend upon that rural system's mission and what it wants to measure. Passenger survey data can also be used, providing qualitative information from the riders. Comments and testimonials from riders can also be useful when service is evaluated, particularly for local elected leaders who may be weighing funding decisions. Additionally, another way to assess the rural transit system's "performance" in the community is to monitor press coverage. News media coverage can influence (and be indicative of) public perceptions of the transit system. Monitoring positive/neutral and negative press coverage can be one way of assessing the system's marketing efforts and perceived quality of service on a very general level.

Assessment of the less traditional measures would be done over time to evaluate how the rural DRT system was "performing" in the areas of interest. There are many different measures that might be used, depending on the areas of interest for a rural DRT system. A small sample of possibilities includes

- Rate of use by seniors (total trips by seniors divided by total trips)—data obtained from schedulers and operators' manifests.
- Rate of use by people with disabilities—data obtained from schedulers and operators' manifests.
- Percentage of trips to/from congregate meal sites to total trips—data obtained from schedulers and operators' manifests.
- Percentage medical trips (total trips to/from medical facilities divided by total trips)—data obtained from schedulers and operators' manifests.
- Number of employment trips provided per day—data obtained from schedulers and operators' manifests. The FTA Section 5316 Program (Job Access and Reverse Commute)

requires that the actual or estimated number of jobs that can be accessed be reported on an annual basis. Employment trips per day on the DRT service is an indicator of how many jobs are being accessed on an ongoing basis on this service, which is, in turn, indicative of the importance of the transportation service to the local economy. For purposes of this measure, a round trip to and from an employment site would be counted as one job accessed.

- Number of individuals using DRT for independent living (e.g., individuals using service to access medical services, counseling, education, employment, grocery shopping, personal business such as banking, and other basic life needs—essentially the customer base of rural DRT service—can be an important measure in demonstrating the value of the service in community). Total unduplicated individuals served per month is a suggested measure—with data obtained from schedulers. This could also be measured on a per-capita basis (i.e., percent of population relying on rural DRT on a regular basis).
- Passenger feedback on service quality—for example, ratings on items such as service reliability, timeliness of service, helpfulness of scheduling staff, drivers—data obtained from passenger survey data as well as individual compliments and complaints received on an ongoing basis.

CHAPTER 5

Assessing Performance—A Typology of Rural DRT

Rural DRT performance can be assessed in different ways. One of the common ways is to compare similar systems against each other, but which systems are similar? Why are they similar? This chapter develops a typology of rural demand-responsive systems, so systems are grouped with other systems according to criteria that influence performance. Preliminary to that, it is useful to identify the factors that influence DRT performance and different performance assessment methodologies.

5.1 Factors Influencing Rural DRT Performance

There are many different factors that affect the performance of a DRT system. For rural systems, one often thinks first of the *size of the service area* as a major factor affecting performance. This is true for many rural systems, with some serving multi-county areas and providing trip lengths that exceed 100 or more miles. Long trips have a negative affect on DRT productivity, limiting the number of passenger trips that can be carried each hour. It is also true that this factor is one that is generally classified as *uncontrollable:* something that the DRT system manager cannot change. There may, however, be actions that the DRT system might take if providing DRT for a very large service area becomes cost-prohibitive, in which case service-area size could be considered *partially controllable.* For example, the system could propose service provision to far distant parts of the service area only on a several-days-per-week or even several-days-per-month basis.

Beyond size of service area, other uncontrollable factors include the weather and related "Acts of God." However, most of the factors affecting DRT performance are *controllable,* or at least *partially controllable,* by the DRT manager. For example, a controllable factor affecting DRT performance is the level of *scheduling skills* possessed by the DRT system. This is highly important for ensuring that effective manifests are created for the vehicle operators, with logical groupings of passenger trips and efficient sequencing of pick-ups and drop-offs at the same time ensuring the riders are picked up on-time and do not have excessive travel times. A DRT manager can improve the system's level of scheduling skills by ensuring that the scheduler or schedulers bring appropriate experience to the position, that initial and ongoing training are provided, that the wage and benefit package encourages stability in the position, that appropriate "tools" are provided for doing the job, and that there are opportunities for feedback from the operators and others out on the road for a "reality check" on the manifests.

Table 5-1 lists the major factors that affect DRT performance. Each factor is identified as controllable, partially controllable, or uncontrollable. Some circumspection is needed when reading this table. Because a factor is listed as *controllable* does not mean that a DRT manager can necessarily influence that factor quickly or completely. For example, the factor *maintenance costs* is generally considered a controllable factor (*6*). A DRT manager does control maintenance practices

Table 5-1. Factors influencing DRT performance.

Factor	"Control" by DRT System?
Operations	
Hiring practices and training for vehicle operators	Controllable
Operator wages and benefits	Controllable / Partially Controllable
Timely vehicle pull-outs with back-up operator availability	Controllable
Relationship of paid operator-hours to vehicle-hours	Controllable
Wages and benefits for other operating staff	Controllable / Partially Controllable
Deadhead time and miles	Partially Controllable
Average system speed	Partially Controllable
Scheduling/Dispatch	
Skills in creating effective manifests	Controllable
Matching vehicle-hours to ridership demand	Controllable
Service Policies Related to	
No-shows and late cancellations	Controllable
Length of advance reservation period	Controllable
Service span: days and hours of service	Controllable
Rider assistance: door-to-door, curb-to-curb, packages, child car seat, etc.	Controllable
Vehicles	
Vehicle type and mix; vehicle specifications	Partially Controllable
Vehicle condition and maintenance practices	Controllable
Maintenance expenses	Controllable
Administration	
Staffing and administrative expenses	Controllable
Safety	
Safety policies and procedures	Controllable
System's "culture of safety"	Controllable
Service-Area Environment	
Service-area size, roadway network, density, land use patterns, constraints (e.g., mountains, bridges, railroad crossings)	Uncontrollable
Strength of local economy/job market, affecting employment environment	Uncontrollable
Weather and "Acts of God"	Uncontrollable
Other	
Type of ridership: ADA only, limited eligibility, general public	Uncontrollable
Contractual constraints: rules imposed by human service agencies that contract for service (e.g., maximum ride time, etc.)	Partially Controllable
Type of operator (city/county, transit authority, private contractor, taxi co.)	Partially Controllable
Demand for DRT service	Partially Controllable
Riders' no-shows and late cancellations	Partially Controllable
Riders' dwell time	Partially Controllable

and procedures including the preventive maintenance program, which helps prevent premature major equipment failures and frequent breakdowns. However, the system may have old vehicles that are miles beyond their official useful life, making it more costly to keep the vehicles roadworthy. To procure new vehicles typically requires time and funding from the state or other funding entities, factors that the DRT manager does not control. However, on a day-to-day basis, the DRT manager is responsible for the costs for maintenance; to list maintenance expenses as something other than controllable would ignore this fact.

Controllable Factors

The factors over which DRT managers have direct influence relate to

- Vehicle operators:
  - Hiring practices and training;
  - Wages and benefits paid to operators (although these are influenced by the local economy and compensation for similar types of jobs);

  - Timely pull-outs with back-up availability; and
  - Practices impacting the relationship of paid operator-hours to vehicle-hours (such as vacation, absenteeism, and other time for which operators are paid but are not providing passenger transportation).
- Other operating staff—scheduler, dispatch, operations supervisor:
  - Hiring practices and training; and
  - Wages and benefits for these other operating staff.
- Scheduling/dispatch:
  - Ability to create effective and efficient manifests for operators; and
  - Extent to which scheduled vehicle-hours match ridership demand patterns.
- Operating policies related to:
  - No-shows and late cancellations—effectiveness of the DRT system's policies and ability to monitor and manage rider infractions;
  - Length of the advance reservation window;
  - Days and hours of operation and, for large service areas, limiting days/hours of service for specific geographic areas; and
  - Passenger assistance—curb-to-curb, door-to-door or door-through-door, handling riders' personal items such as grocery bags, and use of child safety seats.
- Vehicles:
  - Vehicle condition and maintenance practices. While generally under the control of DRT systems, those with old fleets will need to expend more effort (and cost) to keep their vehicles in operative condition.
  - Maintenance expenses. Costs related to vehicle condition and maintenance practices are generally controllable by the DRT system although these are impacted by the age and type of vehicles.
- Administrative expenses:
  - How efficiently can the system administer the service, particularly in the number of staff positions required for administration and costs for that administration.
- Safety:
  - Policies and procedures related to safety; and
  - A management emphasis and commitment to safe operations can influence the DRT system's safety record.

Uncontrollable Factors

Factors over which DRT managers have no control include the following:

- Service-area environment—this is a critical factor, impacting all aspects of DRT service:
  - Characteristics such as size, density, land use patterns, roadway network (including unpaved roads) and service area constraints such as rivers with limited bridge crossings and mountains that limit access through the service area, steep terrain (especially in areas that experience heavy snow and ice), and railroad crossings with frequent intersection delays for vehicular traffic have strong impacts on DRT performance. These influence trip lengths, travel times, opportunities to group rides for improved productivity, on-time performance, and average system speed. Areas with limited wireless phone or radio coverage restrict the ability to adjust schedules for late cancellations or to respond to vehicle breakdowns.
- Strength of the local economy—this affects employment and wage scales, which influences the ease or difficulty in hiring vehicle operators and other transit system staff and the wage/benefits levels that the system must offer.
- Type of ridership—DRT systems typically have no or very limited control over the type of riders that are served, whether ADA paratransit, limited eligibility, or general public.
- Weather and other "Acts of God."

Partially Controllable Factors

Beyond controllable and non-controllable factors, there are factors impacting DRT service performance that can be considered *partially* controllable by the DRT system. Among these include

- Operational issues:
  - Deadhead time and miles. Deadhead is impacted by the location of the garage in relation to the service area and the size of the service area, but can be influenced to some extent if the DRT system can establish satellite parking locations for the vehicles or even allow operators to take vehicles home with them at night to minimize deadhead the next service day; for contracted service, garage location can be influenced by contractual requirements.
  - Average system speed, which influences productivity as well as safety. This speed will depend on the type and environmental characteristics of the service area, scheduling/dispatch efforts as well as dwell times at individual pick-up and drop-off locations, vehicle operator experience, and the roadway network and travel constraints in the service area.
  - Rider no-shows and late cancellations. While every DRT system will experience some level of no-shows and late cancellations, they can be partially controlled by policies that address their occurrence as well as performance levels that ensure service is reliable and timely.
  - Dwell time: this is influenced by DRT system policy (i.e., the wait time) but also by passengers, their mobility levels, the weather (snowy/icy sidewalks will slow riders' access to the vehicle) and the degree to which riders adhere to the policy.
- Vehicles:
  - Vehicle type and mix. This is considered partially controllable since many rural systems do not directly purchase vehicles, but rely on state procurement programs, with some choice as to type of vehicle and sometimes with lengthy timelines to actually obtain the vehicles.
  - Vehicle specifications: appropriate capacity, adequate accessibility, fuel economy, appropriate for weather and terrain (within the parameters of the state's Section 5311 Program or of other procurement schemes).
- Other factors:
  - Type of operator: whether the DRT service is operated by a private contractor, a taxi company, a city or county, or a full-scale transit authority. While the DRT system does not control the organization providing the service, there may be some control over choice of type of day-to-day operator.
  - Contractual constraints: many rural DRT systems provide services on a contract basis for local human service agencies, which may include certain contractual requirements for their clients such as ride times and which must not exceed 60 minutes or very specific rider pick-up/drop-off times because of day program requirements. Such contractual requirements impact DRT scheduling practices and day-to-day service that in turn impact performance; yet, the rural transit system can try and negotiate such contract terms to ensure that the requirements can be reasonably met without undue negative impact on overall operations.
  - Demand for DRT service: riders' demand for service can be partially controlled by decisions and actions of the DRT system such as marketing and public relations as well as the fare structure, but the response by the community and target rider groups is not controllable.

5.2 Different Methodologies for Assessing DRT Performance

Rural DRT systems can assess and analyze their performance in different ways. They may use more than one method, depending on the specific purpose of the assessment or audience of the performance results. Using a combination of methods may also provide a more thorough assessment.

Trend Analysis

Also called a *time series analysis,* trend analysis is a commonly used assessment methodology. With this method, a DRT system compares its own performance on the same measures over time, typically on a monthly and annual basis, with data displayed month by month to account for the seasonal variations of DRT service. Trend analysis allows a DRT system to monitor its performance and measure changes over time.

With trend analysis, a DRT system should note time points when significant changes are implemented or major events occur that impact performance. This will allow subsequent assessments to review performance in light of those changes or events. For example, should the DRT system implement new technology, performance may be impacted as staff learn and adjust to the procedures. It is important to document when that change occurs on the trend line in the performance reports (see Figure 5-1), informing the review of the resulting performance and providing a context for any deviations that might result.

Comparison to Established Norms or Standards

A DRT system can also compare its performance with an established standard or norm. While there are no hard-and-fast standards that must be met by all DRT systems, some norms have developed over time. For example, a norm of 90% on-time performance for trip pick-ups has evolved, particularly for urban paratransit programs, even though there is no requirement for such performance and despite the fact that DRT systems define “on-time” in varying ways.

A DRT system may also set its own standards for performance achievement. This is particularly true when service is provided by contract. Specific standards may be set in contract documents, establishing performance levels that the contractor is expected to meet. This can be beneficial in ensuring contractor attention to performance. Caution is needed, however, in setting those standards as sometimes they may be unrealistic, setting up a difficult dynamic that may harm the contracting relationship. For contracted service as well as directly operated service, standards must be evaluated periodically to ensure they are reasonable and continue to be reasonable in light of any changing conditions that influence performance.

State and regional funding organizations may also set standards that must be met by DRT systems for continued funding consideration. The State of California, for instance, has set specific standards for the achievement of farebox recovery for systems that receive certain state transit funds.

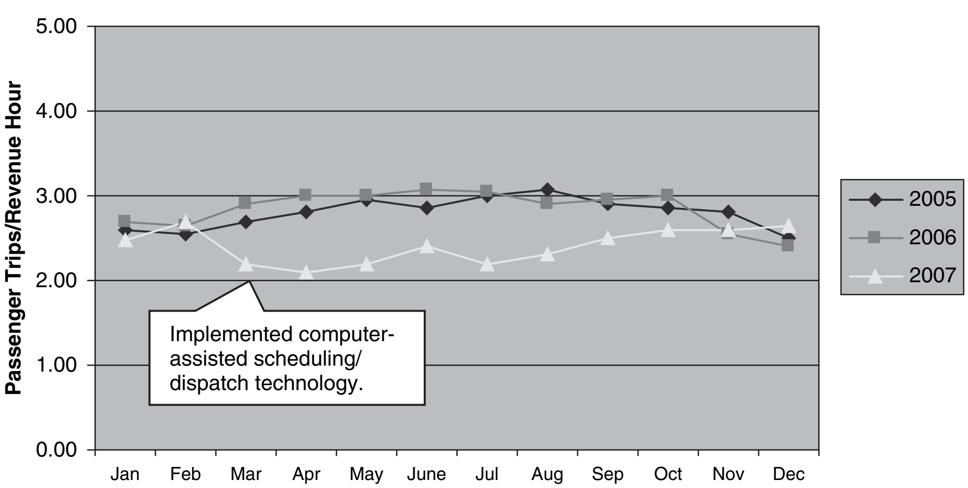


Figure 5-1. Example of DRT productivity trends.

Comparison to Peers

Peer comparison is another and a common approach to assessing DRT performance. With this approach, the DRT system identifies a number of other systems that share basic characteristics, researches the performance of those similar systems on selected performance measures, and compares its own performance with that of the peers. Sometimes these peer assessments are done at the state level for comparisons of Section 5311 systems across the state.

Peer assessments may include caveats, stating something to the effect that peer system comparisons should be "treated with caution" because although selected DRT systems may share similarities, there are differences that influence performance. This means that direct comparisons are not exactly "apples with apples." It may, therefore, be more appropriate to compare a DRT system's performance with the range of performance achieved by similar systems rather than with specific individual numbers.

Peer comparisons provide useful information for a DRT system interested in knowing the performance of other rural systems on specific measures. The range of performance achieved by peer systems provides a context for a rural system to look at its own performance in comparison with that range. This can be a valuable exercise.

Choosing peers, however, may not always be straightforward. One of the objectives of this research project was to develop categories of DRT systems so that the systems in each category share criteria affecting performance. With groupings of similar systems, peer assessments would be more appropriate. The development of this categorization of DRT systems is discussed next.

5.3 Categorization of Rural DRT Systems

Measuring a DRT system against similar systems can be useful for assessing performance. However, with the many different systems across the country, it may not always be clear as to which DRT systems are similar enough to be appropriate peers.

Typology of DRT Systems Based on Criteria Affecting Performance

At an early stage of the research project, DRT systems were categorized as either urban or rural, given the significant differences between the two. With this division, then, it was determined that two guidebooks would be developed: one targeted to urban systems (*TCRP Report 124*) and the second to rural systems, which is this Guidebook (*TCRP Report 136*). However, in addition to urban versus rural, there are a number of other criteria affecting performance:

- Ridership market served,
- Service area or operating environment,
- Type of routing and scheduling,
- Advanced request versus immediate request service,
- Type of organization—transportation only versus multi-purpose agency,
- Type of operator—public agency versus contractor,
- Dedicated versus non-dedicated vehicles,
- Use of advanced technology,
- Door-to-door versus curb-to-curb service,
- Use of volunteers,
- Provision of Medicaid non-emergency transportation, and
- Vehicle operating experience.

These criteria are reviewed below.

Criteria Influencing DRT Performance

Ridership Market Served

A significant characteristic influencing DRT performance is the type of riders that are served (*6, 7*). In the early years of DRT in the 1970s, a major distinction was made between systems that served the general public and systems that served specific population segments of the community, often seniors and persons with disabilities. In terms of performance, DRT systems serving the general public can typically achieve higher productivities than systems serving specialized markets, for a number of reasons:

- The pool of potential riders from the general public is larger, creating a higher density of potential demand.
- Dwell time at pick-up locations is shorter for general public riders. This includes both the established wait time, set by policy, and the time needed for rider boarding and alighting. Data from a number of DRT systems in the mid 1990s found that dwell times at pick-ups for ambulatory riders, which make up the large majority of general public riders, averaged 2 to 4 min, while that for riders using wheelchairs, which may be a significant portion of the specialized rider market, was 4 to 6 min (*8*).
- There tend to be fewer late cancellations and no-shows at systems serving the general public as general public riders are typically less likely to cancel trips on short notice or no-show trips because of health issues and inclement weather.

In the years since the ADA legislation was enacted, a key performance distinction among DRT systems is between those that function as ADA paratransit and those that do not (*5*, *9*, and *10*). Importantly, the ADA regulations establish requirements that systems must meet, a number of which essentially set general or specific standards that affect performance (*5*). Among these include regulations that specify when and where service is to be provided, the fare structure parameters, that all trip purposes be served, that trip requests be taken for next-day service, and that capacity constraints are not allowed. DRT systems that are not ADA paratransit do not have to meet these requirements and have more flexibility in providing service, which means that the DRT systems have more latitude to make changes to improve performance.

