

Research Results Digest 373

A TOOLKIT FOR REPORTING RURAL AND SPECIALIZED TRANSIT DATA—MAKING TRANSIT COUNT

This digest presents the results of NCHRP Project 20-65, Task 28, “An Analysis of Automated Transit Data Collection and Analysis Processes in State DOT Transit Units and a Toolkit for Next Generation Transit Data Analysis.” The research was conducted by the Texas Transportation Institute (TTI) under contract to Kittelson & Associates, Inc. The digest was prepared by Suzie Edrington, Assistant Research Scientist and Principal Investigator; Jonathan Brooks, Assistant Transportation Researcher; Kenneth Joh, Assistant Research Scientist; Michael Vickich, Senior Systems Analyst I; Matthew Sandidge, Assistant Transportation Researcher; and Linda Cherrington, Research Scientist and Transit Mobility Program Director.

BACKGROUND

Increased federal funding of rural transit and specialized service programs brings with it increased accountability requirements. The burden of reporting for these growing programs ultimately rests with the individual state Departments of Transportation (DOTs). These new requirements have emerged during a time when DOTs are challenged financially and are unlikely to be able to support additional staff to satisfy the new reporting needs.

Rural transit providers have also assumed this added responsibility during a time of scarce resources. The need for this research grew out of recognition that rural and specialized transit data are not consistently reported. Rural and specialized transit providers do not have a common understanding of the data definitions for National Transit Database (NTD) reporting; and robust data collection methods are not consistently utilized. State DOTs depend upon transit operators to provide quality data.

State DOTs need a set of tools to assist transit providers in understanding data

definitions and collection requirements, to help transit providers utilize performance data to manage service efficiency and effectiveness, to perform quality control checks on data, and to report data to the NTD and other stakeholders. Automation of the data collection process decreases the administrative burden.

The objective of this research was to identify state DOTs’ data reporting requirements to meet the Federal Transit Administration’s (FTA’s) requirements, and develop a set of tools to assist state DOTs and individual rural and specialized transit providers in data collection, analysis, management, and reporting. The objective was also to conduct an analysis of automated transit data collection and reporting processes in state DOT transit units. Tasks included a review of FTA’s requirements for rural and specialized transit data reporting; issuance of a questionnaire to DOTs to learn about data reporting collection processes and needs; and the preparation of mini-case studies to highlight DOT automated transit data collection and reporting processes.

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CURRENT STATE OF THE PRACTICE

To assess specific DOT data needs, the researchers developed a fact-finding questionnaire. The TTI research team selected five state DOTs to test the pilot questionnaire for this project: Texas, Florida, North Dakota, Georgia, and New York State. Texas, Florida, and New York currently have automated data collection processes and North Dakota and Georgia do not have automated processes for data collection.

The research team issued the questionnaire to the remaining 45 DOTs in November 2010. The team distributed the questionnaire to the contact for each state in the AASHTO Multi-State Technical Assistance Program (MTAP) *Technical Assistance Directory*. A TTI representative attended the 2010 SCOPT/MTAP Annual Winter Meeting December 6-10 and distributed a postcard regarding the questionnaire to encourage participation. Appendix A provides a listing of the questionnaire respondents.

Rural and Specialized Transit Data Collection

The questionnaire provided the researchers with information about how data are collected, what data elements are collected, how quality assurance of data is conducted, and how data are used, as well as the aid provided to transit agencies. Of the 50 state DOTs, there were 37 respondents to the questionnaire. A summary of responses to each question is available by contacting CRP staff and requesting Appendix B to the contractor's final report. Key points about current practices among state DOT reporting include the following.

Existing Data Collection and Reporting Tools

- The majority of the 37 DOT respondents to the questionnaire stated they do *not* provide a training course (62 percent) and do *not* provide a manual (75 percent) to transit agencies to aid in data reporting. The majority of DOT respondents stated DOT staff answers reporting questions (87 percent).

DOT Administrative Burden

- Based on the 37 DOT respondents, DOT staff oversees data reporting for an average of 29 rural transit agencies per DOT (ranging from one to as many as 87 agencies per DOT).

- Of the 37 DOT respondents, 29 DOTs oversee data reporting for specialized transit providers; each of the 29 DOTs oversees an average of 72 specialized transit providers (ranging from one to 210 agencies).

DOT Use of Data

- Ninety-five percent of the state DOTs that responded to the questionnaire stated that collected data is used to report rural transit NTD information. Of the respondents to the questionnaire, 58 percent use rural data as part of formula funding allocation and 50 percent use data for annual program reports. Forty-eight percent of responding state DOTs use specialized transit program data for annual reports and 43 percent use the data for FTA or state required reporting.

Automated Data Collection Systems

The questionnaire also collected information about automated data collection systems. The researchers collected information regarding receipt of data through automated systems, automated quality control checks, and technology used in training. The questionnaire asked each DOT about the ways in which the agency receives data from rural and specialized transit agencies. The technology used included email, fax, spreadsheet, database, and web-based data systems.

All 37 DOTs responded to the question, "How do you receive data from rural transit agencies?" Multiple responses could be chosen for each question. Eleven respondents (30 percent) indicated the DOT uses a web-based system to collect data. The majority use a written report (41 percent) and/or spreadsheets (51 percent) to collect data. Of the 37 DOT respondents, 29 collect data from specialized transit providers. Ten of the 29 (34 percent) use a web-based system to collect data. The majority of data are collected using written reports (48 percent) and/or spreadsheets (45 percent).

Representatives of each DOT were asked, "How does your DOT perform quality control checks on the transit agency data?" Of the 37 respondents, six DOT respondents indicated they used a technology-based method for quality control. Five of the respondents indicated that they "use an automated process looking for unusual changes between reporting periods." One DOT uses an

“online process that looks for unusual data but does not provide comparison reports.”

Three DOTs indicated use of technology in training including emailing instructions, providing instructions in an Excel file based report, and emailing updated reports to U.S. DOT. One agency is interested in developing more web-based training. Although webinar was listed as a possible training method, none of the agencies indicated its use.

CASE STUDIES OF STATE DOTs WITH AUTOMATED DATA COLLECTION SYSTEMS

As a result of the fact-finding questionnaire sent to the state DOTs, the researchers identified four DOTs that use automated systems for transit data reporting that may be instructive for other state DOTs and represent a variety of automated systems: Texas, Alabama, Utah and Iowa. The researchers conducted mini-case studies of these four state DOTs as a means of highlighting themes and trends of automated data collection systems. They also developed a set of questions as guidance and collected the case study information via telephone interview with DOT transit and information system staff. The guidance questions included the following:

- Can you provide a high-level overview of the collection system (functions, interfaces)?
- What are the system capabilities (data entry, data storage, automated quality control, reports)?
- Who accesses the system and how is access controlled?
- What is the history of the system?
- What is the previous system’s description?
- Why was a new system developed?
- What needs are met with the new system that the previous one did not meet?
- What are some other benefits of the new system?
- What are the software components of the system?
- What are the hardware components of the system?
- What are the information technology (IT) staff support requirements needed for the system?
- What common activities must IT perform and how much time does it take each month?
- What training resources are available for the system?
- Would you provide researchers documentation for the system?

From the case study results, the researchers developed a summary for each case study DOT including software utilized, hardware requirements, IT support requirements, and training resources. Chapter 12 of the resulting toolkit provides these case study summaries.

In all of the case studies, DOTs indicated that their systems were developed to fulfill the following functions:

- Provide a uniform interface for reporting the data.
- Centralize the data collection function to simplify reporting and data queries.
- Implement some level of automated quality control with the data entered into the system to reduce errors.
- Manage access to the data by utilizing user login accounts.

All of the case studies showed that DOTs with automated transit data reporting functions have similar system architectures comprised of a standard client-server model:

- The systems house the reporting data in a centralized database.
- The systems have their reporting and data entry business rules in a series of forms (typically hosted on a website).
- The systems present the forms to the user with a standard web browser interface.

Figure 1 shows the standard architecture and data flows used by the DOTs. Table 1 summarizes the software used by each of the DOTs in the case studies.

Since the architectures are similar, the requirement for the hardware to support the architectures is also similar. All of the case study examples utilize separate servers for data storage and for housing

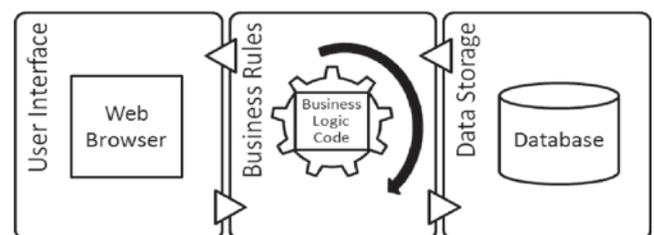


Figure 1 DOT case study standard architecture and data flows.

Table 1 Transit reporting software component summary.

DOT Transit Reporting System	Data Storage	Business Rules	User Interface
Texas DOT PTN-128	Oracle Database	Microsoft ASP.NET	Standard Web Browser
Alabama DOT TRS	Microsoft SQL Server Database	Microsoft ASP.NET/ Crystal Reports	Standard Web Browser/ Windows Forms Executable
Utah DOT PTT	Oracle Database	Oracle Application Express	Standard Web Browser
Iowa DOT Transit Reporting System	Oracle Database	Microsoft ASP.NET	Standard Web Browser

the business rules that are typically present on a machine hosting a web server. All of the systems allow users to utilize their own machines for interfacing into the transit reporting data.

IT support for the systems typically involves in-house DOT computer support staff for general hardware support (in the case of Texas DOT, contractor support) and a single programmer for actual support of the application. Training resources for the systems are provided in the form of user manuals with varying levels of detail. Existing staff members are also used as a resource for training.

- (75%) List of common definition errors and related corrective actions.
- (78%) List of items included in common expense categories of operations, maintenance, administrative, planning, and purchased transportation (including consideration of capital cost of contracting).
- (86%) Defining “contributed services” (in-kind/non-cash items) and how to report both contributed service revenues and expenses.
- (86%) Example forms to assist data collection efforts.

FINDINGS

The research findings reflect the researchers’ focus on the elements needed to develop the final rural and specialized transit toolkit. The summary of findings includes collection and reporting elements for rural transit providers, data needs for specialized transit providers, and automated data collection needs.

Collection and Reporting Elements

Respondents to the request for information identified the following as needs in a toolkit for data collection and reporting. The percent is the number of positive responses out of 37 respondents.

- (86%) Detailed definitions of data elements (e.g., passengers, revenue hours and miles, total hours and miles, operating expense, capital expense, revenues).
- (78%) Explanation of difference in definitions and data collection methods between fixed-route, deviated-route, flexible-route, and demand-response service.

Specialized Transit Data

State DOTs reported a wide range of reporting collection methods and information needs for specialized transit providers, from relying on state DOT staff conducting in-person, on-site visits to gather information from such providers to requiring that specialized transit providers report the same level of financial and operating data as rural transit providers. Ultimately, statutory requirements determine the level of data reported from specialized transit providers.

Automated Data Collection

The vast majority of DOTs use written reports and/or spreadsheets to collect rural and specialized transit data. The administrative burden of collecting, reporting, and performing quality assurance checks can be high without automated systems to assist. Without technology investment funding to implement automated data collection systems, DOTs will continue to rely on DOT staff to assist transit providers in data collection, reporting, and quality control.

CONCLUSIONS

As rural and specialized transit programs continue to be an integral part of the nation's transit system, accountability requirements in reporting data for these growing programs rest with the individual state DOTs. DOTs indicated a need to better equip rural and specialized transit providers with tools to collect and report information to better ensure consistency and quality of data reported. Based on DOT feedback, the research team developed a toolkit with detailed definitions of data elements, explanation of differences in definitions and data collection methods between transit modes of service, a list of common definition errors and related corrective actions, a list of items included in common expense categories, further explanation of certain financial categories, and example forms to assist data collection efforts.

In determining which data elements to include in the toolkit, researchers focused on *rural* NTD data elements and added elements if a majority of DOTs stated additional data elements are collected from transit agencies. For operating data elements, researchers included in the toolkit both rural *and urban* NTD operating data categories. For example, urban NTD requires both vehicle revenue miles and total vehicle miles to be reported where rural NTD requires only vehicle revenue miles.

- For sources of funding data elements, researchers used the rural NTD funding data elements that capture funding categories relevant to both rural and specialized transit agencies. Urban funding source data elements provide a further breakout of revenues such as taxes that are not associated with rural and specialized funding sources.
- For operating and capital expenses, researchers included an expanded breakdown of operating and capital expenses beyond NTD requirements. NTD requires one total amount to be reported for operating and capital expenses. Seventy percent of DOT respondents stated transit agencies are required to report further breakout of expense categories.

The resulting toolkit, *A Toolkit for Reporting Rural and Specialized Transit Data: Making Transit Count*, is presented in Appendix C. The toolkit is based upon data requirements of FTA-funded programs and specific additional data needs expressed

by state DOTs. Approaches and practices that have been used successfully in collecting, managing, and reporting data for rural transit and specialized transit service programs are presented for state-administered transit program use. This toolkit enhances the NTD Rural Reporting Manual in further clarifying data definitions, providing methodology for data collection, listing common reporting errors, listing and explaining expense and revenue categories, providing a quality control checklist for reviewers of data, and providing information on performance measures. The toolkit also provides an overview of considerations in developing and implementing an automated data collection system. The toolkit has 12 chapters. Chapter 1 is the introduction to the toolkit and the remaining chapters 2 through 12 provide the body of the toolkit.

The toolkit is presented as an appendix to the digest for two reasons: 1) it allows for a variety of sample materials from transit providers and other resources to be interlaced throughout the toolkit chapters, and 2) it presents a stand-alone, user-friendly toolkit format to appeal to the target audience. The toolkit provides uniform data collection methods and data definitions for transit providers and state DOT staff to use as a guide in collecting and consistently reporting data.

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APPENDIX A. QUESTIONNAIRE RESPONDENTS

The following state DOTs completed the pilot:

- Florida
- Georgia
- New York
- North Dakota
- Texas

The following state DOTs completed the questionnaire:

- Alabama
- Alaska
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- Idaho
- Illinois
- Indiana

- Iowa
- Louisiana
- Maryland
- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Missouri
- Montana
- Nebraska
- Nevada
- New Hampshire
- Oklahoma
- Oregon
- Pennsylvania
- South Carolina
- Utah
- Vermont
- Virginia
- West Virginia
- Wisconsin
- Wyoming

APPENDIX B. SUMMARY OF QUESTIONNAIRE RESULTS

Appendix B to the contractor's final report provides a summary of responses to each question. Appendix B is not reproduced in this digest but is available on request by contacting CRP staff.

APPENDIX C.

**A TOOLKIT FOR REPORTING
RURAL AND SPECIALIZED
TRANSIT DATA**

—MAKING TRANSIT COUNT

2012

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM
PROJECT 20-65, TASK 28, APPENDIX C

Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act of 1990
ALDOT	Alabama Department of Transportation
AO	Automobile (Vehicle Type)
APC	Automated Passenger Counter (Equipment)
ARC	Association of Retarded Citizens
ARRA	American Recovery and Reinvestment Act of 2009
BR	Over-the-Road-Bus (Vehicle Type)
BU	Bus (Vehicle Type)
CB	Commuter Bus (Transit Mode)
CU	Cutaway (Vehicle Type)
DHHS	United States Department of Health and Human Services
DOJ	United States Department of Justice
DOTs	Departments of Transportation
DR	Demand-Response (Transit Mode)
DT	Demand-Response Taxi (Transit Mode)
ERF	Electronic Registering Farebox (Equipment)
FB	Ferryboat (Transit Mode and Vehicle Type)
FEMA	Federal Emergency Management Agency
FTA	Federal Transit Administration
GIS	Geographic Information Systems (Software)
GPRA	Government Performance and Results Act of 1993
HOV	High Occupancy Vehicle (Lanes or Facilities)
HUD	Housing and Urban Development Programs
ID	Identification
IT	Information Technology
ITS	Intelligent Transportation Systems
JARC	Job Access and Reverse Commute (Section 5316)
MB	Bus (Transit Mode)
MDT	Mobile Data Terminal System (Equipment)
MV	Minivan (Vehicle Type)
NTD	National Transit Database
OMB	Office of Management and Budget (White House Office)
OR	Other (Vehicle Type)
PT	Purchased Transportation
PTT	UDOT Public Transit Team Online Application for Transit Reporting
ROW	Right-of-Way
SAFETEA-LU	Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users
SB	School Bus (Vehicle Type)
SCOPT	Standing Committee on Public Transportation
SV	Sports Utility Vehicle (Vehicle Type)
TCRP	Transit Cooperative Research Program
TRS	ALDOT Transit Reporting System
TxDOT PTN	Texas Department of Transportation: Public Transportation Division
UDOT	Utah Department of Transportation
UPT	Unlinked Passenger Trips
U.S. DOT	United States Department of Transportation
USOA	Uniform System of Accounts
VMTR	Vehicle Miles Traveled Reduced
VN	Van (Vehicle Type)
VP	Vanpool (Transit Mode)

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Chapter I. Introduction

Get Acquainted with the Toolkit

Federal funding of rural transit and specialized transit service programs brings increased accountability requirements. Uniform data collection methods and data definitions among transit providers results in complete and consistent reports. State DOTs need systems which:

- assist providers in understanding data definitions and collection requirements;
- collect data from state-administered transit providers;
- perform quality control checks on these data;
- report these data to the NTD and other stakeholders;
- help providers utilize performance data to improve service efficiency and effectiveness.

The objective of this toolkit is to provide a set of tools that assist in collecting, managing, and reporting data for rural transit and specialized transit service programs.

1.1 RELATIONSHIP TO FTA NTD MANUAL

NTD is FTA's primary national database for statistics on the transit industry. Recipients of FTA's Urbanized Area Formula Program (§5307), and Other than Urbanized Area (rural) Formula Program (§5311) are required by statute to submit data to the NTD. The FTA provides an NTD Rural Reporting Manual as guidance for data reporting requirements.

This *Toolkit for Reporting Rural and Specialized Transit Data* includes both the NTD rural data elements as well as additional data elements identified by DOTs during the research. The toolkit definitions for data elements are consistent with NTD. In this way, data are reported consistently whether reported to NTD, state DOTs, or other stakeholders. Data definitions can vary from transit provider to transit provider. Without a common understanding of terms, definitions, and rigorous data collection methods, differences in reported data will exist.

This toolkit enhances the NTD Rural Reporting Manual in further clarifying data definitions, providing methodology for data collection, listing common reporting

errors, listing and explaining expense and revenue categories, providing a quality control checklist for reviewers of data, and providing information on performance measures.

1.2 TOOLKIT ORGANIZATION

The toolkit has 12 chapters. Chapter 1 is the introduction to the toolkit. The body of the toolkit is arranged as follows:

- **Chapter 2** focuses the toolkit by defining rural and specialized transportation. A brief overview of the federal reporting and state reporting requirements is provided as a point of reference for other chapters in the toolkit.
- **Chapter 3** provides a framework for reporting data by defining transit modes. An understanding of transit modes is important, as data collection methods differ by transit mode.

To improve consistency in data definitions, collection of data, and reporting, Chapters 4 through 9 address data definitions and data collection practices for reporting operating and financial data elements. Common errors in data reporting are outlined. Terms and definitions established through NTD are used as a base.

- **Chapters 4 and 5** focus on reporting of operating data to include passenger counts, service hours, and miles. These chapters provide definitions, collection differences by modes, collection examples, and common reporting errors for these reporting data elements.
- **Chapters 6 and 7** focus on reporting of financial data to include funding sources and expenses. These chapters define accrual accounting, clarify reporting of funds applied versus funds earned and operating versus capital expenses, provide detailed information on revenue and expense categories, and discuss common reporting errors.
- **Chapters 8 and 9** define vehicle and safety reporting requirements consistent with NTD.
- **Chapter 10** provides information on managing data and using data to provide performance information.
- **Chapter 11** discusses considerations in reporting of specialized transit services.
- **Chapter 12** of the toolkit provides an overview of considerations in developing and implementing an automated data collection system.

Chapter 2. Rural and Specialized Public Transportation

The Fundamentals

The purpose of this chapter is to provide background on rural and specialized public transportation data reporting requirements and needs. This chapter establishes a starting point for the following chapters.

2.1 DEFINING RURAL AND SPECIALIZED PUBLIC TRANSPORTATION

Public transportation is defined in the Federal Transit Act as transportation by a conveyance that provides regular and continuing general or special transportation to the public, but does not include school bus, charter, or intercity bus transportation or intercity passenger rail transportation provided by the entity described in chapter 243 - Amtrak (or a successor to such entity) (49 U.S.C. Chapter 53 2005).

Rural general public transportation is defined as agencies receiving Federal Section 5311 Other than Urbanized Area (rural) Formula Program funds. The FTA goals for Section 5311 are:

- to enhance the access of people in non-urbanized (rural) areas to health care, shopping, education, employment, public services, and recreation;
- to assist in the maintenance, development, improvement, and use of public transportation systems in rural areas;
- to encourage and facilitate the most efficient use of all federal funds used to provide passenger transportation in non-urbanized (rural) areas through the coordination of programs and services;
- to assist in the development and support of intercity bus transportation; and
- to provide for the participation of private transportation providers in non-urbanized transportation to the maximum extent feasible.

2.1.2 Specialized Public Transportation

Specialized public transportation can be defined as public transportation programs funded to support target populations. Key federal programs which help fund specialized transportation include:

- *Medicaid* – administered by U.S. Department of Health and Human Services (DHHS) Health Care Financing Administration
- *Title III, Part B: Grants for Supportive Services and Senior Centers* – administered by DHHS Office of the Secretary, Administration on Aging
- *Section 5310 Special Needs of Elderly Individuals and Individuals with Disabilities* – administered by U.S. DOT FTA
- *Section 5316 Job Access and Reverse Commute (JARC)* – administered by U.S. DOT FTA
- *Section 5317 New Freedom Program* – administered by U.S. DOT FTA
- *Temporary Assistance for Needy Families* – administered by DHHS Administration for Children and Families
- *Veterans Medical Care Benefits* – administered by U.S. Department of Veterans Affairs Veteran Health Administration
- *Vocational Rehabilitation Grants to States* – administered by U.S. Department of Education Office of Special Education and Rehabilitative Services

Of the key federal programs that fund specialized transportation services, DOTs most commonly administer Section 5310, Section 5316 JARC, and Section 5317 New Freedom grant programs. Since the Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was authorized in August 2005, the FTA has increased or introduced new funding for these specialized public transportation programs. This toolkit focuses on these three programs. A brief description of these three programs is as follows:

- *Section 5310 Special Needs of Elderly Individuals and Individuals with Disabilities.* Section 5310 provides formula funding to states for the purpose of assisting private non-profit groups in meeting the transportation needs of elderly individuals and individuals with disabilities when the transportation service provided is unavailable, insufficient, or inappropriate to meeting these needs.
- *Section 5316 JARC.* The JARC program addresses the unique transportation challenges faced by individuals seeking to get and keep jobs.

- *Section 5317 New Freedom.* The New Freedom program is a new category of funds introduced in SAFETEA-LU. The purpose of this program is to provide new public transportation services and public transportation alternatives beyond those currently required by the Americans with Disabilities Act of 1990 (ADA). This public transportation program is to assist individuals with disabilities with transportation, including transportation to and from jobs and employment support services.

2.2 FEDERAL REPORTING REQUIREMENTS

The federal government requires reporting of rural and specialized transit data that are legislatively specified. This section briefly outlines the federal requirements.

2.2.1 Rural Public Transportation Federal Reporting Requirements

Rural public transportation providers are required to report operating and financial data to the FTA through NTD. The legislative requirement for the NTD is found in Title 49 U.S.C. 5335(a):

Section 5335 National Transit Database

- (a) National Transit Database – To help meet the needs of individual public transportation systems, the United States Government, state and local governments and the public for information on which to base public transportation service planning, the Secretary of Transportation shall maintain a reporting system, using uniform categories to accumulate public transportation financial and operating information and using a uniform system of accounts. The reporting and uniform system shall contain appropriate information to help any level of government make a public sector investment decision. The Secretary may request and receive appropriate information from any source.
- (b) Reporting and Uniform Systems – The Secretary may award a grant under section 5307 or 5311 only if the applicant and any person that will receive benefits directly from the grant are subject to the reporting and uniform systems.

SAFETEA-LU amended the NTD provisions to establish annual reporting requirements for recipients and beneficiaries of Section 5311 grants. Additionally, Title 49 U.S.C. 5311 (b)(4) was amended to provide certain specifications of the NTD reporting requirement for Section 5311 grant recipients:

- (4) Data Collection – Each recipient under this section shall submit an annual report to the Secretary containing information on capital investment,

operations, and service provided with funds received under this section, including –

- (a) Total annual revenue;
- (b) Sources of revenue;
- (c) Total annual operating costs;
- (d) Total annual capital costs;
- (e) Fleet size and type, and related facilities;
- (f) Revenue vehicle miles; and
- (g) Ridership.