This criterion—type of ridership market served—is particularly significant for urban DRT systems since many urban DRT systems function as ADA paratransit services, with different parameters impacting performance than is the case for limited eligibility or general public DRT systems. Given the important distinctions, ridership market served was one of the criteria used to categorize urban DRT systems for *TCRP Report 124.*

Most rural DRT systems, however, are available to the general public rather than being limited to specific rider groups, so differences in the rider groups served are less useful for categorizing rural systems. To the extent that rural systems operate fixed-route service, however, they have to provide ADA service as a complement to their fixed routes; these systems will have to ensure that their ADA paratransit services meet established regulations.

BayTransit

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Service Area or Operating Environment

The service area influences DRT performance in several significant ways: number of people living in the service area, geographic size, and distribution of residential areas and trip destination areas. A service area with a larger population will have a larger pool of potential riders. A service area that is large geographically will tend to have longer trip lengths, and a low-density dispersion of residential areas and trip destinations across a service area will also mean longer trip lengths and less opportunity to group trips.

For a large geographic service area, whether there is just one major center of commerce and retail or two or more centers will also impact DRT trip lengths. With just one major community in a large rural area and with a dispersion of residential areas, many DRT trip lengths will be long. However, if there are two or more larger communities with the same dispersion of residential areas, the DRT system may be able to focus at least some of the trips (e.g., shopping) to the closer communities. In this way, the DRT system may be able to reduce the number of longer trips. Trip length is a particularly important performance factor: DRT systems can serve fewer longer trips in a given amount of time compared with shorter trips, which impacts both productivity and cost per passenger trip (*5*).

Other aspects of the service area may also impact performance—for example, geographic features influencing the ease or difficulty of travel throughout the community. Geographic features such as mountains or coastal barrier islands may limit the highway network so that DRT systems serving such areas have longer trip distances and travel times compared with other DRT systems serving areas where the highway network is not similarly constrained.

The service-area criterion has been used to categorize both urban DRT and rural DRT systems for purposes of the research project. For urban systems, service area is defined by population size of the service area, with categories commonly used in the transit industry: *small urban,* with populations from 50,000 to 200,000; *large urban,* with populations from 200,000 to 1 million; and *largest urban,* with populations greater than 1 million. The urban DRT systems were categorized first by this criterion, then by ridership market served.

For rural DRT, the service-area criterion is also used to categorize the systems. Rather than population size, the general geographic size of the service area is used, defined by the three main categories of service area that are used for Rural NTD reporting: *municipal* (primarily serving a single municipality or town), *county* (serving primarily a single county), and *multi-county* (serving primarily within the boundaries of two or more counties).

Type of Routing and Scheduling

The type of routing and scheduling structure has an important influence on DRT operations and performance (*5–7, 9–11*). DRT systems with a very flexible or unconstrained routing/scheduling structure will not be as productive as those with a less flexible, constrained structure. The distinction is often described as "many-to-many," with many different pick-ups going to many different destinations, versus "many-to-few," "few-to-few," or "few-to-one," where groups of riders are transported to only a few drop-offs or just one drop-off. The former type of DRT will have many individualized trips, with less opportunity for shared riding and thus fewer trips provided in a given amount of time, whereas the latter have more opportunity to group passengers since there are limited destinations. The grouping of passenger trips will increase productivity and decrease cost per passenger trip.

In order to increase the ability to group trips, many rural DRT systems operate some constrained service, with service to and from specific parts of the service area or to and from specific destinations operated on a fixed schedule. For example, a county-based system may serve an outlying small community at a set time each day: a vehicle is scheduled to depart at a fixed time from that community at 9:00 A.M and then is scheduled to arrive in the county's main town 90 min later. Individuals in the outlying community who wish to travel to the main town would book a ride for the 9:00 A.M trip, with the DRT vehicle then scheduled for individualized rider pick-ups in the small community and drop-offs in the main town. In this way, the rural DRT system has grouped riders' trips from the outlying community by constraining them to a set schedule. Such hybrid demand/scheduled service might be seen as "few-to-few."

While the type of routing/scheduling has an important affect on DRT performance, it is difficult to capture with discrete categories since DRT systems are not solely many-to-many or many-to-one or few-to-one and so on. DRT systems typically have a mix of trip types using different routing/scheduling schemes.

Advanced Request versus Immediate Request Service

From the perspective of a DRT system, there are several performance differences between immediate and advance request service. With immediate request service, a DRT system is able to change and insert trips on a real-time basis, providing the opportunity for higher productivity (*12*). Cancellations and no-shows are less frequent with immediate response DRT systems (*13*).

With advance reservation service, however, a DRT system can focus on refining the service-day schedule and operators' manifests, providing an opportunity for performance improvements. Late cancellations and no-shows, however, will negate some of this effort, creating "holes" in operators' schedules. DRT research has found, using simulation of advanced technology, that there is a 4% to 5% decrease in productivity for every 10% increase in the late cancellation rate (*14*).

Performance data from the sample of rural DRT systems that participated in this research project show that those systems operating as immediate response have a higher productivity than those operating as advance response. The difference is over two passenger trips per hour. (It should be noted that immediate response service is not appropriate in all service areas; this is discussed in more detail in Chapter 7.)

While this is a significant performance difference, this criterion has not been used for the typology of DRT systems since the distinction between the two types of scheduling is not a clear and discrete one. As was found in the research, DRT systems—even if immediate response—provide some subscription service, which is advance reservation service; most DRT systems provide some immediate response service, such as will-calls or "urgent trips," albeit for many DRT systems, such immediate response service is only a small proportion.

Type of Organization—Transportation-Only versus Multi-Purpose Agency

The type of organization that provides DRT service is another criterion that has been found in prior research to have some affect on cost performance, at least for rural systems. Specifically, an early TCRP study of rural transit suggested that rural services be distinguished between those provided by agencies that function as *transportation-only* agencies and those provided by *multi-purpose* agencies (*11*). That study found wide cost differences between the two types of agencies and reported that such differences seem to reflect different accounting and reporting procedures: administrative and overhead costs are spread among different services and programs for multi-purpose agencies while transportation-only agencies absorb all administrative and overhead costs. Cost differences, according to the study, may also result from operating practices since multi-purpose agencies may be more likely to use volunteers. Given the cost differences that were found, that study separated the rural agencies on this criterion for purposes of presenting performance data.

Some cost differences by type of organization were also found among urban DRT systems through analyses done for this research project. Based on the performance data from the urban DRT systems, it was found that those urban DRT systems operated by transit districts and transit authorities tended to have a higher cost structure than those operated by other types of organizations, predominately cities, as measured by operating cost per revenue-hour. A transit district or authority generally has a full complement of functions needed for transit within one organization, and full cost accounting is more standard when compared with other organization types that are not transit only.

Recent TCRP research (*TCRP Report 127*) on transit employee compensation at rural and small urban transit systems looked at employee wages and benefits at different types of transit organizations (*15*). This research found that non-profit agencies provide lower compensation compared with transit authorities and governmental units (e.g., cities, counties); this will impact the organization's cost structure, given that labor is the largest single operating cost component. Furthermore, that study's data also suggest that non-profit organizations tend to be the more frequent transit provider in multi-county areas compared with providers in primarily single-municipal or primarily single-county service areas. These findings suggest that the cost structure for rural transit systems operating in multi-county areas will be somewhat lower compared with rural systems in the primarily municipal and primarily single-county service areas, and the performance data from the rural DRT systems participating in this research study bear this out. Data from the study's sample of rural DRT systems show that the average operating cost per hour for systems in the multi-county service area are less than the average cost per hour for systems in the other two service-area categories, by roughly 30% to 35%.

While type of organization has not been chosen as a criterion to further categorize DRT systems for this Guidebook, to some extent the categorization by service-area type captures cost differences suggested by organization type, at least for the multi-county category, where the more common organization type is a non-profit agency.

Type of Operator—Public Agency versus Contractor

DRT systems can be differentiated by whether they are directly operated by a public agency versus privately operated by contract *(5*, *16*, and *17).* This criterion is more significant for urban DRT systems as the large majority of rural systems operate services directly (*4*).

The major performance distinction between the two types of operator is generally considered to be cost. With differences in labor costs between public and private transit entities and the fact that labor is the dominant component of transit operating costs, it is generally accepted that DRT services that are contracted to private entities may result in some cost savings compared with services directly operated by a public entity. Recent research based on data from urban systems suggests that cost differences may not be statistically significant, however (*18*). According to this research, this in part may be due to use of financial penalties for contracted service, to the extent that contractors may be bidding price structures that cover expected losses due to the penalties, or to the scheduling of vehicles in such way as to avoid conditions that result in the penalties.

Dedicated versus Non-Dedicated Vehicles

The issue of dedicated versus non-dedicated vehicles is important from several perspectives when differentiating types of DRT service. A "dedicated" vehicle is one that is used only for the DRT service; a "non-dedicated" vehicle is one that is used for the DRT service some of the time, but is used for other transportation purposes when not in use for the DRT system. A taxi vehicle is a good example of a non-dedicated vehicle. A city may purchase its DRT service from a local taxi company, with DRT service provided through user-side subsidies to eligible riders, for example, with coupons or tickets. The taxi vehicles provide DRT service when providing a trip to an eligible coupon holder, but provide private taxi service when transporting other types of riders.

Use of non-dedicated service may improve cost efficiency since the public entity sponsor purchases only that amount of service that is needed; yet, dedicated service provides more control to the sponsoring public agency, which may result in somewhat higher quality service. From a data-collection perspective, data collection may be somewhat more difficult with non-dedicated services, particularly taxis, and this may impact efforts of the public entity sponsor in monitoring performance.

Use of Advanced Technology

Considerable research has been conducted that analyzes the impact of advanced technology on DRT performance, with the general conclusions being that use of advanced technology provides various performance improvements. In particular, the literature suggests that use of CASD systems can improve productivity (*18–22*) although reportedly the magnitude of improvement was generally not large. Improvements in such areas as the reservations function, dynamic dispatching, and providing improved information to riders have also been reported (*22*).

In addition to CASD, an AVL system has been found to improve DRT performance, according to some published accounts and research (*14, 23–25*). Improvements relate to higher on-time performance and productivity gains to the extent that the real-time information provided through AVL can be used to make scheduling adjustments.

For rural transit, advanced technology has also been found to facilitate performance improvements in customer service with improved information available to give to riders, improved system safety, reduced data entry time, and improved control of vehicle operators and their hours (*26*).

Door-to-Door versus Curb-to-Curb Service

The distinction between DRT that operates as door to door and curb to curb is another criterion affecting DRT operations and performance. From an operational perspective, door-to-door service is sometimes considered to increase dwell time, measured as the time that the vehicle spends from the time it arrives at the pick-up or drop-off location to the time that it departs, given that the vehicle operator goes to the door of the passenger's building at both the pick-up and drop-off to provide assistance to and from the vehicle. However, the paratransit industry lacks good, quantifiable data as to the extent of the effect, and there are some who maintain that door-to-door service may shorten dwell time (at least at the pick-up end). This is because the operator announces his arrival by going to the rider's door (rather than sitting passively in his vehicle and waiting for the rider) and then helps the rider negotiate—and perhaps negotiate more quickly with the assistance—the distance from the pick-up building to the vehicle.

The level of rider assistance—door-to-door versus curb-to-curb service—is a performance-related criterion that receives more attention at urban DRT systems than at rural systems. Rural DRT systems typically have a policy regarding the level of rider assistance that is offered, but there is often considerable flexibility with respect to individual riders' assistance needs.

Use of Volunteers

The use of volunteers for DRT is another practice that affects DRT performance. DRT systems, particularly in rural areas and smaller communities, may use volunteers as drivers in conjunction

Volunteer Driver Program

The Volunteer Driver Program provides safe, reliable transportation to individuals who are on assistance or have needs that can not be met by our public transit systems. Paul Bunyan Transit works in cooperation with Beltrami County, MNDOT and private pay individuals to transport customers to doctor's appointments, clinics, treatment centers and home visits.

with paid drivers; these systems may also use volunteers to serve in other capacities, such as administrative assistance (*5, 27*). Use of volunteers will provide a different cost structure than a system that uses only paid staff. For example, if operating statistics for the volunteer component are included in the system's total operating data and costs, performance on measures that use operating costs may look "better" given that there will be no labor costs for the volunteers.

This research study found that only one of the participating rural DRT systems uses volunteers on a regular basis, and operating data and costs for this service component are kept separate from other DRT services. This allows the rural system to assess its volunteer component as a distinct service and not one that is commingled with the rest of the system's services.

Provision of Medicaid Non-Emergency Transportation

The provision of Medicaid non-emergency transportation is yet another factor that can affect the operations and performance of DRT systems. According to research, its impact on DRT performance is mixed (*28*). Providing Medicaid transportation may have the potential to enhance performance as the addition of the Medicaid clients adds to the pool of riders, thus allowing the system to schedule more trips per unit of service supplied.

Yet, Medicaid trips may also hinder performance. Where such trips are long to distant medical facilities, performance will be negatively impacted. Other Medicaid-related factors can negatively impact performance, including the level of recordkeeping required for Medicaid transportation providers and the eligibility verification process, which can be difficult and time consuming. Additionally, state Medicaid agencies typically require specific software programs to interface with central state records, and these programs are expensive to purchase.

Importantly, Medicaid's impacts on DRT service are affected by location since Medicaid is a state-administered program, with each state determining its own approach to providing Medicaid transportation and with varying requirements on the transportation providers. Some states have very stringent requirements for Medicaid transportation, similar to ADA paratransit requirements, which can significantly impact DRT performance.

The analysis of data and information collected from the rural DRT systems participating in this research project suggests that the impacts of Medicaid transportation are particularly affected by the distances that must be traveled to serve the medical destinations, with high mileage and time-consuming trips. Several of the systems have developed practices which try to mitigate some of these service impacts, such as serving the distant facilities only on selected days each week (not all states allow systems to implement such practices). One multi-county system coordinates some of its medical trips including Medicaid with neighboring providers to try and create efficiencies. A single-county system opened up its longer-distance Medicaid trips to other riders to improve productivity.

The contract arrangements for payment of Medicaid transportation service was another Medicaid-related topic raised by some of the participating rural DRT systems. Several systems reported that their contract provided essentially a fixed amount pre-determined at the start of the year. While there might be options to ask for supplemental funds or to obtain a fuel adjustment, several of the rural systems reported financial difficulties in providing the Medicaid transportation, with two multi-county systems reporting that they were running a deficit on that part of their service.

Several of the other participating rural transit systems mentioned more flexibility in relation to payment, with less stress on the DRT system. One county-based system where close to one-third of all trips are Medicaid explained that its Medicaid budget, submitted each quarter, will be adjusted up or down based on the actual costs incurred during the preceding quarter.

Medicaid is a large funding resource for transportation in all states. In rural areas, funding for Medicaid can be a significant source of operating revenue yet rural systems have to grapple with the operational impacts that such service can have on the overall DRT system.

Vehicle Operator Experience

The tenure and experience of DRT vehicle operators is increasingly being recognized as a criterion affecting DRT performance. Experienced DRT vehicle operators—those who are familiar with the service area, know their passengers' trip patterns, and understand the system's policies and procedures—can contribute to improved DRT performance, including productivity.

DRT performance can be impacted where there are high rates of turnover among vehicle operators as many operators leave their positions before they become experienced. TCRP Project F-13, "Vehicle Operator Recruitment, Retention, and Performance in ADA Complementary Paratransit Services," has been investigating the relationships among vehicle operator recruitment, retention, and performance, specifically in relation to ADA paratransit services. As part of that study, a national survey of public transit agencies and their contractors was conducted, and high annual turnover rates were noted in many operations. The survey also indicated that a lack of workforce stability is having an impact on performance in some systems. The research is identifying the factors that affect recruitment and retention and is examining successful practices, including wage parity and integration of fixed-route and ADA paratransit workforces at some public transit agencies. The research is also attempting to quantify the impacts of turnover on service productivity and service quality.

Typology of DRT Systems Developed Through the Research Project

Building on earlier research that attempted to classify DRT services and analyses of performance data collected through this research project, a typology of rural DRT systems has been developed and is shown in Table 5-2. Use of the three-part service-area criterion captures the relative size of the area within which rural DRT systems operate. Service area size is highly correlated with trip length—a factor with great influence on DRT productivity. This typology of rural DRT systems is used to present the performance data of the DRT systems that participated in the rural phase of the research project, which is the topic of Chapter 6.

Table 5-2. Typology of rural DRT systems.

Municipal DRT Systems	County DRT Systems	Multi-County DRT Systems
Service operated primarily within a single city, village, or town	*Service operated primarily within boundaries of one county*	*Service operated primarily within boundaries of two or more counties*

CHAPTER 6

Performance Data from Representative Systems

This chapter presents performance data from the representative rural DRT systems that participated in the research project. These data provide *benchmarks,* allowing comparisons among similar types of DRT systems.

6.1 Rural Systems Participating as Representative Systems

To assist DRT systems in comparing their performance against other systems, the Guidebook provides data on key performance measures for a representative number of rural DRT systems, categorized by the typology defined in Chapter 5.

Finding Representative DRT Systems

To find representative DRT systems within the categories of the typology, various DRT systems of different types and in different parts of the country were contacted for participation in this research project. The objective was to provide valid reference points for each category, not to provide a statistically balanced sample of systems. There was an attempt made to provide geographic diversity of representative DRT systems, but no attempt to find high performers or low performers to frame the data.

Collecting Data from Representative DRT Systems

Once representative DRT systems agreed to participate, the researchers asked for the key performance data, with Fiscal Year 2007 as the target year (although the specific months defining a fiscal year varied), using both on-site visits and telephone interviews. Information about the system, its service, and its operating environment was also collected to develop an understanding of the factors and circumstances affecting each system's performance. It was agreed with the participating systems that the research report would not relate specific performance data to individual systems. The 24 participating systems are listed in Table 6-1, and their locations are shown in Figure 6-1.

The data elements requested from the participating DRT systems include passenger trips; vehicle-miles; vehicle-hours; operating costs and safety incidents, as defined by Rural NTD; and on-time performance. Data for passenger trips, miles, operating costs, and usually hours were readily available from the participating systems; however, there was very limited data on NTD-defined safety incidents. This is not to say that all the systems had perfect safety records, but not all the participating systems collect safety data conforming to Rural NTD definitions and for those that do, there was little data to collect.

Table 6-1. Rural DRT systems participating in the research project.

DRT System	Location	Provider and Service Area
Albert Lea Transit	Albert Lea, MN	Private non-profit agency serving developmentally disabled adults, serving primarily a single city
ALTRAN	Munising, MI	County, serving primarily a single county
Atomic City Transit Dial-A-Ride	Los Alamos, NM	City, serving primarily a single city
Bay Transit	Urbanna,VA	Private non-profit senior agency, serving 10 counties in eastern Virginia
B.C. Country Rural Dial-A-Ride	Vestal, NY	County, serving primarily a single county
Central Florida Regional Planning Council (RPC) Transportation Disadvantaged Program	Bartow, FL	Regional planning organization, with a contracted private service operator, serving 3 counties in central Florida
City of Cleburne Transportation	Cleburne, TX	City, serving primarily a single city
Columbia Area Transit (CAT)	Hood River, OR	Transit district, serving primarily a single county
Dial-A-BATS	Bullhead City, AZ	City, serving primarily a single city
Fresno County Rural Transit Agency (FCRTA)	Fresno, CA	Joint powers transit agency created by agreement between participating cities and county, serving the county
Garrett Transit Service	Oakland, MD	Private non-profit community action agency, serving primarily a single county
Hancock Area Transportation Services (HATS)	Findlay, OH	Private non-profit community action agency, serving primarily a single county
Hill Country Transit District	San Saba, TX	Transit district, affiliated with non-profit community action agency, serving 8 counties in central Texas
Inter-County Public Transportation Authority	Elizabeth City, NC	Private non-profit health services agency, serving 5 counties in northeastern North Carolina
Intracity Transit – Paratransit System	Hot Springs, AR	City, serving primarily a single city
Johnson County Transportation	Cleburne, TX	Provided through City of Cleburne, serving primarily a single county
McIntosh Trail Transit System	Griffin, GA	Regional planning organization, with service operated by a non-profit contractor, serving 5 counties in central Georgia
Monroe County Shared Ride	Scotrun, PA	Transit district, serving primarily a single county
Moscow Valley Dial-A-Ride and Paratransit	Moscow, ID	Private non-profit transportation agency, serving primarily a single city
Paul Bunyan Transit	Bemidji, MN	Private non-profit transit organization created by joint agreement between participating city and county, serving primarily a single county
Pulaski Area Transit	Pulaski, VA	Private non-profit senior agency, serving primarily a single city
Regional Coordinated Area Transportation System	Asheboro, NC	Private non-profit senior agency, serving 2 counties in central North Carolina
River Cities Public Transit (RCPT)	Pierre, SD	Private non-profit transportation agency, serving 10 counties in central South Dakota
VTA Paratransit	Edgartown, MA	Transit authority, with service operated by a private contractor, serving primarily a single county

Regarding on-time performance, again, there was little data to collect from the participating systems. The majority of the DRT systems report that pick-up and drop-off times are recorded, usually with vehicle operators writing arrival times at their stops on their manifests. However, these data are not summarized from the manifests for any operating reports on a routine basis. Typically, the DRT manager stated that the data were available should there be a question or complaint about vehicle timeliness, and they check the applicable operator manifest for the data should an issue arise. Only one of the participating systems had formal on-time performance percentages to report. Rural DRT systems, however, should be encouraged to collect and report on-time performance statistics for service monitoring and performance assessment. Timeliness at both the pick-up end and drop-off end are important and critical for evaluating DRT service reliability.

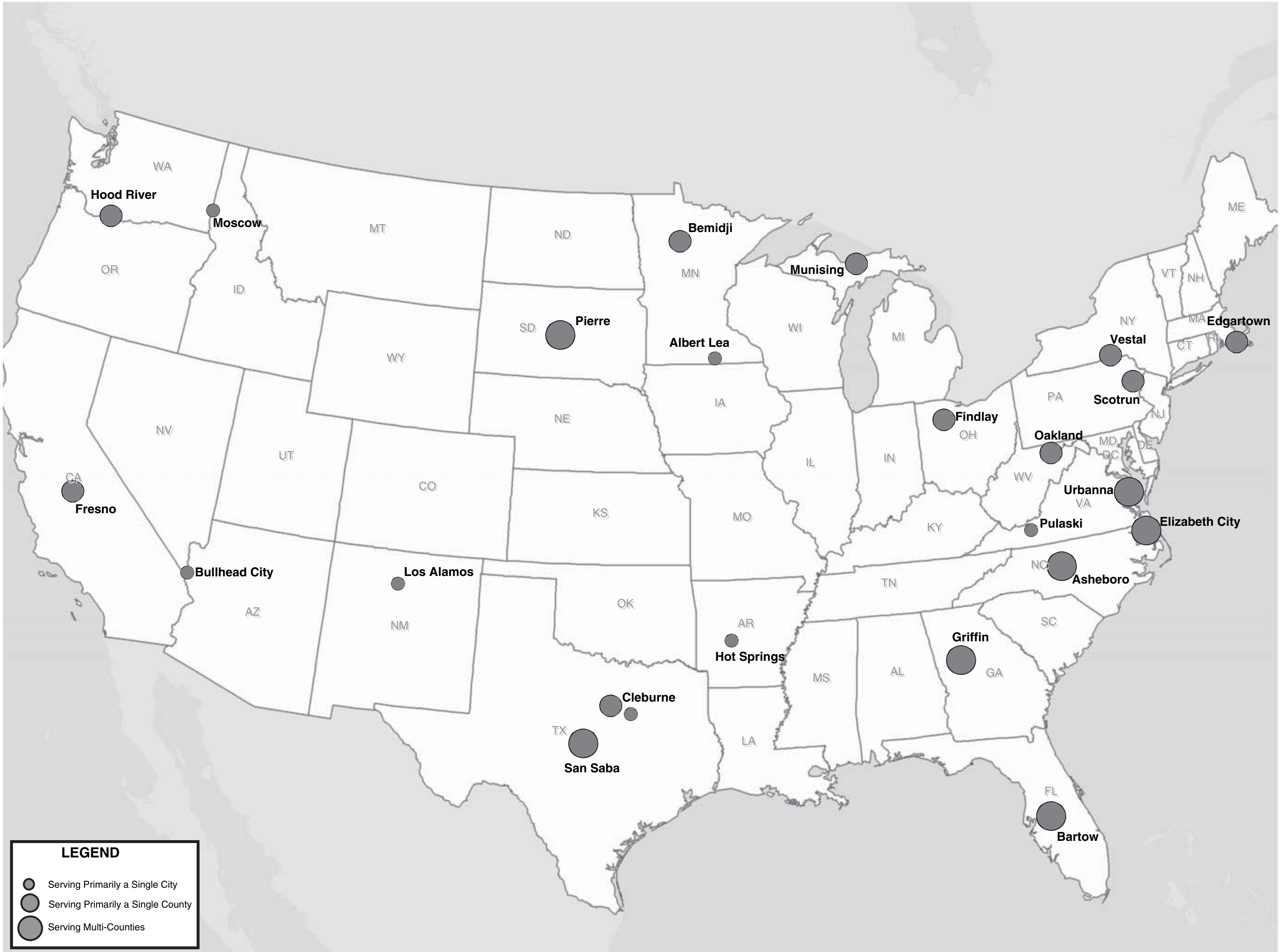

Figure 6-1. Representative rural DRT systems participating in research project.

In analyzing the collected data, the researchers found that data for other service modes were sometimes commingled with that for DRT and that the reported performance data did not always match the definitions being used for the project. The most common data issue found was that, where rural systems operate demand-response and route deviation service, the system reported *combined* operating data, so the data for the two modes were commingled. In such cases, additional information was requested from that system so that the route deviation data could be separated out, with only demand-response data remaining.

The other issue related to the reporting of vehicle-hours. As was found during the urban phase of the research project, some systems substitute operator pay-hours or some other hours data for vehicle-hours. Again, additional information was requested so that the data could be adjusted to conform more closely to the data definitions being used for the Guidebook. Where adjustments were made, they were reviewed with the specific DRT system to ensure agreement, and all adjusted data are noted where appropriate in this chapter.

Finally, despite efforts to adjust the performance data, the statistics for one of the participating 24 DRT systems are not included in the peer data presented in this chapter.

6.2 Comparing Your Performance Against Other Systems—Performance Data of Representative Rural DRT Systems

This section provides the performance data from the representative systems for four of the key measures—passenger trips, vehicle-hours, vehicle-miles, and operating costs—using "stock" graphs. For each of these measures—passenger trips per vehicle-hour, operating cost per vehicle-hour, operating cost per vehicle-mile, and operating cost per passenger trip—the performance data are shown within the three categories of rural DRT, as defined by the typology developed through this project (and described in Chapter 5).

In addition to the data from the representative systems, data from the Rural NTD Report Year 2007 are shown on the graphs, providing data from a much larger sample of rural DRT systems. With access to the 2007 Rural NTD dataset, data for rural systems operating DRT were extracted for analysis. In order to assess cost performance measures, rural systems operating only DRT were selected because rural reporters provide *total* operating cost without any mode-specific cost data. Without mode-specific costs, it is not possible to assess DRT only for those rural systems that operate DRT and other modes.

For each of the graphs presenting data from the representative rural DRT systems and for each of the three service-area types, the range and average of the rural DRT-only NTD reporters are shown. These same data are shown in table form in Appendix A. It should be noted that the 2007 Rural NTD data were reviewed prior to inclusion in this project, and DRT systems with incomplete data or with datapoints far outside what would be expected were deleted, generally data more than two standard deviations from the mean. While the Rural NTD data did not receive the same level of scrutiny that was possible through this research project for the participating DRT systems, inclusion of the NTD data alongside that of the systems from the research project provides a larger framework for rural DRT performance data.

Passenger Trips Per Vehicle-Hour—Productivity

Productivity may be the most important single performance measure for a DRT system. Data from the representative systems, as well as data from the Rural NTD, show that productivities are generally somewhat higher for rural DRT systems serving smaller service areas (see Figure 6-2).

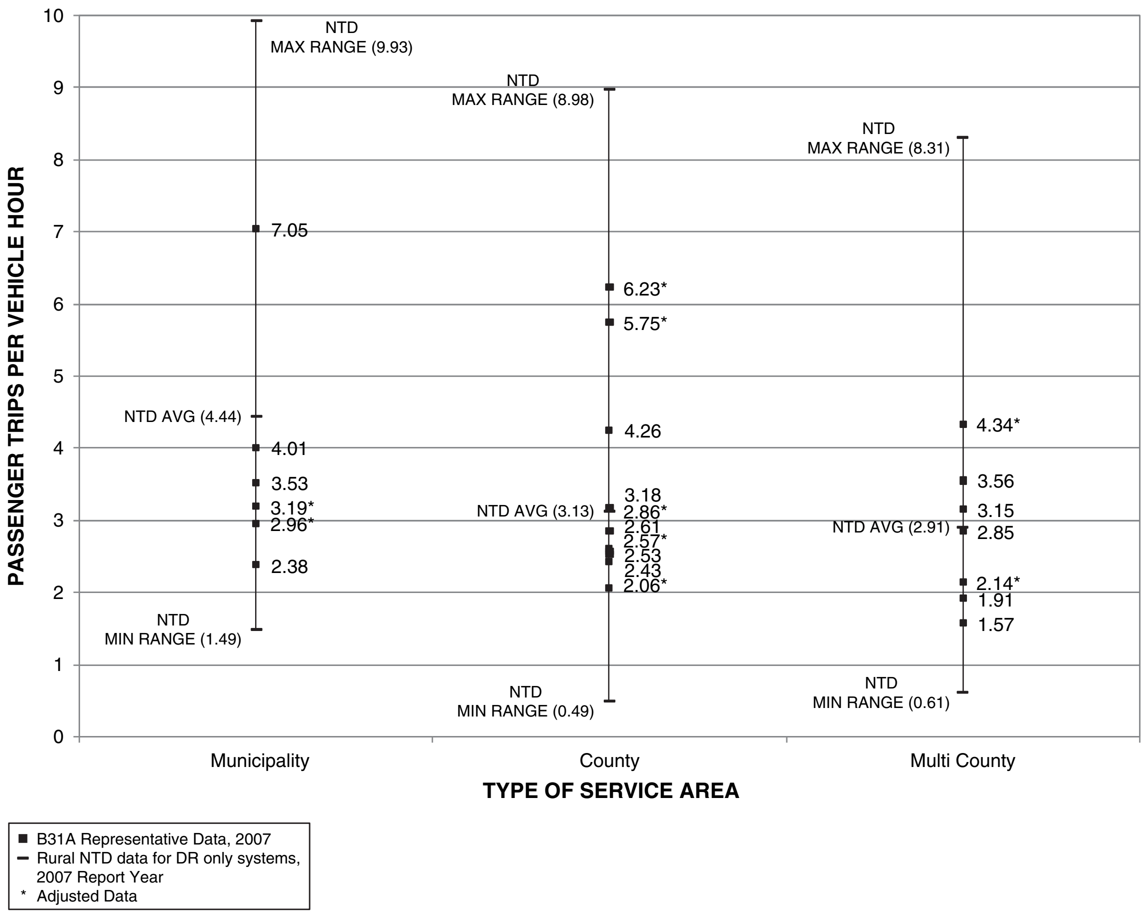

Figure 6-2. Rural DRT systems: passenger trips per vehicle-hour.

The productivities of those systems serving predominately a single municipal area tend to be higher than those of systems serving predominately a single county, which in turn trend higher than those systems serving multi-county areas. This would be expected, as systems serving smaller service areas will have shorter trip lengths, so more trips can be served in a given vehicle-hour. DRT systems with smaller service areas would also be expected to generally have less deadhead time, and this will benefit productivity since the productivity measure for rural DRT uses vehicle-hours, as opposed to revenue-hours, in the denominator.

A few of the representative systems deserve note for their high or low datapoints compared with the other representative systems. The municipal DRT system with productivity of 7.05 operates in a small and compactly developed geographic area, and some of the service appears to operate less like demand-response and more like route deviation. This is an informal arrangement that seems to be a carry-over from when the service operated more as fixed route. The municipal system with the lowest productivity—2.38—is an ADA paratransit service.

The county system with productivity of 6.23, which is the high point for primarily single-county systems, operates as immediate response and, significantly, is actually a composite of a number of smaller, community-based DRT systems that are linked together in a very large service area with intercity routes. While the productivities of the different community DRT systems within the county vary, together they average over six passengers per vehicle-hour. From a performance reporting perspective on this measure, this county system should more appropriately be seen as a number of primarily municipal systems.

The county system with a productivity of 5.75, also considered high for a county-based service, operates predominately as immediate response; with the vehicles equipped with AVL and MDTs, the dispatchers proactively dispatch service in real-time, sending out trips to the operators about 30 min in advance. With the technology and skilled dispatchers, "the drivers are pushed most of the time," according to the system manager.

For the multi-county rural systems, both the high and low productivity points can be noted. The high productivity of 4.34 passenger trips per vehicle-hour is found at a system where, while the service area is a large 10-county region, the majority of the trips are provided within a 5-mile radius of the primary community. Also, the system serves a significant number of school-aged riders, providing service to and from daycare and other before/after school destinations. This rural system has actively sought out such trips, which, since they are "many-to-one" and "few-to-one," will improve productivity.

The low productivity datapoint within the multi-county service-area category at 1.57 passenger trips per vehicle-hour is a result of several factors for that particular rural system. Chief among them is the fact that almost one-fourth of its trips are for Medicaid purposes, and many of these go to destinations beyond the primary three-county service area. Additionally, the system uses a taxi company as one of three primary service contractors, and the taxi trips tend to be single-ride.

Operating Cost Per Vehicle-Hour

Operating cost per vehicle-hour is a key cost-efficiency measure. Data from the representative systems are shown in Figure 6-3. It can be seen that systems in the predominately municipal and predominately single-county categories show similarities on this performance measure, ranging from $32 to $35 per hour up to $74 to $78, with clustering roughly between $40 to $49 per vehicle-hour. The ranges shown for the Rural NTD data are also similar for the two service-area-type categories.

Data for the multi-county rural systems, however, show somewhat lower cost per vehicle-hour figures. This may be explained, at least in part, by the fact that most of the multi-county systems are non-profit organizations, where, according to recent research, compensation is less than at governmental units (e.g., municipalities or counties) and transit districts (*15*). This impacts their cost structure since labor costs are the major component of operating costs.

Operating cost differences may also result, to some extent, from cost allocation procedures; systems that are part of a larger organization and particularly a multi-purpose human service agency may not fully allocate costs to their transit service. A transit district, on the other hand, will have the full complement of functions needed for transit within one organization and full cost accounting is more typical.

The high datapoints in Figure 6-3 merit note. For the predominately municipal service-area category, the high point of $74.04 per vehicle-hour is influenced by the fact that this is an ADA paratransit system, operated by a small city where there is labor market competition for vehicle operator positions and where there is no wage or training distinction between fixed-route and paratransit operators. Additionally, all operators have Commercial Driver Licenses (CDL). There were also recent scheduling improvements that increased shared riding with less one-on-one taxi-type service, and this reduced paratransit vehicle-hours and subsequently increased passenger trips per vehicle-hour. Without reductions in related operating and overhead costs, such as for scheduling/dispatch and ADA eligibility certification, the factors worked together to increase the cost per vehicle-hour.

For the predominately single-county service-area category, the two high datapoints—$77.90 and $78.05 per vehicle-hour—come from rural systems that are transit authorities, which have

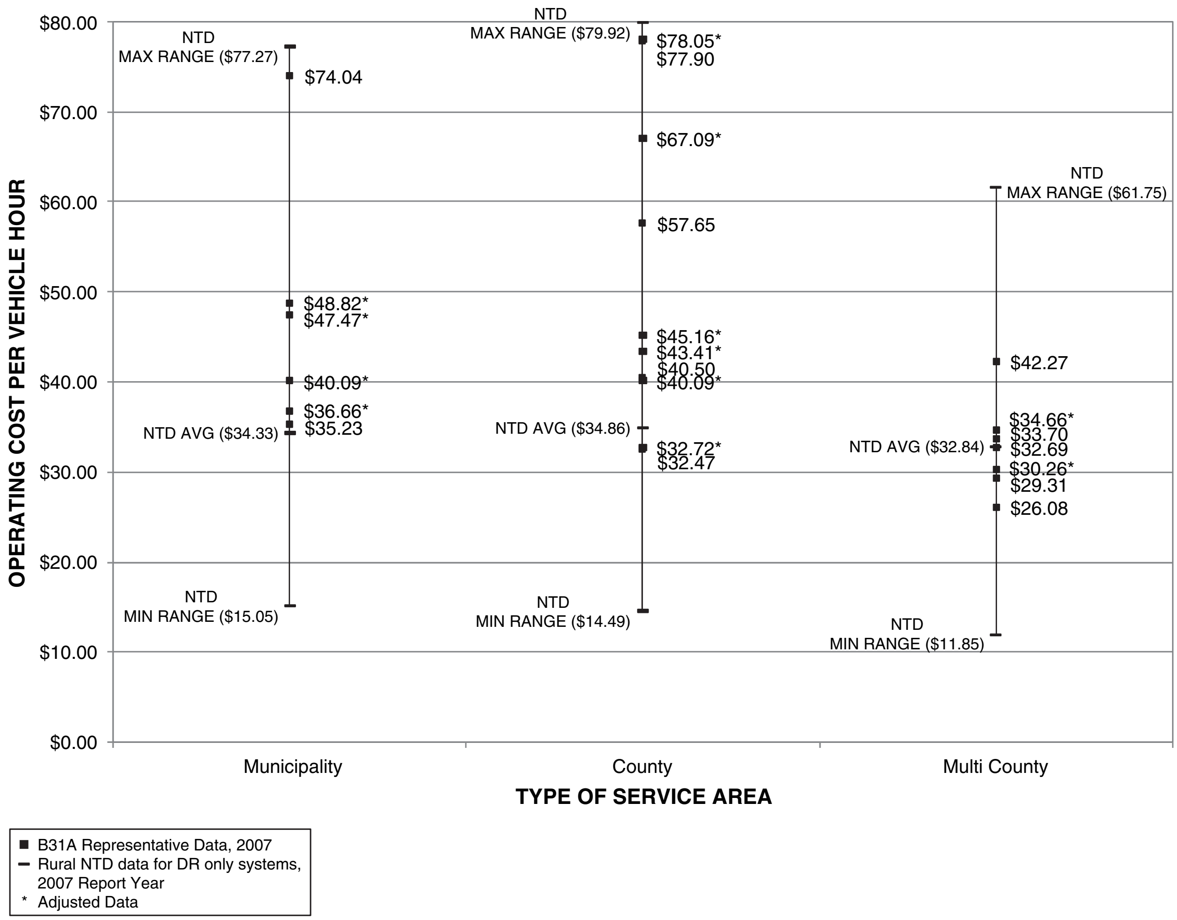

Figure 6-3. Rural DRT systems: operating cost per vehicle-hour.

a higher cost structure compared with other transit organizations (e.g., cities, counties, and non-profits). Additionally, both of the systems, while rural, are located near major metropolitan areas in higher-wage regions of the country.