2.2.2 Specialized Public Transportation Federal Reporting Requirements

Federal reporting data requirements for specialized transit programs are described under the Government Performance and Results Act (GPRA) that required FTA by law to “establish performance goals to define the level of performance” and to also “establish performance indicators to be used in measuring relevant outputs, service levels, and outcomes” for each of its programs. The performance measures differ for Section 5310, Section 5316 JARC, and Section 5317 New Freedom. These measures are designed to fulfill FTA’s obligations under this Act. FTA captures overall program measures to be used with the GPRA and the Performance Assessment Rating Tool process for the U.S. Office of Management and Budget.

Section 5310 Federal Reporting Requirements

The following measures are targeted to capture overarching program information as part of the annual report that each Section 5310 grantee submits to FTA. Specific reporting requirements for Section 5310 recipients can be found in Chapter 6, Section 17 of circular FTA C 9070.1F. These reporting requirements include annual program of projects status reports, milestone activity reports, financial status reports, program measure reports, and disadvantaged business enterprise reports. The two measures established for the Section 5310 program are:

- a. *Gaps in Service Filled*. Provision of transportation options that would not otherwise be available for older adults and individuals with disabilities measured in numbers of older adults and individuals with disabilities afforded mobility they would not have without program support.
- b. *Ridership*. Actual or estimated number of rides (as measured by one-way trips) provided annually for individuals with disabilities and older adults on Section 5310–supported vehicles and services (FTA C 9070.1F).

Section 5316 JARC Federal Reporting Requirements

The following measures are targeted to capture overarching program information as part of the annual report that each Section 5316 JARC grantee submits to FTA. Specific reporting requirements for Section 5316 JARC recipients can be found in Chapter 6, Section 16 of circular FTA C 9050.1. These reporting requirements include annual program of projects status reports, milestone activity reports, financial status reports, program measure reports, and disadvantaged business enterprise reports. Section 5316 JARC recipients should submit both quantitative and qualitative information as available on each of the following measures:

- a. *Jobs*. Actual or estimated number of jobs that can be accessed as a result of geographic or temporal coverage of JARC projects implemented in the current reporting year.
- b. *Ridership*. Actual or estimated number of rides (as measured by one-way trips) provided as a result of the JARC projects implemented in the current reporting year.

Section 5317 New Freedom Federal Reporting Requirements

The following measures are targeted to capture overarching program information as part of the annual report that each Section 5317 New Freedom grantee submits to FTA. Specific reporting requirements for Section 5317 New Freedom recipients can be found in Chapter 6, Section 16 of FTA C 9045.1. These reporting requirements include annual program of projects status reports, milestone activity reports, financial status reports, program measure reports, and disadvantaged business enterprise reports. The three measures established for the New Freedom program are:

- a. *Service Increases or Enhancements*. Increases or enhancements related to geographic coverage, service quality, and/or service times that impact availability of transportation services for individuals with disabilities as a result of the New Freedom projects implemented in the current reporting year.
- b. *Infrastructure, Technology, Vehicles*. Additions or changes to environmental infrastructure (e.g., transportation facilities, sidewalks, etc.), technology, and vehicles that impact availability of transportation services as a result of the New Freedom projects implemented in the current reporting year.
- c. *Ridership*. Actual or estimated number of rides (as measured by one-way trips) provided for individuals with disabilities as a result of the New Freedom projects implemented in the current reporting year (FTA C 9045.1).

2.3 STATE REPORTING REQUIREMENTS

Reporting requirements differ across state DOTs for rural and specialized transit program data. Researchers distributed a fact-finding questionnaire to the 50 state DOTs. Of the 37 respondents, approximately 50 percent stated that rural transit providers are asked to report the same categories as NTD, approximately 25 percent stated more categories than NTD, and 25 percent stated fewer categories. Of the 37 state DOT respondents, 28 administer specialized transit programs. State DOTs reported a wide range of reporting requirements for specialized transit providers, from relying on recurrent in-person on-site visits to gather information from such providers to requiring that specialized transit providers report the same level of financial and operating data as rural transit providers. Ultimately, statutory requirements determine the level of data reported from specialized transit providers.

Ninety-five percent of all state DOTs that responded to the questionnaire stated that data collected is used to report rural transit NTD information. Of the state DOT respondents to the questionnaire, 58 percent use rural data as part of formula funding allocation and 50 percent use data for annual program reports. Forty-eight percent of state DOTs use specialized transit program data for annual reports and 43 percent use the data for FTA or state required reporting. In determining which data elements to include in the toolkit, researchers focused on *rural* NTD data elements and included other elements if a majority of DOTs stated additional data elements are collected from transit providers.

- For operating data elements, the toolkit includes rural *and urban* NTD operating data categories. For example, urban NTD requires both vehicle revenue miles and total vehicle miles to be reported, whereas rural NTD requires only vehicle revenue miles. The toolkit includes information for both vehicle revenue miles and total vehicles miles.
- For sources of funding data elements, the toolkit uses the 21 rural NTD funding data elements that capture funding categories relevant to both rural and specialized transit providers.
- For operating and capital expenses, the toolkit includes a more detailed breakdown of operating and capital expenses than required by NTD. Rural NTD requires DOTs to report one total amount for operating and capital expenses. Seventy percent of DOT respondents stated transit providers are required to report further breakout of expense categories.
- For safety and vehicle data, the toolkit includes NTD requirements to establish consistency in reporting.
- The toolkit also offers general information on data collection methods as requested.

Chapter 3. Transit Modes

The Framework

Data collection and reporting differs by mode of transit service. For example, data requirements for traditional fixed-route, fixed-schedule transit service are different from data requirements for demand-response transit service. Further, NTD requires data to be reported by transit service mode. This chapter provides detailed descriptions of modes used for rural and specialized public transit.

3.1 DEFINING TRANSIT MODES

A **mode** is a system for carrying transit passengers described by specific right-of-way, technology, and operational features. Transit providers operate one or more modes of transit service. This toolkit provides major modal categories and then expands to include subcategories that fall within the major category. Rural public transit service providers are required to report to NTD using the following modes of public transit service: bus (MB), commuter bus (CB), demand-response (DR), demand-response taxi (DT), ferryboat (FB), vanpool (VP), and other.

3.2 BUS (MB) AND COMMUTER BUS (CB)

NTD gathers information on the modes identified as bus (MB) and commuter bus (CB). MB typically operates as a fixed-route including subcategories of route deviation, point deviation, or flexible-route service. CB also operates as a fixed-route system that primarily connects outlying areas with closed-door service of at least five miles and routes of extended length. NTD uses CB mode for reporting of Section 5311(f), Intercity Bus Program provided under a *public entity*.

Data collection methods differ for subcategories of MB and CB transit service. MB and CB are modes that carry many passengers on a vehicle typically powered by engines using onboard fuel. While buses powered by internal combustion engines using fossil or hybrid fuels, such as diesel or bio-diesel, remain the most common, the number of buses fueled using alternative fuels, such as electricity or fuel cells, is increasing.

3.2.1 Fixed-Route Service

Traditional public transit services typically operate as a fixed-route service. **Fixed-route service** operates vehicles along specific routes. Passengers board and alight at designated stops along the route according to a preset schedule. Passengers can obtain the schedule either in printed timetables or electronic timetables online; stop times are also usually indicated on posted signs or electronic variable message signs posted at the bus stop or station. Figure 1 illustrates fixed-route service operation.

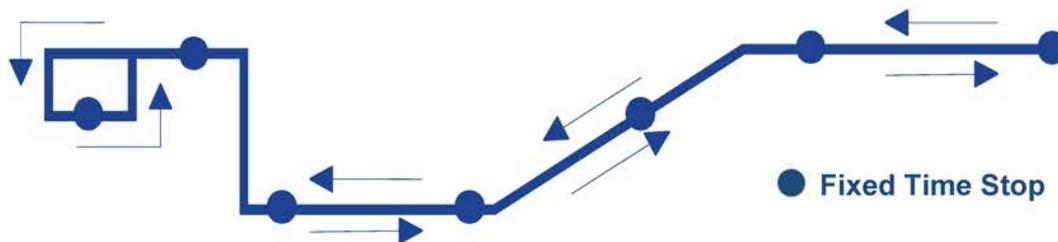


Figure 1. Diagram of Fixed-Route Service

Fixed-route service can vary in type, including local, feeder and circulator, express, park-and-ride, and bus rapid transit service types. These fixed-route service types typically have distinguishing vehicles (see Figure 2). CB service typically uses over-the-road (motor coach) buses.



Figure 2. Fixed-Route Service Type Vehicles

3.2.2 Fixed-Route Hybrid Configurations

Route deviation, requested stop, and flexible-route segment service are hybrid configurations of fixed-route systems predominately operating as a fixed-route service but adapting features to include demand-response service.

Route Deviation

Deviated-route service is transit service that operates along a fixed alignment at generally preset times similar to fixed-route service, but the vehicle may deviate from the route alignment to serve destinations within a prescribed distance of the route. Vehicles operate on a regular schedule along a well-defined path, with or without marked bus stops, and deviate to serve demand-response requests within a zone around the path. The width or extent of the zone may be precisely established or flexible (for more information see *TCRP Synthesis 53*). Following an off-route deviation, the bus typically returns to the point on the route the bus left (see Figure 3).

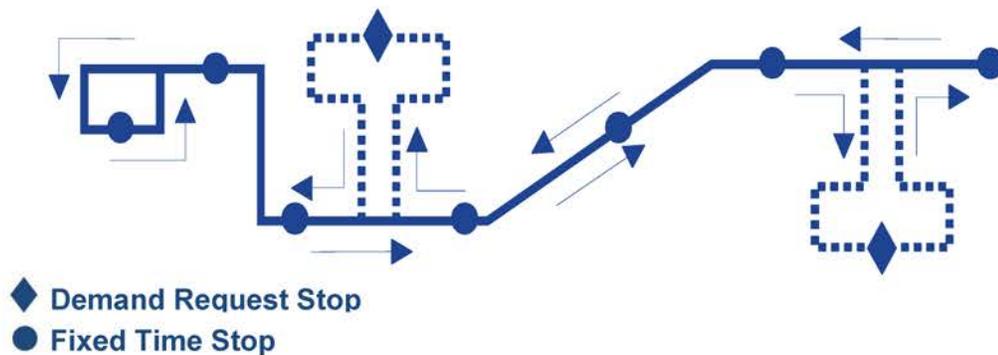


Figure 3. Diagram of Deviated-Route Service

Requested Stop

Requested stop service is transit service that operates in conventional fixed-route, fixed-schedule mode and also serves a limited number of defined stops near the route in response to passenger requests (see Figure 4). Requested stops differ from flag stops in that requested stops are not directly on the route.

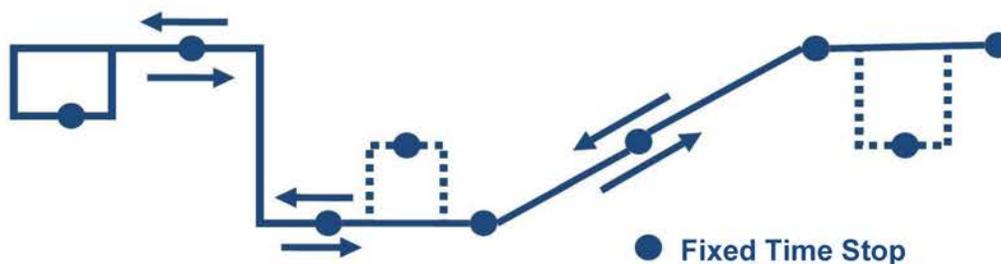


Figure 4. Diagram of Requested Stop Service

Flexible-Route Segment

Flexible-route segment service is transit in which vehicles operate in conventional fixed-route, fixed-schedule mode but switch to demand-responsive operation for a limited portion of the route (see Figure 5).

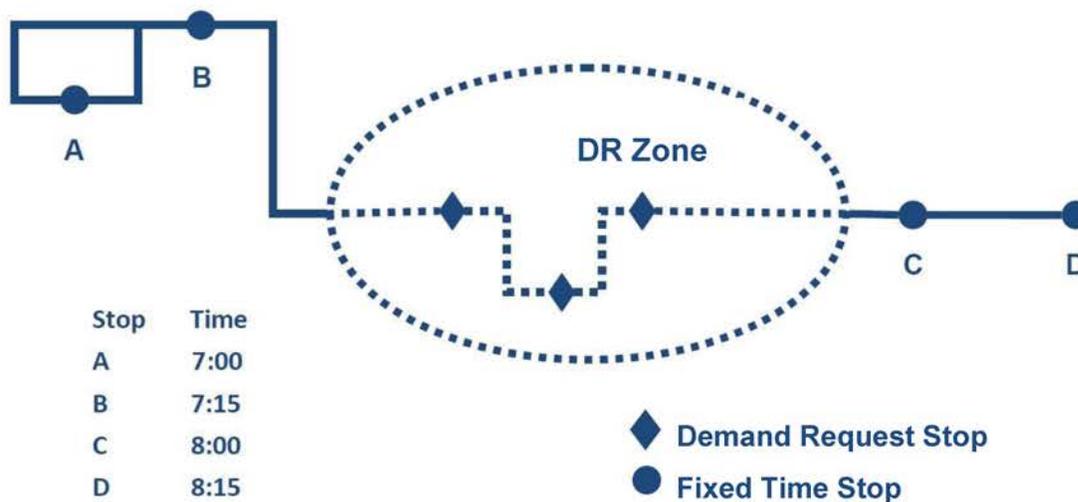


Figure 5. Diagram of Flexible-Route Segment Service

3.3 DEMAND-RESPONSE (DR) AND DEMAND-RESPONSE TAXI (DT)

DR is a type of paratransit service that is characterized by its flexible routing, shared rides, and activation at the initiation of the rider by prior arrangement. Generally, demand-response service types can be distinguished by the group or type of rider served: general public, specialized/limited eligibility demand response, and ADA paratransit (see *TCRP Report 124*, 2008). The NTD Glossary of Terms describes DR as follows:

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. The following types of operations fall under the above definitions provided the operation is not on a scheduled fixed-route basis:

- Many origins - many destinations,
- Many origins - one destination,
- One origin - many destinations, and
- One origin - one destination.

DR transit services operate using a reservation system. Passengers call in advance and can request a pick-up and drop-off at their origin and destination. DR transit may be operated within a limited area or zone or be limited to specific target markets (i.e., elderly individuals, individuals with disabilities). DR services play an important role in rural regions, since DR services are often more feasible in rural areas with low passenger demand than traditional fixed-route services (see Figure 6).

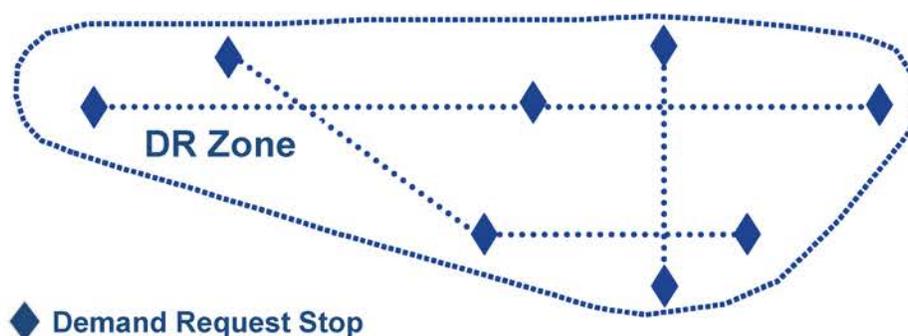


Figure 6. Diagram of DR Service

Sponsored Demand-Response Services

The NTD Rural Reporting Manual requires that Section 5311 grant recipients report data for sponsored demand-response services. “*Sponsored services* are public transportation services that are paid, in whole or in part, directly to the transit provider by a third party.” Transit providers may offer these services as part of a Coordinated Human Services Transportation Plan. Sponsors may include the Veterans Administration, Medicaid non-emergency medical transportation and Head Start programs. Reporting of sponsored services applies only to the DR mode (National Transit Database 2011).

3.3.1 Demand-Response Taxi (DT)

Demand-response taxi (DT) is a form of demand-response operated by taxicab providers. NTD requires rural transit providers to report DT as a separate mode.

Collection of data for DT differs, however, from conventional demand-response service. Taxicab companies count passenger trips and meter fare miles but not necessarily revenue time. Taxicab service is typically paid for by passenger trip from origin to destination (for the revenue part of the trip). Data collection methods for reporting taxicab time and miles and reporting purchased transportation expenses are discussed in later chapters.

3.3.2 Demand-Response Hybrid Configurations

Point deviation, zone route, and DR connector services are hybrid configurations of demand-response services predominantly operating as a demand-response service but adapting features to include fixed-route time points.

Point Deviation

Point deviation service is transit service that serves demand-response requests within a zone and also serves a limited number of bus stops within the zone without any regular path between the stops (see Figure 7).

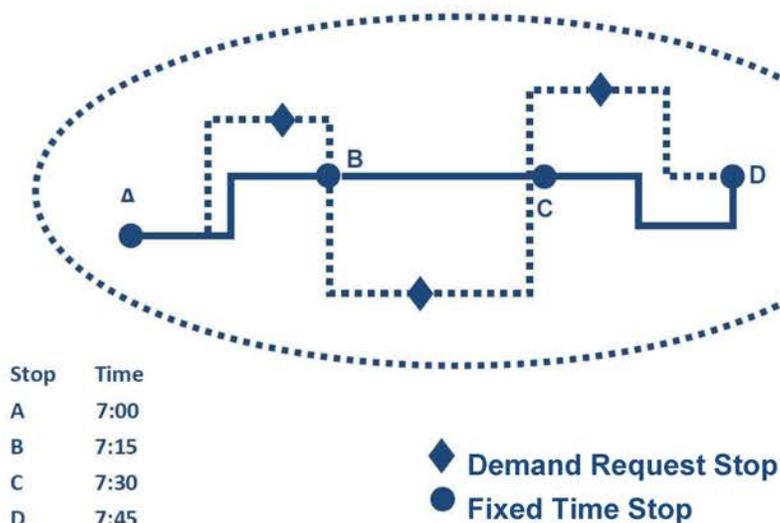


Figure 7. Diagram of Point Deviation Service

Zone Route

Zone route service is transit service that operates in demand-response mode along a corridor with established departure and arrival times at one or more end points (see Figure 8).

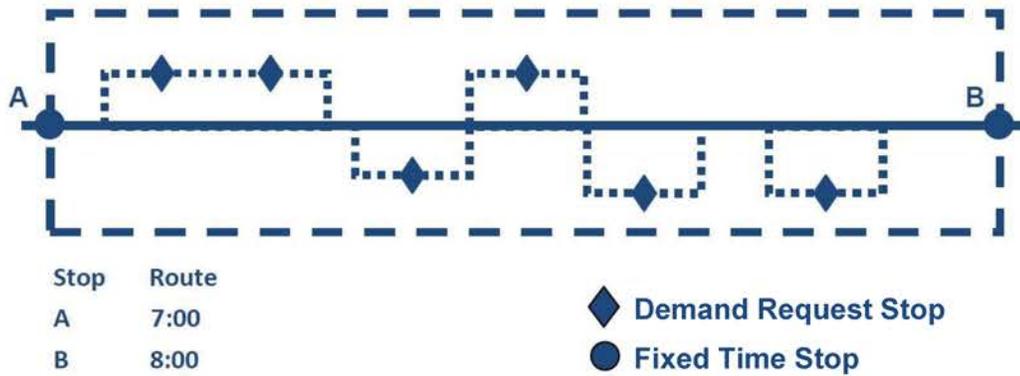


Figure 8. Diagram of Zone Route Service

Demand-Response Connector Service

Demand-response connector service is transit service that operates in demand-response mode within a zone, with one or more scheduled transfer points that connect with a fixed-route network. A high percentage of ridership consists of trips to or from the transfer points (see Figure 9).

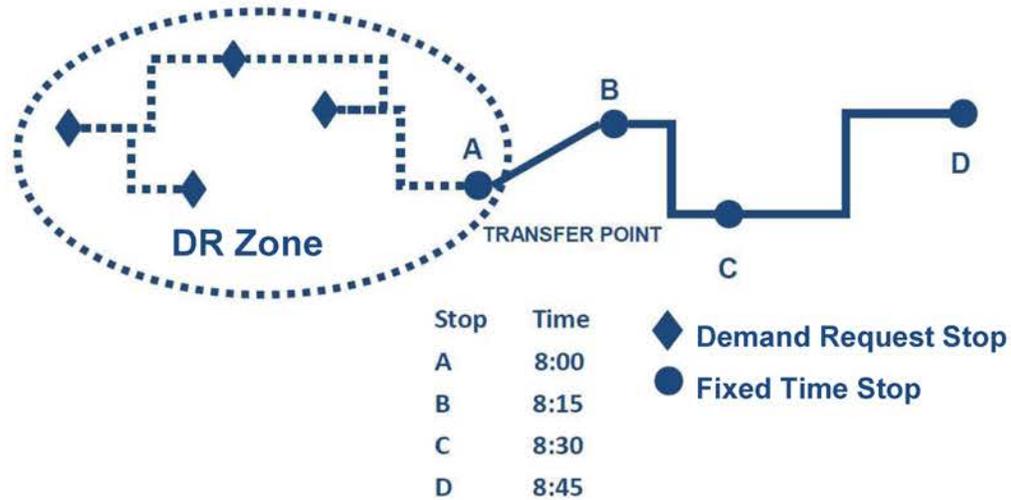


Figure 9. Diagram of Demand-Response Connector Service

3.4 VANPOOL (VP)

VP is a type of paratransit service comprised of vans, small buses, and other vehicles operating as a ridesharing arrangement. NTD describes VP as providing transportation to a group of individuals traveling directly between their homes and a regular destination within the same geographical area. To be considered a VP, vehicles must have a minimum seating capacity of seven persons, including the driver. For inclusion in the NTD, a transit service is considered a mass transit service if the service:

- is operated by a public entity, or
- is one in which a public entity owns, purchases, or leases the vehicle(s).

VP must also be in compliance with mass transit rules including ADA provisions and be open to the public, and that availability must be made known. Other methods to promote public participation in ridesharing arrangements are:

- The provision of parking spaces
- Use of high occupancy vehicle (HOV) lanes

Coordination or clearinghouse services to facilitate private vanpools do not qualify as public VP.

3.5 FERRYBOAT (FB) AND OTHER MODES

The NTD rural reporting system includes **Ferryboat (FB)** and **Other** as modes for reporting. Ferryboat is a mode that carries passengers over water. The 2011 NTD Rural Reporting Manual directs users to select “Other” if MB, CB, DR, DT, VP or FB does not fit the service provided. The NTD *urban* reporting system includes the following modes in addition to MB, CB, DR, DT, VP and FB that may be included in the “Other” category for rural public transportation reporting:

- Aerial tramway
- Alaska railroad
- Automated guideway
- Cable car
- Commuter rail
- Heavy rail
- Inclined plane
- Jitney
- Light rail
- Monorail
- Publico
- Trolleybus

Chapter 4. Counting Passengers

Not as Straightforward as You Might Think

This chapter provides concepts relevant for reporting passenger data. The basic concepts covered include the following:

- Definition of unlinked vs. linked passenger trips
- Inclusion of sponsored passenger trips
- Passenger counting methods
- Common reporting errors

Terms and definitions established through NTD are used as a base for passenger reporting concepts. *TCRP Report 124* and *TCRP Synthesis 77* definitions and concepts are also used in this section of the toolkit.

4.1 DEFINING UNLINKED VS. LINKED PASSENGER TRIPS

Most rural and specialized transit providers count passenger trips as unlinked passenger trips. NTD defines **passenger trips** as the number of passengers who board public transportation vehicles. For **unlinked passenger trips (UPT)**, a passenger is counted each time when boarding a vehicle no matter how many vehicles are used to travel from origin to destination. For fixed-route transit systems, ridership is typically measured by the number of passenger boardings (i.e., unlinked passenger trips). Personal care attendants and companions are counted as passengers as long as they are not employees of the transit system and regardless of whether a fare is paid or not.

A few rural transit providers also measure linked passenger trips. A **linked passenger trip** is a trip from origin to destination on the transit system. Even if a passenger must make several transfers during a one-way journey, the trip is counted as one linked trip on the system. Since measuring linked trips is more complicated and difficult than measuring unlinked trips (and reporting linked trips is also not an FTA requirement) few rural transit providers report passenger trips as linked trips.

UPTs (passenger boardings) can be viewed as a measure of transit utilization (at the system, route, or sub-route level), while linked trips are useful for measuring passengers. For fixed-route transit systems, the ratio of unlinked to linked passenger

trips indicates the relative use of transfers in the transit system. Determining the actual number of passengers using a transit system is complicated by the difficult task of tracking the number of transfers from one vehicle or mode to the next, from one agency to another, and from the use of day passes and cash.

For demand-response systems, passengers typically do not transfer between origin and destination, so the number of UPTs is equal to the number of people transported for most DR systems.

4.2 INCLUSION OF SPONSORED PASSENGER TRIPS

For NTD, transit providers should report both general public and sponsored service passenger trips. **Sponsored services** are public transportation services that are paid, in whole or in part, directly to the transit provider by a third party. These services may be offered by transit providers as part of a Coordinated Human Services Transportation Plan. Common sponsors include the Veterans Administration, Medicaid non-emergency medical, and Head Start programs.