Operating Cost Per Vehicle-Mile

Operating cost per vehicle-mile, similarly to operating cost per vehicle-hour, is a cost-efficiency measure. Data from the representative rural systems (see Figure 6-4) show that generally the operating cost per vehicle-mile is somewhat higher for the predominately municipal service-area type, with costs for systems in the predominately single-county service area trending lower, and, with the multi-county service-area systems, lower still. The Rural NTD data show somewhat higher costs for the predominately municipal category, while costs per vehicle-mile are more similar for the other two categories.

Based on data from the representative systems, it seems the high datapoints for both the predominately municipal service-area systems ($5.84 and $4.65 per vehicle-mile) and the predominately single-county systems ($5.75, $5.60, and $4.47 per vehicle-mile) stem primarily from relatively high costs per vehicle-hour combined with slower average speeds. These systems operate in smaller service areas compared with other systems in their categories, with no or limited out-of-primary-service-area trips. This results in minimal or no higher-speed highway driving among these systems.

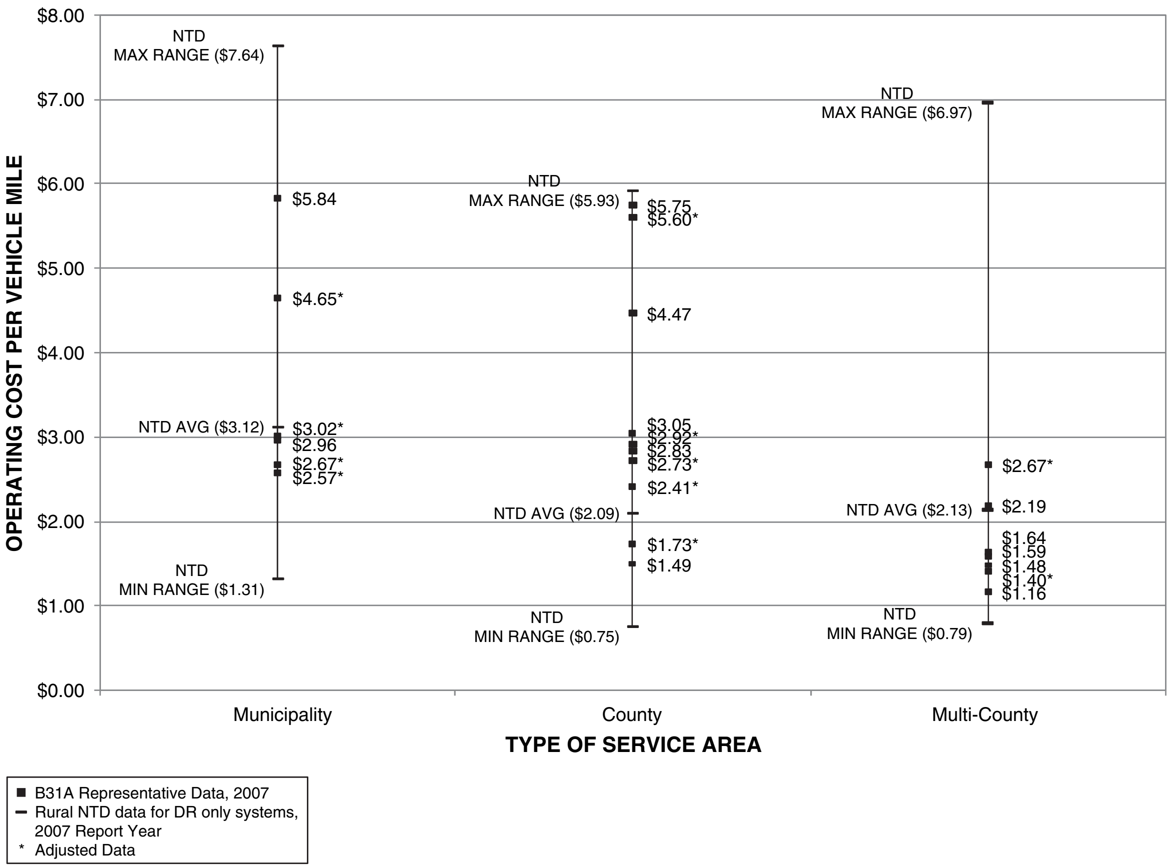

Figure 6-4. Rural DRT systems: operating cost per vehicle-mile.

These data from the predominately municipal and predominately county rural systems can be contrasted, for example, to the low datapoint for the multi-county service-area systems at $1.16 per vehicle-mile. That particular rural system, operated by a non-profit agency in a lower-wage region part of the country, has a cost per vehicle-hour of less than $30 and, with trips throughout its five-county service area with many including highway travel, an average speed of 22 mph. This is significantly faster than the average speed of the rural systems with the high costs per vehicle-mile in the other two categories, which show average speeds of 11 to 13 mph.

Operating Cost Per Passenger Trip

This measure is considered a cost-effectiveness measure, combining elements of *operating cost* per vehicle-hour and *passengers trips* per vehicle-hour. The representative rural DRT system data, shown in Figure 6-5, show that those systems with low productivity combined with relatively high costs per hour have high costs per passenger trip, as would be expected. In the primarily municipal service-area category, for example, the system with an operating cost per passenger trip of $31.17 operates ADA paratransit service with a relatively low productivity and also has the highest cost per vehicle-hour of systems in that category.

In the primarily single-county service area, the two high datapoints—$30.76 and $30.38 per passenger trip—come from systems with lower productivities compared with other systems in that category (and one of these systems is predominately an ADA paratransit service) and both are transit districts, with a higher cost structure compared with the other organization types.

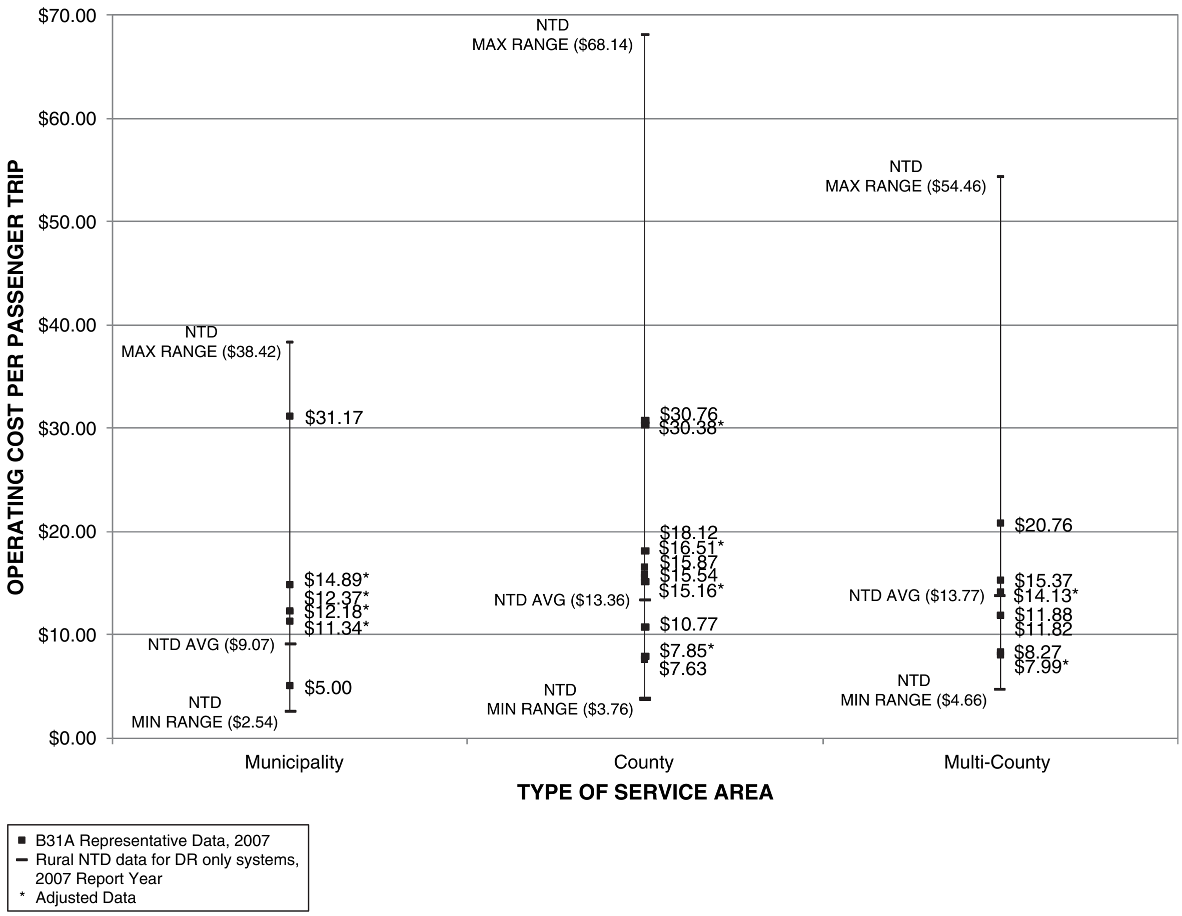

Figure 6-5. Rural DRT systems: operating cost per passenger trip.

While systems with low productivity and high costs per hour show high cost per passenger trip, the opposite is also shown: those DRT systems with high productivity and relatively lower costs per hour have the lower costs per passenger trip. In the primarily municipal service-area category, for example, the system with the $5.00 per passenger trip has both the highest productivity and lowest cost per hour in the category.

Interestingly, the operating cost per passenger trip for rural DRT systems in all three of the categories—those operating in primarily a single municipality, primarily in a single county, and in multi-county areas—appears to cluster in similar ranges, from about $11 to $15, although the primarily single-county systems show a somewhat broader grouping, from $11 to $18 per passenger trip.

Performance Measures for Safety and Service Timeliness

As noted above, there was very limited data from the representative rural DRT systems on the safety measure—Rural NTD safety incidents per 100,000 vehicle-miles—or for on-time performance. The majority of the participating DRT systems does not formally measure on-time performance and, thus, had no on-time data to provide for the project, but all monitor their safety performance, as would be expected. Only a few had the NTD safety incident data. When questioned about their safety experience, most of the managers indicated that they had no accidents and certainly none that reached the NTD reporting thresholds.

Table 6-2. Rural NTD safety incident data, FY2007.

Rural DRT Category	Average Reportable Major Incidents Per 100,000 Miles
Primarily municipal service area (102 systems)	0.14
Primarily single-county service area (262 systems)	0.28
Multi-county service area (115 systems)	0.09

Source: 2007 Rural NTD database, rural transit systems operating only DRT, with outliers removed.

The 2007 Rural NTD data can be examined to assess safety incidents for rural transit systems, providing a larger database than that of this project. Based on the DRT systems in the Rural NTD database that were assessed for performance statistics in this chapter ($N = 479$ systems) and based on the reported safety data, the average incidents per 100,000 miles is 0.21. This is based on a total of 387 reportable major incidents that were reported to NTD that year.

The safety data can also be reviewed by the typology of rural DRT systems, with the average reportable safety incidents per 100,000 miles as shown in Table 6-2. When looking at actual reported numbers of incidents, the NTD data show that the vast majority of rural DRT systems have no reportable safety incidents. The average number of reportable major incidents per rural system in the municipal and single-county service-area categories is less than one; for systems in the multi-county category, there is an average of two incidents per system. While rural systems in the multi-county category had on average more reportable safety incidents, its average per 100,000 miles is less than that in the other two categories because of the significantly more miles traveled: multi-county DRT systems traveled more than 800,000 annual miles on average, compared with 115,000 for primarily municipal systems and 243,000 for primarily single-county systems.

6.3 Summary Rural DRT Performance Data

The performance data from the representative rural DRT systems are summarized in Table 6-3, within the three categories of the typology. The important factors influencing the reported performance are also shown, as gleaned through the on-site visits and interviews with the DRT system managers. The various influencing factors, discussed in more detail in Chapter 5, include those that can be controlled or at least partially controlled by the transit system, while others are uncontrollable but must be acknowledged for their impact on performance. In addition, summary performance data and selected operating characteristics are shown by system for the representative rural DRT systems in Appendix B.

Passenger Trips Per Vehicle-Hour

This measure of system productivity showed a large range: a high of 7.05 passenger trips per vehicle-hour to a low of 1.57. As was found in the urban phase of the research, those DRT systems with smaller service areas tend to have higher productivities.

Based on the research on rural DRT, the main controllable and partially controllable factors that influence higher productivity include the following:

- A focus on routine group trips that are many-to-one and few-to-one. In particular, several of the higher productivity systems provide before- and after-school trips, with high group loads.
- The ability to group trips for unaffiliated riders, particularly for longer-distance trips.

Table 6-3. Summary performance data from representative rural DRT systems and influencing factors.

Representative Rural DRT System	Passenger Trips per Vehicle-Hour *Effectiveness*	Operating Cost per Vehicle-Hour *Cost-Efficiency*	Operating Cost per Vehicle-Mile *Cost-Efficiency*	Operating Cost per Passenger Trip *Cost-Effectiveness*
Primarily-Single-Municipality Systems (5 systems)	2.38–7.05	$35.23–$74.04	$2.57–$5.84	$5.00–$31.17
Primarily-Single-County Systems (10 systems)	2.06–6.23	$32.47–$78.05	$1.49 -$5.75	$7.63 -$30.76
Multi-County Systems (7 systems)	1.57–4.34	$26.08–$42.27	$1.16–$2.67	$7.99–$20.76
Factors Influencing Performance				
Controllable/ Partially Controllable	• Group trips for agency clients • Ability to group trips for unaffiliated riders, particularly for longer-distance trips • Use of AVL • Use of immediate response vs. advance reservation service • Extent of long-distance, out-of-primary-service-area trips • Characteristics of contracted service, in particular Medicaid • Measures to reduce deadhead • No-shows/late cancellations	• Administrative/overhead costs • Costs for operator labor	• Administrative/overhead costs • Costs for operator labor	• Administrative/overhead costs • Costs for operator labor • Group trips for human service agency clients and ability to group trips for unaffiliated riders • Use of AVL • Use of immediate response vs. advance reservation service • Extent of long-distance, out-of-primary-service-area trips • Measures to reduce deadhead • No-shows/late cancellations
Uncontrollable	• Size of service area • Geographic constraints of service area • Requirements for long-distance, out-of-service-area trips • Type of ridership, i.e., ADA paratransit vs. non-ADA	• Type of organization, i.e., transit district, city/county, private non-profit • Location in higher/lower labor-wage region of country • Type of ridership, i.e., ADA paratransit vs. non-ADA	• Type of organization, i.e., transit district, city/county, private non-profit • Size of service area and its influence on miles traveled • Types of roadways traveled and operating speeds on those roadways • Weather conditions that impact operating speeds	• Type of organization, i.e., transit district, city/county, private non-profit • Size of service area and geographic constraints • Requirements for long-distance, out-of-service-area trips • Type of ridership, i.e., ADA paratransit vs. non-ADA

- Use of AVL in particular and of MDTs, which facilitate immediate response/same-day service. The AVL allows the dispatchers to "see" where the vehicles are, and they can send or re-direct the closest vehicle for an immediate pick-up. This ability to know vehicle locations also gives the dispatchers improved control over the operators, allowing them to ensure that the operators are effectively deployed.
- Use of immediate response or same-day scheduling, where dispatchers schedule trips in real-time, often providing very short response times, used in smaller service areas.
- Efforts to reduce deadhead time and miles.
- Low rate of no-shows and late cancellations.
- Characteristics of contracted service, in particular Medicaid transportation. One of the rural systems that is a Medicaid transportation provider for a brokerage has discretion as to which long-distance Medicaid trips it accepts, according to the agreement—a factor that enables the system to ensure that the Medicaid trips it does provide can be grouped with other trips to maximize productivity.

Uncontrollable factors include the following:

- The size of the service area.
- Geographic constraints of the service area, including mountains, rivers, and other bodies of water that impact the roadway network, resulting in longer trips to travel around these constraints.
- Requirements for long-distance and out-of-service-area trips.
- The type of ridership, with the few rural systems in the sample that serve predominately ADA paratransit trips showing lower productivities.

Operating Cost Per Vehicle-Hour

Performance on operating cost per vehicle-hour also showed a large range across the representative rural DRT systems contributing to the research: a low of $26 to a high of $78 per vehicle-hour. The systems with the lowest cost per vehicle-hour are non-profit organizations serving multi-county areas, which may not be *fully* allocating costs to the DRT system (e.g., all administrative and overhead costs attributed to the DRT program). Those with the highest costs per hour are transit districts or governmental units with more extensive administrative structures operating in primarily single-county or municipal service areas.

According to the research, the controllable and partially controllable factors include the following:

- Costs for DRT administration, including the need for such functions as contract monitoring, certification, and Medicaid transportation administration.
- Costs for operator labor. This is generally controllable for a transit system, but less controllable if the DRT system must pay according to a pre-determined pay scale.

Uncontrollable factors include the following:

- The type of transit organization—that is, whether the DRT service is provided by a transit district; a governmental unit (city, county, or joint powers arrangement); or a private non-profit.
- The location of the system in a higher- or lower-wage region of the country. Recent research on transit employee compensation in rural and small urban areas found that the region of the country is among the key variables correlated with wages (*15*).
- The type of riders that are served. While there were only a few systems in the study sample that are predominately ADA paratransit, these had higher costs per hour, resulting from various factors including greater administrative needs related to eligibility/certification and longer service spans to match fixed-route service.

Operating Cost Per Vehicle-Mile

The measure operating cost per vehicle-mile showed a low of $1.16 per vehicle-mile for a multi-county system operated by a non-profit in a lower-wage region of the country. The high was more than $5.00 per mile as seen at several systems that share few characteristics except for the fact that they have relatively high costs per hour compared with the other participating rural systems and traveled at slow average speeds compared with others in the sample. The slower speeds were impacted predominately by smaller service areas, with limited travel beyond the primary service-area boundaries.

Interestingly, one of the participating transit systems that appears as a high datapoint on cost per vehicle-hour for the county service-area category is a mid-point on the measure cost per vehicle-mile. This is because the system has significant travel outside its county borders, with those miles traveled on highways at highway speeds, with a systemwide average speed of 27 mph.

Controllable and partially controllable factors influencing this measure include those same factors related to operating costs, including costs for administration and operator labor. Operating costs may also be impacted if the rural system has significant long-distance trips to destinations beyond the primary service area, which will increase operating costs related to vehicle factors such as fuel and maintenance. These costs can be controlled to some extent by scheduling practices although these efforts may be limited if the trips are required for Medicaid purposes.

There are a number of uncontrollable factors including the following:

- The type of provider organization—that is, whether the system is a transit district, city/county, or private non-profit.
- The size of service area, which influences miles traveled.
- The type of roadways traveled (e.g., dirt roads, two-lane roads, or Interstate highways) and operating speeds on those roadways.
- Weather conditions, which can impact operating speeds on roadways.

Operating Cost Per Passenger Trip

This measure is a composite of both operating cost per vehicle-hour and passenger trips per vehicle-hour. For the rural DRT systems included in the project, the cost per passenger trip ranges from $5, considered low for a DRT system, to a high shown by several systems of more than $30 per passenger trip—costs more similar to those at larger urban DRT systems. The data show a clustering within the range of $11 to $18 per passenger trip across the three service-area types.

The factors influencing this measure are the same as those that impact cost per hour and passenger trips per hour. Important to recognize is the critical role that productivity plays with this measure. One of the rural county-based systems with a relatively high cost per hour—more than $65 per vehicle-hour—has a cost per passenger trip of less than $11, due to the system's high productivity.

CHAPTER 7

Improving Performance

This chapter presents a range of policies, procedures, strategies, and practices that can improve DRT performance, providing possible ideas and actions that rural transit systems can consider for improving their performance. Some of the actions are discussed in detail, building on the specific experiences of rural DRT systems participating in the research project. This was a major focus of the project: identifying actions and strategies that rural DRT systems have taken to improve their performance and documenting their experiences. In some cases, the participating DRT systems were able to provide data quantifying the positive performance outcomes. More frequently, the systems described the qualitative results of their actions.

7.1 Actions for Improving Rural DRT Performance

There are numerous actions that a rural DRT system can consider for improving its performance. Many of these are similar to those identified through the project's urban phase and documented in *TCRP Report 124,* such as developing and enforcing a no-show policy to combat the lost time and resources resulting from rider no-shows.

To some extent, the areas of emphasis for performance improvement may differ for rural systems as compared with their urban counterparts. Rural systems may be more interested in expanding their ridership base by contracting with local human service agencies to transport those agencies' clients, for example. A large urban DRT providing ADA paratransit service may take a different approach, with a focus on managing demand.

Interestingly, some of the rural systems participating in the research project had opposite experiences with the same strategies implemented to improve performance. For example, two of the participating systems changed their route deviation service to demand-response with significant productivity gains. However, another system went the other way, changing part of its demand-response service to route deviation and improving productivity. Thus, it is important to understand the operating environment within which a rural system operates when planning performance improvements.

Various policies, procedures, strategies, and practices that can affect DRT service positively in the shorter- and longer-term are listed in Table 7-1. The focus of this list is those actions specifically identified by the rural DRT systems included in the research as well as those identified by urban DRT systems that are relevant for rural DRT. Also listed are a number of actions generated during early efforts of the research. Not all the listed actions are appropriate for all rural DRT systems, and, importantly, there are likely other actions and strategies that DRT systems have implemented in their communities across the country with resulting performance improvements, which are not captured through this project.

Table 7-1. Actions to improve DRT performance identified through research project.

Actions	Identified		
	By Rural DRT Systems	By Urban DRT Systems	Through Research & Experience
Operations			
Improve vehicle operator compensation	✓	✓	
Establish comprehensive vehicle operator training program	✓		
Use part-time drivers	✓		
Schedule back-up operators	✓		
Rotate demand-response and fixed-route operators	✓		
Establish satellite parking areas for service vehicles	✓		
Assign certain operators to take DRT vehicle home at night	✓		
Align operator shifts to meet ridership demand		✓	✓
Cross train staff		✓	
Scheduling/Dispatch			
Implement computerized scheduling/dispatch system	✓	✓	✓
Implement AVL and MDTs	✓	✓	✓
Provide scheduled service to frequented destinations	✓		
Provide immediate response service			✓
Professionalize scheduling/dispatch function			✓
Maximize use of subscription service			✓
Review, refine, tighten subscription trips on periodic basis			✓
Accept "will-calls" judiciously			✓
Obtain operator input on schedules on periodic basis			✓
Service Design			
Ensure service design "fits" community, revise as needed	✓		
Use volunteers for long-distance one-to-one trips	✓		
Use rural DRT as feeder service to rural inter-city routes	✓		
Policies and Procedures			
Adopt and enforce no-show/late cancel policy	✓	✓	
Develop and enforce cancellation policy	✓		
Shorten the advance reservation period		✓	
Establish on-time pick-up window			✓
Establish wait time policy			✓
Establish policies/procedures for bad weather operations			✓
Educate riders on policies and procedures		✓	
Funding			
Get involved in community, build relationships, and gain funding	✓		✓
Establish effective payment schemes for human service agency clients/riders	✓		
Sell advertising on vehicles	✓		
Marketing, Public Relations, and Passenger Relations			
Focus marketing efforts on general public	✓		
Advertise with campaign/yard signs	✓		
Identify key person at human service agencies to address rider-related issues	✓		
Maintenance and Vehicles			
Provide effective preventive maintenance practices			✓
Ensure appropriate mix of DRT vehicles			✓
Safety			
Monitor accident trends	✓		✓
Involve operators in a safety committee	✓		✓
Reward safe operators			✓
Establish a "culture of safety"			✓

7.2 Performance Improvement Actions—More Details and Selected Experience

This section of the chapter discusses the various improvement actions identified in Table 7-1 and, for many of these, provides the experiences of the rural DRT systems participating in the project. The actions are organized into the eight categories used in the table: operations; scheduling/dispatch; service design; policies and procedures; funding; marketing, public relations, and passenger relations; maintenance and vehicles; and safety. Within each of the eight categories, actions reported by the DRT systems participating in the research are discussed, after which additional actions, generated during the early efforts of the research project, are identified.

Another way of organizing the improvement actions is by the specific performance issue that is addressed; see Table 7-2. In this way, readers of the Guidebook interested in a specific aspect

Table 7-2. Performance improvement actions identified through research project, listed by performance issue.

Performance Issue	Management Action	See Page
Improve productivity	Implement AVL (and MDTs)	68
	Align operator shifts to meet ridership demand	66
	Provide scheduled service to frequented destinations	70
	Consider immediate response service	72
	Professionalize scheduling/dispatch function	73
	Maximize use of subscription service	73
	Review, refine, and tighten subscription trips on periodic basis	73
	Accept "will calls" judiciously	73
	Obtain vehicle operator input on schedules on a periodic basis	74
	Establish wait time policy	78
	Adopt and enforce no-show/late cancel policy	75
	Educate riders on policies and procedures	79
	Ensure effective preventive maintenance practices	83
Increase ridership	Focus marketing efforts on general public	82
	Advertise with campaign/yard signs	82
	Get involved in community, build relationships	80
Improve customer service	Implement AVL (and MDTs)	68
	Educate riders on policies and procedures	79
	Establish on-time pick-up window	78
	Establish comprehensive vehicle operator training program	63
	Schedule back-up operators and ensure service coverage	64
	Identify key person at human service agencies for rider-related issues	83
Reduce cancellations and no-shows	Adopt and enforce no-show/late cancel policy	75
	Develop and enforce cancellation policy	76
	Shorten advance reservation window	77
	Educate riders on policies and procedures	79
Reduce deadhead	Establish satellite parking areas for service vehicles	65
	Assign certain operators to take service vehicle home at night	65
	Provide scheduled service to frequented destinations	70
Improve staffing flexibility and efficiency	Use part-time operators	64
	Implement computerized scheduling/dispatch system	67
	Establish effective payment schemes for agency clients/riders	81

(continued on next page)

Table 7-2. (Continued).

Performance Issue	Management Action	See Page
Stabilize operator workforce	Improve vehicle operator compensation	63
	Establish comprehensive vehicle operator training program	63
Improve DRT staff working environment: – increase retention, – increase understanding across functional areas, and – improve relationship with riders	Improve vehicle operator compensation	63
	Establish comprehensive vehicle operator training program	63
	Rotate demand-response and fixed-route operators	65
	Cross train staff	66
	Educate riders on policies and procedures	79
Increase funding resources	Get involved in community, build relationships, gain funding	80
	Sell advertising on vehicles	81
Improve cost efficiency	Use part-time operators	64
	Implement computerized scheduling/dispatch system	67
	Establish satellite parking areas for service vehicles	65
	Use volunteers for long-distance one-on-one trips	75
	Ensure effective preventive maintenance practices	83
	Ensure effective mix of DRT vehicles	83
Improve safety	Establish comprehensive vehicle operator training program	63
	Monitor incident and accident trends	84
	Involve operators in a safety committee	84
	Reward safe operators	85
	Establish policies/procedures for bad weather operations	79
	Ensure effective preventive maintenance practices	83
	Implement AVL	68
	Educate riders on policies and procedures	79
	Establish a "culture of safety"	85
Consider alternative service design options	Change route deviation to demand-response	74
	Change demand-response to route deviation	74
	Use volunteers for long-distance one-on-one trips	75
	Use rural DRT as feeder service to rural intercity routes	75
	Coordinate separate, neighboring DRT services	75

of rural DRT performance (e.g., improving productivity) can look at the improvement actions identified for that specific issue. Table 7-2 also indicates the page number in this chapter where the improvement actions are discussed.

Operations

Many of the issues under the operations category relate to vehicle operators. With labor costs the largest single component of transit costs and vehicle operators the largest employee group, improvement actions targeted to vehicle operators can bring important performance benefits.

Improvement Actions Reported By Participating Rural Systems

Improve vehicle operator compensation. DRT systems understand well the critical role that their vehicle operators play in providing effective service. Well-trained and experienced operators can contribute to a more productive and more efficient and effective DRT service. If wages and benefits paid to operators are too low in comparison to wages and benefits for similar positions in the community or region, they may not be sufficient to attract and retain quality employees. The result will be excess turnover among operators (e.g., 30% to 50%), which results in ongoing needs to recruit and train new operators (and increases overhead expenses) as well as a constant stream of new and inexperienced operators. The inexperienced operators will be less familiar with the service area, will not know the riders and their needs, and will not be as productive as more experienced operators. An ongoing large proportion of new operators may also impact safety because such operators may be at higher risk for incidents and accidents.

While operator wages and compensation may receive more attention in larger, urbanized communities, the issue is relevant in rural areas as well. Research has found that the position of vehicle operator is among the hardest positions to fill and retain although smaller transit agencies seem to have somewhat less trouble than larger agencies (*29*). *TCRP Report 127* provides compensation guidelines for rural and small urban transit systems, including benchmark wage and benefit data and guidance on compensation decisions.

The 24 rural transit systems that participated in the research project reported differing experiences related to vehicle operator hiring and retention. Some reported no problems; some reported that while part of their operator staff was relatively stable, another part was not. Frequently, the systems reported that their operators tended to be retired individuals, often less interested in full-time positions or benefits.

Those that reported problems noted that among the younger operators there was more turnover. Several reported problems retaining operators with a CDL license. One system, a private non-profit agency, was having trouble retaining operators with CDLs. As a way to address the problem, the agency began to phase out the larger vehicles from its fleet, those that required a CDL for operation. Additionally, several of the participating rural systems reported problems competing for operator positions with trucking companies and the local school district.

Improve vehicle operator compensation. Improving vehicle operator compensation is an obvious strategy to ensure an effective and stable operator workforce, but it is an action that not all systems can take, depending on budget situations. One of the participating rural systems, located in the country's western region, reported that it increased starting operator wage rates beyond minimum wage to $11 per hour. Also, when the provision of zero-deductible healthcare insurance (provided for staff working 30+ hr/wk) became too expensive, this transit system determined that it would cost $14,000 less per year to reimburse staff for the cost of the deductible than to pay the premium for zero-deductible. These and other changes have contributed to a stable operator work force. Another system reported that it made a conscious decision to pay its well-qualified operators to work overtime when this becomes necessary rather than hire less-qualified staff, stating that its overtime expenses are typically offset by the savings in health insurance and other benefits that would be required for additional staff.

Establish comprehensive vehicle operator training program. Rural systems should ensure that they establish comprehensive training and re-training programs for their operators. Such training programs may be less formalized at small systems compared with large urban systems, particularly where the rural transit service is a component of a larger, multi-purpose organization. Nevertheless, training is crucial to ensure safe operations and service quality to passengers.

Effective training and re-training programs may help rural systems retain operators and reduce turnover. In particular, training programs that include a focus on supporting and monitoring trainees and mentoring programs for new operators have been found to be effective in retention of operators (*30*). A number of the participating rural systems specifically cited their comprehensive operator training program as a practice that had performance benefits. For

example, Hill Country Transit District, a large multi-county system in Texas has an in-house training program, including CDL certification, which includes 3 weeks of operator training. It also provides annual refresher training. The system reports long-term operator staff with very low turnover.

Another multi-county system, River Cities Public Transit in South Dakota, has in-house training that provides CDL certification and includes the CTAA Passenger Service and Safety (PASS) program, available through the state's transit association. This system reports that it has experienced reduced insurance costs as a result, as well as fewer accidents and no wheelchair-related incidents since implementing its comprehensive training program. The rural system manager correlates the system's investment in its operator staff with the system's high service quality.

A third multi-county rural system participating in the research developed a comprehensive driver training program using a nationally recognized consultant. The program includes 40 hr of instruction including classroom and on-the-road training with an instructor, plus an additional 20 hr of on-the-road training in the specific part of the large service area to which the operator is assigned.

One of the participating rural systems developed a specialized operator training program, beyond the federal CDL requirements, that incorporates state training requirements for transporting youth. This operator training program was developed to meet the system's own needs. However, once the training program started and operators were trained, other local transportation providers would lure the newly trained operators away with a small increase in wages or benefits. To address this, the transit agency opened up its training program and makes it available to other agencies.

Use part-time operators. Many of the participating rural DRT systems use part-time vehicle operators, with several calling out specific actions related to part-time staff. One rural system reported that it hired part-time operators to cover mid-day time periods so that service capacity during the mid-day, when DRT ridership can remain strong, would not be impacted when full-time operators had lunch breaks.

A multi-county system located in an area that is attractive to retirees has had success in recruiting and retaining recently retired individuals to work as part-time vehicle operators. The system manager reports that these individuals typically do not want a full-time position, and that they are motivated less by wages and benefits and more by an interest in "serving the community." The system has benefited as its part-timers have become a stable core of operators, giving the system flexibility in staffing and covering operating hours that may vary throughout the large service area. There are also cost-savings since the system does not provide health insurance for part-time employees.

Schedule back-up operators to ensure service coverage. Systems of all sizes should ensure that they have back-up operators who can fill in when regularly scheduled operators are not able to work due to illness, vacation, or other reasons. For a small system, this might involve asking an operator with a scheduled day off if he or she could work instead. Or it may mean that office staff members should be cross trained to serve as operators when the need arises. In this way, scheduled service can be maintained for the riders. In central California, Fresno's FCRTA, with a workforce of about 50 vehicle operators who are assigned to different small communities across the large county service area, reports that it typically schedules about 10 back-up or standby operators each service day to ensure service continuity.

Rotate demand-response and fixed-route operators. Intracity Transit in Hot Springs, Arkansas, rotates its demand-response and fixed-route operators on a 4-wk cycle and reports that this practice provides flexibility in staffing as well as improving staff cooperation and understanding of the different responsibilities involved in fixed-route versus demand-response service. Additionally, the practice helps prevent a phenomenon sometimes seen at transit systems where operators of fixed-route service are considered "better" than those of demand-response. With a rotating schedule, the operators reportedly share "tips" about serving particular demand-response riders, helping to create a shared working environment rather than one divided between "better" and "less better" tiers of operators.

Establish satellite parking areas for service vehicles to reduce excess deadhead time and mileage. Several of the rural systems with large service areas have established satellite parking areas for some of their transit vehicles, area selected because the satellite location is within or close by the particular part of the service area to which the vehicles are assigned. The operators of those vehicles (and often it may be just one vehicle) then report to that satellite location to pick up their vehicle and begin their service day.

A number of the larger rural systems are operated through non-profit organizations such as an area agency on aging or community action agency, and the transit system is able to use its affiliated offices such as a senior center for satellite parking. Garrett County Transit in western Maryland, for example, uses a senior center affiliated with its parent community action organization that is located about 25 miles from its main facility and parks five transit vehicles there. The driver manifests are sent to that senior center before each service day via fax, and the operators report directly to that senior center to get their vehicle and daily schedule. This practice had reduced significant deadhead time and miles.

One of the county-based rural systems found that its use of satellite parking areas in its very large service area must be considered with security in mind. Since the system has experienced stolen batteries with its transit vehicles parked at unsecured satellite parking areas, it now looks for safer venues such as the secured lots of the small cities within its county service area.

Assign certain operators to take service vehicle home at night to reduce deadhead. Several of the participating rural systems reported that they have selected operators to take their assigned transit vehicle home at night. One of the systems referred to this practice as "out-posting." The operators selected for this practice are often those who are scheduled to provide service in the outer parts of a large service area and who also live in or near those outer parts. The operator then has his or her service vehicle available at the start of the day without having to travel to the main DRT facility and deadhead back to provide transportation service. This practice reduces the deadhead time and miles that would be otherwise required and also benefits that operator who now does not need to commute the distance to the central facility to pick up the service vehicle.

The Inter-County Public Transportation Authority (ICPTA), a multi-county system in northeastern North Carolina, reports that some of its operator hiring decisions may be influenced by where the individual lives, facilitating the rural system's practice of having some of the operators take a transit vehicle home at night to reduce deadhead requirements on service days. This rural system, provided through a county health department, indicated that its operators can use the local health department offices in the various counties of the service area to fax in their manifests at the end of their service day, facilitating recordkeeping.

One issue of note with this strategy is that DRT systems receiving FTA funds must consider compliance with FTA's drug and alcohol testing regulations, specifically related to vehicle operator monitoring by supervisory staff for "reasonable suspicion testing," which becomes more difficult when operators start their service day from their homes.

Other Improvement Actions

Align operator shifts to meet ridership demand. DRT systems should ensure that they schedule their vehicle operators' shifts to match the system's ridership patterns. A mix of full-time and part-time operators typically provides a DRT manager with more flexibility for efficient operator scheduling. The scheduling of lunch and other breaks should be done to maximize capacity during peak demand times. The ability to schedule lunch and other breaks on a real-time basis, using time that is freed-up by no-shows or late cancels, is another way to maximize productivity *(31)*.