4.3 PASSENGER COUNTING METHODS

Passenger trips are typically counted using two methods: a total count (**100 percent count**, sometimes referred to as a **census**) and an estimate based on a **sample**. The counting of *all* passenger trips is called a 100 percent count. If available and reliable, 100 percent counts must be reported. If 100 percent counts are not available or reliable, passenger trips must be estimated and reported based on a sampling procedure. The FTA requirements are:

- minimum confidence of 95 percent, and
- minimum precision level of +/-10 percent

Transit providers that attempt to do a 100 percent count may miss some of the vehicle trips because of personnel problems or equipment failures. If these vehicle trips are 2 percent or less of the total, then the transit provider should factor up the data to account for the missing percentage. If the missed vehicle trips are more than 2 percent of the total, then the transit provider must have a qualified statistician approve the methodology for factoring the data to account for the missing percentage. Approved sampling techniques are described later in this chapter.

4.3.1 Automated vs. Manual Collection Systems

Automated and manual systems (and a combination of both) are used to collect passenger trip data. These systems include:

- clickers;
- pencil and paper;
- hand-held units;
- estimate from passenger revenue;
- electronic registering fareboxes;
- on board surveys;
- vehicle operator trip cards;
- demand-response mobile data terminal (MDT) systems;
- automated passenger counters (APCs); and
- smart cards.

The following three sections discuss passenger trip collection methods for fixed-route, demand-response, and vanpool services.

Fixed Route

Ridership on fixed-route transit service can be collected through manual and automated means or a combination thereof.

Manual Count Method

The standard approach to counting fixed-route passengers for rural transit has been to conduct a 100 percent count. Manual counting requires the operator to count and record the number of boarding passengers. An operator can manually count passengers using one of several methods. The following paragraphs provide discussion on manual methods of counting fixed-route passengers.

One method of passenger counting often used by rural transit providers is to require operators to fill out a log sheet to record the number of passengers picked up and dropped off at each stop. This method provides the transit provider with not only ridership data but also information on the number of passengers picked up and dropped off at particular stops. Table 1 provides an excerpt from a driver log sheet.

Table 1. Fixed-Route Driver Log Sheet

	TRIP TIME	BUS STOP	PASSENGER COUNT		COMMENTS
			ON	OFF	
1	4:49	Garage			
2	5:09	Thunderbird & Dawn			
3	5:22	Park & Crestview			
4	5:45	ACC Cypress Creek			
5	5:49	Lakeline Mall & Pecan			
6	05:55/6:05	Lakeline Station			
7	6:07	Lakeline Mall & Pecan			

Some buses are equipped with counter systems in which the driver clicks a button on a control panel or a hand-held device as passengers board the bus. The driver records the number of passengers onto a log sheet by one-way bus trip. If the data are recorded only at the end of the driver's run, then the level of detail is the route total, not by trip or by stop.

Other transit providers may use a ticket system for manually counting passengers. Tickets are typically sold by a clerk or vending machine and contain two matching halves. The operator retains the matching tickets and counts the tickets at the end of the day. These tickets provide a record for the transit provider.

Automated Count Method

Technology allows transit providers to transition to automated passenger counters on the bus fleet. These counters count by sensing boarding passengers. Transit providers using automated counters often retain the manual data collection procedures to test the validity of the new technology and to validate data for NTD reporting.

Combination Count Method

Transit providers that use a combination of automated and manual methods to collect ridership data often use a combination of electronic farebox plus manual collection, or APC plus manual collection (see *TCRP Synthesis 77*, 2008). In fact, FTA requires manual checks annually to validate APC data for NTD reporting.

Transit providers can estimate ridership from fare revenue collected. This is not considered a 100 percent count but allows the transit provider to get an estimate of ridership. This method may not capture attendants, children, or other non-fare-paying riders. Larger transit providers may use an electronic registering farebox (ERF), which automatically counts the passenger based on the fare placed in the box. ERFs

require drivers to register the type of fare required of the boarding passenger. ERFs are able to count and disaggregate the passengers by type, route, and trip.

Demand Response

Passenger boarding data for DR are “obtained from driver logs or mobile data terminals (MDTs) which should be designed so that vehicle operators record or verify the number of passengers boarding at each pick-up location. For volunteer services, reporting forms should be developed that will capture passenger counts. For non-dedicated service such as taxi services, contract arrangements with the taxi company need to include requirements that vehicle operators report the number of passengers boarding at each pick-up location, if such data are not routinely collected. These data would then be included on the taxi company invoice to the transit provider” (*TCRP Report 124*, 2008). Passenger data requirements are similar to fixed route, with the addition of tracking companions and attendants along with scheduled patrons/clients.

Vanpool

For vanpool service, transit providers report the driver as a passenger since most drivers are not paid wages and are commuting to work. Drivers keep daily logs with the number of passengers riding. These logs are reported to the transit provider, and ridership is manually tallied. When calculating performance measures such as vehicle miles traveled reduced (VMTR) as a result of vanpool service, the drivers must be removed from the ridership count. VMTR from vanpool service assumes that each of the vanpool riders would be driving his or her own automobile. Since the vanpool driver is driving an automobile (vanpool), he or she cannot be counted as a passenger for VMTR calculations.

Approved Sampling Techniques

There are two approved sampling techniques described in circulars that provide definitions, sampling procedures, data recording procedures, annual report compilation, and sample selection information. The sampling techniques are available on the NTD Program website (<http://www.ntdprogram.gov/>):

1. FTA C 2710.1A Sampling Techniques Obtaining Fixed Route Bus Operating Data Required under the Section 15 Reporting System—this procedure provides an estimate of passenger trips and passenger miles for fixed-route bus systems.
2. FTA C 2710.2A Sampling Procedures for Obtaining Demand-Responsive Bus System Operating Data Required under the Section 15 Reporting

System—this procedure is used to estimate passenger trips and passenger miles for demand-response systems.

Alternative sampling techniques may also be used but must be approved by a qualified statistician. If a transit provider uses automatic passenger counters for collecting passenger boardings, the transit provider must obtain FTA approval. See the current NTD Annual Reporting Manual for requirements for using both alternative sampling techniques and automatic passenger counters (<http://www.ntdprogram.gov/>).

4.4 SUMMARY OF COUNTING PASSENGERS

The following is a summary of items to remember about counting passengers:

Do Not Report Transit Employees as Passengers

Transit system employees should not be 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 are conducting surveys, observing vehicle operations, or 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.

Do Not Exclude Personal Care Attendants and Companions

A common reporting error is excluding personal care attendants and companions in passenger trip counts. Attendants and companions should be included in passenger counts as long as they are not employees of the transit providers. In addition, attendants and companions should be included regardless of whether or not they are fare-paying passengers.

Count Each Boarding as an Unlinked Passenger Trip (UPT)

According to FTA reporting requirements, passenger trip counts should be based on the number of passenger boardings on a transit service vehicle (unlinked passenger trips). Trips involving transfers should be counted as multiple trips, not as one trip. Therefore, counts should not be based on origin to destination or linked trips. A round trip without transfers should be counted as two trips, not one.

Do Not Report Passengers Based on Fares Sold

Passenger counts should not be based on the number of tickets or passes sold on the transit system but by actual passenger boardings onto the transit vehicle.

Do Not Report Animals as Passengers

Service animals and pets should not be included in the passenger count.

Do Not Report Fare-Paying Passengers Only

A common reporting error is excluding passengers that do not pay a fare. Passenger counts should include both fare-paying and non-fare-paying passengers. A common error is to neglect to include non-fare-paying attendants and children.

Count All Passenger Types

Some transit providers incorrectly count only general public passengers. Sponsored service passenger trips should be counted as well.

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Chapter 5. Hours and Miles

Ties to the Vehicle in Service

This chapter provides a general discussion of the concepts relevant for reporting transit service data. Understanding the measures of service supplied will help public transportation providers determine how to collect and report data. The basic concepts covered include the following:

- Revenue Service and Deadhead
- Revenue Hours and Miles
- Vehicle Hours and Miles
- Collecting and Calculating Hours and Miles
- Common Reporting Errors

5.1 REVENUE SERVICE AND DEADHEAD

The key to understanding how to collect and report miles and hours of service is to understand the terms revenue service and deadhead. Revenue service and deadhead relate *directly* to the operation of the vehicle in providing passenger service.

Revenue service is when the transit vehicle is providing public transportation and is available to carry passengers. Vehicles operated in fare-free service are considered in revenue service. Revenue service is measured in hours and miles. Revenue service is defined as the service from the first passenger pick-up point of the service (fixed-route first bus stop or demand-response first passenger pick-up) to the last passenger drop-off point of the service (fixed-route last bus stop or demand-response last passenger drop-off). Revenue service includes the time scheduled as layover/recovery time, typically at both ends of the route for fixed-route and the time between passenger pick-ups and drop-offs for demand-response. However, revenue service excludes scheduled breaks such as lunch, and revenue service does not include vehicle operator training or maintenance testing. Revenue service relates only to passenger service.

Deadhead is the operating time and miles needed to move a transit vehicle into revenue service and out of revenue service. Deadhead is very specific. Deadhead in fixed-route services is the travel between:

- the garage and the beginning of the route; and
- the end of a route and the garage.

For demand-response services, deadhead is the travel between:

- the garage and the first passenger pick-up or dispatching point; and
- the last passenger drop-off and the garage or dispatching point.

When a transit vehicle is deadheading, the driver operates closed-door and the vehicle is not available to passengers—the vehicle is moving either into service or out of service. Deadhead does not include non-service-related hours and miles such as maintenance testing and operator training.

Total service covers the time and miles from when a transit vehicle starts from the garage (pull-out time) to go into revenue service to the time the vehicle returns to the garage (pull-in time) after completing its revenue service. Total service is equal to revenue service plus deadhead and is measured in hours and miles. Note that total service does not include hours and miles associated with operator training, vehicle maintenance testing, transporting vehicles to/from maintenance facilities, and operator lunch breaks, as these hours and miles are not directly associated with providing passenger service.

5.2 REVENUE HOURS AND MILES

As mentioned previously, revenue service is measured in terms of hours and miles. This section provides definitions of revenue hours and miles for fixed-route, demand-response, taxicab, and vanpool services.

5.2.1 Revenue Hours

For **fixed-route** transit, revenue hours include running time and layover/recovery time:

- *Running Time*—The time the transit vehicle takes to travel from the beginning to the end of the transit route. The passenger timetable typically shows the running times for all trips operated by a transit provider.
- *Layover/Recovery Time*—The time typically is scheduled at the end of each trip and usually ranges from 10 to 20 percent of the running time.

The time is scheduled to provide the transit operator a rest break and to provide an opportunity to get the transit service back on schedule.

Fixed-route revenue hours are calculated by adding together the running time *and* layover/recovery time. Notice the definition of revenue service states “is available to carry passengers”; therefore, the vehicle is still considered in revenue service even when not carrying passengers on its route.

For **demand-response** transit, revenue hours include all time from the point of the first passenger pick-up to the last passenger drop-off, as long as the DR operator and vehicle do not return to the dispatching point (e.g., the garage or some other location such as a satellite location or the operator’s home) after completing the operator’s work assignment. Revenue hours do not include scheduled time off such as operator lunch breaks.

Taxicabs and vanpools typically provide DR service, and therefore revenue hours are counted the same way, that is, the time from the first passenger pick-up to the time of last passenger drop-off. Often taxis and vanpools are used to provide DR trips on a trip-by-trip basis. In such cases, revenue time is simply the time from the passenger pick-up to that passenger’s drop-off. However, if taxi or vanpool service is scheduled to operate with no breaks and be available for DR service for a part of a day, such as during specific late-night hours, then the hours that are dedicated to DR service are counted as revenue time, using the same definition as above.

5.2.2 Revenue Miles

Revenue miles are the distance traveled during revenue service, which includes distance traveled during running time and layover/recovery time for fixed-route service. For demand-response service (which includes most taxis and vanpools), revenue miles are the distance traveled from the point of the first passenger pick-up to the last passenger drop-off, as long as the DR vehicle does not return to the dispatching point. Revenue miles do not include travel during scheduled time off such as driver lunch breaks. Revenue miles correspond to revenue hours.

For **fixed-route** service, a transit vehicle may travel along a transit route when there are no passengers riding. Even though there is no passenger on board, the miles traveled are considered revenue miles as long as the operator does not return to the garage or does not have scheduled time off.

For **demand-response** service, the vehicles may travel between a drop-off and a pick-up when there are no passengers riding; even though there is no passenger on

board, the miles traveled are considered revenue miles as long as the operator does not return to the dispatching point or does not have scheduled time off.

The use of paid or volunteer drivers is not a factor in determining revenue miles. If volunteers are used to provide DR service, the miles that the volunteer drives between the first passenger pick-up and the last passenger drop-off are counted as revenue miles.

When demand-response service is provided by taxis or other non-dedicated providers, revenue miles are counted the same way, that is, the miles operated from the first passenger pick-up to the last passenger drop-off. Often taxis are used to provide DR trips on a trip-by-trip basis. In such cases, revenue miles are simply the miles operated from the passenger pick-up to that passenger's drop-off. However, if taxi service is scheduled to operate with no breaks and be available for DR service for a part of a day, for example, during specific late-night hours, then the miles operated are counted as revenue miles, using the same definition as above.

5.3 VEHICLE HOURS AND MILES

Vehicle hours and miles include revenue service and deadhead. This section provides detailed information on vehicle hours and miles for fixed-route, demand-response, and taxicab services.

5.3.1 Vehicle Hours

Vehicle hours (called total service hours in some states) include the time when a transit vehicle starts from a garage or other storage location (pull-out time) to go into revenue service to the time the vehicle returns to the garage (pull-in time) after completing its revenue service. Vehicle hours include revenue hours and deadhead hours. Vehicle hours do not include scheduled time off such as vehicle operator lunch breaks.

For **demand-response** service, vehicle hours cover the time from garage pull-out to garage pull-in as long as the demand-response vehicle does not return to the dispatching point or the vehicle operator does not have scheduled time off. If volunteers are used to provide demand-response service, their time is counted as vehicle hours, using the same definition, that is, 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, for example, a medical appointment, as part of the trip, the time spent at the medical appointment is

counted in the same way as scheduled time off; the time is not counted as part of vehicle hours.

When demand-response service is provided by taxis or other non-dedicated providers, vehicle hours are counted the same way as revenue hours, that is, the time from the first passenger pick-up to the time of last passenger drop-off. This means that revenue hours and total hours for non-dedicated service will be the same number. However, if taxi service is scheduled to operate with no breaks and be available for demand-response service for a part of a day, for example, during specific late-night hours, then the hours that are dedicated to demand-response service are counted as vehicle hours, using the same definition as above.

5.3.2 Vehicle Miles

Vehicle miles (called total service miles in some states) cover the distance traveled from when a transit vehicle starts from a garage or other storage location (pull-out) to go into revenue service to the time the vehicle returns to the garage (pull-in) after completing its revenue service. Vehicle miles do not include travel during scheduled time off such as vehicle operator lunch breaks. Vehicle miles correspond to vehicle hours.

Vehicle miles cover the distance traveled by the fixed-route or demand-response vehicle from the garage pull-out time to garage pull-in time. Vehicle miles are the sum of two types of miles:

- Revenue miles that cover the distance traveled between the beginning and the end of a transit route plus layover/recovery time for fixed-route service. For demand-response service, revenue mileage is the distance traveled between the first passenger pick-up and the last passenger drop-off.
- Deadhead miles that cover the distance traveled between garage pull-out and the beginning of the transit route (or first passenger pick-up) and between the end of the transit route (or last passenger drop-off) and garage pull-in.

If volunteers are used to provide demand-response service, their distances traveled are counted as vehicle miles, using the same definition, that is, the distance traveled from garage (or other storage location) pull-out to garage pull-in, exclusive of any scheduled time off. Vehicle miles do not cover transportation activities such as exclusive school bus service and charter service.

When demand-response service is provided by taxis or other non-dedicated providers, vehicle miles are counted the same way as revenue miles, that is, the time

from the first passenger pick-up to the time of last passenger drop-off. However, if taxi service is scheduled to operate with no breaks and be available for demand-response service for a part of a day, for example, during specific late-night hours, then the miles operated as part of the demand-response service are counted as vehicle miles, using the same definition as above.

5.4 COLLECTING AND CALCULATING HOURS AND MILES

Automated and manual scheduling/dispatching systems (and a combination of both) are used to collect and calculate revenue and vehicle hours and miles data. This section provides a discussion and examples of how transit providers collect and calculate miles and hours for transit service reporting. Note that for transit service reporting, *actual* hours and miles should be reported as opposed to *scheduled* service. Scheduled service refers to the service that was planned to be operated. NTD requires that actual service hours and miles be reported. Generally, scheduled service is detailed in internal documents and provided to the users in public timetables. Actual service is very close to scheduled service but is adjusted (miles and hours) for two situations:

- Missed service that may have resulted from shortages of operators and revenue vehicles, vehicle breakdowns, weather-related cancellations of service, and other service interruptions. Scheduled service hours and miles should be adjusted down for all missed service.
- Extra or additional service operated as needed to meet the expected high ridership for special events such as fairs, parades, and civic celebrations. Scheduled service hours and miles should be adjusted up for extra or additional service operated.

The hours and miles reported are the actual services provided during the time period. Therefore, the hour and mile totals should include data for both typical and out-of-the-ordinary days. The hours and miles reported should be adjusted to correspond to actual service performed. Actual service should be reported as scheduled service less missed service plus added service.

5.4.1 Fixed-Route Hours and Miles Calculation Method

Revenue hour data are obtained from driver logs or MDTs, which should be configured so that vehicle operators record the actual times that they go into and out of revenue service. Revenue mile data should correspond with the actual odometer readings recorded by the operator when the vehicle goes into and out of revenue

service. Vehicle hour data should report the actual times that the transit vehicle leaves the garage at pull-out and returns at pull-in. Vehicle mile data should correspond with the reported odometer readings when the vehicle leaves the garage at pull-out and returns at pull-in. Figure 10 provides an example of a driver log for fixed route in a format for collecting fixed-route hours and miles.

	Trip Time	Bus Stop	Passenge Count		COMT. CODE
			ON	Off	
1	4:49	Garage			
2	5:09	Thunderbird & Dawn			
3	5:22	Park & Crestview			
4	5:45	ACC Cypress Creek			
5	5:49	Lakeline Mall & Pecan			
6	05:55/6:05	Lakeline Station			
7	6:07	Lakeline Mall & Pecan			
8	6:13	ACC Cypress Creek			
9	6:31	Park & Crestview			
10	6:43	Paseo De Vaca & Crossbow			
11	6:45	Lago Vista HS/Bronco Lane			
12	06:55/7:04	Thunderbird & Dawn			
13	7:17	Park & Crestview			
14	8:40	ACC Cypress Creek			
15	7:44	Lakeline Mall & Pecan			
16	7:50/08:00	Lakeline Station			
17	8:02	Lakeline Mall & Pecan			
18	8:08	ACC Cypress Creek			
19	8:26	Park & Crestview			
20	8:38	Paseo De Vaca & Crossbow			
21	8:40	Lago Vista HS/Bronco Lane			
22	08:50/08:54	Thunderbird & Dawn			
23	9:06	Park & Crestview			
24	9:27	ACC Cypress Creek			
25	9:31	Lakeline Mall & Pecan			
26	09:36/09:40	Lakeline Station			
27	9:42	Lakeline Mall & Pecan			
28	9:48	ACC Cypress Creek			
29	10:06	Park & Crestview			
30	10:18	Paseo De Vaca & Crossbow			
31	10:20	Lago Vista HS/Bronco Lane			
32	10:30/10:34	Thunderbird & Dawn			
33	10:46	Park & Crestview			
34	11:07	ACC Cypress Creek			
35	11:09	Lakeline Mall & Pecan			
36	11:16/11:25	Lakeline Station			

ROUTE: 214 - (AM)

DATE: _____

VEHICLE: _____

DRIVER: _____

	ODOMETER	TIME
Garage:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>
1st Stop:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>
Last Stop:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>
Garage:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>

Fuel & Vehicle Changeouts

Vehicle #1 _____

Begin: _____

End: _____

Vehicle #2 _____

Begin: _____

End: _____

Vehicle #3 _____

Begin: _____

End: _____

Customer Type

A _____

S _____

C _____

HPP _____

MI _____

DP _____

MP _____

W/C _____

S/C _____

Comment Codes

F - Fuel

V - Vehicle Swap

M - Mechanical

D - Driver

O - Other

Figure 10. Fixed-Route Driver Log

Table 2 illustrates how to calculate the vehicle revenue hours and miles and vehicle total hours and miles for a fixed-route bus assignment. The starting and ending locations are recorded for each stop with the start and end time/distance. Recall that revenue hours and miles for fixed route are the running time (first stop to the last stop) plus the layover/recovery time. In Table 2, the revenue hours are 1:05 and the revenue miles are 13; the total hours are 1:30 and the total miles are 21.

Table 2. Calculating Fixed-Route Vehicle Revenue and Total Hours and Miles

Starting Location	Ending Location	Start Time	End Time	Time (Minutes)	Distance (Miles)	Activity
Garage	First bus stop	6:30	6:35	0:05	2	Deadhead
First bus stop	Second bus stop	6:35	6:40	0:05	1	Running time
Second bus stop	Route 22 layover point	6:40	6:50	0:10	3	Running time
Route 22 layover point	Route 22 layover point	6:50	7:00	0:10	0	Layover / Recovery time
Route 22 layover point	Second bus stop	7:00	7:10	0:10	3	Running time
Second bus stop	Third bus stop	7:10	7:25	0:15	3	Running time
Third bus stop	Fourth bus stop	7:25	7:40	0:15	3	Running time
Fourth bus stop	Garage	7:40	8:00	0:20	6	Deadhead
Total				1:30	21	
Revenue Hours =		1:05 Running time + layover/recovery time				
Revenue Miles =		13 Running miles				
Total Vehicle Hours =		1:30 Deadhead + running + layover/recovery time				
Total Vehicle Miles =		21 Deadhead + running miles				

5.4.2 Demand-Response Transit Hours and Miles Collection and Calculation

The collection of demand-response hours and miles is similar to fixed-route transit. Revenue hour data are obtained from driver logs or MDTs, which record the actual times that vehicles go into and out of revenue service (from first passenger pick-up to last passenger drop-off). Revenue mile data should correspond with the actual odometer readings recorded by the operator when the vehicle goes into and out of revenue service. Vehicle hour data should report the actual times that the transit vehicle leaves the garage at pull-out and returns at pull-in. Vehicle mile data should correspond with the reported odometer readings when the vehicle leaves the garage at pull-out and returns at pull-in. Figure 11 provides an example of a driver log for demand-response service.

Date: _____		Driver's Name: _____		Total Passengers: _____		Customers/Companions _____		Attendants _____			
Vehicle: _____		Driver's Signature: _____		Total Fares: _____		Cash/Check _____		Passes _____			
						Pre-Pay _____		Tickets _____			
Time:		Run Start	First Pickup	Break1 Start	Break1 End	Break2 Start	Break2 End	Last Dropoff	Run End		
Odometer:											
		Scheduled				Actual					
Customer Name	Mobility Aid	Attendant/ Companion(s)	Request Time	Pickup Time	Pickup Address	Dropoff Time	Dropoff Address	Pickup Time	Dropoff Time	Pickup Odometer	Dropoff Odometer
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
										Complete <input type="checkbox"/> Cancellation <input type="checkbox"/> No Show <input type="checkbox"/>	
Fare Collected :		Cash _____	Check _____	No Charge _____	Pass _____	Pre-Pay _____	Ticket _____	Trip Type/Funding Source: <input type="text"/>			
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
										Complete <input type="checkbox"/> Cancellation <input type="checkbox"/> No Show <input type="checkbox"/>	
Fare Collected :		Cash _____	Check _____	No Charge _____	Pass _____	Pre-Pay _____	Ticket _____	Trip Type/Funding Source: <input type="text"/>			
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
										Complete <input type="checkbox"/> Cancellation <input type="checkbox"/> No Show <input type="checkbox"/>	
Fare Collected :		Cash _____	Check _____	No Charge _____	Pass _____	Pre-Pay _____	Ticket _____	Trip Type/Funding Source: <input type="text"/>			
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
										Complete <input type="checkbox"/> Cancellation <input type="checkbox"/> No Show <input type="checkbox"/>	
Fare Collected :		Cash _____	Check _____	No Charge _____	Pass _____	Pre-Pay _____	Ticket _____	Trip Type/Funding Source: <input type="text"/>			
Notes/Comments: _____											

Figure 11. Demand-Response Driver Manifest Example

Table 3 illustrates how to calculate the vehicle revenue hours and miles and vehicle total hours and miles for a demand-response system. The starting and ending locations are recorded for each stop with the start and end time/distance. Recall that revenue hours and miles for demand response are from the first passenger pick-up to the last passenger drop-off less the time off the clock for a lunch break. In Table 3, the revenue hours are 8:00 and revenue miles are 120 miles. Total hours are 8:10 and total miles are 125 miles.