While larger, urban DRT systems that have labor contracts may need to schedule operator shifts and breaks according to work rules, smaller rural DRT systems may not have such issues. However, some systems, particularly those operated by municipalities or counties, have operators scheduled according to the public entity's standard 40-hr, 9-to-5 workweek even though the DRT ridership patterns may not correspond to office hours (*6*). Most DRT systems have off-peak periods with lower ridership when a full complement of service may not be merited and busier time periods when additional capacity is needed. In such cases, the DRT manager should try to arrange for more flexible staffing and set up operator schedules that match ridership patterns. This will ensure more productive service.

Several of the DRT systems participating in the urban phase of the research project have given particular attention to this strategy, specifically managing the supply of their revenue hours to match demand. This requires that the DRT system understand its ridership patterns, by hour and day of week, by month and by season. Once ridership patterns are understood, the DRT system can then schedule its operators' work schedules to match expected ridership patterns. In this way, the system can reduce less productive time and increase its productivity.

Cross train staff. Cross training staff was a management action identified in the urban phase of the DRT research project. With the interdependency of various DRT functions, for example, the relationship between dispatch and vehicle operators and an understanding of each other's position responsibilities can contribute to a better working relationship among staff and provide performance benefits through increased knowledge of service issues.

Cross training may happen spontaneously in a smaller, rural DRT system because with a small staff, members may have to fill in for each other on occasion. However, cross training can also be done on a more formal basis, with an objective of having staff better understand their colleagues' responsibilities, which can lead to improved working relationships across the various DRT functions.

Scheduling/Dispatch

Many of the participating rural DRT systems reported actions that they had taken to improve the scheduling of trips and, in some cases, the dispatching as well. These improvement actions are discussed below. Beyond the reported actions, there are others that can be considered and these are also identified.

Improvement Actions Reported by Participating Rural Systems

Implement computerized scheduling/dispatch systems. Use of technology at rural transit systems is increasing (*32*), and research has documented actual or potential performance improvements for rural transit with use of CASD systems in a number of specific areas. These include customer service, with the ability to provide all riders with the same level of service using a uniform approach to reservations and scheduling; improved scheduling procedures; increased productivity, with the improved scheduling procedures; more efficient billing procedures, with improved data that is available more quickly; and potential staff reduction or re-assignment with the more efficient procedures when using CASD (*26*).

While research in Illinois found that the benefits of CASD increase with the number of DRT vehicles and trips (*22*), there are many small and rural DRT systems that have installed CASD systems. DRT systems with as few as 10 vehicles in service can benefit from a CASD (*13*). At systems smaller than this, experience seems to show that the effectiveness of CASD varies considerably.

Research on use of CASD in rural areas found that some DRT staff are not using all capabilities of the system, in part as they believe that certain functions are better done manually (*26*). Training was found to be helpful in encouraging staff to better utilize the system as well as changing certain procedures (*26*). Training is also useful to ensure that transit staff use the systems to maximize their usefulness and positive impacts on performance. Research has also found that many users of CASD systems need additional training on their technology as some aspects of the system are learned through trial and error (*22*).

More than half of the rural DRT systems participating in the research project use some type of computerized scheduling/dispatch system for taking reservations and scheduling trips. A few have sophisticated systems commonly used for large urban systems, but more use computerized systems that are designed for smaller agency applications.

As discussed in *TCRP Report 124,* the urban DRT systems focused on the operational improvements obtained with their scheduling/dispatch systems such as more accurate scheduling and "tighter" operator manifests. However, the rural systems seemed more focused on the improved administration of the scheduling/dispatch function provided by their CASD systems, including reduced staff efforts and better data and recordkeeping.

Reported performance improvements. The following performance improvements were reported:

- **Reduced staff efforts for scheduling/dispatch function:** With a CASD, several participating rural systems reported specific reductions in staff efforts involved with scheduling/dispatch and related recordkeeping duties. One system, operating a county-based coordinated service with about 30 vehicles and multiple funding sources, said it reduced its staff involved in trip editing from somewhat more than four FTEs to two.

Reported Benefits of Computerized Scheduling/Dispatch Systems

- Reduced staff efforts for scheduling/dispatch
- Improved vehicle operator schedules
- More efficient reporting and administration

Another county system noted that its CASD was an impetus for more efficient staffing: rather than having staff share responsibility for call-taking and scheduling, the two functions were divided so that one person is responsible for call-taking and a second for scheduling.

- **Improved vehicle operator schedules:** A small community-based DRT system notes that its operator schedules are more efficient with its scheduling/dispatch software, which also provides the ability to map the pick-up and drop-off locations.
- **More efficient reporting and administrative procedures:** CASD can facilitate more efficient administrative procedures. Albert Lea Transit in Minnesota states that its computer system provides "very efficient and accurate reports." B.C. Country Rural Dial-A-Ride in New York State recounted that its computerized system has greatly facilitated the billing of the various human service agencies whose clients use the DRT service, with more accurate and accessible data. Two other rural systems reported that their "office operations" are noticeably more efficient and that required monthly reports can now be provided electronically to the state DOT Section 5311 Program managers.

Qualifications. As was found in the urban phase of the research study and has been documented in earlier research (*22*), the implementation period for new technology can be difficult:

- **Implementation takes time and effort:** Two of the rural systems described implementation and transition periods of many months, with significant staff efforts and frustrations needed to bring the system to a functioning state.
- **Data entry requirements can be burdensome:** One of the participating systems reported significant efforts to obtain and enter the data needed by its new CASD. In particular, this system had to obtain rider information to create "client files." To help wrestle rider information forms from several thousand individuals, the system gave a free ride coupon to those riders who completed and turned in their forms.
- **New performance data may not demonstrate improvements:** Research during the urban phase of the project found that performance may actually decline for a time period after implementation of new scheduling/dispatch software. This could be due to the learning curve that is needed for staff to adapt to the new software, and it may also result from more accurate data or even data that is defined differently by the software than was the case with prior manual methods. In particular, the scheduling/dispatch software may compute vehicle-hours and revenue-hours with a method that provides different results than the earlier manual method. If the new method gives greater hours data and ridership data are consistent, productivity will appear lower. Experience with rural transit also shows that in some cases, a good scheduler may be able to create operator schedules that are more efficient than those done by a computerized system.

  One of the participating rural systems, which appreciated the more efficient staffing that its new scheduling/dispatch system facilitated, found that its productivity showed notable declines with the new technology. It is not clear whether this was impacted by different data computation methods, but it was reportedly influenced in part by changes in ridership, with a loss of a human service agency client and that agency's daily group trips as well as an increase in longer trips in the county as opposed to shorter trips within the county's largest community.

Implement AVL and MDTs. While AVL and MDT technology are less common at rural systems, research has found that such equipment provides for performance improvements for rural transit in the following areas: better customer service since dispatchers can provide more accurate information to riders because they can "see" where the vehicles are; increased system safety, with dispatchers more easily and more quickly able to respond to incidents since they can "see" vehicles' locations; reduced data entry time; more informed maintenance decisions, when MDTs are used to transmit pre-trip inspection reports for vehicles housed at remote or satellite locations; better control over operator hours; and improved monitoring of schedule adherence (*26*).

In particular, the use of MDTs to transmit pre-trip vehicle inspections for vehicles housed in decentralized satellite locations, providing more informed maintenance decisions, was found to be an especially interesting use of MDTs for rural agencies (*26*).

While only a few of the participating rural DRT systems have AVL and MDTs, the few that have the technology cited performance improvements, particularly related to productivity. This can be compared with the urban DRT systems participating in the first phase of this research project, which were more interested in the improvements in on-time performance that were enabled with AVL/MDTs. This may be due to the fact that most of the urban systems provide ADA paratransit, where there is significant attention to trip timeliness.

Reported performance improvements. The following improvements in performance were reported:

- **Allows dispatchers to "control" service in real-time, inserting passenger trips as trip requests are received, improving productivity:** Since dispatchers can "see" vehicle locations with the AVL, they are able to redirect operators on a real-time basis to insert additional passenger trips that fit into the operators' already scheduled trips and general path of travel. This is particularly useful where service is provided on an immediate response basis or for same-day requests and will-calls for DRT systems that are predominately advance request.

  Paul Bunyan Transit in rural Minnesota, with about 11 DRT vehicles operating on an average day, credits its system's AVL, implemented in 2004, with its ability to achieve its system wide productivity of almost six passenger trips per hour. While the system's productivity has been relatively high since the system began in 2000, there has been a substantial increase in the service area since then that also brought an increase in riders. However, the system's total DRT mileage has not increased commensurately with the service area expansion, indicating that scheduling/dispatch efforts have contained deadhead mileage and focused more attention on shared riding and grouping trips. According to this rural system, the dispatchers use their AVL and "push" the operators "most of the time," keeping the system's productivity above five passenger trips per hour despite the increased rural service area size. Notably, this has been achieved without a CASD system.
- **Better management of vehicle operators and service:** The AVL technology allows the dispatchers and other control room staff to better manage vehicle operators when they are out on the street. One of the rural systems participating in the research study said the AVL allows the dispatch staff to "monitor" vehicle operators. Another system reported that the AVL prevents operators from claiming that "they are busy" when they are really "just parked someplace." Dispatchers can capture this time for productive service when otherwise, without AVL, that time would likely become a lost resource. AVL also allows the rural systems to monitor speed, an issue that is typically more relevant for rural systems than their urban counterparts. The improved ability to manage operators is a significant benefit of AVL.
- **Accurate response to "Where's my ride?" calls:** Dispatchers can use the AVL when riders call to ask about their particular trip. With the ability to "see" a specific vehicle, the dispatcher can more accurately respond to riders asking when their vehicle will arrive. This technology was identified as particularly useful for one of the participating rural DRT systems that was experiencing overwhelming demand, with many riders calling to ask "Where's my ride?".
- **Monitor vehicle timeliness:** With the AVL, dispatchers can monitor whether operators are running on schedule. One of the rural system reports that its dispatchers will contact an operator who is running late to find out the reasons. If necessary, trips that might have been

Reported Benefits of AVL and MDTs

- Dispatchers can "control" service in real-time, improving productivity
- Better management of vehicle operators and service
- Accurate response to "Where's my ride?" calls
- Monitoring of vehicle timeliness
- Reduction in vehicle no-show complaints
- Improvements to system safety

sent via the MDT to that operator can then be re-directed to another operator to maintain schedule adherence.

- **Reduce vehicle no-show complaints:** Paul Bunyan Transit uses its AVL data to review complaints from riders about a vehicle no-show. By reviewing stored AVL data, the rural system can check to see whether its vehicle was actually at the scheduled pick-up location at the scheduled time and whether it waited the full 3 min, according to system policy. This data typically shows that the vehicle was where it was supposed to be and waited the full 3 min. Similarly to a number of urban DRT systems from the first phase of the research project, this rural system has seen a noticeable decrease in complaints from riders about vehicles not showing up, with credit to the AVL technology.
- **Improve system safety for riders and operators:** When there are road calls or other incidents or emergencies, the DRT system can respond more quickly because it can pinpoint vehicles' location. This is particularly important when the system needs to direct emergency responders to a vehicle. In a rural service area, it may be hard for an operator to know his precise location when traveling on a rural highway with few cross-streets or other reference points. After one of its vehicles had a mechanical failure on a return trip from an out-of-service area medical trip, one of the rural systems reported that its dispatcher was able to quickly re-direct another vehicle, relatively close by, to pick up the two riders aboard the first vehicle. This was possible because the dispatcher knew the locations of all the system's vehicles.

Provide scheduled service to frequented destinations to improve productivity. Many of the rural DRT systems participating in the research reported scheduling policies and procedures that serve certain destinations or defined trips only at scheduled times and often only on specific scheduled days. Importantly, the scheduled service operates only if there is demand, typically arranged on an advance reservation basis. These practices serve to group common trips at pre-determined times, providing more productive and efficient service. While there were numerous permutations on these policies and procedures as reported by the participating rural systems, the general practice is particularly important in large, sparsely populated service areas, characteristics of many rural DRT systems.

RCATS — Regional Coordinated Area Transportation System — Serving Randolph and Montgomery Counties

ASHEBORO RESIDENTS –
LOCAL MEDICAL APPOINTMENTS
Mon – Fri ....8:30 AM - 2:00 PM

RANDOLPH COUNTY RESIDENTS –
LOCAL MEDICAL APPOINTMENTS
Mon – Fri ....9:00 AM - 12:00 Noon

ASHEBORO AND RANDOLPH COUNTY RESIDENTS – OUT OF TOWN MEDICAL APPOINTMENTS
Mon, Tues –
Greensboro and High Point...........9:00 AM - 12:00 Noon
Wed –
Salisbury (VA Hospital) ....9:00 AM - 12:00 Noon
Th – Winston-Salem ....9:00 AM - 12:00 Noon
Fri – Durham ....9:00 AM - 12:00 Noon
Mon, Wed, Fri –
** Chapel Hill............................9:00 AM - 12:00 Noon

Based on the research, two main "themes" for the scheduled service practices emerged: first, there are services scheduled by geography, either for sub-areas within a larger service area or to out-of-service area destinations, and second, there are services scheduled by trip purpose, for example, shopping trips or medical trips. In both cases, the practices target frequented destinations.

Variations on these two types of scheduled service—sometimes referred to as *fixed-schedule service*—are identified below, as reported by the rural DRT systems. Specific performance data resulting from the scheduling practices were not available, but it is clear that they lead to improved performance if the alternative is to serve such trips on a purely demand-response basis.

Services scheduled by geography. Among other county- and multi-county-based rural systems participating in the research, B.C. Country Rural Dial-A-Ride serves outlying parts of its service areas only on certain specified days per week. The system ensures that each of its outlying communities is served at least twice per week, with the schedule providing for two trips into the county's urbanized area, in the morning and early afternoon, and two return trips, in the early and late afternoon, giving the rural riders a choice of travel times into the urbanized area on their particular service day. The trips are provided only on a request basis, so there is no service if no one calls; however, the rural system's dispatcher said, "We always get calls."

The rural DRT system in Beltrami County, Minnesota, also serves some of its outlying communities only on a scheduled basis, with service to one of the distant communities provided just twice per month. To further improve productivity, this rural system requires a minimum of four passengers for each of its scheduled trips from the outlying communities; otherwise, the scheduled trip will not operate. With this policy in place, riders will often group themselves in advance and then call to request the trip, now guaranteed to operate as long as the riders have created a group of four.

Some of the rural systems also indicated that they serve longer-distance, out-of-service-area trips only on specified days—again, a strategy to try and create group trips and improve efficiency. In particular, this strategy often applies to out-of-service area medical trips. The RPC coordinated system in central Florida and RCATS in North Carolina, among others, travel to out-of-service-area destinations only on a set day per week.

Services scheduled by trip purpose and destination. DRT service can also be scheduled by trip purpose and destination, again, to try and create group loads and improve productivity. This is commonly done with shopping trips—for example, a DRT system will schedule service to a particular grocery store every Tuesday and to a second grocery store every Thursday at prescheduled times. Riders call in advance to reserve space on the scheduled trip they desire.

Medical trips are another common trip purpose for rural DRT systems, and, because some of these trips are longer distance and problems can be encountered with changing times for return trips, many of the participating rural DRT systems have developed policies and procedures just for medical trips. For example, as noted above, a number of the participating systems serve medical trips that are out of the service area only on specified days per week, and some specify that medical appointments should be made for morning hours only, allowing adequate time to provide return trips. One of the system managers noted that doctors' offices do not always want to cooperate with the transit system's policy, but the policy remains firm.

Even for within-service area medical trips, one of the participating rural systems asks its riders to schedule all medical appointments, generally located in the county's largest community, between 10:30 A.M. and 11:30 A.M. With this policy, this DRT system can try and group trips going into the main community in the mid-to-late morning, and then group return trips back to the outlying communities.

Given the large number of medical trips for rural DRT systems, other scheduling practices have evolved to try and improve the efficiency of such trips. For return trips from medical appointments, Valley Transit in Idaho, for example, schedules in advance its riders' return trips from medical appointments but calls the riders' medical office before sending the vehicle to check whether the appointment is running late. This allows the system to reschedule the return trip if needed, avoiding the situation where the DRT system has to send a second vehicle to pick up the rider because he was not ready when the first vehicle arrived at the advance scheduled time. Valley Transit also specifies that should any rider have follow-up medical appointments, the rider is to ask the medical office to schedule the follow-up appointments directly with the DRT system, helping to ensure that the transit system, with excess demand at times of the day, can meet the rider's transportation needs for the next appointments.

As another permutation on scheduling for medical trips, two of the participating rural systems note that they have opened up their longer-distance medical trips to riders with other trip purposes, increasing the ability to group trips and improve productivity. As one example, Monroe County Shared Ride opened its service to the Veterans Hospital for non-medical trip purposes when originally this out-of-service-area destination was served only for medical trips. This practice allows other riders to access the more urbanized area where the hospital is located and, from a performance perspective, improves the productivity of that service.

Other Improvement Actions

Provide immediate response service. While provision of immediate response service was not cited as a specific performance improvement action by any of the participating rural DRT systems, data from the systems indicate that the provision of immediate response/same-day service can benefit productivity, especially when the transit system has AVL. This is a strategy that is appropriate in smaller service areas.

Performance improvements. The performance improvements were as follows:

- **Productivity:** Based on the performance data for the 23 rural DRT systems providing data for the research project, the average productivity for those systems operating as immediate response is 5.15 passengers per hour (5 systems), compared with an average productivity of 2.85 passengers per hour for those systems that are predominately advance reservation (18 systems). This is measured as passenger trips per vehicle-hour.

  Contributing to the higher productivities achieved by the rural systems that operate as immediate response include

  – Three of the immediate response systems operate predominately in small and compact geographic areas, where trips can be dispatched quickly and response times for riders are relatively short.
  – Two of the systems have AVL, which are used by the dispatchers to route vehicles efficiently, and passengers' trips can be dispatched to operators in real time since the dispatchers know the location of each vehicle and can divert the closest vehicle for last minute pickups; this allows the systems to serve more passenger trips with their available capacity.

  It should be noted that the categorization of the systems between immediate response versus advance reservation is not completely discrete as the advance reservation systems all indicated that they provide, or at least will try to provide, some same-day service when capacity allows or when the passenger's trip is deemed urgent. Additionally, all of the systems, even those that provide immediate response/same-day service, provide some subscription service. This means that a portion of the service (often as much as 50% of total trips) is pre-booked and can be considered advanced reservation.

  Despite these qualifications, the data from the systems in the research project indicate that provision of immediate response service, within the appropriate service area and particularly with the advantage of AVL, clearly benefits productivity.

- **Fewer no-shows/late cancellations:** Immediate response DRT systems also benefit from fewer no-shows and late cancellations than are typical with advance reservation DRT systems; this in turn benefits productivity. Rider no-shows, in particular, and late cancellations harm DRT performance, representing wasted DRT resources. Research conducted for the urban phase of this research project identified two urban DRT systems that documented specific productivity gains from reducing their respective no-show rates with focused enforcement.

  Among the limited number of rural systems participating in the rural phase of the research that operate as immediate response DRT, FCRTA in central California specifically noted that it has no problems with no-shows or late cancellations and does not even have a no-show policy. Riders call for a trip when they are ready to go, and the system is able to provide service relatively quickly, except perhaps in heavy peak times. FCRTA service is provided within a number of small, single communities throughout the large rural county, which range in size from 1 to 7 sq. miles; DRT vehicles are generally based within each of the communities, facilitating short response times.

Professionalize scheduling/dispatch function. Experienced and trained schedulers and dispatchers will help ensure effective and productive DRT service. This can be achieved by providing wages and benefits that attract and retain quality staff and minimize turnover. Training should also be available. Specific training for operating staff, including schedulers and dispatchers, is often available through RTAP programs either at the state level, through a regional RTAP consortium (such as the Mid-Atlantic RTAP), or both. The National Transit Institute, among others, offers a course in paratransit scheduling and dispatching fundamentals.

Sometimes at smaller systems, schedulers and dispatchers are promoted from operator positions, providing them relevant experience from the operator perspective. Training, however, particularly in scheduling, should be provided that will enhance the individuals' ability to develop effective schedules for the system. Effective dispatchers also must have supervisory capabilities and skills as well as the ability to multi-task.

Maximize provision of subscription trips. Subscription trips can benefit DRT operations and help achieve improved productivity in several ways. Since the trips are repetitive and known in advance, schedulers can focus on them and work to continually improve and tighten their fit onto runs so that additional trips can be accommodated on the runs. Scheduling can also be streamlined: the call-taker does not have to spend time taking calls for these trips since the passengers do not call in for each trip. Further, passengers on subscription trips may work together to improve service—for example, passengers may use peer pressure on another whose habits inconvenience the other riders and delay operations (e.g., a rider who is habitually not ready to board when the vehicle arrives, inconveniencing the other passengers, may be "spoken to" by his peers). DRT systems should establish procedures so that passengers with repetitive trips, even once-a-week trips, schedule these trips on a subscription basis.

Review, refine, and tighten subscription trips on a periodic basis. Importantly, however, the DRT scheduler must review all subscription trips on a regular basis to tighten the runs and ensure maximum productivity. In this way, the DRT system will realize the benefits of subscription trips. At the same time, the scheduler should attempt to maintain some stability in the runs, to take advantage of operators' experience with their runs.

Accept "will-calls" judiciously. A will-call is a DRT trip that is not scheduled in advance, but rather the rider "will call" when she is ready to be picked up. The DRT system then fits in the trip as best it can. Essentially, a will-call is an immediate response trip. Will-calls are typically trips that may be difficult to schedule in advance, such as return trips from doctors' appointments.

For DRT systems that operate as advance reservation, will-calls can be an effective approach to serving trips where riders have limited control over their pick-up time. If riders schedule such return trips in advance, they may end up as "no shows" because their appointments are not yet completed when the vehicle arrives for the trip home. In such case, the DRT system must then schedule another trip to get the rider home, which results in two trips. It may be more cost-effective to schedule such return trips as will-calls.

However, if a DRT system accepts too many will-calls, it may be difficult to fit the trips in with the prescheduled trips, and this may harm productivity. Thus, a balance is needed for DRT systems that accept will-calls. Achieving that balance may depend on some trial and error—in other words, experience.

Obtain vehicle operator input on schedules on a periodic basis. The DRT system should provide an opportunity for the schedulers and dispatchers to meet with vehicle operators on a periodic basis to discuss scheduling practices and gain the insights and experience that the operators obtain each service day. This on-the-street understanding will give schedulers and dispatchers a realistic assessment of the system's scheduling practices and may provide information that could improve scheduling.

Service Design

While the research project did not focus on service design options, several of the participating rural systems specifically identified service design changes that benefited their performance.

Improvement Actions Reported by Participating Rural Systems

Ensure service design "fits" community, revise as appropriate. Rural transit systems must ensure that their service design model fits their community needs in terms of land use, development patterns, and ridership demand and use patterns. While a rural transit system may implement a certain design model, the system should evaluate this over time to assess how well the particular service model meets the community's conditions and ridership. Three of the rural systems participating in the research revised their original transit design to service models that were more appropriate for the community's transit needs, with performance improvements.

Change route deviation to demand-response. Two of the rural systems participating in the research changed route deviation service (also referred to as flex-route) to demand-response, with productivity improvements. Pulaski Area Transit, a small community-based system in Virginia, had a productivity of 4.9 passengers per hour with its route deviation. After 1 year of operation, the service was changed to demand-response and achieved a productivity of 7.0 over 12 months, serving a broader range of riders than with the route deviation, including more general public passengers as well as children who are transported to and from before- and after-school daycare.

ICPTA, a multi-county system in North Carolina, had operated a route deviation service in its largest community, with a productivity of approximately 1.6. When the system converted this service to traditional demand-response, productivity improved to an estimated 3.0 passenger trips per hour.

In both cases, the rural system managers determined that their community's land use and development patterns as well as the ridership on route deviation might be better served with the greater flexibility provided by demand-response.

Change demand-response to route deviation. Another rural system participating in the research changed part of its demand-response service to route deviation, designing two routes after analyzing ridership patterns and concentrations of pick-ups and drop-offs. This small city's deviated routes link senior housing facilities as well as a high school and community college with Wal-Mart and a local mall, achieving a combined productivity of 7.7 passenger trips per vehicle-hour. This can be contrasted to the productivity of the system's demand-response service of 2.96.

Use volunteers for long-distance one-on-one trips. If a rural DRT system has a volunteer driver component, use of volunteers for long-distance single-passenger trips can be a cost-efficient strategy. Otherwise, such trips can require a vehicle and operator for a significant portion of the service day. One of the participating rural systems uses its volunteer drivers to provide medical trips to a medical facility in a neighboring state, a trip that can be more than 100 miles one way. Based on FY2007 data, these long-distance one-way trips cost the rural transit system $37.45 on average for mileage reimbursement for the volunteer drivers. If an additional estimated 15% is added for administration of the volunteer program, the average trip cost is estimated at $43.07. If those trips were provided by the transit system, it is estimated that, based on the system's operating cost per vehicle mile, each one-way trip would cost $215, about five times the cost through the volunteer driver program.

Coordinate separate, neighboring DRT services. One of the participating rural DRT systems is a composite of two formerly separate systems. Paul Bunyan Transit in Beltrami County, Minnesota, was formed with the merger of the county DRT system and a separate DRT system serving the largest community in the county. With the coordination, there emerged a more focused and efficient transit system. Before the merger, annual ridership data on the two separate systems fluctuated up and down year to year; after the merger, ridership increased annually over the next 3 years, indicating a more stable and focused operation. The cost per hour and cost per mile data decreased slightly after the merger, while before, the cost per hour and per mile indicators had trended upwards, sometimes by more than 10% annually.

Use rural DRT as feeder service to rural intercity routes. FCRTA has structured its rural services so that vehicles are assigned to provide local DRT service within the various smaller communities in the large, nearly 6,000-sq. mile service area and also to connect with the agency's rural intercity routes, which link the smaller communities to the Fresno-Clovis urbanized area. In this way, the small communities have all-day coverage for local trip needs, while long distance trip needs are met with the intercity routes. If the DRT vehicles were assigned also to operate the intercity service, the communities would lose some of their local intra-community demand-response service since the vehicles would be otherwise engaged running the longer-distance routes.

Policies and Procedures

Policies and procedures help structure DRT service and its daily operations. Those that affect riders need to be clearly articulated and publicized for the riders so that they, and the community organizations with which many riders are affiliated, understand how the DRT system works and what their responsibilities are for service provision. DRT service operates more smoothly and, from a performance perspective, more productively when both the DRT staff and the riders that are served understand and follow the system policies and procedures.

Improvement Actions Reported by Participating Rural Systems

Adopt and enforce no-show policy. DRT systems, particularly those that operate as advance reservation, invariably have some level of no-shows and late cancellations. No-shows, in particular, have a negative impact on performance. When a rider fails to show up for a scheduled trip or cancels at the door, the DRT system has wasted a DRT trip, harming productivity. No-shows can also have a detrimental effect on on-time performance when an operator waits at a scheduled pick-up location beyond the DRT system's stated wait time because subsequent trips on the operator's schedule may then be late. No-shows additionally inconvenience other riders who might be on-board the vehicle when a no-show occurs; these riders have wasted their time waiting at the pick-up location of the no-show rider and may have had a more direct and timely trip had the no-show trip been cancelled with adequate notice.

Late cancellations may have the same negative effect as a no-show, depending on when the cancellation is made. If late cancellations are a problem for a DRT system, it is important for the system to include late cancels in its no-show policy. This includes specifically defining a late cancellation—the point at which a cancellation becomes so late that it is difficult or not possible for the system to reuse the capacity freed up by the cancelled trip.

While rural DRT systems generally seem to have less of a problem with no-shows and late cancellations than do urban systems, it is important to develop policies to address no-shows and late cancellations as well. While it is often a small subset of the riders who frequently abuse the policies, enforcement is also important.

Performance improvements. The following improvement was reported:

- **Reduced no-shows:** Several of the participating rural systems noted performance benefits from enforcement of their no-show policies (see Table 7-3). While the policies vary, the managers spoke to the critical role of enforcement: it is not enough to just adopt and publish a policy.

Develop and enforce a cancellation policy. While cancellations do not have the same negative consequence on DRT performance as no-shows or late cancellations, they do have an impact, particularly when cancellations become excessive. When riders book trips and the trips are placed on vehicle schedules, they occupy space on the DRT system. Subsequent trip requests are then placed around those trips, and this can impact the times scheduled for those riders with subsequent requests. It may even impact the availability of a trip for riders with subsequent requests. When scheduled trips are later cancelled, they become "holes" in the schedule. Some of those "holes" will be re-filled with trip requests made later so that the capacity is re-used. However, the process of trip-taking, scheduling, and then canceling trips takes staff time; when there are many cancellations, this has to be seen as detrimental to DRT performance.

Table 7-3. Experience with no-show policy enforcement.

No-Show Policy	Performance Effects
Policy of multi-county rural system states: if 3 no-shows within a 2-month period, rider can be suspended for 1 week. Rider must pay for each no-show trip. If rider exceeds $50 in unpaid no-shows, service is suspended until fares are paid. Policy strictly enforced starting in FY07.	No-show rate decreased from more than 15% to 1% after enforcement.
Policy of rural county-based system requires trips to be cancelled at least 1 hour before the scheduled trip; 3 no-shows in a 30-day period may result in service suspension.	Enforcement of policy implemented in 2000 has decreased no-shows by one-half, from an estimated 4% of trips to 2%.
Multi-county system's policy states that trips must be cancelled 24 hrs before trip pick-up time or by 4:00 P.M. the day prior to trip. If trip is not cancelled and rider does not appear for trip, it is counted as a no-show. Three no-shows in a 60-day period may result in suspension of service. System began strict enforcement with suspensions given to a small number of frequent offenders.	No-show rates decreased: • FY05 3.7% • FY06 2.8% • FY07 2.6%
Two-county rural system with about 60% subscription riders, many from human service agencies, states in "Riders Guide" that "excessive no-shows may result in suspension of service." A cancellation less than 2 hours before pick-up is counted as a no-show, unless dispatch can re-route the vehicle. Human service agencies charged the fare when one of their clients/riders no-shows, a practice that gets the attention of and help from the agency in dealing with the offending rider.	No-shows are not seen as a major problem, at 1% or less of total scheduled trips.

One of the participating rural systems has developed a policy to combat excessive cancellations, in addition to its policy for no-shows and late cancellations. This county-based system found that many riders were booking trips as "back-up" in case their preferred transportation plans fell through. When these riders found they did not need their scheduled DRT trips, they cancelled, and this became increasingly time-consuming for the DRT staff. To address this, the DRT system adopted a policy that states that riders who cancel more than 30% of their scheduled trips in a 1-month period may be suspended from service for 1 month. The DRT system indicates that it has had to enforce this policy only infrequently as it sends a warning letter to offenders prior to any suspension and works with riders when there are medical or other mitigating reasons for the cancellations.

Another approach to excessive cancellations is to reduce the advance reservation time period. This was not articulated by any of the rural DRT systems participating in the research as a performance action, but was commonly cited by urban DRT systems in the first phase of the research and is discussed below.

Other Improvement Actions

In addition to the improvement actions identified by the rural DRT systems in the research project, there are other policies and procedures that may help improve performance.

Shorten advance reservation period to reduce trip cancellations. Reducing the advance reservation window for DRT service was a strategy that a number of DRT systems participating in the urban phase of the research have taken, with positive results in terms of reducing the number of cancellations. One system also saw a small decrease in the number of no-shows.

When advance reservation periods are lengthy, riders may book trips weeks in advance and then find their trip needs change over that time period. With shorter advance notice time periods, riders should be more sure of their plans when they book their DRT trips and less likely to cancel. There may even be fewer no-shows as riders may be less likely to forget a scheduled trip with a shorter time period between booking and taking a trip.

Many systems, rural and urban, use a 14-day advance reservation window for scheduling trips. This was the time period required for ADA complementary paratransit systems by the ADA regulations when first promulgated in 1991. However, through amendments made in 1996, this requirement was changed and now ADA paratransit systems are required to accept trips, at a minimum, on a next-day basis; no longer is there a requirement to accept trips 14 days or even 2 or 3 days in advance.[1] The longer time period allowed for riders to make trip reservations was believed to contribute to both additional calls for canceling and rescheduling trips during that 2-week time period as well as to result in additional no-shows or same-day cancellations because riders had forgotten their trips booked two weeks ago or had last minute changes to their travel plans (*33*).

Many rural DRT systems do not provide any ADA paratransit service. Despite this, a 14-day advance reservation window is the most common policy based on the rural systems in the research project (see Table 7-4). While some of the systems indicated that riders do not always begin booking trips as far in advance as the policy allows, others noted that trip times and availability are more open the farther out that riders book. Of the 16 rural systems participating in the research that have formal advance reservation time periods, 9 use a 14-day advance reservation window.

Table 7-4. Advance reservation windows used by rural systems in research project.

Length of Advance Reservation Time Period	No. of Systems
3 business days	1
7 days	3
14 days	9
30 days	3

[1] Should an ADA paratransit system change its advance reservation scheduling window, it must ensure public input and participation in developing changes, in keeping with ADA regulations.

To the extent that a rural system has excess cancellations, shortening the window can be an effective approach. Based on the urban phase of the research project, urban DRT systems that reduced their windows indicated that the action was beneficial, reducing cancellations and the staff time and effort needed to handle them. One system, for example, which reduced its 14-day advance reservation window to 7, saw a reduction in its cancellations from 22% of trip reservations to 18%, with the reduction happening in the first month of the change.

Table 7-5. On-time definitions used by rural systems participating in research project.

On-Time Definition	No. of Systems
On-time if reach destination by promised time	2
10-min window	1
15-min window	2
20-min window	1
30-min window	6
1-hr window:	
+/– 30 min.	1
+ 45 min. / –15 min.	1

Establish on-time pick-up window. While rural DRT systems are less likely to formally measure the timeliness of their pick-ups (or their drop-offs) than their urban counterparts, many rural systems have established pick-up time windows or policies for their riders. Of the rural systems participating in the research, 14 have defined policies for "on-time" DRT service, with 12 having established "windows" of on-time (see Table 7-5).

The remaining systems either do not have defined policies on DRT timeliness or operate as immediate response. At least two of the latter systems informally measure the response time for their service, which is the time difference, in minutes, between when the rider calls for service and when the vehicle arrives.

It is noted that there is no one measure of on-time that is appropriate for all DRT systems. The length of the on-time window should be set based on DRT system policies and other local and service area conditions. A 30-min on-time window—typically operationalized as 15 min before the scheduled pick-up time to 15 min after—is the most common on-time window for urban DRT systems and, based on the rural systems participating in the research project, also the most common for rural systems that define a window.

While the majority of the participating rural DRT systems have defined "on-time" for their service, only one of these systems formally reports its on-time trip percentage on a routine basis.

Trip timeliness is perhaps the most important single measure of service quality from a DRT rider's perspective. DRT managers typically have an informed sense of how timely their service is, and, if there is a complaint about a late trip, typically the operator's manifest can be checked to assess the trip specifics. However, a formal process for monitoring DRT timeliness would provide the system with routine data for measuring this aspect of DRT service quality.

This Guidebook suggests that rural DRT systems should measure and report their on-time data, at least on a sampling basis. Chapter 4 of the Guidebook provides suggestions on data collection and performance measure calculation for on-time performance.

Establish wait time policy. In addition to a policy for an on-time window, DRT systems should establish a wait time policy, defining how long the DRT vehicle will wait for a passenger at the pick-up location. Such a policy is important as it provides a defined time period, after which the vehicle may depart for the next location on its schedule. Waiting for excess amounts of time for riders at pick-up locations unnecessarily delays the vehicle, inconveniences other passengers who might be on the vehicle, and adds to unproductive time for the DRT system, which will negatively affect performance.

A defined wait time policy is also important for enforcing a no-show policy. With establishment and articulation of the wait time policy to riders, the DRT system makes clear the time period after which a rider may become a no-show. Waiting excess amounts of time for a rider who then is a no-show, again, unnecessarily delays the vehicle and negatively affects performance.

Of the rural systems participating in the research project, most have defined wait times for passengers at pick-up locations. The most typical is 5 min, although some use 3 min. One of the systems that is predominately immediate response service noted that it is considering going to a 2-min wait time. Interestingly, a few systems stated that their wait time is "3 to 5 minutes." From a policy perspective as well as an operational perspective, it is better to state only one time, providing a uniform and standard time that can be used by vehicle operators and dispatchers as well as riders.

Establish policies and procedures for bad weather operations. DRT systems must ensure that they have well-articulated procedures in place for operations in bad weather—for example, during snowy and icy weather—to minimize the potential for accidents due to poor road conditions or passenger accidents from icy walkways. Operators need to be trained and continuously retrained during the appropriate seasons about the particular policies and procedures.

These policies and procedures also need to be explained to riders and, as appropriate, to the human service agencies with which they are affiliated. This allows the riders and agencies to better plan trips during bad weather seasons, including, for example, if bad weather impacts trips mid-day before riders' return trips home have been completed.

Educate riders on policies and procedures. Educating DRT riders on how to use the demand-response transportation service can be a strategy that helps riders use the DRT system more effectively and responsibly. While DRT systems typically have training and re-training programs for their staff, systems may neglect this function for their riders and the agencies that serve them. Riders who are well educated and knowledgeable about the policies and procedures of the system can contribute significantly to a well-functioning system.

Education programs can be targeted to all riders or to specific groups of riders (e.g., subscription riders or riders traveling for certain trip purposes such as dialysis) as well as to the various human service and other agencies whose clients use the DRT system. One of the urban DRT systems participating in the first phase of the research project found that its average dwell time at pick-up locations decreased measurably after its formal education campaign, which reinforced to riders that "you need to be ready to leave at the *start* of your on-time window."

Importantly, educating riders should not be seen as a one-time effort. It must be something that is sustained and repeated on a periodic basis, both to reinforce the information to long-time riders and to make it available to new riders. Education efforts for riders should be complemented with efforts to educate vehicle operators and other DRT staff as well, so staff understands what is expected of them and what is expected of the riders. Given the interdependency between riders and DRT staff and particularly vehicle operators, such education efforts can improve the functioning of the DRT system and its performance.