Table 3. Calculating Demand-Response Vehicle Revenue and Total Hours and Miles

Starting Location	Ending Location	Start Time	End Time	Time (Hours/Minutes)	Distance (Miles)	Activity
Garage	First pick-up point	4:30	4:35	0:05	2	Deadhead
First pick-up point	Lunch begin	4:35	8:35	4:00	60	In service
Lunch begin	Lunch end	8:35	9:05	0:30	3	Lunch break
Lunch end	Last drop-off point	9:05	13:05	4:00	60	In service
Last drop-off point	Garage	13:05	13:10	0:05	3	Deadhead
Total				8:40	128	
Revenue Hours =	8:00		In service time			
Revenue Miles =	120		In service miles			
Total Vehicle Hours =	8:10		Deadhead + in service time (excludes lunch break)			
Total Vehicle Miles =	125		Deadhead + in service miles (excludes lunch break)			

Requiring vehicle operators to turn in manifest information daily is highly recommended. In this way, as questions arise, information may be checked for accuracy while still fresh in the memories of the operators and dispatchers. A spreadsheet or database may be used to check the data for reasonableness. Table 4 illustrates how a spreadsheet/database may be helpful in automating hour, mile, and passenger summary reports and in quality control. Table 4 contains the recorded data for four driver manifests. Table 5 provides the automated calculations derived from the formulas within the spreadsheet. Note that Table 5 provides a summary of hours, miles, and passengers and provides the average speed, deadhead ratio (percent of deadhead to total hours or miles), and productivity for each manifest. These automated calculations provide a means to check for errors and serve as a management tool.

Table 4. Manifest Data Collection

Date	Manifest	Passengers			Garage Out		1st Pickup		Break Start		Break End		Last Drop-off		Garage In	
		Patrons	Companions	Attendants	Odometer	Time	Odometer	Time	Odometer	Time	Odometer	Time	Odometer	Time	Odometer	Time
Summary		137	1	3												
3/18/2011	1	27			40,224	8:33	40,230	8:47	40,375	13:18	40,375	14:23	40,410	16:15	40,435	16:55
3/18/2011	2	25	1		91,435	8:01	91,437	8:11	91,467	10:42	91,467	12:00	91,513	16:15	91,514	16:22
3/18/2011	3	57		1	41,311	7:50	41,319	8:30	41,353	12:09	41,353	13:09	41,405	16:15	41,406	16:25
3/18/2011	4	28		2	47,030	8:13	47,044	8:35	47,159	13:32	47,159	14:40	47,194	16:19	47,212	16:44

Table 5. Datasheet Automated Calculations

Date	Manifest	Total Revenue		Total Deadhead		Total Vehicle		Speed Check			Deadhead Ratio	
		Miles	Hours	Miles	Hours	Miles	Hours	Revenue	Deadhead	Total	Miles	Hours
Summary		492	2:30	75	2:48	567	5:18	18.57	26.79	19.35	13%	10%
3/18/2011	1	180.00	6:23	31.00	0:54	211.00	7:17	28.20	34.44	28.97	15%	12%
3/18/2011	2	76.00	6:46	3.00	0:17	79.00	7:03	11.23	10.59	11.21	4%	4%
3/18/2011	3	86.00	6:45	9.00	0:50	95.00	7:35	12.74	10.80	12.53	9%	11%
3/18/2011	4	150.00	6:36	32.00	0:47	182.00	7:23	22.73	40.85	24.65	18%	11%

Many demand-response providers utilize routing and scheduling software coupled with MDTs to aid in data collection and calculations for operating statistics. These software and hardware tools have the capability to calculate and summarize the operating data using multiple variables and parameters. For example, a transit provider can set the parameters to include or exclude driver break periods or out-of-service periods when calculating revenue hours and miles. By having the ability to customize reports, transit providers can track a variety of performance measures in multiple formats. Figure 12, Figure 13, Figure 14, and Figure 15 provide excerpts from reports generated using three different routing and scheduling software packages.

Figure 12 illustrates an example summary of revenue hours and passenger counts from January 10, 2011, for all vehicles of a transit provider. The summary also includes performance measures such as passengers per hour.

Figure 13 and Figure 14 provide example report excerpts that show revenue miles and hours for a vehicle over several days. Figure 15 provides an excerpt of a report that includes several operating statistics such as passenger trip types, revenue miles, and revenue hours for several vehicles in a fleet side by side.

Several routing and scheduling packages have the ability to customize the reports to the transit provider's needs.

Rural, small urban, and specialized transit providers typically use multiple sources of funding. These programs have different rules, requirements, and clientele. Automated routing and scheduling packages have the ability to categorize trips by funding source or program. The software can create summary reports based on the program. Transit providers can customize the summary reports to include details on each program's performance. Figure 16 provides an example program summary report.

Trip Hours Productivity															
Ride Date: 2011-01-10 to 2010-01-10															
Total Hours	Total Trips	Flex Trips	Pass. No.	Transferred Trips	Transferred Pass. No.	Service Hours	Live Hours	DH Hours	Passengers Per			Trips Per			
									Srv Hours	Live Hours	Total Hours	Srv Hours	Live Hours	Total Hours	
2628	4933	0	5802	0	0	2328.3	2328.3	204.3	2.5	2.5	2.2	2.12	2.1	1.88	

Figure 12. Report Excerpt 1

For Time Period: 03/01/2011 To 03/31/2011								
Printed: 4/15/2011 3:33 pm								
Vehicle ID								
Date	Run Name	Garage Start	First Pickup Odometer	Last Dropoff Odometer	Garage Stop	Revenue Miles	Non-Revenue Miles	Service Miles
1220								
03/04/2011	Veh:1220	189,789	189,790	189,974	189,982	184	9	193
03/07/2011	Veh:1220	189,864	189,890	190,022	190,024	132	28	160
03/08/2011	Veh:1220	190,017	190,021	190,117	190,120	96	7	103
03/11/2011	Veh:1220	190,115	190,118	190,239	190,241	121	5	126
03/14/2011	Veh:1220	190,238	190,241	190,311	190,319	70	11	81

Figure 13. Report Excerpt 2

For Time Period: 03/01/2011 To 03/31/2011
Printed: 4/15/2011 3:28 pm

Vehicle ID								
Date	Run Name	Garage Start	First Pickup Time	Last Dropoff Time	Garage Stop	Revenue Hours	Non-Revenue Hours	Service Hours
1220								
03/04/2011	Veh:1220	6:57 am	7:06 am	1:20 pm	2:41 pm	6.23	1.50	7.73
03/07/2011	Veh:1220	4:43 am	5:27 am	12:24 pm	12:56 pm	6.95	1.27	8.22
03/08/2011	Veh:1220	4:30 am	5:09 am	12:00 pm	12:24 pm	6.85	1.05	7.90
03/11/2011	Veh:1220	6:00 am	6:04 am	2:08 pm	2:10 pm	8.07	0.10	8.17
03/14/2011	Veh:1220	5:16 am	5:35 am	9:05 am	10:10 am	3.50	1.40	4.90

Figure 14. Report Excerpt 3

Trip Date	Child<5	W/C	1 Way Trip	Monthly Pass	Guests/ ATTEND	Total Trips	Non Rev Miles	Non Rev		Total Time	Rev Time	Rev Miles	Total Miles	Total Fare	Program
								Time	Time						
VIC-1723	0	5	5	9	0	19	6	85	495	410	77	83	8	DR	
3/1/2011	0	5	5	9	0	19	6	85	495	410	77	83	8		
VIC-1788	0	0	2	0	2	4	9	40	360	320	201	210	0	DR	
3/1/2011	0	0	2	0	2	4	9	40	360	320	201	210	0		
VIC-1796	0	0	2	0	2	4	7	76	570	494	266	273	0	DR	
3/1/2011	0	0	2	0	2	4	7	76	570	494	266	273	0		
Grand Total	0	5	9	9	4	27	22	201	1425	1224	544	566	8		

Figure 15. Report Excerpt 4

For DateRange: 03/01/2011 To 03/31/2011

Service Miles	Deadhead Miles	No Show Miles	Revenue Hours	Passenger Hours	Cancel	Attnd Count	AMB	Vehicle Miles	Passengers
Revenue Miles	Passenger Miles	Service Hours	Deadhead Hours	No Show Hours	No Shows	Guest Count	Wheelchair	Vehicle Hours	
Aldersgate - Contract									
1,360	132	13	86.68	181.30	3	0	280	2,931	280
1,228	3,599	97.68	11.00	0.00	40	0	0	229.45	
American Cancer Society									
849	85	0	23.75	24.67	0	0	16	3,178	16
764	1,005	27.82	4.07	0.00	0	0	0	105.70	
Area Agency on Aging (West Central TX COG)									
972	125	0	95.33	153.47	13	0	195	7,453	227
847	1,947	105.38	10.05	0.00	39	0	32	582.12	
Ballinger Memorial Hospital - Swann Clinic									
83	27	0	7.07	3.47	3	0	13	1,839	23
56	32	7.73	0.67	0.00	2	0	10	93.98	
Coleman Head Start									
888	298	0	133.08	81.90	107	0	240	1,081	240
590	1,291	143.93	10.85	0.00	117	0	0	158.28	
CTO, Inc. Brownwood Head Start									
770	118	0	141.08	238.10	163	0	427	1,170	427
652	3,313	154.60	13.52	0.00	60	0	0	179.13	
Erath County Senior Citizens									
1,900	160	0	142.48	68.23	23	4	253	11,933	326
1,740	1,100	162.17	19.68	0.00	1	1	68	700.82	

Figure 16. Productivity by Funding Source

5.4.3 Hybrid Fixed-Route and Demand-Response Hours and Miles Collection

Transit providers that operate hybrid fixed-route and demand-response services such as deviated-route or flex-route service collect revenue miles and hours using a combination of fixed-route and demand-response methodologies. Typically, hybrid system revenue hours closely resemble fixed-route because of the operator's obligation to meet fixed time points. In this way, the beginning and ending route times are similar or the same from day to day. However, the revenue miles fluctuate from day to day because of the varying number of demand response requests during the route's operation. Transit providers record the miles on a daily basis just as fixed-route service miles would be recorded—the operator writes down the odometer reading at the garage and first stop and records the information again at the last stop and the garage. Hybrid fixed-routes have fixed time points so each time an operator travels the entire route without receiving a demand-response call, the miles will be the same. When operators deviate from the fixed-route to pick up a demand-response passenger, the bus travels more miles. Transit providers record the revenue miles each day for hybrid fixed-route service. The daily miles fluctuate based on the number of demand-response passengers picked up on the hybrid service.

5.4.4 Taxicab and Vanpool Miles and Hours Data Collection

Manual recording of passenger trips taken via taxicabs, vanpools, and other non-dedicated demand-response services relies on vehicle operators to provide accurate data. Revenue mile data are obtained from driver logs or mobile data terminals, which should be configured so that vehicle operators record the actual odometer readings when entering and leaving revenue service. For volunteer services, reporting forms should be developed that will capture revenue miles. For non-dedicated service such as taxi services, arrangements with the taxi company will need to include requirements that vehicle operators report the mileage between the pick-up and drop-off locations, if such data are not routinely collected. These data would then be included on the taxi company invoice to the transit provider. While some demand-response systems that use taxis for non-dedicated service check the taxi-reported data using mapping software that calculates distance between two locations, such calculated mileage cannot be used for NTD reporting; NTD requires that actual miles be reported.

Revenue hour data are obtained from driver logs or MDTs, which should be configured so that vehicle operators report the actual times entering and leaving revenue service. For taxis, vanpools, or other non-dedicated service, the taxi or other provider company should be required to report the time from passenger pick-up to

5.5 SUMMARY OF HOURS AND MILES

The following is a summary of items to remember in reporting revenue and vehicle hours and miles:

Do Not Report Deadhead as Part of Revenue Hours and Miles

Revenue hours and miles should be reported from first passenger stop to last passenger stop on fixed-route transit, and from the first pick-up to the last drop-off for demand-response service. Revenue hours and miles do not include the time and distance from garage pull-out to the beginning of a route (or first passenger pick-up) and the time and distance from the end of the route (or last passenger drop-off) to garage pull-in.

Do Not Report Non-Service Hours and Miles in Revenue or Vehicle Hours and Miles

Reporting of operator training, vehicle maintenance testing, and transporting of vehicles to maintenance facilities should not be included in the calculation of revenue/vehicle hours and miles.

Be Careful in Treatment of Lunches and Breaks

Scheduled lunches and breaks should not be included in the calculation of revenue/vehicle hours and miles. If a transit provider does not subtract scheduled lunches and breaks, as is required by NTD, the transit provider will overstate revenue and vehicle hours. A transit provider that uses an automated scheduling system should select the system parameters to exclude scheduled lunches and breaks to correctly report revenue hours and miles.

Do Not Report Total Hours Based on Driver Pay Hours

Payroll hours should not be used to report revenue or vehicle hours. Vehicle hours should be measured from garage pull-out to garage pull-in. Payroll hours include time that is not included in vehicle or revenue time.

Do Not Report Total Vehicle Miles Based on Total Odometer Miles from the Fueling Reports (All Miles)

Since odometer miles may include miles outside of revenue or total service (e.g., lunch breaks, trips to maintenance facilities), total vehicle miles should be reported from garage pull-out to garage pull-in.

Count Hours and Miles When No Passengers Are On Board the Vehicle

Hours and miles should be counted as part of revenue or total service when the transit vehicle is providing public transportation and available to carry passengers, even if the vehicle is not carrying passengers. Although there may be no passengers on board, the vehicle is considered to be in revenue service and hours and miles should be counted as long as the vehicle operator does not return to the dispatching point.

Cross-Verify Revenue Miles and Hours from the Automated Scheduling System with a Manual Data Collection

Since automated routing systems may estimate miles based on direct point-to-point miles, which may significantly vary from actual mileage, transit providers should remember to manually sample driver manifests to verify revenue miles from an automated scheduling system.

Report Taxi Provider Hours

Because taxi companies operate using meter fares calculated on miles driven, supplemental reporting of hours may be required to ensure both miles and hours are reported for the passengers carried.

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Chapter 6. Expenses

Not Only Billing—the Cost of Providing Service

This chapter outlines transit expenses, documents critical expense information, and identifies common reporting errors. The purpose of this information is to increase the accuracy of reported transit data by equipping transit providers with a concentrated source of information about expenses. The chapter organization is:

- 6.1 Accrual Accounting Method of Recording Expenses
- 6.2 Operating vs. Capital Expenses
- 6.3 A Common Chart of Accounts
- 6.4 Operating Expenses by Function
- 6.5 Indirect Costs
- 6.6 Capital Expenses
- 6.7 Operating and Capital Expense Reporting Form Example
- 6.8 Summary of Expenses

Reporting Expenses

Establishing a framework for reporting expenses (costs) is important to ensure accuracy of data and to understand and manage transit program costs. The following elements are considerations in establishing a cost-reporting framework:

- Report all expenses to identify the total cost to provide transit service.
- Report costs based on the public transportation industry required standard for NTD using the Uniform System of Accounts (USOA).
<http://www.ntdprogram.gov/ntdprogram/pubs/reference/USOA.pdf>
- Report costs based on the accrual method of accounting – as required in the USOA.
- Segregate and report capital costs separately from program operating costs.
- Report costs by functional area (i.e., transit operations, maintenance, administration) and by different modes (i.e., fixed-route, demand response) to better understand and manage costs.
- Report overhead and indirect costs.

This toolkit follows the NTD reporting approach that captures direct costs as well as all overhead and indirect costs, including costs that are shared with other public

agencies. Overhead and indirect costs might include legal services, administrative support, data processing, billing, and purchasing.

The USOA is the basic reference document for the NTD. USOA contains the accounting structure *required* by federal transit laws. The USOA requires the accrual method of accounting. Those transit providers that use cash-basis or encumbrance-basis accounting, in whole or in part, must make work sheet adjustments to record the data on the accrual basis as described in the USOA (see <http://www.ntdprogram.gov/ntdprogram/pubs/reference/USOA.pdf>).

Transit providers should report all expenses, not just those expenses that are allowable for grant reimbursement. Reporting expenses based on only allowable grant reimbursable expenses does not capture the total cost of providing transit service. Recipients of grant funds must be familiar with rules and procedures to understand the difference in reporting allowable costs for grant reimbursement and reporting total cost for NTD and other stakeholder reporting requirements. National Archives and Records Administration, Office of Management and Budget Guidance for Grants and Agreements, consolidates all circulars relating to financial and audit guidance for any federal grants into Title 2 of the Code of Federal Regulations (see <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=%2Findex.tpl>).

Two circulars that define allowable and unallowable expenses and cost categories for state, local, Indian tribes, and non-profit organizations are:

- OMB Circular A-87, Cost Principles for State, Local and Indian Tribal Governments
http://www.whitehouse.gov/omb/circulars_a087_2004.
- OMB Circular A-122, Cost Principles for Non-Profit Organizations
http://www.whitehouse.gov/omb/circulars_a122_2004.

6.1 ACCRUAL ACCOUNTING METHOD OF RECORDING EXPENSES

There are two accounting methods that a transit provider may use to record expenses in the financial records: cash-basis accounting and accrual accounting. The key difference between the two methods is how and when financial transactions are recorded. NTD requires accrual accounting to ensure that revenues and expenses are properly matched to the services provided and passengers served.

6.1.1 Cash-Basis Accounting

In **cash-basis accounting**, the transit provider records expenses when the cash is actually paid out and records revenue when the cash is actually on-hand or in a bank account.

6.1.2 Accrual Accounting

The USOA requires the accrual method of accounting or that transit providers that use cash-basis or encumbrance-basis accounting, in whole or in part, make work sheet adjustments to record the data on the accrual basis as described in the USOA (see <http://www.ntdprogram.gov/ntdprogram/pubs/reference/USOA.pdf>).

In an **accrual accounting** system, expenses are recorded when incurred, even if service or supplies have not been actually paid yet. For example, when a transit provider buys fuel for buses, the provider may not pay for the fuel until a month or so later when the provider receives the bill. Under accrual accounting the fuel expense is booked in the accounting period in which the fuel is used (this matches the time period when the service is performed) not in a future period when the bill is actually paid.

Example. The transit provider uses 1,000 gallons of fuel worth \$4,000 to provide service in June. The transit provider records \$4,000 expenses for fuel in June whether or not actual payment or reimbursement occurred in the same month.

6.2 OPERATING VS. CAPITAL EXPENSES

The total cost of providing transportation service equals the sum of all operating and capital expenses.

Operating expenses are typically expenses that are consumed in a single calendar or fiscal year to operate transit service. These expenses include labor, fringe benefits, materials and supplies (e.g., fuel), maintenance, office space, equipment and administrative costs. Administrative costs are a kind of operating cost. Administrative costs may be more difficult to quantify when the transit provider is a part of a larger organization. Administrative expenses are those used to support the performance of a program's basic function of providing transit service.

Capital expenses refer to the expenses associated with long-term acquisitions and leases of physical assets, such as buses, garages, and maintenance facilities.

According to NTD, capital expenses are the costs incurred that exceed \$5,000 or the capitalization value established by the local government unit if lower.

6.2.1 Operating Expenses Eligible for Capital Reimbursement

An operating expense that is eligible for reimbursement at the capital reimbursement rate (e.g., an expense for preventive maintenance) is still reported as an operating expense. For example, preventive maintenance is defined for Section 5311 federal grants as an operating expense that is eligible for capital reimbursement. The scope of this toolkit does not address which operating expenses are eligible for capital reimbursement as these expenses may differ from state to state. The following FTA circulars provide further guidance on eligible capital expenses:

- FTA C 9040.1F Nonurbanized Area Formula Program Guidance and Grant Application Instructions
http://www.fta.dot.gov/documents/FTA_C_9040.1F.pdf
- FTA C 9070.1F Elderly Individuals and Individuals with Disabilities Program Guidance and Application Instructions
<http://www.fta.dot.gov/documents/C9070.1F.pdf>
- FTA C 9050.1 The Job Access Reverse Commute (JARC) Guidance and Application Instructions
http://www.fta.dot.gov/documents/FTA_C_9050.1_JARC.pdf
- FTA C 9045.1 New Freedom Program Guidance and Application Instructions
http://www.fta.dot.gov/documents/FTA_C_9045.1_New_Freedom.pdf

6.3 A COMMON CHART OF ACCOUNTS

NTD requires the use of a uniform chart of accounts as described in the USOA. A uniform chart of accounts is essential to track all expenses relating to the provision of transit service. A key element of the chart of accounts is the establishment of expense classes, typically according to USOA classes. Detailed expense classes typically include the following:

- Labor
- Fringe benefits
- Services
- Materials and supplies
- General administrative expenses (allocated central services, if applicable)

- Utilities
- Casualty and liability costs
- Taxes
- Purchased transportation
- Miscellaneous expenses
- Interest expense
- Leases and rentals
- Depreciation and amortization
- Capital expenses

Each expense class may have detailed subcategories. For example, the category “labor” could have separate entries for drivers, administrators, dispatchers, and mechanics. Some transportation providers have separate expense categories for salaries paid for training or overtime. Other expense categories that may be useful in certain conditions include indirect expenses (for multi-service agencies providing transportation and other services), expense transfers, and interest expenses (*TCRP Report 144*, 2011).

6.4 OPERATING EXPENSES BY FUNCTION

Transit provider expenses can be described by function. Some examples of functional areas include:

- Transit Operation Expenses
- Maintenance Expenses
- Administration Expenses
- Purchased Transportation Expenses

Functional areas represent a set of line item expenses and cost drivers. Transit staff supervisors are often held accountable for costs by functional area. An understanding of the factors that drive costs by functional area provides a useful perspective to see the importance and value of reporting expenses accurately.

The following sections define and describe rural transit *operating* expenses, by the functional areas depicted in the list above. The purpose is to understand expenses and to correct common expense reporting errors.

6.4.1 Transit Operations Expense

Transit operations expense is an operating expense and includes all expenditures associated with activities to dispatch and operate vehicles in revenue service to carry passengers, including direct supervision and clerical support. Operations expenses are typically the largest expense function. The following is a list of expenses that fall into the functional area of transit operations.

<p>Transportation administration and support</p> <ul style="list-style-type: none"> •Garage and station supervision •Safety & training •Field supervision •Accident investigation 	<p>Revenue vehicle movement control</p> <ul style="list-style-type: none"> •Starters •Dispatching •Technology support (AVL, signal priority)
<p>Scheduling of transportation operations</p> <ul style="list-style-type: none"> •Data collection activities (ride check, running time checks) •Scheduling and run-cutting •Development of schedule summaries 	<p>Revenue vehicle operation</p> <ul style="list-style-type: none"> •Operators •Fuels and lubricants (and related taxes) •Tires •Vehicle licensing and registration •Lease and rental costs (facilities, vehicles)
<p>Ticketing and fare collection</p> <ul style="list-style-type: none"> •Producing fare media •Distributing fare media •Pulling vaults •Counting cash •Processing debit/credit card transactions 	<p>System security</p> <ul style="list-style-type: none"> •Patrolling buses and stations •Securing operating facilities •Monitoring closed circuit TV •Court appearances

6.4.2 Maintenance Expense

Maintenance expense is an operating expense and includes all expenditures associated with *vehicle* maintenance and *non-vehicle* maintenance. Preventive maintenance is included in this expense category. Although preventive maintenance is eligible for *reimbursement* as a capital expense, preventive maintenance is an operating expense by definition. Transit providers should report all maintenance expenses (including the portion eligible for capital reimbursement) as an operating expense.

Vehicle Maintenance

Vehicle maintenance is all expenditures associated with the activities to ensure revenue vehicles and service (non-revenue) vehicles are operable, cleaned, fueled, inspected and repaired. Vehicle maintenance expenses are typically the second largest expense function. The following is a list of expenses that fall into the functional area of vehicle maintenance.

Maintenance administration – vehicles	Servicing revenue vehicles	Inspection and maintenance of revenue vehicles
<ul style="list-style-type: none"> • Maintaining vehicle databases • Accumulating performance data • Providing technical training • Scheduling and recording maintenance activities • Engineering maintenance activities 	<ul style="list-style-type: none"> • Interior and exterior washing/cleaning • Refueling • Adding engine oil or water • Movement of vehicles for servicing 	<ul style="list-style-type: none"> • Schedule preventive maintenance • Minor repairs and fluid changes • Road calls/towing • Component rebuild/overhaul • Major repairs • Major unit replacement • Accident repair • Vandalism repair • Inspection and maintenance of service vehicles

Note. Some vehicle maintenance expenses, such as engine rebuilds and overhauls, may be a capital expenditure if the total cost of labor and materials necessary for the rebuild or overhaul is greater than \$5,000 or the capitalization value used by the agency if lower.

Non-vehicle Maintenance

Non-vehicle maintenance is all the activities associated with ensuring buildings, grounds and equipment (garages, passenger stations and shelters, administration buildings); fare collection equipment; and communications systems, track structures, tunnels and power systems are operable. The following is a list of expenses that fall into the functional area of non-vehicle maintenance expenses:

- Inspecting, cleaning, repairing and replacing components for:
 - fare collection and counting equipment
 - roadway and track
 - structures, tunnels, bridges
 - passenger stations (including shelters and custodial)
 - operating station buildings, grounds and equipment
 - garage and shop buildings, grounds and equipment

- communication systems
- general administration buildings, grounds and equipment
- Maintenance administration – non-vehicles (preparing maintenance records and training facility maintenance personnel)
- Vandalism repairs of buildings, grounds and equipment
- Operation and maintenance of electric power facilities

6.4.3 Administration Expenses

Administration expenses are all expenditures associated with activities (other than operating and maintenance activities) supporting the provision of transit service. If a transit provider is part of a larger organization, many of these supporting services may be provided by the larger organization. Section 6.5 discusses allocation of costs provided by the larger organization. The following is a list of expenses that fall into the functional area of administrative expenses:

<p style="text-align: center;">Finance and procurement</p> <ul style="list-style-type: none"> • Accounting • Payroll • Budgeting and financial reporting • Purchasing • Storing and issuing materials • Inventory management • Real estate management 	<p style="text-align: center;">Marketing and customer service</p> <ul style="list-style-type: none"> • Telephone information • Complaint lines • Distributing information to facilities • Promotions • Media relations • Market research
<p style="text-align: center;">Accidents (not repair of)</p> <ul style="list-style-type: none"> • Claims management • Payments for injuries and damages • Defending liability cases • System safety planning 	<p style="text-align: center;">General activities</p> <ul style="list-style-type: none"> • Personnel administration • General legal services • General insurance • Data processing • General engineering • Office management and services • General management • General function

6.4.4 Purchased Transportation Expenses (PT)

Purchased transportation expenses are expenses incurred and billed by purchased transportation providers (sellers) in the operation of the contracted transit services. The expenses are equal to the payments or accruals made to the transit provider (net of fare revenues the seller may have collected) and all purchased transportation fare revenues associated with the service (fare revenues collected by both the buyer and seller).

In purchased transportation, the provider (seller) is obligated in advance to operate public transportation services for a public transit provider or governmental unit (buyer) for a specific monetary consideration, using its own employees to operate revenue vehicles. Purchased transportation agreements to operate transit service may or may not include an agreement to provide maintenance, vehicles and facilities.

Expenses that are not a part of the purchased transportation agreement, and therefore the buyer is under no obligation to pay the seller, should not be reported as purchased transportation. Do **not** report the following expenses in purchased transportation:

- Expenses for which the buyer has no obligation to pay – for example, if the service costs the seller more than his contract covers.
- Expenses incurred by the buyer in support of the purchased transportation service – for example, salaries and wages of transit provider personnel administering or working in some capacity in support of the agreement, fuel and tires if provided to the seller, vehicle maintenance, marketing, advertising, legal services, and ticket sales if provided by the buyer. These are called other costs incurred by the buyer and are reported in the appropriate expense category.

The next two sections provide additional information on the treatment of PT passenger fare revenue and capital costs included in PT negotiated rate to accurately report PT *operating* expenses.

Purchased Transportation and Fares

In many cases, PT providers collect and retain fare revenues and deduct the fares from the invoice. To properly account for the cost of the PT service and account for fare revenues, fares should be added back to the invoice to report the full PT expense and the fares should be reported as passenger fares.

Example. In the example below, a negotiated contract rate of \$15.00 per passenger is charged to provide 1,000 passenger trips during the period. The PT expense is \$15,000 ($\$15.00 \times 1,000$). The PT provider invoices the buyer of service \$13,000 because the PT provider has retained \$2,000 collected for passenger fares. The buyer of PT reports the \$15,000 under Purchased Transportation Expense and \$2,000 under Passenger Fare Revenue.

Contract Rate	\$15.00
Number of Passengers	1,000
Purchased Transportation Expense	\$15,000
Less Fares Retained (\$2/passenger)	(\$2,000)
Invoiced Amount	\$13,000

If fares are . . . negotiated contract rate

Some contracts include a negotiated contract with an agreement that the seller will retain a set amount for passenger fares and will charge an adjusted rate for the retained fare.

Example. In the example below, the estimated cost per passenger of \$15.00 and fare revenue per passenger of \$2.00 results in a negotiated contract rate of \$13.00. The PT provider invoices the buyer of service \$13.00 per passenger to carry 1,000 passengers during the period for a total of \$13,000. The buyer of PT reports the purchased transportation cost of \$15.00 per passenger for a total of \$15,000 under Purchased Transportation and the fare revenues of \$2.00 per passenger for a total of \$2,000 as Passenger Fare Revenue.

Negotiated Operating Rate	\$15
Negotiated Fare	(\$2)
Contract Rate	\$13
Number of Passengers	1,000
Invoiced Amount	\$13,000

Negotiated Operating Rate	\$15
Number of Passengers	1,000
Purchased Transportation Expense	\$15,000

Fares Negotiated	\$2
Number of Passengers	1,000
Passenger Fare Revenue	\$2,000

Note. Reporting the full PT expense and PT passenger fares is important because otherwise the cost of providing service is not reported accurately and total passenger fares is incorrect.

Purchased Transportation and Capital Expense

To report *operating expenses* separately from capital expenses, capital costs for vehicles and/or facilities in the PT rate must be reported separately. The buyer of service may require the seller to provide the vehicles and/or facility (capital costs) in the negotiated PT rate. The PT seller charges a negotiated rate that includes both the operating expense associated with the operations and maintenance and the capital cost associated with providing the vehicle and/or facility.

Example. For example, if a PT contract is negotiated at a rate of \$50.00 per hour and the contract includes \$10.00 per hour to provide the vehicles and facility, then deduct the capital expense from purchased transportation when reporting operating expenses.

6.5 INDIRECT COSTS

Transit providers may be a part of a larger organization such as a health and human service agency, city or county. The larger organization may provide services and facilities across multiple programs. The larger organization may provide utilities, IT support, bookkeeping, purchasing, accounting, legal, general management and rent, for example. The cost of these types of services may be overlooked when transit providers calculate the cost of a specific program. The transit provider should include both direct and indirect cost in reporting expenses.

Cost allocation plans and indirect cost plans are a means to identify costs and to ensure accounting for the total cost of a program. OMB Circular A-87: Cost Principles for State, Local and Indian Tribal Governments and OMB Circular 122: Cost Principles for Nonprofit Organizations address direct and indirect costs and the methods for allocating these costs. These circulars address development of a certified cost allocation plan or a certified indirect cost rate proposal. These circulars can be found at http://www.whitehouse.gov/omb/circulars_default.

6.6 CAPITAL EXPENSES

Capital expenses include expenses related to the purchase of facilities, vehicles and equipment. Capital items are an article of non-expendable tangible personal property having a useful life of more than one year and an acquisition cost threshold consistent with federal and local requirements. The cost threshold by FTA requirements is at least \$5,000 or the capitalization value used by the transit provider if lower.

Capital expenses are reported using the accrual accounting principle that states expenses are reported in the period when expenses are incurred (i.e., the month in which a purchase results in a liability for benefits received, regardless of whether or not the expenditure is paid during the reporting period). Capital expenses include, but are not limited to, the following.

Facilities capital expenses include administration, central/overhaul maintenance facilities, light maintenance and storage facilities, and equipment of any of these items. Some example categories of facilities capital expenses that may apply to rural transit are:

- *Passenger station* is a capital expense for passenger boarding and alighting areas with platforms including transportation centers and park-and-ride facilities but excluding transit stops on streets.
- *Administration building* is a capital expense for a building that houses management and support activities.
- *Maintenance facility* is a capital expense for a building used for maintenance activities such as garages and shops.

Rolling stock capital expenses are the expenses for vehicles, including boats, used by transit providers. Categories of rolling stock capital expenses are:

- *Revenue vehicle* is a capital expense for a vehicle used to transport passengers.
- *Service vehicle* is a capital expense for a vehicle used to support transit activities such as tow trucks, supervisor cars, and police cars (sometimes referred to as a non-revenue vehicle).

Other capital expenses include furniture, equipment that is not an integral part of buildings and structures, shelters, signs, and passenger amenities (e.g., benches) not in passenger stations. Categories of all other capital expenses are:

- *Fare revenue collection equipment* is a capital expense for equipment used to collect fares such as fare boxes, turnstiles, and ticket machines.

- *Communications and information systems* is a capital expense for equipment for communicating such as radios and for information management such as computers and software.
- *Other is any capital expense that does not fall in the categories defined above.*

6.7 OPERATING AND CAPITAL EXPENSE REPORTING FORM EXAMPLE

Below is an example of a form to report all costs of providing transit service. The form reports expenses by function and class, and by operating and capital. This form may be modified to include additional expense functions and classes. Transit providers may use this form to report total expenses for all transit service provided or to report expenses by mode or by grant. If used to report by grant, an additional column might be added to record expenses that are not eligible for grant reimbursement. In this way, the transit provider has a means of tying grant billing-statements to the total cost expense report (see Figure 18).

EXPENSE CLASS	Transit Operations	Maintenance	Administration	TOTAL (Full-Cost)
Labor				
Operator's salaries and wages				
Other salaries and wages				
Fringe Benefits				
Services				
Contract service fees				
Advertising fees				
Other services				
Materials and Supplies				
Fuel and lubricants				
Tires and tubes				
Other materials and supplies				
Utilities				
Casualty and Liability Costs				
Taxes				
Property taxes				
Vehicle registration fees				
Fuel/Lube taxes				
Other taxes				
Purchased Transportation				
Miscellaneous Expenses				
Dues/ subscriptions				
Travel and meetings				
Tolls				
Bad debt expense				
Advertising/promotion media				
Other miscellaneous expense				
Interest Expense				
Leases and Rentals				
Vehicles				
Maintenance garage				
Other facilities				
Other Costs				
TOTAL OPERATING COSTS				
TOTAL CAPITAL COSTS				
Vehicles				
Facilities				
Equipment				
Capital in PT				

Figure 18. Example of Full-Cost Expense Report

6.8 SUMMARY OF EXPENSES

The following is a summary of items to remember in reporting expenses:

Report Operating Expenses that are Eligible for Reimbursement at the Capital Reimbursement Rate in the Appropriate Operating Expense Category

An operating expense that is eligible for reimbursement at the capital reimbursement rate is still reported as an operating expense. Report operating expenses that are eligible for reimbursement at the capital reimbursement rate for grant reimbursement in the appropriate operating expense category (e.g., preventive maintenance).

Adjust for Passenger Fares in Purchased Transportation Expenses

If a PT seller retains passenger fares and deducts from the invoice, the buyer should add fare revenue back to the invoice amount to report the total cost of the transit service purchased.

Separate Capital and Operating in Purchased Transportation Expenses

Report the capital portion (vehicles, facilities and equipment) of purchased transportation services as capital; separate from operating expenses.

Report Indirect Expenses

If a transit provider is part of a larger organization, ensure that the costs of services and facilities provided by the larger organization are captured and reported.

Report All Transit Functions or Unallowable Costs

Ensure that the full cost of providing transit service is reported (operational, purchased transportation, and capital). Report costs eligible for grant reimbursement and costs that are not eligible for grant reimbursement.

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Chapter 7. Revenues

Where the Funding Comes From

This chapter outlines rural transit funding sources (revenue streams), documents critical information to report revenues, and identifies common reporting errors. The purpose of this information is to increase the accuracy of reported rural transit data by equipping rural and specialized transit providers with a source of information about revenue. The chapter organization is:

- 7.1 Accrual Accounting Method of Recording Revenues
- 7.2 Contributed Services
- 7.3 Description of Revenue Sources
- 7.4 Charter, Exclusive School Bus, and Freight Tariff Revenue
- 7.5 Reporting Bonds and Loans
- 7.6 Summary of Revenues

How to Report Revenues

NTD requires revenues to be reported by funding source including funds for both operating and capital expenditures. Report only those funds that are (or will be) applied to the transit provider for transit projects during the reporting period. If a transit provider is part of a larger entity such as a social service organization, city or county, do not report revenues received to support non-transit related activities associated with the larger entity. This toolkit follows the NTD reporting approach that captures revenues that are applied to direct costs as well as overhead and indirect costs, including costs that are shared with other public agencies. Overhead and indirect costs might include legal services, administrative support, data processing, billing, and purchasing.

The USOA is the basic reference document for the NTD. USOA contains the accounting structure *required* by federal transit laws. The USOA requires the accrual method of accounting (discussed further in Section 7.1). Transit providers that use cash-basis or encumbrance-basis accounting, in whole or in part, must make worksheet adjustments to record the data on the accrual basis as described in the USOA (see <http://www.ntdprogram.gov/ntdprogram/pubs/reference/USOA.pdf>).

7.1 ACCRUAL ACCOUNTING METHOD OF RECORDING REVENUES

There are two accounting methods that a transit provider may use to record revenues in the financial records: cash-basis accounting and accrual accounting. The key difference between the two types is how and when financial transactions are recorded. NTD requires accrual accounting to ensure that revenues and expenses are properly matched to the services provided and passengers served.

7.1.1 Cash-Basis Accounting

In **cash-basis accounting**, the transit provider records revenue when the cash is actually on-hand or in a bank account and records expenses when the cash is actually paid out. In the cash accounting method, the transit provider records debits and credits to accounts only when money actually changes hands.

7.1.2 Accrual Accounting

In the **accrual accounting** method, the transit provider records revenues when service is rendered, not when the cash is received. In the accrual accounting method, the transit provider records debits and credits to accounts when the transaction itself takes place, regardless of when cash actually exchanges hands.

Example. A transit provider operates 1,000 hours of service in June for a cost of \$20,000 and is reimbursed for the service from grant funds in July. Based on accrual accounting methodology, the transit provider records the revenue in June, even though the transit provider did not receive the grant revenues until July. The unpaid costs are booked as a payable/liability and the uncollected revenue is booked as a receivable/asset. The expenses, revenues and service (hours, miles, passengers) are all recorded in the same time period. The benefit of accrual accounting is that expenses and revenues are matched to when service is delivered to provide a better means to evaluate financial health and the cost of providing service.

7.2 CONTRIBUTED SERVICES

Contributed services are receipt of *non-cash* assets or services from another entity that benefits the transit provider. Contributed services include physical assets and services. In-kind services are a type of contributed services where the transit provider derives a benefit from another entity but is under no obligation to pay for that benefit.

The transit provider should keep a record of the financial value of any and all contributed services including in-kind services. Many transit providers receive a large percent of the transit budget from contributed service. If contributed services were not reported, the cost of providing the service would not be accurate. However, rural transit providers do not report the value of in-kind services to NTD. The NTD Rural Reporting Manual states: “Do not report in-kind services even though they were used as match in a federal grant” (Rural NTD 2011).

When documenting the value of contributed services, report:

- Physical assets as the fair market value of the physical asset at the date received.
- Services if the service meets the following test:
 - The service is significant and essential.
 - The transit provider has reasonably good control over the services.
 - There is an objective basis to value services.
 - The service benefits people outside the contributor’s organization.

Examples of contributed services include:

- Utility services provided without-charge.
- Marketing provided without-charge.
- Maintenance services provided without-charge.
- Office space provided without-charge.

When reporting contributed services, then an equal amount of contributed service expense should be reported to equal the amount of contributed service revenue. Report the value of in-kind services even though there is no expectation for reimbursement.

7.3 DESCRIPTION OF REVENUE SOURCES

This section defines and explains information by revenue category corresponding to the NTD Rural Reporting Manual as depicted in Figure 19 below.

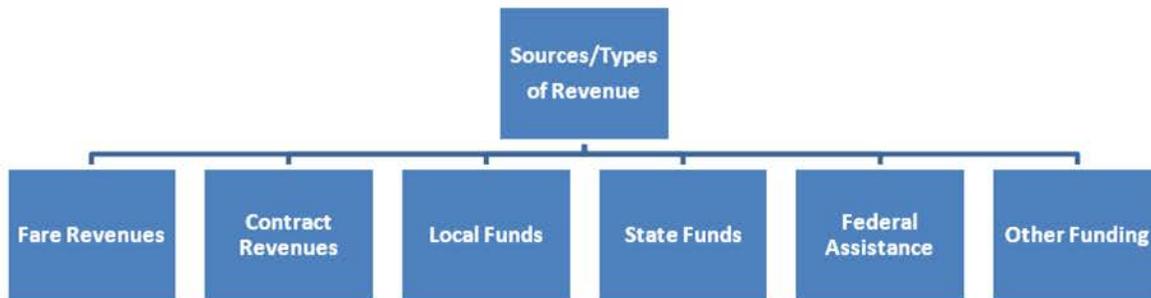


Figure 19. Revenue Sources

7.3.1 Fare Revenue

Fare revenues are the revenues earned from carrying passengers. Fare revenues are usually the amount paid by the rider (*passenger fares*) to use transit services but may also include *special transit fares*, as discussed below (National Transit Database 2011). Fares may be collected in several ways, including:

- Before service is provided (e.g., through the sale of media such as passes, tickets, tokens sold to passengers)
- Directly at the point of service (e.g., farebox, turnstile)
- After the service is provided, (e.g., through weekly or monthly billing)

Passenger Fares

The USOA defines **passenger fares** as revenues earned from carrying passengers along regularly scheduled and demand-responsive routes. Passenger fares include the base fare, zone premiums, express service premiums, extra cost transfers, and quantity purchase discounts applicable to the passenger's ride. Passenger fares include:

- *Full Adult Fares*: revenues earned by transporting passengers for the full adult fare.
- *Senior Citizen Fares*: revenues earned by transporting passengers who pay a special, reduced fare because they are older than a prescribed age limit.
- *Student Fares*: revenues earned by transporting passengers who pay a special, reduced fare because they are enrolled in an educational institution.
- *Child Fares*: revenues earned from carrying passengers who pay a special, reduced fare because they are younger than a prescribed age limit.
- *Disabled Rider Fares*: revenues earned from carrying passengers who pay a special, reduced fare because they are an individual with a disability.

- *Park and Ride - parking revenue only*: revenues earned from parking fees paid by passengers who drive to “park and ride” parking lots operated by the transit company to utilize transit service.
- *Special Ride Fares*: revenues earned from carrying passengers who pay a special, reduced fare for a reason other than those specified above (USOA 2010).

Special Transit Fares

The USOA defines **special transit fares** as fare revenues earned for *rides* given in regular transit service, but paid for by some organization other than by the rider. In addition, special transit fares include funds for rides given along special routes for which funds may be guaranteed by a beneficiary of the service. Special transit fare contracts are *not* a contract for service but a contract for fares based on the *rides* provided. Special transit fares may include:

- *Contract Fares for Postal Workers*: revenues earned by providing rides for postal workers with periodic contractual payments (rather than farebox collections) made directly by the U.S. Postal Service to the transit provider.
- *Contract Fares for Police Officers*: revenues earned by providing rides for police officers with periodic contractual payments (rather than farebox collections) made directly by the police authority to the transit provider.
- *Special Route Guarantees*: the amounts paid by organizations (e.g., industrial firms, shopping centers, public and private universities) to guarantee a minimum amount of funds on a line operated especially for the benefit of the payer.
- *State and Local Government*: revenues earned under contractual arrangements with state or local governments for transit fares other than postal workers, police officer and special route guarantees.
- *Other Special Contract Transit Fares - Other Sources*: revenues earned under contractual arrangements with non-government entities for transit fares other than special transit guarantees.
- *Non-Contract Special Service Fares*: revenues earned by providing special service rides (e.g., sporting events, sightseeing, special tours) where fares are not guaranteed on a contractual basis (USOA 2010).

Fare Assistance ... is Not a Passenger Fare

Local government financial support to cover the difference between full adult fares and special reduced fares is considered fare assistance and is reported in the appropriate state and local fund category. Fare assistance is not considered

passenger fare revenue. Local fare assistance may include funding to cover the difference in the full adult fare and reduced fares for individuals with disabilities, elderly individuals, students and/or other groups specified.

Purchased Transportation and Fares

Purchased transportation (PT) fare revenues are the fare revenues derived from the PT service, regardless of whether fares are retained by the seller or returned to the buyer. PT fares are usually collected by the seller. However, PT fares can also be fares collected or sold by the buyer for passengers who ride purchased service. For example, if the buyer of the PT service sells tickets, tokens or passes to passengers, this revenue is part of PT fare revenues. Fare revenues derived from PT service should be reported as fare revenue whether retained by the seller or returned to the buyer. For information on ensuring PT fares and PT operating expenses are properly reported refer to Chapter 6 Section 6.4.4 “Purchased Transportation Expenses.”

7.3.2 Contract Revenues

Contract revenues are revenues received from any organization, government, agency, or company that result from a formal contractual agreement with the transit provider to provide a transit service. The transit provider is a *seller* of transportation services through a contract agreement. Contracts may be federal, state, local or privately funded to provide transportation service.

Contract for Service vs. Contract for Fares (Special Transit Fares)

A contract for service is different from a contract for fares (see Special Transit Fares above). A contract for service is a contractual arrangement to pay the transit provider for transit service and is not based on the rides provided. A contract for fares (special transit fares) is a contractual arrangement to pay the transit provider for the number of rides provided. The following are two examples based on university-affiliated contracts that highlight the difference between contracts for service and contracts for fares.

Example of Contract for Service. A public transit provider contracts to a university to provide a transit service that is open to the general public, but the service is designed with the university students in mind. The university pays the full cost of the transit service based on the hours of service provided. This is an example of a contract agreement for service. The income from this contract is reported as contract revenue.

Example of Contract for Fares. A public transit provider picks up students from a local university on local routes. As the passengers board the transit vehicle, students flash their student identification (ID) card from the university. The students are able to ride without paying a fare when boarding the bus. The transit provider counts the number of passengers flashing a student ID. The transit provider then reports the number of student riders to the university. In return, the university pays a fixed amount per student for those trips. This is an example of a contract for fares. The income from this contract is reported as fare revenues.

7.3.3 Local Funds

Local funds are the revenues from local governmental entities to support the operating and capital costs of the transit system. Local government financial support to cover the difference between full adult fares and special reduced fares is reported as local funds. The NTD Rural Reporting Manual states that local funds include but are not limited to the following:

- *Tax levies* – a specified amount from local tax levies that is dedicated to supporting public transit system operating costs and capital costs.
- *General funds* – transfers from the general fund of local governments to cover the local share portion of the transit system operating and capital budget.
- *Specified contributions* – contributions from city, county, or other municipal government towards the local share portion of the transit system operating and capital budget.
- *Reserve capital funds* – transfers from a capital reserve fund of local governments expressly established to be used to cover the local share portion of transit system capital costs.
- *Donations* – donations from individuals or organizations to help cover the costs of providing transit service but which are not related to specific passengers or trips, and to help cover capital costs. In the NTD Urban Reporting Manual, donations are classified as a type of “non-transit” related revenue.
- *Other* – other revenues such as advertising. In the NTD Urban Reporting Manual, advertising revenues are classified as a type of auxiliary transit revenue.

A rural transit provider may earn revenues from other local sources that are not specifically called out in the NTD Rural Reporting Manual. Additional other revenues types are discussed below.

Other local fund revenues are classified as non-transit related revenues and auxiliary transportation revenues in the NTD *Urban* Reporting Manual. The NTD *Rural* Reporting Manual does not provide a definition for the rural transit report. USOA defines non-transit related and auxiliary transportation revenue as:

- *Non-transit related revenues* are the revenues earned from activities not associated with the provision of transit service. Non-transit related funds include, but are not limited to:
 - Sale of maintenance services
 - Rental of revenue vehicles
 - Rental of buildings and other property
 - Investment income
 - Parking facility revenue
- *Auxiliary transportation revenues* are revenues received from property owned, leased or operated by the transit system. Auxiliary transportation revenues may include:
 - Station concessions
 - Vehicle concessions
 - Advertising services

7.3.4 State Funds

State funds are financial assistance obtained from a state government to assist with paying the costs of providing transit services and paying capital costs. State financial support to cover the difference between full adult fares and special reduced fares is included in this revenue category. The NTD Rural Reporting Manual describes state funds to include, but not be limited to:

- *Tax levies* — a specified amount from state tax levies that is dedicated to supporting public transit system operating or capital costs.
- *General funds* — transfers from the general fund of state governments to cover the local share portion of the transit system budget.
- *Specified contributions* — contributed from the state towards the local share portion of the transit system budget.

7.3.5 Federal Assistance

Federal assistance is financial assistance from the federal government to assist with paying the costs of providing transit services and capital cost. Sources of federal assistance revenue that are reported by rural transit providers include:

FTA §5309 Capital Program Funds

- Program provides capital assistance for three primary activities:
 - New and replacement buses and facilities
 - Modernization of existing fixed guideway systems
 - New fixed guideway systems

FTA §5310 Special Needs of Elderly Individuals and Individuals with Disabilities Formula Program

- Program provides capital assistance to state and local governments and private non-profit groups in meeting the transportation needs of elderly individuals and individuals with disabilities
- The State (or State-designated agency) administers the section 5310 program

FTA §5311 Other than Urbanized Area Formula Program

- Program provides formula funding to States and Indian Tribes for the purpose of supporting public transportation in areas with a population of less than 50,000
 - FTA §5311 Tribal Transit funds
 - FTA §5311 ARRA Other than Urbanized Area Formula funds
 - FTA §5311 ARRA Tribal Transit funds
 - FTA §5311 ARRA Transit Investment for Greenhouse Gas and Energy Reduction funds (Capital only)
- Funding may be used for capital, operating, State administration, and project administration expenses
- FTA §5340 Growing States and High Density State formula funds distributed may be reported within this category of funds

FTA §5316 Job Access and Reverse Commute Program funds

- Pertains to access to jobs projects for the development and maintenance of transportation services designed to transport welfare recipients and eligible low-income individuals to and from jobs and activities related to their employment (including finance of planning, capital, and operating costs)
- Pertains to reverse commute projects for public transportation designed to transport residents of urbanized areas and other than urbanized areas to suburban employment opportunities (including any projects to subsidize the costs associated with adding reverse commute bus, train, carpool, van routes, or service from urbanized areas and other than urbanized areas to suburban workplaces)

FTA §5317 New Freedom Program funds

- Formula program to encourage services and facility improvements to address the transportation needs of persons with disabilities that go beyond those required by the Americans with Disabilities Act
- Funds may be used for associated capital and operating costs

FTA §5320 Alternative Transportation in Parks and Public Lands Program funds

- Program to support public transportation projects in parks and public lands
- Funds may be used for planning and capital projects in or in the vicinity of any federally owned or managed park, refuge, or recreational area that is open to the general public

Other FTA funds

- FTA funds not included above
- Other FTA funds may include:
 - FTA Research, Development, Demonstration and Training Projects (§5312)
 - Interstate Transfer Program

Other federal funds

- Other federal non-FTA funds
- There are approximately over 60 non-FTA federal programs that fund transit. Some of the most highly funded programs include: Medicaid, Headstart, Temporary Assistance for Needy Families, Veterans Medical Care Benefits, 21st Century Learning, Title III B Supportive Services, Vocational Rehabilitation

7.3.6 Other Funding

The final category of revenues in the NTD Rural Reporting Manual is **other funding**. Other funding is a miscellaneous category to report revenues that cannot be categorized within the above revenue categories of: fare revenues, contract revenues, local funds, state funds, and federal assistance.

7.4 CHARTER, EXCLUSIVE SCHOOL BUS, AND FREIGHT TARIFF REVENUE

Charter service, exclusive school bus service, and freight tariff revenues associated with the operating and capital cost of these services should be documented. However the Rural NTD does not require revenues for charter, exclusive school bus service, and freight tariffs to be reported to NTD.

Charter service, exclusive school bus service, and freight tariffs are defined as follows:

- *Charter service and exclusive school bus service.* Charter service is a vehicle hired for exclusive use that does not operate over a regular route or on a regular schedule and is not available to the general public. Exclusive school bus service is the use of buses to carry children and school personnel to and from their schools or school-related activities.
- *Freight tariffs.* Revenues earned from carrying freight on runs whose primary purpose is passenger operations.

FTA has very specific regulations that pertain to charter and exclusive school bus service. These regulations can be found at the following links:

Charter Service:

<http://edocket.access.gpo.gov/2008/pdf/08-86.pdf>

School Bus Operation:

http://www.access.gpo.gov/nara/cfr/waisidx_09/49cfr605_09.html

7.5 REPORTING BONDS AND LOANS

A **bond** is a government financial mechanism used to raise funds. Bonds are secured debt offered through a legal entity (usually a state or local government) that guarantees two rights to the purchaser:

- The right to receive a fixed interest payment (e.g., 10%), often semiannually, on the par value of the bond (e.g., \$10,000), and
- The right to be paid the par value of the bond (e.g., \$10,000) at a definite future date when the bond matures (e.g., 20 years after issuance).

A **loan** is a financing mechanism used to raise funds. Loans can be either secured or non-secured debt. Loans typically are offered to transit providers by commercial entities (e.g., banks) or other government entities (e.g., states, counties, cities). The terms of the loan specify the duration of the loan (e.g., 10 years), the interest rate (e.g., 5 percent), and frequency of payments (e.g., monthly, quarterly, annually). Generally, the payments are constant (or level) for the term of a loan. Each payment consists of interest and principal (repayment of a portion of the loan amount). When the last payment is made, the entire principal will have been repaid.

How to Report Bonds and Loans

Report the proceeds from government agency bonds or loans issued during the period as revenues in the appropriate state or local fund category. Report the interest as an operating expenditure. For information on accounting practices for bonds and loans refer to USOA. For more information regarding bonds, refer to the FTA online publication: “Financing Techniques for Public Transit” (1998).

7.6 SUMMARY OF REVENUES

The following is a summary of items to remember in reporting revenues:

Report an Equal Amount of Contributed Service Expense

If reporting contributed services, an equal amount of contributed services expense should be reported to equal the amount of contributed services revenue.

Do Not Report Fare Assistance as Passenger Fare Revenue

Local fare assistance is reported in the appropriate state and local source of funds and is *not* considered passenger fare revenue.

Report Fares Collected by Purchased Transportation Provider

Ensure that fare revenues retained by the seller of purchased transportation are captured as fare revenue.

Do Not Report the Total Amount of Grant Funds Approved

Do not report the total amount of funding in an approved grant application, only the grant funds earned from an incurred expenditure during the period (accrual accounting practices).

Chapter 8. Vehicles, Other Resources, and Maintenance Facilities

Owned, Leased, and Borrowed

This chapter outlines relevant information for rural transit providers to report vehicles, other resources, and maintenance facilities. The purpose of this information is to identify the information each state DOT must report to NTD—and how rural transit providers should report the same information. The chapter contains four sections:

- 8.1 Revenue Vehicles
- 8.2 Other Resources: Taxis, Volunteers, and Personal Vehicles
- 8.3 Maintenance Facilities
- 8.4 Summary of Vehicles, Other Resources, and Maintenance Facilities

The 2011 Rural NTD Reporting Manual refers to reporting revenue vehicles and maintenance facilities as “asset/infrastructure information.” Additional circumstances regarding other resources are explained separately. The first three sections in this chapter describe how to comply with NTD rural reporting requirements. Transit providers report data about vehicles and maintenance facilities as an inventory at the end of the reporting period—a snapshot in time.

8.1 REVENUE VEHICLES

Revenue vehicles are the rolling stock (floating stock in the case of ferries and boats) used by rural transit providers to provide revenue service for passengers.

8.1.1 How to Report Revenue Vehicles

Rural transit providers must report two levels of information about the revenue vehicle fleet:

- Information about transit provider fleet.
- Detailed characteristics of each vehicle.

Reporting Fleet Characteristics

Rural transit providers report three fleet characteristics:

- Total number of revenue vehicles.
- Largest source of funding for purchase/lease of vehicles.
- Number of ADA accessible vehicles in fleet.

Total Number of Revenue Vehicles

Rural transit providers report the **total number of vehicles** in the fleet at the end of the reporting period. The total fleet includes all revenue vehicles used to carry passengers, including any vehicles used by a contractor that operates purchased transportation service for the general public.

Source of Funding for Purchase/Lease

Rural transit providers should report the **largest source of funding for purchase/lease of vehicles by vehicle type** (the types are described in the next section). When reporting, a rural transit provider selects a vehicle type in use, such as cutaway, and reports whether the source of funding is FTA; other federal, state, or local; or private.

ADA Accessible Vehicles

Report the number of ADA **accessible vehicles** in the fleet at the end of the reporting period. To be considered an accessible vehicle, the vehicles may be equipped with wheelchair lifts or ramps, or built with a low floor.

The number of ADA accessible vehicles in the fleet should not be more than the total number of revenue vehicles.

8.1.2 Reporting Individual Vehicle Details

Rural transit providers report five characteristics of each revenue vehicle in the transit provider fleet:

- Vehicle Type
- Vehicle Length
- Vehicle Seating Capacity
- Year of Manufacture
- Type of Ownership

The next five sections contain definitions and descriptions for each of the vehicle characteristics.

Vehicle Type

Revenue vehicles are generally one of the types described below. If a transit provider has a vehicle that does not fall under one of the NTD categories, then report as “Other (OR)” and provide a description. The vehicle types and accompanying descriptions are included in the following illustrations (for full definitions of each vehicle type, see <http://www.ntdprogram.gov/ntdprogram/Glossary.htm>).



Automobile (AO)

- An automobile (AO) is a passenger car up to and including station wagons in size.



Bus (BU)

- A bus (BU) is a rubber-tired passenger vehicle powered by diesel, gasoline, battery, or alternative fuel engines contained within the vehicle. Vehicles in this category do not include school buses.



Cutaway (CU)

- A cutaway (CU) transit vehicle is built on a van or truck chassis by a second stage manufacturer. The chassis is purchased by the body builder, a framework is built for the body, and then the body is finished for a complete vehicle.



Minivan (MV)

- Typical minivans are Dodge Caravans or Honda Odysseys.



Over-the-road bus (BR)

- An over-the-road bus is a bus characterized by an elevated passenger deck located over a baggage compartment (42 U.S.C. 12181(5)).



School bus (SB)

- A school bus is a passenger vehicle that is designed primarily to transport more than ten elementary and secondary school students.

**Sports utility vehicle (SV)**

- A sports utility vehicle is a high-performance four-wheel drive car built on a truck chassis. Most SVs are designed with a roughly square cross-section, an engine compartment, a combined passenger and cargo compartment, and no dedicated trunk.

**Van (VN)**

- Typical vans are 8-18 passenger vehicles such as Ford E-Series or Dodge Ram vans.

**Other (OR)**

- Vehicle does not fit into one of the other eight categories; describe the vehicle in your own terms.

**Ferryboats (FB)**

- A vessel for carrying passengers and/or vehicles over a body of water. The vessels are generally steam or diesel powered conventional ferry vessels. They may also be hovercraft, hydrofoil and other high-speed vessels.

Vehicle Length

Report the **length** of each revenue vehicle to the nearest whole foot (e.g. 30, 35, 40, 44, and 60).

Seating Capacity

Report the seating capacity of the vehicle. **Seating capacity** is the actual number of seats on board the vehicle and generally is cited in the specification used in manufacturing the vehicle. When reporting the seating capacity, do not include the driver's seat. If you have a modified vehicle with adjustable seats to accommodate spaces for wheelchairs or scooters, report the maximum seating capacity of the vehicle at any given time. Seating capacity refers to the physical seats available to ambulatory individuals. The wheelchair spaces are not included in the seating capacity calculation.

Year of Manufacture

Report the **original year** that the vehicle was manufactured; if the vehicle was rebuilt, make a note providing the **year of rebuild**.

Type of Ownership

Report the **type of ownership** of each vehicle. There are four types of ownership reported to NTD:

- Owned
 - Owned by service provider
 - Owned by public agency for service provider
- Leased
 - Leased by service provider
 - Leased by public agency for service provider

Transit providers should report which of the four types of ownership each revenue vehicle is in the fleet.

8.2 OTHER RESOURCES: TAXIS, VOLUNTEERS, AND PERSONAL VEHICLES

Some rural transit providers use other resources for some or all of their service. The three most common types of other resources are taxicabs, volunteers, and personal vehicles. This section explains how rural transit providers should report these types of other resources.

8.2.1 Volunteer Resources

If a rural transit provider uses volunteer resources (drivers) for some services, the provider should report the number of volunteer drivers available. This information is reported as a separate item from other reported information about paid drivers. State agencies that report rural transit information to NTD report the number of volunteer drivers each transit provider has available—if any.

8.2.2 Personal Vehicles in Service

If a transit provider permits use of personal vehicles to provide some or all transit services, the transit provider should report the number of personal vehicles routinely used. Personal vehicles used for service are not included in the number of revenue vehicles; rather, personal vehicles are reported separately as a number of personal vehicles used routinely to operate public services.

8.2.3 Taxicabs

If taxicabs are used for some or all of the service, the transit provider should report taxicab vehicle revenue miles and unlinked passenger trips in the demand-response mode of service separately from other passenger trips. Taxis used for service are not included in the reported number of revenue vehicles.

8.3 MAINTENANCE FACILITIES

Maintenance facilities are the garages and buildings where routine maintenance and minor repairs are performed (general-purpose maintenance facility).

Rural transit providers should report the number of general-purpose maintenance facilities by ownership type at the end of the transit provider's reporting period. Transit providers should report ownership of maintenance facilities as one of four types of ownership (similar to revenue vehicles):

- Owned
 - Owned by service provider
 - Owned by public agency for service provider
- Leased
 - Leased by service provider
 - Leased by public agency for service provider

Transit providers should not report maintenance facilities if maintenance services are performed at any other facility. For example, if a transit provider contracts with a taxicab company for demand-response service and the taxicab vehicles are taken to the local gasoline service station for routine repairs, oil changes, etc., the local gasoline service station is not reported as a maintenance facility.

8.4 SUMMARY OF VEHICLES, OTHER RESOURCES, AND MAINTENANCE FACILITIES

The following is a summary of items to remember in reporting vehicles, other resources, and maintenance facilities:

Report Total Number of Active Vehicles

Report active vehicles available to operate in revenue service, including spares and vehicles temporarily out of service for routine maintenance and minor repairs.

Report Contractor-Provided Revenue Vehicles

Report all revenue vehicles used to carry passengers, including any vehicles used by a contractor that operates purchased transportation service.

Do Not Report Non-Dedicated Service Vehicles

Vehicles used in non-dedicated service such as vanpool and taxi service (incidental taxi) are not included.

Report Owned and Leased General-Purpose Maintenance Facilities

Rural transit providers should report the number of general-purpose maintenance facilities by ownership type at the end of the transit provider's reporting period.

Do Not Report Maintenance Facilities If Contract for Maintenance

Transit providers should not report maintenance facilities if maintenance services are performed at any other facility not owned or leased by the service provider.

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Chapter 9. Reporting Safety Data

Be Careful!

Safety is an important concern for rural and specialized transit providers. The safety of a transit system is a key measure to ensure that steps are being taken to reduce fatalities, injuries, and other safety-related incidents. While safety performance standards may vary across state DOTs and transit providers, the safety incident rate is a key measure that incorporates an assessment of both service operations as well as passenger service quality. The safety of the transit system may not be an attribute that passengers consider each day while riding the transit system, but safety is a dimension of customer service quality. This toolkit uses NTD definitions to assess safety. Information provided in Section 9.2, Discussion of NTD Safety Definitions, is cited from *TCRP Report 124: Guidebook for Measuring, Assessing, and Improving Performance of Demand-Response Transportation*.

This chapter outlines relevant information for rural transit providers to report safety-related metrics—namely the number of reportable incidents, fatalities, and injuries. The chapter has three sections:

- 9.1 Reportable Incidents
- 9.2 Discussion of NTD Safety Definitions
- 9.3 Summary of Safety Data

The first two sections in this chapter document how to comply with NTD rural reporting requirements.

9.1 REPORTABLE INCIDENTS

According to NTD a reportable incident is an event that is related to or **affects revenue service** and **meets one or more of the following reporting thresholds**:

- A fatality.
- Injury requiring immediate medical attention away from the scene for one or more persons.
- Estimated property damage equal to or exceeding \$25,000.

Reportable incidents include events that occur at bus stops on streets, in transit centers, and in parking lots of transit centers.

Incidents occurring in the maintenance department of a transit provider or related to maintenance activities are excluded from the reportable incident category, as are incidents involving an on-duty bus operator not engaged in directly performing his/her operator duties.

The following types of incidents are *not* reportable to the NTD:

- Mechanical, industrial, or administrative work activities that do not affect revenue service.
- A transit provider service vehicle is involved in a collision during installation of bus stop signs (does not affect revenue service).
- A bus operator on break is injured while crossing a street and is transported to a local hospital. The employee was disengaged from his/her direct operator duties (i.e., on break), thus the injury incident is not reportable because the event is not related to and does not affect revenue operations.
- A bus operator is performing a standard pre-trip inspection and falls, injuring herself/himself and requiring transport for immediate medical attention. The operator is acting in association with the mechanic shop procedures for safe vehicle operations. Thus the maintenance exclusion applies to pre-trip inspections.
- A fatality due to natural causes or a person found deceased on transit property.

The following types of incidents are reportable to NTD:

- A supervisory vehicle driving an operator to a bus to start revenue service is involved in a collision is a reportable incident.
- A bus operator is outside the bus and waiting for passengers or assisting passengers onto the bus. Operator falls and is injured, requiring transport. An incident is reportable if a bus operator is injured while engaged in his/her operator duties while providing revenue service.

9.1.1 Fatalities

The NTD definition of **fatality** is a transit-caused death that occurs within 30 days of a transit incident and occurs due to a collision, derailment, fire, hazardous material spill, Act of God, evacuation, security incident or other incident. Fatalities also

include transit-related suicides. If death occurs after 30 days, the transit provider should classify the death as an injury.

There is one exception to this rule: Deaths resulting from illnesses or other natural causes, or otherwise not associated with an incident, are not reported. For example, a person suffering a fatal heart attack in a transit facility would not be reported to NTD.

9.1.2 Injuries

The NTD defines an **injury** as physical harm to persons that requires immediate medical attention away from the scene. Immediate medical attention includes transport to the hospital by ambulance. It also includes transport 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 immediate transport.

Immediate medical attention means that medical attention was sought without delay after the incident occurred. 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.

The medical attention received must be at a location other than the location at which the incident occurred. The intent of this distinction is to exclude injuries that require only minor first aid or other assistance at the scene. This distinction is not, however, intended to be burdensome for the transit provider. It is not a requirement that a transit provider follow up on each person transported by ambulance to ensure that they actually received medical attention at the hospital.

It is acceptable to count each person immediately transported away from the scene for medical attention as an injury, whether or not the person appears to be injured.

9.2 DISCUSSION OF NTD SAFETY DEFINITIONS

An important element of safety definitions for NTD reporting is that the incident must involve a transit vehicle or occur on transit-controlled property. This means that the incident occurs in an environment under the direct control of the transit system. For a transit provider that operates only DR service, this definition typically limits the reporting of incidents to those involving transit vehicles since most DR providers do not own or control other transit facilities such as stations, buildings, or shelters.

Another important element is the requirement that an injury must involve immediate medical attention away from the incident scene. This means that an injured person who receives treatment at the incident scene is not included in the definition of an incident. In addition, an injured person who delays receiving treatment until after the event is not included in the definition of an incident.

The definition of an incident for NTD reports is event oriented. The definition goes beyond measuring injuries to passengers and includes events related to property damage and other safety concerns.

The NTD definitions for incidents and injuries have evolved over the years, and the current thresholds for reporting safety incidents are considerably different from the requirements prior to 2002. NTD definitions and reporting requirements for safety-related events (incidents, fatalities and injuries) provide standards that are consistent across all transit providers. In addition to the NTD reporting requirements, a transit provider may keep additional records for safety-related events that fall below the NTD thresholds or beyond the NTD definitions. For example, many transit providers document and analyze every incident as preventable or non-preventable. The transit provider may use the additional data to improve safety, but the information is not reported to NTD.

9.3 SUMMARY OF SAFETY DATA

The following are items to remember about reporting safety data.

Report Incidents If Affects Revenue Service

Reportable incidents include events that occur at bus stops on streets, in transit centers, and in parking lots of transit centers. Incidents occurring in the maintenance department of a transit provider or related to maintenance activities are excluded from the reportable incident category, as are incidents involving an on-duty bus operator not engaged in directly performing his/her operator duties.

Report Incidents That Meet Definitions and Thresholds

Report incident if results in:

- A fatality.
- Injury requiring immediate medical attention away from the scene for one or more persons.
- Estimated property damage equal to or exceeding \$25,000.

Chapter 10. Managing Data and Performance

Beyond Reporting

Performance measurement is important for rural and specialized transit providers for evaluating the efficiency, effectiveness, and quality of service provided to their riders. While much has been written for the transit industry on performance measurement, many of these reports focus on transit providers in urban areas. This chapter will serve as a guide for some of the key measures of performance that are relevant to transit for rural and specialized transit. This chapter also provides a checklist for reviewers of data to ensure data quality.

10.1 GOALS AND OBJECTIVES

Essentially, the performance measurement process starts with establishing goals and objectives for service; identifying selected measures or indicators that capture key aspects of fixed-route or demand-response service and operations; setting goals for standards of performance; measuring performance through the collection and tabulation of the data needed to calculate the measures; assessing the resulting measures; and developing actions to improve performance.

The process should also involve a feedback loop so that the performance goals are reviewed periodically after performance has been measured and assessed. Over time, a particular performance goal may need to be adjusted based on service operations, changes to the overall environment within which the transit system operates, or achievements that call for raising the goal to a higher standard of performance.

10.2 IMPORTANCE OF CONSISTENT DATA AND QUALITY CONTROL CHECKLIST

An essential step in assessing transit performance is consistency in data collection and developing clear definitions for the performance data and for performance measures. Chapters 3 through 7 of this toolkit provide data collection methods and data definitions:

- Chapter 3 provides a framework for defining transit modes.

- Chapter 4 explains the various methods for counting passenger trips for fixed-route and demand-response systems.
- Chapter 5 provides a breakdown of revenue vs. total service including revenue and vehicle hours and miles.
- Chapter 6 provides an overview of capital and operating expenses.
- Chapter 7 covers revenue reporting and definitions.

A challenge facing rural and specialized transit providers is developing a consistent framework for how performance measures are defined and calculated. Fixed-route and demand-response systems do not always use the same definitions for data elements, nor calculate performance measures in the same manner. For example, some providers calculate productivity using total vehicle hours as the denominator while others use revenue hours. This makes comparisons between transit providers not only difficult but also less meaningful since the performance measures are not consistent. The intent of this toolkit is to provide consistency in data reporting that can then be used as the basis for defined performance measures.

Using the operating and financial data identified in Chapters 3 through 7, this chapter identifies the key performance measures for rural and specialized transit. While there are many different measures that can be used to evaluate transit providers, capturing the important aspects of performance does not require a long list. One of the objectives of developing this toolkit is to identify examples of measures to assess efficiency, effectiveness, and quality for fixed-route and demand-response systems in rural and specialized transit.

10.3 QUALITY CONTROL—CHECKLIST FOR DATA ACCURACY AND REASONABLENESS

Reporting accurate and consistent data is important to providing transit stakeholders with meaningful information. Data are used in many ways, including to communicate successes, recognize where improvements are needed, report on performance, and possibly to allocate funding. The purpose of the following checklist is to provide a means to help in the review of operating and financial data reports.

Passenger Counting Checklist

- Transit provider employees should *not* be counted as passengers while performing work activities on transit vehicles
- Personal care attendants and companions should be counted as passengers
- Each passenger boarding is counted regardless of origin and destination or number of passes or tickets sold
- Passengers of each fare type or specific transportation program are counted
- Passengers are counted whether a fare is paid or not
- Service animals are not counted as passengers

Calculating and Reporting Hours and Miles Checklist

- Revenue* miles and hours do not include deadhead miles and hours
- Revenue or total miles and hours do not include *non-service* hours or miles (usage of the vehicle for driver training, transporting the vehicle to maintenance facility, etc.)
- Lunches and breaks are not included in the revenue hours
- Revenue miles and hours are counted even when no passengers are riding the bus
- Revenue miles and hours generated from an automatic scheduling system have been cross-verified using a manual data collection process
- Revenue hours generated from taxicab service have been reported

Reporting Expense Checklist

- An accrual accounting method is used to report expense data so that revenues and expenses are properly matched against the service provided and passengers served
- Contributed service expense is reported to equal the contributed service revenue
- Purchased transportation expense includes full cost of the service (passenger fares earned by the provider are included in the expense)
- Capital expenses are reported separate from operating expenses in purchased transportation
- Indirect expenses (facilities and other services) are reported even if the transit provider is part of a larger organization
- Operational and capital allowable and unallowable expenses are reported

Reporting Revenue Checklist

- An accrual accounting method is used to report revenue data so that revenues and expenses are properly matched against the services provided and passengers served
- All revenues, including donated (contributed services, in-kind, non-cash), are reported if full-cost accounting approach is required
- Grant funds relating to costs incurred are reported, not the total amount approved in the grant application
- Fare revenues collected by the purchased transportation provider are reported as fare revenue
- All revenues from contracts or other sources are reported

Other Reasonableness Checks

- System speed is consistent

System speed is influenced by service area coverage, service type, distance between stops and number of passengers boarding the vehicle. Fluctuations in speeds may occur if there are significant changes in the number of passengers carried, introduction of new services or a segment of the service is eliminated. For example, if a long-distance service with significant highway miles is introduced, speeds may increase overall.

- Average weekly or monthly passenger trips are consistent

Compare the average weekly passenger trips generated to a sample of dispatch trip logs or driver manifests to ensure that automated passenger trip counts are capturing all trips and/or that all trip types are captured.

- Revenues and expenses balance
- Performance measures are consistent
 - Passengers per revenue mile or revenue hour
 - Cost per passenger
 - Cost per revenue mile or revenue hour
 - Farebox recovery ratio (fare revenue to operating expense) is consistent

10.4 AN OVERVIEW OF PERFORMANCE MEASURES

A number of published research reports provide various performance measures for fixed-route and demand-response service, including:

- *TCRP Report 88: A Guidebook for Developing a Transit Performance-Measurement System*
- *TCRP Report 124: Guidebook for Measuring, Assessing, and Improving Performance of Demand-Response Transportation*
- *TCRP Report 141: A Methodology for Performance Measurement and Peer Comparison in the Public Transportation Industry*
- *TCRP Synthesis 56: Performance-Based Measures in Transit Fund Allocation*

The researchers used the terms and definitions from these reports in this chapter. The literature review conducted as part of the research project for *TCRP Report 124* found more than 60 different measures that have been used to assess demand-response service. While some of these measures apply only for demand-response service, several apply to fixed-route transit systems as well.

The purpose of this toolkit is to simplify the list and to identify a common set of performance measures that would be applicable to both fixed-route and demand-response systems. For an individual transit provider, the selection of performance measures will depend on the provider's specific goals and objectives, and may also depend on the type of transit service that is provided as well as other local factors. Fixed-route and demand-response providers may also need to assess performance using measures selected by the responsible state department of transportation. A number of states provide state funding to transit providers and require that the providers report specified performance data as a condition of the financial support. Rural and specialized transit providers may have other organizations to report performance to, such as other funding agencies; for those operating coordinated services, specified performance data may be required for the coordinated human service agencies.

Overall, the procedures for reporting performance measures tend to be more streamlined and the requirements less stringent for transit providers in rural areas compared to urbanized areas. However, the types of performance measures that are reported vary widely across transit providers and by states. While an exhaustive list of all performance measures is beyond the scope of this toolkit, a list of common performance measures used for fixed-route and demand-response systems is

provided below. This toolkit will cover key performance measures for rural and specialized transit providers.

Effectiveness	Efficiency	Quality	Others
<ul style="list-style-type: none"> • Passenger Trips per Revenue Hour • Passenger Trips per Vehicle Hour • Passenger Trips per Revenue Mile • Passenger Trips per Vehicle Mile 	<ul style="list-style-type: none"> • Operating Cost per Revenue Hour • Operating Cost per Vehicle Hour • Operating Cost per Revenue Mile • Operating Cost per Vehicle Mile • Operating Cost per Passenger Trip • Farebox Recovery Ratio 	<ul style="list-style-type: none"> • Average Travel Time • On-Time Performance • Response Time* (as measured by the minimum time between when service is requested and when provided) • Trip Denials per Trips Requested* • Complaints per 1,000 Passenger Trips 	<ul style="list-style-type: none"> • Accidents per 100,000 Vehicle Miles • No-Shows per Scheduled Trips* • System Speed <p>*Applies to demand-response transit</p>

10.5 KEY PERFORMANCE MEASURES FOR RURAL AND SPECIALIZED TRANSIT

From the many performance measures listed above, the following key performance measures for rural and specialized transit were selected for this toolkit. Using a smaller set of measures to assess transit performance may be preferable to using a long list of indicators. This approach allows a transit provider to concentrate on essential elements of service performance. Depending on the results of those limited measures, the transit provider may need to delve deeper into its operations, examining additional and more detailed data to identify reasons behind the performance results. The key performance measures for fixed-route and demand-response systems selected for this toolkit are listed and discussed below.

Key performance measures for fixed-route and demand-response services selected for this toolkit are:

- passenger trips per revenue hour;
- operating cost per revenue hour;
- operating cost per passenger trip; and
- fare recovery ratio.

10.5.1 Passenger Trips per Revenue Hour

Passenger trips per revenue hour measures the productivity of a fixed-route or demand-response system. This is a key performance measure for fixed-route transit, and often considered the most important single measure of demand-response performance, assessing the system's effectiveness. As a performance measure, passenger trips per revenue hour measures the ability of a fixed-route system to serve passenger trips effectively on specific transit routes. This measure can be used to identify heavily used routes as well as underutilized routes. For demand-response systems, this productivity measure captures the ability of the demand-response system to schedule and serve passenger trips with similar origins, destinations, and time parameters, using the least number of in-service vehicles and revenue hours. This is the essence of shared-ride, public demand-response service.

While the productivity measure can be calculated with either revenue hours or vehicle hours, revenue hours have generally been used for fixed-route and demand-response transportation. This is because vehicle hours include time that the transit system is not in revenue service, such as deadhead. Productivity is sometimes measured as passenger trips per mile. This measure is more applicable to fixed-route systems than demand-response systems. Given the low passenger volumes on demand response relative to mileage, this ratio usually results in a number less than one. Such resulting numbers are not particularly logical given that an actual passenger trip is not less than one; passenger trips per hour is an easier number to visualize.

$$\text{productivity measure} = \text{total passenger trips} \div \text{total revenue hours}$$

Therefore, productivity is calculated by taking the number of total passenger trips and dividing by total revenue hours.

Factors Impacting Productivity

There are various factors that affect the ability of fixed-route or demand-response systems to be productive. These factors include the size of the service area, the distribution of residential and employment centers, and the daily commuting patterns of riders' trips.

For fixed-route transit, large service areas and transit lines serving areas with low residential and employment density are less likely to be productive than transit providers serving more compact areas with higher residential and employment densities. Within metropolitan areas, transit routes with higher passenger trips per revenue hour are typically in dense central city areas rather than low-density suburbs.

Transit providers in rural areas tend to be less productive than urban areas due to lower population densities.

For rural and specialized transit, demand-response transit systems are a primary mode of public transportation. For demand-response systems, the size of the service area and the distribution of residential and destination areas will have a significant impact on productivity. If the service area is large and passengers request trips to distant and dispersed destinations, efficient scheduling of multiple riders will be necessary to ensure productivity. Transit operators should pursue opportunities to schedule riders on the same vehicle at the same time for travel to a common destination to maintain productivity.

Other factors that impact productivity of demand-response systems 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 familiarity with the service area and passengers' trip-making patterns; and the operating environment including traffic and the roadway network.

The type of demand-response service—particularly whether the service functions as ADA paratransit or not—also affects productivity because ADA regulations have effective limits on the flexibility that a demand-response system has to maximize shared rides. This also may mean lower productivity. Some of these are examples of uncontrollable factors affecting the performance of demand-response systems as measured by passenger trips per revenue hour. Such factors affecting demand-response performance are discussed in more detail in *TCRP Report 124*.

Performance Considerations

Performance on passenger trips per revenue hour can be impacted by a number of causes. The following is a list of ways to improve productivity for this measure.

For fixed-route transit:

- use of transit routes that effectively connect residential and major destination areas;
- high density of passengers within the service area;
- efficient scheduling of routes and times;
- minimizing of burdens for passengers, including multiple transfers and waiting times; and
- creation of fare structures and schedules that are easy for riders to understand.

For demand-response transit:

- use of scheduling practices that group similar passenger trips to the same destination, or a limited number of destinations;
- effective management of service operations that are able to respond to changes on a real-time basis;
- minimizing lengthy passenger trips; and
- minimizing no-shows and late cancels.

10.5.2 Operating Cost per Revenue Hour

Operating cost per revenue hour is generally considered the key cost-efficiency measure, assessing the financial resources needed to produce a unit of service, defined as an hour of revenue service. In other words, what does the transit provider spend to put service on the street for one revenue hour? This measure, however, does not evaluate *use* of the transit service, and, as such, should be assessed in conjunction with the performance measures that evaluate ridership utilization. This is a measure of service efficiency and indicates the cost of one revenue hour of service.

$$\text{operating cost per revenue hour} = \text{total operating cost} \div \text{total revenue hours}$$

Similar to the productivity measure, practices vary as to whether the measure uses *revenue hours* or *vehicle hours* in the denominator. Revenue hours are preferred for several reasons including the following:

- Revenue hours are consistent with the denominator normally used for the productivity measure—passenger trips per *revenue hour*.
- Revenue hours facilitate incorporation of taxi-based and other non-dedicated provider data. Demand-response service provided by taxis or other non-dedicated vehicles is usually trip specific—from a particular origin to a particular destination—and the concept of deadhead mileage and time is not relevant. Non-dedicated providers should be required to provide to the demand-response system their mileage and time data for each trip that the agency provides, regardless of how the agency paid, so that revenue miles and time can be computed and included with data for dedicated service.
- Governments, as sponsors and funders of public transit service, are primarily interested in buying revenue hours of service. Transit operators bear the responsibility of providing revenue hours of service effectively by minimizing deadhead.

Performance Considerations

The key elements in this measure are operating costs, with the major components of costs related to staff labor and vehicle operations and their maintenance, and the amount of revenue service, as measured by hours. This latter data element is determined by the established service span, demand for service, allocation of revenue hours as determined by vehicle availability, vehicle operator assignments, and scheduling practices.

Performance measured by operating cost per revenue hour can be impacted by a number of causes. The following is a list of ways to improve productivity for this measure:

- Keep maintenance expenses in check by replacing older and less efficient vehicles with newer, more efficient fleets.
- Reduce the cost of administration and overhead through efficient management of staff and transit operators.
- Improve revenue vehicle hours through efficient scheduling practices and services.

Vehicle operator labor is a major cost center. For the transit industry in general, labor including fringe benefits may account for up to 70 to 80 percent of total operating costs, with the majority of employees working in vehicle operations. The labor rates paid to vehicle operators are somewhat controllable but will depend on the local job market and wages paid for similar positions at competing organizations. Rates may also be influenced by labor contracts between transit employees and the transit provider through the collective bargaining process.

Maintenance is another important cost center. Based on NTD data for the transit industry in general, vehicle maintenance may account for up to 20 percent of operating expenses. While maintenance costs may vary depending on the type of vehicle, its age, and vehicle operating conditions, maintenance costs may be minimized by employing the following practices:

- Provide on-time preventive maintenance inspections of transit vehicles (preventive maintenance inspections should be done every 2,000-6,000 miles).
- Ensure prompt repair by qualified mechanics (either transit provider-employed mechanics or vendor-supplied maintenance).
- Improve the performance of preventive maintenance programs by establishing a monitoring system that clearly distinguishes scheduled and unscheduled maintenance.

More detailed information about preventive maintenance for transit buses can be found in *TCRP Synthesis 81: Preventative Maintenance Intervals for Transit Buses*.

10.5.3 Operating Cost per Revenue Mile

Operating cost per revenue mile is another service efficiency measure often used for performance assessments, either in addition to or instead of operating cost per hour. Many fixed-route transit providers use this measure to determine which routes are performing efficiently, and this measure is useful in identifying routes that may be overextended or redundant. Demand-response services may also use this measure to determine whether their service area should be expanded or reduced.

$$\text{operating cost per revenue mile} = \text{total operating cost} \div \text{total revenue miles}$$

Operating cost per revenue mile is the total operating cost divided by revenue miles and indicates the operating cost per one mile of revenue service. Operating cost per revenue mile of service is influenced by fluctuations in costs and miles of service scheduled. Performance on this measure could be improved by regular maintenance, efficient scheduling practices and services, and efficient management of staff and transit operators.

10.5.4 Operating Cost per Passenger Trip

Operating cost per passenger trip is a critical cost-effectiveness measure. This measure combines elements of operating cost per revenue hour and passenger trips per revenue hour, relating productivity to the hourly operating cost. As a composite measure, a fixed-route or demand-response transit system may have low operating costs, but if productivity is also low, the operating cost per passenger trip may be high. Conversely, a transit system may have a relatively high cost on a revenue hourly basis, but if its productivity is high, the cost per passenger trip may be low.

$$\text{operating cost per passenger trip} = \text{total operating cost} \div \text{total passenger trips}$$

Operating cost per passenger trip is a measure that decision makers typically look to: what does a trip for one passenger cost to provide? This is a key measure for examining a transit provider's ability to carry out a core function—that is, transport passengers in a cost-effective manner.

Performance Considerations

Performance on operating costs per passenger trip can be impacted by a number of causes. The following is a list of ways to improve productivity for this measure:

- Reduce operating costs
 - Labor costs, maintenance, and administrative costs
- Improve productivity
 - Schedule revenue hours that are aligned with ridership demand
 - Schedule practices that effectively group similar passenger trips
 - Minimize lengthy passenger trips
 - Minimize no-shows and late cancels
 - Ensure effective dispatch control that is able to respond to changes on a real-time basis

Improving performance requires a reduction in operating costs and/or an increase in the number of passenger trips that are served—productivity—without expansion of resources and therefore costs. Allocating service based on passenger demand will typically keep this performance statistic relatively stable from month to month. For example, decreasing service hours during holidays when passenger demand is low will reduce costs and keep the operating cost per passenger trip relatively constant.

10.5.5 Farebox Recovery Ratio

Farebox recovery ratio is a key performance measure for transit systems that carry a large proportion of fare-paying passengers. This measure is especially important for fixed-route transit systems in urban areas, since most of these systems charge a fare. For rural and specialized transit, farebox recovery ratio could be used to measure efficiency for those systems that charge a fare. However, since many specialized transit providers (and demand-response systems) carry passengers that do not pay a fare, the farebox recovery ratio may not always be a good measure of performance.

The farebox recovery ratio measures the proportion of the amount of revenue generated through fares by paying customers as a fraction of the cost of total operating expenses.

$$\text{farebox recovery ratio} = \text{fare revenues} \div \text{operating expenses}$$

Example. A farebox recovery ratio of 1 would indicate that fares cover 100 percent of the operating expenses of the transit provider. Since nearly all U.S. transit providers depend on subsidies for operating expenses, the farebox recovery ratio is typically below 1. In 2005, the average farebox recovery ratio for U.S. transit providers was 0.335, or 33.5 cents for every dollar of operating expenses (FTA NTD 2005). Farebox recovery ratios for rural and specialized transit providers tend to be lower than urban transit providers due to the lower proportion of paying passengers on these systems. In addition to being a performance measure, farebox recovery

ratios are often used to help determine fare policy and help provide direction in making decisions about changes in the fare structure of transit systems.

10.6 OTHER PERFORMANCE MEASURE CATEGORIES

In addition to the key performance measures described above, which focus mainly on cost effectiveness and efficiency, many rural and specialized transit providers use additional performance measures. These can be grouped into categories, such as safety, mobility, accessibility, and reliability. Measures of safety include statistics on incidents, mobility measures include average travel times and speeds, accessibility measures typically measure the ease of reaching destination opportunities within a specific time or distance, and reliability measures may include on-time performance. While these are important performance measures, the use of these measures is not consistent across states. Therefore, detailed descriptions of these measures are not included in this toolkit.

10.7 GRAPHICAL EXAMPLES OF PERFORMANCE MEASURES

The purpose of this section is to show how performance measures can be shown graphically, which can be used by transit providers or state DOTs to show performance data and trends. The following pages in this toolkit include examples of graphs and charts of actual performance data from various sources, including TCRP reports and performance data reporting manuals from state DOTs and transit providers.

10.7.1 Bar Graphs

One of the simplest but most effective ways to show performance data is using a bar graph. Bar graphs are useful for comparing transit performance across different transit providers, or comparing transit performance across different transit modes. Figure 20 shows an example of how performance measure data can be presented using a bar graph.

Service Efficiency

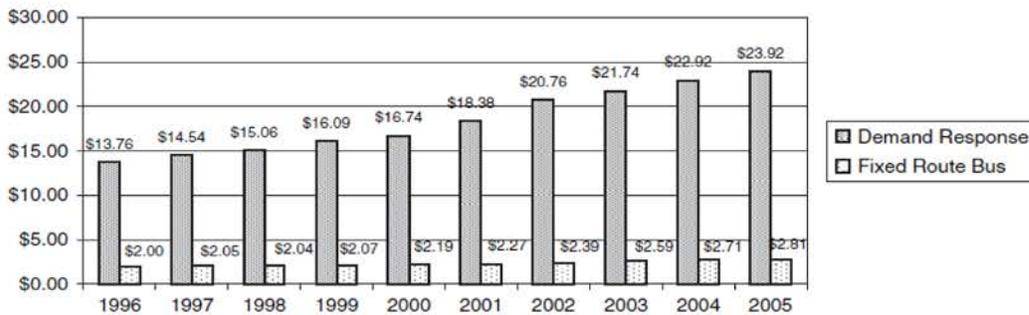
Chart Q. Operating Expense per Revenue Hour



Source: Pace Bus, 2011

Figure 20. Example of Bar Graph

Clustered bar graphs can be used to compare two or more different transit modes over a period of time. Figure 21 shows an example of this type of graph.



Source: National Transit Database.

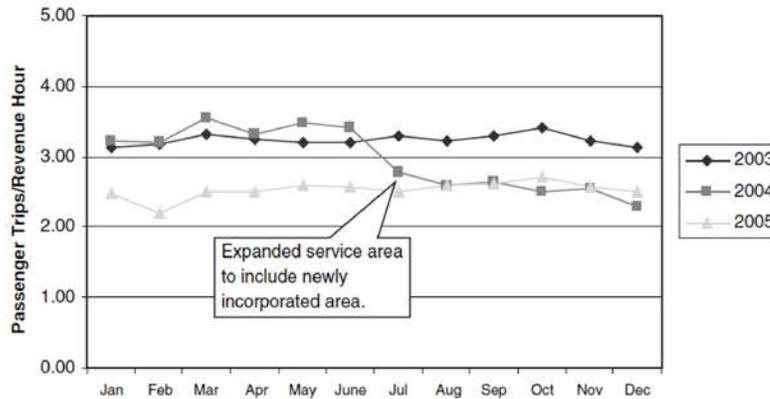
Source: TCRP Report 124

Figure 21. Example of Clustered Bar Graph

10.7.2 Line Graphs

Line graphs are useful for showing trends in transit performance over a period of time. These can be single- or multiple-line graphs. Multiple-line graphs can be used to compare trends in different categories, such as comparing performance measures across different transit providers and modes. Line graphs can also be used by state

DOTs to show performance averages across all transit providers. Figure 22 shows a multiple-line graph.

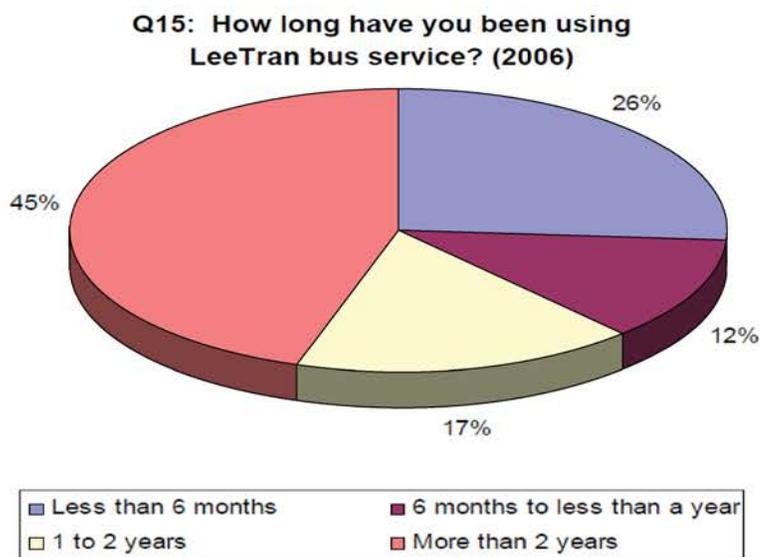


Source: TCRP Report 124

Figure 22. Example of Multiple-Line Graph

10.7.3 Pie Charts

Pie charts are most useful for showing proportions or shares. This type of graph could be used to show the proportions of riders from different transit providers or the proportion of certain types of riders on a given transit system. While pie charts can be effective in comparing the slice (or proportion) to the whole pie, comparing slices within the pie may be difficult, especially if slices are small. Figure 23 shows an example of how transit data can be presented using a pie chart.

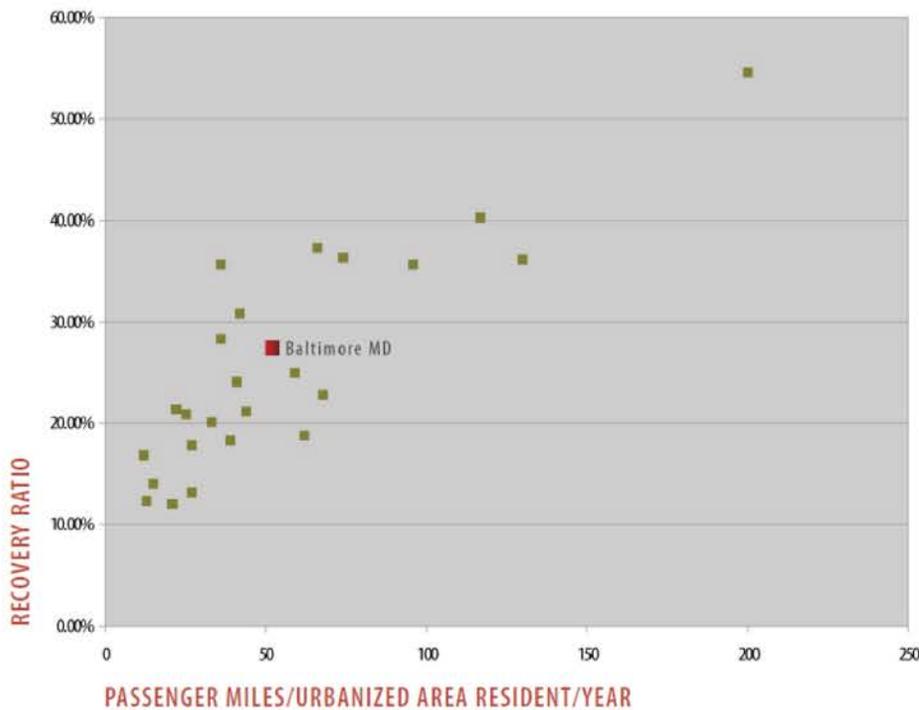


Source: Tindale-Oliver & Associates.

Figure 23. Example of Pie Chart

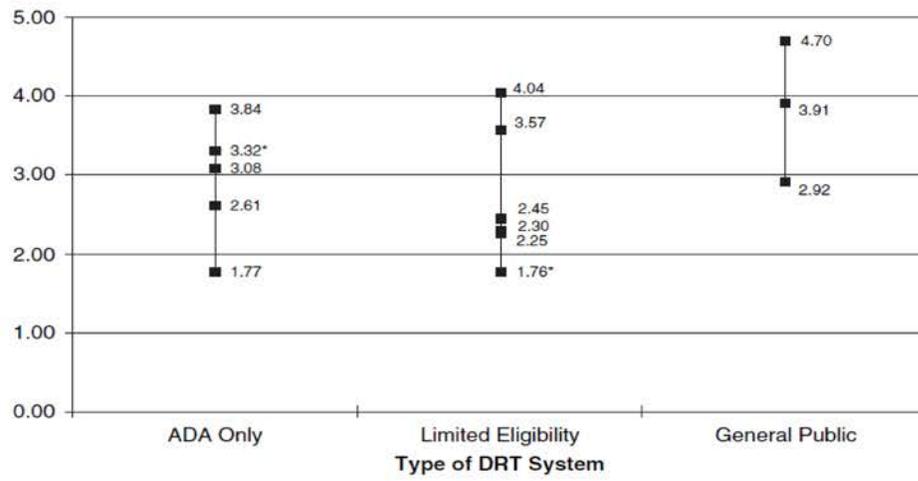
10.7.4 Other Graphs

Other types of graphs may be used to show transit performance data, including scatter plots and stock charts (or box plots). These are less commonly used than bar and line graphs. Scatter plots are useful for displaying the value of two variables for a set of data. For example, in Figure 24, a scatter plot is used to compare passenger miles per urbanized area per year with the farebox recovery ratios of transit providers in Baltimore and other cities. Box plots are useful for showing the range of observations and identifying outliers. Figure 25 shows a stock chart (box plot) of passenger trips per revenue hour for various demand-response systems. In this example, transit operators with the highest and lowest passenger trips per revenue hour are easily observed for each type of DR system.



Source: Citizens Planning and Housing Association of Metropolitan Baltimore, 2008.

Figure 24. Example of Scatter Plot



Source: *TCRP Report 124*

Figure 25. Example of Stock Chart (Box Plot)

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Chapter II. Specialized Transit Service

Reporting Considerations

Many state DOTs administer specialized transit service programs including Section 5310 Special Needs of Elderly Individuals and Individuals with Disabilities, Section 5316 Job Access and Reverse Commute, and Section 5317 New Freedom. Data reporting requirements for these programs are driven by federal and statutory requirements. Chapter 2 of this toolkit briefly describes federal performance measure reporting requirements for these programs. In addition to reporting the federally required performance measures, transit providers that operate specialized transit report data must meet state reporting requirements.

The state's role in administering Section 5310, JARC, and New Freedom programs includes documenting the state's policies and procedures for administration through the State Management Plan (SMP), certifying that projects are derived from a *locally* developed, coordinated public transit-human service transportation plan ("coordinated plan"), monitoring local project activity, and overseeing project audit and closeout. The SMP should describe the state's method for collecting and reporting data for performance measurements and describe any standards set by the state for matters such as productivity, cost effectiveness, or service standards and detail state reporting requirements.

Further, Section 5310, JARC, and New Freedom programs differ from Section 5311 in the expenses that are eligible for federal grant reimbursement. These differing eligible expenses can also dictate the type of data required to be reported.

The purpose of Chapter 11 is to describe Section 5310, JARC, and New Freedom program goals, federal reporting requirements, and program eligible expenses to provide insight on the variety of data that may be required to be reported by the state.

11.1 SECTION 5310

The stated goal of the Section 5310 program is to improve mobility for elderly individuals and individuals with disabilities throughout the country. Toward this goal, FTA provides financial assistance for transportation services planned, designed, and carried out to meet the special transportation needs of elderly individuals and individuals with disabilities in all areas—urbanized, small urban, and

rural. The program requires coordination with other federally assisted programs and services in order to make the most efficient use of federal resources (Federal Transit Administration 2007).

11.1.1 Apportionment

FTA, on behalf of the Secretary of Transportation, apportions the funds annually to the states based on an administrative formula that considers the number of elderly individuals and individuals with disabilities in each state. These funds available for apportionment are subject to annual appropriations by Congress (Federal Transit Administration 2007).

Funds are obligated based on the annual Program of Projects (POP) included in a statewide grant application. The state ensures that local applicants and project activities are eligible and in compliance with federal requirements, that private for-profit transportation providers are provided an opportunity to participate to the maximum extent feasible, and that the program provides for maximum feasible coordination of transportation services assisted under the grant. Once FTA approves the application, funds are available for state administration (usually through the state DOT) and allocation to individual sub-recipients within the state (FTA C 9070.1F - Elderly Individuals and Individuals with Disabilities Program 2007).

11.1.2 Federal Reporting Requirement

FTA requires transit providers that receive Section 5310 funds to submit both quantitative and qualitative information as available on each of the following measures:

- *Gaps in Service Filled.* Provision of transportation options that would not otherwise be available for older adults and individuals with disabilities measured in numbers of older adults and people with disabilities afforded mobility they would not have without program support.
- *Ridership.* Actual or estimated number of rides (as measured by one-way trips) provided annually for individuals with disabilities and older adults on Section 5310-supported vehicles and services (Federal Transit Administration 2007).

11.1.3 Eligible Expenses

Section 5310 provides funding for eligible capital expenses. FTA Circular 9070.1F describes eligible capital expenses.

Funds for the Section 5310 program are available for capital expenses as defined in Section 5302(a)(1) to support the provision of transportation services to meet the special needs of elderly persons and persons with disabilities. Examples of capital expenses include, but are not limited to the following:

- buses
- vans
- radios and communication equipment
- vehicle shelters
- wheelchair lifts and restraints
- vehicle rehabilitation; manufacture, or overhaul
- preventive maintenance, as defined by NTD
- extended warranties which do not exceed the industry standard
- computer hardware and software
- initial component installation costs
- vehicle procurement, testing, inspection, and acceptance costs
- lease of equipment when lease is more cost-effective than purchase
- acquisition of transportation services under a contract, lease, or other arrangement
- the introduction of new technology, through innovative and improved products, into public transportation
- transit related ITS
- supporting new mobility management and coordination programs among public transportation providers and other human service agencies providing transportation

When a state DOT permits the **lease of equipment or facilities** to be treated as a capital expense, the state must establish criteria for determining cost-effectiveness in accordance with FTA regulations. The FTA regulations are codified in “Capital Leases,” 49 CFR part 639 and OMB Circular A-94.

Both capital and operating costs associated with **contracted services** are eligible capital expenses. User-side subsidy programs are eligible for funding. The state, as recipient of the Section 5310 funds from FTA, has the option to decide whether to provide funding for contracted services. Funds may be requested for contracted services covering a time period of more than one year. The capital eligibility

of acquisition of services as authorized in 49 U.S.C. 5310(a)(3) is limited to the Section 5310 program.

Under Section 5310, **mobility management** is an eligible expense for funding. Mobility management activities may include:

- The promotion, enhancement, and facilitation of access to transportation services, including the integration and coordination of services for individuals with disabilities, older adults, and low-income individuals
- Support for short-term management activities to plan and implement coordinated services
- The support of state and local coordination policy bodies and councils
- The operation of transportation brokerages to coordinate providers, funding agencies, and customers
- The provision of coordination services, including employer-oriented Transportation Management Organizations' and Human Service Organizations' customer-oriented travel navigator systems and neighborhood travel coordination activities such as coordinating individualized travel training and trip planning activities for customers
- The development and operation of one-stop transportation traveler call centers to coordinate transportation information on all travel modes and to manage eligibility requirements and arrangements for customers among supporting programs
- Operational planning for the acquisition of intelligent transportation technologies to help plan and operate coordinated systems inclusive of Geographic Information Systems (GIS) mapping, Global Positioning System (GPS) technology, coordinated vehicle scheduling, dispatching and monitoring technologies as well as technologies to track costs and billing in a coordinated system and single smart customer payment systems (Acquisition of technology is also eligible as a standalone capital expense).

11.2 SECTION 5316 JARC

The stated goal of the JARC program is to improve access to transportation services to employment and employment-related activities for welfare recipients and eligible low-income individuals and to transport residents of urbanized areas and non-urbanized areas to suburban employment opportunities. Toward this goal, the FTA provides financial assistance for transportation services planned, designed, and carried out to meet the transportation needs of eligible low-income individuals and of

reverse commuters regardless of income. The program requires coordination of federally assisted programs and services in order to make the most efficient use of federal resources (Federal Transit Administration 2007).

11.2.1 Apportionment

Of the total JARC funds available, FTA apportions 60 percent among designated recipients in large urbanized areas; 20 percent to the states for small-urbanized areas; and 20 percent to the states for rural and small urban areas under 50,000 in population. JARC funds are apportioned among the recipients by formula. The formula is based on the ratio that the number of eligible low-income and welfare recipients in each such area bears to the number of eligible low-income and welfare recipients in all such areas. The low-income population is determined according to the latest available U.S. census data for individuals whose family income is below 150 percent of the poverty line. Data on welfare recipients will be used if they become available at appropriate disaggregate levels (Federal Transit Administration 2007).

11.2.2 Federal Reporting Requirements

FTA requires two measures of performance for the JARC program:

- Actual or estimated number of jobs that can be accessed as a result of geographic or temporal coverage of JARC projects implemented in the current reporting year.
- Actual or estimated number of rides (as measured by one-way trips) provided as a result of the JARC projects implemented in the current reporting year (Federal Transit Administration 2007).

11.2.3 Eligible Expenses

FTA Circular 9050.1 states that JARC funding is provided for capital, planning, and operating expenses that support the development and maintenance of transportation services designed to transport low-income individuals to and from jobs and activities related to their employment and to support reverse commute projects. Eligible projects may include, but are not limited to, capital, planning, and operating assistance to support activities such as the following:

- Late-night and weekend service.
- Guaranteed ride home service.
- Shuttle service.

- Expansion of fixed-route public transit routes.
- Demand-responsive van service.
- Ridesharing and carpooling activities.
- Transit-related aspects of bicycling.
- Local car loan programs that assist individuals in purchasing and maintaining vehicles for shared rides.
- Promotion, through marketing efforts, of the:
 - use of transit by workers with non-traditional work schedules;
 - use of transit voucher programs by appropriate agencies for welfare recipients and other low-income individuals;
 - development of employer-provided transportation such as shuttles, ridesharing, carpooling;
 - use of transit pass programs and benefits under Section 132 of the Internal Revenue Code of 1986; and
 - support of the administration and expenses related to voucher programs.
- Acquisition of GIS tools.
- Implementation of ITS, including customer trip information technology.
- Integration of automated regional public transit and human service transportation information, scheduling and dispatch functions.
- Deployment of vehicle position-monitoring systems.
- Subsidizing the costs associated with adding reverse commute bus, train, carpool van routes or service from urbanized areas and non-urbanized areas to suburban work places.
- Subsidizing the purchase or lease by a non-profit organization or public agency of a van or bus dedicated to shuttling employees from their residences to a suburban workplace.
- Other facilitation of the provision of public transportation services to suburban employment opportunities.
- Support of new mobility management and coordination programs among public transportation providers and other human service agencies providing transportation.

The **transit voucher** activity is intended to supplement existing transportation services by expanding the number of providers available or the number of passengers receiving transportation services. Vouchers can be used as an administrative mechanism for payment to providers of alternative transportation services. The JARC program can provide vouchers to low-income individuals to purchase rides, including (1) mileage reimbursement as part of a volunteer driver program, (2) a taxi trip, or (3) trips provided by a human service agency. Providers of transportation can then submit the voucher to the JARC project-administering agency for payment based on pre-determined rates or contractual arrangements. Transit passes for use on

fixed-route or ADA complementary paratransit service are not eligible. Vouchers are an operational expense that requires a 50/50 (federal/local) match.

Under JARC, **mobility management** is eligible for reimbursement. Mobility management techniques may enhance transportation access for populations beyond those served by one agency or organization within a community. For example, an agency could receive JARC funds to support the administrative costs of sharing services the agency provides to its own clientele with other low-income individuals and to coordinate use of vehicles with other non-profits, but the non-profit agency could not use JARC funds to pay for operating the service. Mobility management is intended to build coordination among existing public transportation providers and other transportation service providers with the result of expanding the availability of service. Mobility management activities may include:

- Promotion, enhancement, and facilitation of access to transportation services, including the integration and coordination of services for individuals with disabilities, older adults, and low-income individuals.
- Support for short-term management activities to plan and implement coordinated services.
- Support of state and local coordination policy bodies and councils.
- Operation of transportation brokerages to coordinate providers, funding agencies, and customers.
- Provision of coordination services, including employer-oriented transportation management organizations' and human service organizations' customer-oriented travel navigator systems and neighborhood travel coordination activities such as coordinating individualized travel training and trip planning activities for customers.
- Development and operation of one-stop transportation traveler call centers to coordinate transportation information on all travel modes and to manage eligibility requirements and arrangements for customers among supporting programs.
- Operational planning for the acquisition of intelligent transportation technologies to help plan and operate coordinated systems inclusive of GIS mapping, global positioning system technology, coordinated vehicle scheduling, dispatching and monitoring technologies as well as technologies to track costs and billing in a coordinated system, and single smart customer payment systems (acquisition of technology is also eligible as a standalone capital expense).

11.3 SECTION 5317 NEW FREEDOM

The New Freedom formula grant program aims to provide additional tools to overcome existing barriers facing Americans with disabilities who want to enter the

workforce and fully participate in society. Lack of adequate transportation is a primary barrier to gainful employment for individuals with disabilities. The 2000 Census showed that only 60 percent of people between the ages of 16 and 64 with disabilities are employed. The New Freedom formula grant program seeks to reduce barriers to transportation services and expand the transportation mobility options available to people with disabilities beyond the requirements of the ADA of 1990 (Federal Transit Administration 2007).

11.3.1 Apportionment

FTA apportions New Freedom funds as follows:

- Sixty percent of the funds are apportioned among designated recipients, as defined in Section 5307(a)(2), for urbanized areas with a population of 200,000 or more in the ratio that the number of individuals with disabilities in each such urbanized area bears to the number of individuals with disabilities in all such urbanized areas.
- Twenty percent of the funds are apportioned among the states in the ratio that the number of individuals with disabilities in urbanized areas with a population of less than 200,000 in each state bears to the number of individuals with disabilities in urbanized areas with a population of less than 200,000 in all states.
- Twenty percent of the funds are apportioned among the states in the ratio that the number of individuals with disabilities in other than urbanized areas (rural areas) in each state bears to the number of individuals with disabilities in other than urbanized areas in all states.

11.3.2 Federal Reporting Requirements

FTA requires transit providers that receive New Freedom program funds to measure performance using the following three criteria:

- Increases or enhancements related to geographic coverage, service quality, and/or service times that impact availability of transportation services for individuals with disabilities as a result of the New Freedom projects implemented in the current reporting year.
- Additions or changes to environmental infrastructure (e.g., transportation facilities, sidewalks, etc.), technology, and vehicles that affect availability of transportation services as a result of the New Freedom projects implemented in the current reporting year.
- Actual or estimated number of rides (as measured by one-way trips) provided for individuals with disabilities as a result of the New Freedom

projects implemented in the current reporting year (Federal Transit Administration 2007).

11.3.3 Eligible Expenses

FTA Circular 9045.1 states that the following activities are examples of eligible projects meeting the definition of new public transportation under New Freedom:

- Enhancing paratransit beyond minimum requirements of the ADA. ADA complementary paratransit services can be eligible under New Freedom in several ways as long as the services provided meet the definition of “new”:
 - Expansion of paratransit service parameters beyond the three-fourths mile required by the ADA.
 - Expansion of current hours of operation for ADA paratransit services that are beyond those provided on the fixed-route services.
 - The incremental cost of providing same-day service.
 - The incremental cost of making door-to-door service available to all eligible ADA paratransit riders, but not as a reasonable modification for individual riders in an otherwise curb-to-curb system.
 - Enhancement of the level of service by providing escorts or assisting riders through the door of their destination.
 - Acquisition of vehicles and equipment designed to accommodate mobility aids that exceed the dimensions and weight ratings established for common wheelchairs under the ADA and labor costs of aides to help drivers assist passengers with oversized wheelchairs. This would permit the acquisition of lifts with a larger capacity, as well as modifications to lifts with a 600 lb design load, and the acquisition of heavier-duty vehicles for paratransit and/or demand-response service.
 - Installation of additional securement locations in public buses beyond what is required by the ADA.
- Offering feeder services—new “feeder” service (transit service that provides access) to commuter rail, commuter bus, intercity rail, and intercity bus stations, for which complementary paratransit service is not required under the ADA.
- Making accessibility improvements to transit and intermodal stations not designated as key stations—improvements for accessibility at existing transportation facilities that are not designated as key stations established under 49 CFR 37.47, 37.51, or 37.53, and that are not required under 49 CFR 37.43 as

part of an alteration or renovation to an existing station, so long as the projects are clearly intended to remove barriers that would otherwise have remained. New Freedom funds are eligible to be used for new accessibility enhancements that remove barriers to individuals with disabilities so they may access greater portions of public transportation systems, such as fixed-route bus service, commuter rail, light rail, and rapid rail. This may include:

- Building an accessible path to a bus stop that is currently inaccessible, including curb cuts, sidewalks, accessible pedestrian signals, or other accessible features.
 - Adding an elevator or ramps, detectable warnings, or other accessibility improvements that are not otherwise required under the ADA to a non-key station.
 - Improving signage, or way finding technology.
 - Implementing other technology improvements that enhance accessibility for people with disabilities including ITS.
- Offering travel training—new training programs for individual users on awareness, knowledge, and skills of public and alternative transportation options available in their communities. This includes travel instruction and travel training services.
 - Adding new public transportation alternatives beyond the ADA. The following activities are examples of projects that are eligible as new public transportation alternatives beyond the ADA under the New Freedom program:
 - Purchasing vehicles to support new accessible taxi, ridesharing, and/or vanpooling programs. New Freedom funds can be used to purchase and operate accessible vehicles for use in taxi, ridesharing, and/or vanpool programs provided that the vehicle has the capacity to accommodate a passenger who uses a “common wheelchair” as defined under 49 CFR 37.3, at a minimum, while remaining in his/her personal mobility device inside the vehicle, and meeting the same requirements for lifts, ramps, and securement systems specified in 49 CFR part 38, subpart B.
 - Supporting the administration and expenses related to new voucher programs for transportation services offered by human service providers. This activity is intended to support and supplement existing transportation services by expanding the number of providers available or the number of passengers receiving transportation services. Only new voucher programs or expansion of existing programs are eligible under the New Freedom program. Vouchers can be used as an administrative mechanism for payment of alternative transportation services to

- supplement available public transportation. The New Freedom program can provide vouchers to individuals with disabilities to purchase rides, including:
- mileage reimbursement as part of a volunteer driver program;
 - a taxi trip; and
 - trips provided by a human service agency.
- Providers of transportation can then submit the voucher for reimbursement to the recipient for payment based on pre-determined rates or contractual arrangements. Transit passes for use on existing fixed-route or ADA complementary paratransit service are not eligible. Vouchers are an operational expense that require a 50/50 (federal/local) match.
- Supporting new volunteer driver and aide programs.
 - Supporting new mobility management and coordination programs among public transportation providers and other human service agencies providing transportation.

Under New Freedom, **new volunteer driver programs** are eligible and include support for costs associated with administration, management of driver recruitment, safety, background checks, scheduling, coordination with passengers, and other related support functions; mileage reimbursement; and insurance associated with volunteer driver programs. The costs of new enhancements to increase capacity of existing volunteer driver programs are also eligible. FTA notes that any volunteer program supported by New Freedom must meet the requirements of both “new” and “beyond the ADA.” FTA encourages communities to offer consideration for utilizing all available funding resources as an integrated part of the design and delivery of any volunteer driver/aide program.

Under New Freedom, **mobility management** is an eligible cost. Mobility management techniques may enhance transportation access for populations beyond those served by one agency or organization within a community. For example, a non-profit agency could receive New Freedom funding to support the administrative costs of sharing services the agency provides to its own clientele with other individuals with disabilities and coordinate usage of vehicles with other non-profits, but not the operating costs of the service. Mobility management is intended to build coordination among existing public transportation providers and other transportation service providers with the result of expanding the availability of service. Mobility management activities are the same activities for JARC mobility management found in Section 11.2.3 above.

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Chapter 12. Automated Data Collection Systems

What You Might Want to Know

Automated data collection systems are beneficial to data quality control. Collecting data through automated systems allows central user access, streamlined data corrections, queries and reports without manual data entry, calculation of performance measures, flagging of errors, and improved data review process. This chapter presents:

- Case study results of DOT automated transit data collection
 - Texas Department of Transportation
 - Alabama Department of Transportation
 - Utah Department of Transportation
 - Iowa Department of Transportation
- A summary of case study findings
- A guide for developing automated transit data collection systems

12.1 DOT CASE STUDIES IN AUTOMATION

As a result of the fact-finding questionnaire sent to the 50 state DOTs, researchers identified several of the most technologically advanced automated systems for transit data reporting. This section summarizes each of the technologies that the most advanced systems use including software utilized, hardware requirements, IT support requirements, and training resources. The case studies are an attempt to summarize the components of automated transit reporting systems and are not intended to be an endorsement of specific software.

12.1.1 Texas Department of Transportation

The Texas Department of Transportation (TxDOT) Public Transportation Division (PTN) uses the PTN-128 system for collecting and reporting public transit data. PTN-128 is a web-based application that provides methods for data entry and data reporting through a standard web-browser interface. The data entered into the PTN-128 system is stored in a relational database in a central location accessible by a

series of web forms. The system provides users with reports in Microsoft Excel-based spreadsheets, which include the following:

- Monthly data with year-to-date totals
- Variances from previous year
- Quarterly summaries
- Trend graphs
- Annual summaries
- Transit district summaries

PTN-128 also has the capability of managing user accounts and reporting transit providers. In order to access the system, transit providers must authenticate using the username and password assigned by system administrators. Using a series of web forms, PTN-128 administrators can define transit providers and user roles for accessing the system. Individual users also have the capability of changing their contact information using the web interface.

The PTN-128 system handles the transit data management, user and transit provider management, data storage, and data reporting functions as shown in Figure 26.

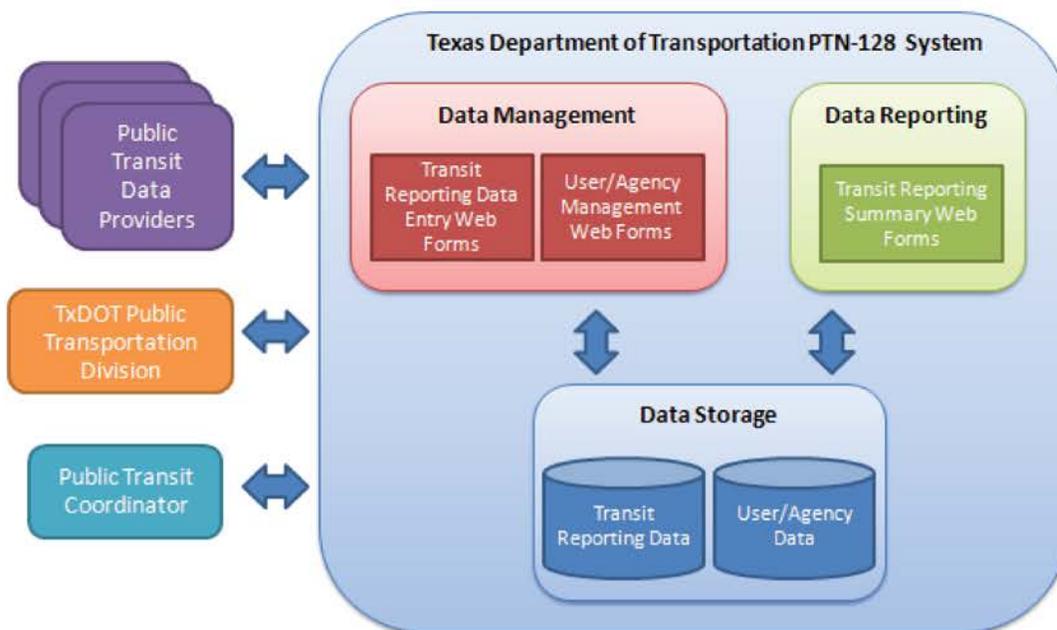


Figure 26. TxDOT Transit Data Reporting System

History and Development

Prior to the web-based application, transit providers entered information into a Microsoft Excel spreadsheet and emailed the file to the TxDOT public transportation coordinator, who then reviewed the data and emailed the file to the TxDOT Public

Transportation Division. This made the process and data difficult to maintain and keep consistent. Changes to spreadsheets were difficult to administer among all the transit providers, and quality control of the data was lacking. Storage of the data was achieved through individual spreadsheets, which made searching and reporting difficult. Because of the difficulties that the system presented, TxDOT determined that a revised data collection system was needed to allow for quality assurance checks, trend analysis, and use of data as a management tool. As a result, the PTN-128 system was developed as a tool used by transit districts to report financial and operating data to the state. Initially, the system hosted 30 small urban and 38 rural transit districts. Currently, the system has expanded to include the addition of 8 large transit authorities and more than 140 specialized transit providers.

The PTN-128 system centralizes the data entry forms and quality control mechanisms by providing a uniform interface for all transit providers. This web-based data collection and reporting tool provides several features for transit district staff and reviewers to better ensure data accuracy and reasonableness, including comparisons to previous year data, performance measurements, color-codes to flag potential errors (missing data, negative miles/hours, significant changes in monthly data), revenue-to-expense comparison, and annual performance reports.

Modifications to data entry forms can be made for all providers instantly. Quality control measures are implemented in a single location for all providers and enable data administrators to have instant feedback when data quality is suspect—for instance, when there are unusual changes between reporting periods. In addition, all reporting data are instantly stored and backed up on servers in a central location. These servers have the ability to control access to data and resources, which allows administrators to permit only users with appropriate permissions to access or change the data.

Software Used

The PTN-128 system uses the Microsoft ASP.NET web platform as its interface for the data management and data reporting components. ASP.NET is a software development framework used to host dynamic web applications. To allow users to access the system over the web, ASP.NET requires that the web server software, Microsoft Internet Information Services, be running on the machine containing the software codebase. For both data entry and reporting purposes, PTN-128 also employs a component that embeds Microsoft Excel-based spreadsheets into its web interface. These spreadsheets are similar to the ones used in the system prior to PTN-128; however, the sheets operate in a centralized environment (hosted on a website) with all data stored in a single location rather than on an individual user's computer.

Figure 27 is a screenshot of the main data entry screen from PTN-128 showing the embedded Excel spreadsheet as the data entry form.

City of Abilene - Citylink		SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
Actual Vehicle Hours												
Revenue		6,339	7,512	5,898	6,501	6,703	6,227	6,602	6,819	6,231	6,590	6,691
Total Vehicle		7,093	8,406	6,600	7,279	7,501	6,968	7,388	7,630	6,972	7,374	7,487
Deadhead Hours		754	894	702	774	798	741	786	811	741	784	796
Deadhead Ratio		10.6%	10.6%	10.6%	10.6%	10.6%	10.6%	10.6%	10.6%	10.6%	10.6%	10.6%
Actual Vehicle Miles												
Revenue		95,912	95,938	79,889	86,453	86,778	83,992	88,109	90,866	81,269	85,088	86,566
Total Vehicle		91,317	98,702	81,487	86,876	87,391	85,709	92,738	93,439	83,500	92,317	89,047
Deadhead Miles		5,405	2,764	1,598	423	603	1,717	4,629	2,573	2,231	6,229	2,481
Deadhead Ratio		5.9%	2.8%	2.0%	0.5%	0.7%	2.0%	5.0%	2.8%	2.7%	6.7%	2.8%
System Speed:												
Revenue		13.6	12.8	13.5	13.3	12.9	13.5	13.3	13.3	13.0	13.1	12.9
Total		12.9	11.7	12.3	11.9	11.6	12.3	12.6	12.2	12.0	12.5	11.9
Deadhead		7.2	3.1	2.3	0.5	0.8	2.3	5.9	3.2	3.0	7.9	3.1

Figure 27. TxDOT Data Entry Screen Example

For data storage, PTN-128 utilizes an Oracle relational database system. Transit reporting information entered into the spreadsheets from the web interface is stored in the Oracle database in a series of tables. In addition, individual transit provider and user information is stored in the database. Figure 28 illustrates the interaction of the various software components involved in the system.