Since riders of rural DRT systems are frequently clients of human service agencies that have arrangements with the DRT system, it is also important that the DRT system educate staff at those agencies on the policies and procedures of the transportation service. In this way, the human service agency staff understands what the DRT system can, and cannot, do. The agency sponsors can also then help their clients as appropriate with transportation issues and more importantly resolve issues that might arise with the DRT system. This has been the experience reported

Good Things to Know . . .

- Be ready to be picked up 15 minutes early
- Drivers will wait for you about 5 minutes
- *It's the law* ... passengers must wear seat belts
- For everyone's safety, there can be no smoking, eating or drinking in Bay Transit vehicles
- Although we know how much you appreciate your driver, tipping is not allowed
- Weather conditions may cause cancellation of bus service, please listen closely to local radio stations for information
- Children under 12 years of age must be accompanied by an adult to ride on Bay Transit

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by one of the rural systems included in the research project in relation to no-shows. This transit system works with its sponsoring human service agencies when one of the agency clients has excessive no-shows, addressing issues or problems that the particular rider might be having. This transit system also charges the local agency the fares for any no-show trips incurred by its clients so that the agency shares with its riders the responsibility for following the system's policies and procedures.

Funding

The issue of funding for DRT received significantly more attention during the rural phase of the research project than during the urban phase. Managers of the rural systems participating in the project frequently singled out strategies that they had taken to secure funding and specifically local funding.

According to 2007 Rural NTD data, collectively the country's rural systems (with over 1,300 systems reporting) spent somewhat over $1 billion for annual operating expenses. Operating subsidies to support these systems came from the federal government, composing 34% of total operating subsidies, from state governments at 25%, and from the local level at 40%. Funds from the local level are the largest single share of operating subsidies and are clearly important for rural transit systems, particularly where state support is limited.

Improvement Actions Reported by Participating Rural Systems

Get involved in the community, build relationships, and gain funding. Managers of several of the participating rural systems described active and purposeful involvement in their communities, which has led to partnerships or agreements with local governments and businesses that result in financial support for the transit system. PAT, a primarily-municipal system in Virginia, for example, spends concerted effort to get involved in the community. The manager belongs to the Chamber of Commerce, visits new businesses that come to the community, participates in local events often with one of the transit vehicles, and develops brochures and handouts that showcase his transit system. This material includes data on ridership specifically to major destinations served by transit such as the hospital, community college, and a large retailer, which the manager then shows to those specific entities—evidence of the transit system's role in bringing passengers to those destinations. In addition to significant local funding from the city and county (which provided 24% of total operating revenue for FY07), PAT has received funding from local businesses. This includes a considerable contribution from the local Wal-Mart that funded Saturday service for a number of Saturdays (the system operates weekdays only) as well as $50 from a local fast food restaurant—a very small amount but meaningful in that the small business even considered support for local transit.

The manager of a rural system in Maryland, GTS, has spent concerted efforts to build relationships with local county leaders, communicating the transit system's important role in the county. These efforts helped secure a significant funding commitment from the county, which was the first time the county had funded public transit. These funds were used as match for seven new vehicles, an important performance improvement strategy when many vehicles in the 30+ vehicle fleet were miles beyond their useful life. Funding from the county has continued, now contributing about 17% to the total operating budget.

Another participating rural system, Moscow Valley Dial-A-Ride and Paratransit, specifically cites strong community involvement as helping the transit system generate in-kind and local match funding support. For example, the local match for one of the system's recent vehicle purchases was provided in full by a local medical center. This contribution was acknowledged on the side of the vehicle, giving the medical center credit for its support. The local match for a second vehicle was funded by a local community foundation and a private individual who owns local rental properties as well as by the city. Their contributions were also acknowledged on the side of the vehicle.

In Pierre, South Dakota, all staff members of River Cities Public Transit are encouraged to be involved in the community in a professional capacity as well as in their personal lives. Relationships are developed, trust is built, and awareness is raised through this involvement, strengthening the standing of the system in the community and supporting its coordination efforts.

Interestingly, active involvement in the community by transit managers in rural and small urban communities has been found in prior research to be one of a number of characteristics of the more innovative small transit systems (*34*). This *active involvement* was found to include a variety of approaches such as membership in the Chamber of Commerce and other community organizations, frequent communication of the transit system's achievements at local events and forums, efforts to seek out and respond to community transit needs with new transit services, and having an entrepreneurial orientation—all of which helped the transit system to gain visibility and support throughout the community and to secure local funding commitments.

Establish effective payment schemes for human service agency clients/riders. Providing transportation for clients of local human service agencies is a common practice for rural DRT systems. Such transportation can be provided through formal contract agreements or more informal arrangements. The rural system must ensure, however, that the mechanism for paying for that transportation is workable and effective from the transit system's perspective.

A number of the smaller rural systems have arrangements so that the agency riders use tickets or punch cards for trip payment, with the agencies purchasing the fare media directly from the transit system and then providing that to their clients, either at the full or discounted price. As another approach, one of the participating rural systems invoices each of the human service agencies for which it provides service a flat rate per month per client. Previously, the transit system invoiced for individual trips, but the administrative time required for individual client trip tracking and invoicing was burdensome, and the transit system changed to the monthly flat rate per client scheme. Another rural system found its invoicing practices difficult until it implemented a CASD, which greatly facilitated the monthly billing procedures for contracting human service agencies and also reportedly made it more accurate. This county-based rural system generates about $4,000 monthly in passenger fares from riders sponsored by the local department of social services.

Sell advertisements on vehicles. Several of the participating rural systems sell bus wraps, either window or side wraps. Albert Lea Transit, a four-vehicle rural system in Minnesota, generates about $5,000 in advertising revenues from bus window wraps. This is a way for local businesses, which are reportedly supportive of local transit, to contribute to its operating costs. This system has also negotiated an advertisement trade with the local radio station, which is worth about $6,500 per year. The transit system places ads for the station on its vehicle exteriors in exchange for free advertising on the radio. Bay Transit in Virginia generates about $5,000 annually in ads placed on the back of some of its vehicles. While the transit systems acknowledged that the "traveling billboards" do not generate significant amounts of funds, all sources are important where funding is a perennial concern.

One of the participating systems noted that it did get a few concerned comments from the community as several callers complained that riders could not see out of the bus windows that were wrapped. Perhaps ironically, these were not riders of the system, as the wraps do not obscure visibility for the riders. But this may be an issue to address with the community at the outset if a system is introducing bus wraps.

Marketing, Public Relations, and Passenger Relations

Transit marketing and public relations are sometimes considered to be just advertising and promotion for the service. Yet, a comprehensive marketing program can do more than just attract new passengers—it can also create community support for the transit system, helping to ensure that public transit is seen as a beneficial community service, which then helps secure local funding for the transit system. In this way, then, one of the management actions described earlier by rural systems participating in the research—to get involved in the community, build relationships, gain funding—can also be considered marketing. However, managers of participating rural systems specifically linked that action to funding, so it is included under that heading. Nonetheless, it is clear that a transit system's involvement and participation in the community—through membership in local civic organizations, speaking engagements, participation at local community events, and so forth—are also part of marketing and public relations. Beyond involvement in the community to build support for rural transit, there are other actions identified by rural DRT systems that participated in the research.

Improvement Actions Reported by Participating Rural Systems

Focus marketing efforts on the general public. Many rural transit systems are provided by senior service or other human service agencies and, in some cases, their transit services originated as specialized services for seniors or other specialized rider groups. The general public may not realize that the transit service is open to all riders.

Several of the participating systems reported that they developed specific marketing efforts targeted to the general public, advertising the fact that their transit services are for everyone in the community. These efforts included designing and placing decals on the vehicles advertising that the transit service is "open for all riders," distributing flyers and writing press releases that clearly state that service is open to everyone in the community, and ensuring that system brochures and other rider informational pieces stress that the service is open for all members of the community.

Advertise with campaign/yard signs. One of the rural systems designed and purchased a large number of "campaign" or "yard" signs, 18 x 24 in. corrugated plastic board signs with wire stakes for inserting the signs into the ground. These were placed alongside the rural roadways in the system's service area, advertising "Anyone Can Ride Anywhere for $3.00" in the listed five counties. This advertising campaign was highly successful, with ridership increasing more than 10% the following month. Phone calls to the transit system also increased significantly, with many new callers asking about the service. It should be noted that some governments restrict these signs from highway rights-of-way under their jurisdiction for safety reasons.

Identify "point person" at human service agencies to help address rider issues. VTA in Dukes County, Massachusetts, reported the importance of identifying and building a cooperative relationship with one key person at each of the local human service agencies which the DRT system serves to help resolve rider-related issues. When there are issues with a specific rider that impact DRT service (e.g., the rider's wheelchair has safety problems or a rider seems uncharacteristically disoriented), the transit system can work with that agency individual to cooperatively address the problem. In this way, the transit system can leverage help in dealing with issues of its riders that impact transportation operations.

For most rural DRT systems, many riders are clients of local human service agencies or are affiliated with an agency. Often the riders are elderly and they may not have family close by. In some cases, the rural system has evolved from an agency-operated service that was as much social service as transportation. Thus, many rural transit systems find that they must address more than just transportation for their riders.

By building a cooperative relationship with a key person at the various human service agencies at the front end, the rural transit system can greatly facilitate addressing the social service–related aspects that can rise for its riders. When this "point person" can help the rider with a safer mobility device or address new behavior issues that a DRT driver might observe, the DRT service will operate more efficiently and effectively.

Maintenance and Vehicles

Improvement Actions Reported By Participating Rural Systems

Ensure effective preventive maintenance practices. Maintenance costs may consume roughly from 15% to 20% of a transit agency's operating budget, depending on a variety of factors. Costs for the maintenance function may be controlled, in part, by having an effective and thorough preventive maintenance (PM) program. The PM program should be developed in accordance to the type of vehicles that the DRT system operates. Performance of systematic, regularly scheduled maintenance at specified intervals will minimize breakdowns, road calls, and unscheduled maintenance problems—events that increase operating costs and affect performance. While none of the participating rural transit systems spoke specifically of the role that PM plays in their system performance, it is clearly important and the cornerstone of an effective maintenance program, which will benefit performance by helping to control costs and service interruptions.

Ensure effective mix of DRT vehicles. Having a fleet of different types of vehicles may provide some performance benefits, with impacts on operating and maintenance costs. Larger vehicles (e.g., 24-ft cutaway) will be more expensive to operate and maintain than the smaller paratransit vehicles (e.g., raised-roof van) because of both increased maintenance cost and increased fuel expense (*35*), but they provide more flexibility in terms of group loads. Smaller vehicles, including vans and sedans, are less expensive to operate and maintain and may be effective for much of the DRT system's service. Having a substantial number of accessible vehicles in the fleet will allow for greater flexibility in scheduling trips for riders who use mobility aids or otherwise need the use of a lift.

Many DRT systems use a mix of vehicle sizes and types to maximize cost-effectiveness in dealing with spatial and temporal variations in demand and ridership. Recent research has assessed DRT fleet size and mix from a theoretical perspective and suggests a modeling approach to determine the most effective mix, but recognizes that the approach is still very preliminary and that research into current mixed fleet practices would benefit the industry (*36*).

One of the participating systems that operates in a large multi-county region reported use of a new, more fuel-efficient vehicle. According to this system, this vehicle, commonly used by delivery services, is well-suited for smaller passenger loads traveling long distances. The savings on fuel have been significant, with the new vehicles costing one-third to fuel compared with more standard paratransit cut-away vehicles.

Safety

The participating rural systems did not frequently discuss safety in direct relation to performance improvements although several systems noted that they believed their vehicle operator training programs were comprehensive and contributed to a safer operating environment and fewer accidents. One system noted that it has provided the CTAA PASS program (a driver certification program) to its operators, offered through the system's state transit association, in addition to training to obtain CDLs. The transit manager credits these training programs with reduced insurance costs as well as fewer accidents and no wheelchair passenger–related incidents.

Improvement Actions Reported by Participating Rural Systems

Monitor incident and accident trends. DRT management should review and monitor incidents and accidents to look for commonalties or trends. For example, there may be certain locations with a higher than average accident rate, or there may be accidents resulting from the vehicle type or design (e.g., vehicle steps on a certain type of vehicle result in a relatively high number of passenger falls/injuries), or there may be certain operators that have had a disproportionate share of incidents or accidents. Such review and assessment are important in the effort to reduce unsafe or potentially unsafe occurrences. Accidents have a clear toll on a DRT system, often beyond the financial impacts.

Hill Country Transit District in Texas has developed a comprehensive approach to safety. In addition to a 3-week training program and annual refresher training for operators, the rural system has a thorough accident investigation process. A supervisor trained in accident investigation goes to each accident site with a camera and accident forms to collect data on the incident. This information is assessed in conjunction with an accident review committee which, among other responsibilities, determines fault, mitigating circumstances, and safety of the particular location.

Involve operators in a safety committee. A DRT system might consider establishing a safety committee that includes vehicle operator representatives as well as supervisors and representatives from maintenance. Such a committee should be tasked with reviewing all accidents to assess their preventability/non-preventability and with considering actions as appropriate to address the accidents and strategies to prevent them. A safety committee provides an ongoing mechanism to help review and assess accidents and also gives the employees and particularly vehicle operators some "ownership" over the system's safety record.

Hill Country Transit District's accident review committee, part of its comprehensive approach to safety, is composed of the system manager, the fleet manager, the operator involved in the accident, that operator's supervisor, and another operator. After a determination of fault is made, the committee without the two operators determines the discipline that may be needed. With its comprehensive approach, the rural system, operating in a large multi-county service area with close to 50 vehicles in peak service, has seen its accidents decrease from an annual average of nine from 2005 to 2007 to none in 2008.

Reward safe operators. Many transit systems including DRT systems have established an incentive/reward program that recognizes operators with safe driving records. This specifically rewards individual safe operators and also provides appropriate role models for other operators. In addition to awards such as gift certificates or similar items, a "winning" operator might be offered the opportunity to compete in a regional or state bus roadeo, where bus operators compete against each other in various skill areas related to passenger service.

Establish a "culture of safety." Transit systems may improve their safety record by establishing an agencywide commitment to safety, with a continuing strong focus on safe operations through various ways. These include establishing a safety committee, developing system objectives tied to accident reduction, giving awards to safe drivers, providing daily safety announcements, and continually reinforcing the importance of safe operations.

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APPENDIX A

Rural NTD Data, Demand-Response-Only Systems, 2007 Report Year

Table A-1. Rural NTC demand-response-only systems, 2007 report year.

Service-Area Type	Low	High	Average	Standard Deviation	N
All Rural DR Only Systems					**479**
Passenger Trips per Vehicle-Hour	0.49	9.93	3.36	1.74	
Operating Cost per Vehicle-Hour	$11.85	$79.92	$34.33	$13.22	
Operating Cost per Vehicle-Mile	$0.75	$7.64	$2.32	$1.09	
Operating Cost per Passenger Trip	$2.54	$68.14	$12.55	$7.82	
Rural DR Only Systems Serving Predominately a Municipal Area					**102**
Passenger Trips per Vehicle-Hour	1.49	9.93	4.44	2.05	
Operating Cost per Vehicle-Hour	$15.05	$77.27	$34.33	$12.99	
Operating Cost per Vehicle-Mile	$1.31	$7.64	$3.12	$1.33	
Operating Cost per Passenger Trip	$2.54	$38.42	$9.07	$5.26	
Rural DR Only Systems Serving Predominately a Single County Area					**262**
Passenger Trips per Vehicle-Hour	0.49	8.98	3.13	1.49	
Operating Cost per Vehicle-Hour	$14.49	$79.92	$34.86	$13.67	
Operating Cost per Vehicle-Mile	$0.75	$5.93	$2.09	$0.85	
Operating Cost per Passenger Trip	$3.76	$68.14	$13.36	$8.38	
Rural DR Only Systems Serving Predominately a Multi-County Area					**115**
Passenger Trips per Vehicle-Hour	0.61	8.31	2.91	1.53	
Operating Cost per Vehicle-Hour	$11.85	$61.75	$32.84	$11.83	
Operating Cost per Vehicle-Mile	$0.79	$6.97	$2.13	$0.99	
Operating Cost per Passenger Trip	$4.66	$54.46	$13.77	$7.53	

Note: Systems with incomplete or highly questionable data were removed.

APPENDIX B

Summary Performance Data and System Characteristics by Individual System for Representative Rural DRT Systems, FY07 Data

Table B-1. Summary performance data and system characteristics by individual system for representative rural DRT systems, FY07 data.

Pass. Trips/ Veh. Hr	Op. Cost/ Veh. Hr	Op. Cost/ Veh. Mile	Op. Cost/ Pass. Trip	Computer-Assisted Sched./Dispatch?	AVL?	MDTs?	Reservation Window
Primarily Single Municipality Systems							
7.05	$35.23	$2.96	$5.00	N	N	N	Predominately same-day
4.01	$48.82*	$4.65*	$12.18*	Y	N	N	Advance reservation, up to 14 days in advance
3.53	$40.09*	$3.02*	$11.34*	N	N	N	Predominately same-day
3.19*	$47.47*	$2.57*	$14.89*	N	Y	N	Predominately same-day & up to 14 days in advance
2.96*	$36.66*	$2.67*	$12.37*	Y	N	N	Advance reservation, up to 14 days
2.38	$74.04	$5.84	$31.17	Y	N	N	Advance reservation, up to 30 days
Primarily Single County Systems							
6.23*	$67.09*	$5.60*	$10.77	N	N	N	Predominately same-day
5.75*	$45.16*	$2.92*	$7.85*	N	Y	Y	Predominately same-day & up to 7 days in advance
4.26	$32.47	$1.49	$7.63	Y	N	N	Advance reservation, at least 1 day
3.18	$57.65	$4.47	$18.12	N	N	N	Advance reservation, up to 14 days
2.86*	$43.41*	$2.73*	$15.16*	Y	N	N	Advance reservation, to 30 days
2.61	$40.50	$3.05	$15.54	Y	N	N	Advance reservation, up to 14 days
2.57*	$78.05*	$2.83	$30.38*	Y	N	N	Advance reservation, up to 7 days
2.53	$77.90	$5.75	$30.76	Y	Y	Y	Advance reservation, up to 14 days
2.43	$40.09*	$2.41*	$16.51*	N	N	N	Advance reservation
2.06*	$32.72*	$1.73*	$15.87	Y	N	N	Advance reservation, up to 14 days
Multi-County Systems							
4.34*	$34.66	$2.67*	$7.99*	Y	Y	Y	Advance reservation and some same-day
3.56	$42.27	$2.19	$11.88	N	N	N	Advance reservation, up to 14 days
3.15	$26.08	$1.16	$8.27	N	N	N	Advance reservation, up to 7 days
2.85	$33.70	$1.59	$11.82	Y	N	N	Advance reservation, up to 14 days
2.14*	$30.26	$1.40*	$14.13*	N	N	N	Advance reservation, at least 1 day
1.91	$29.31	$1.64	$15.37	Y	N	N	Advance reservation, up to 30 days
1.57	$32.69	$1.48	$20.76	Y	N	N	Advance reservation, 3 business days

*Adjusted data.

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation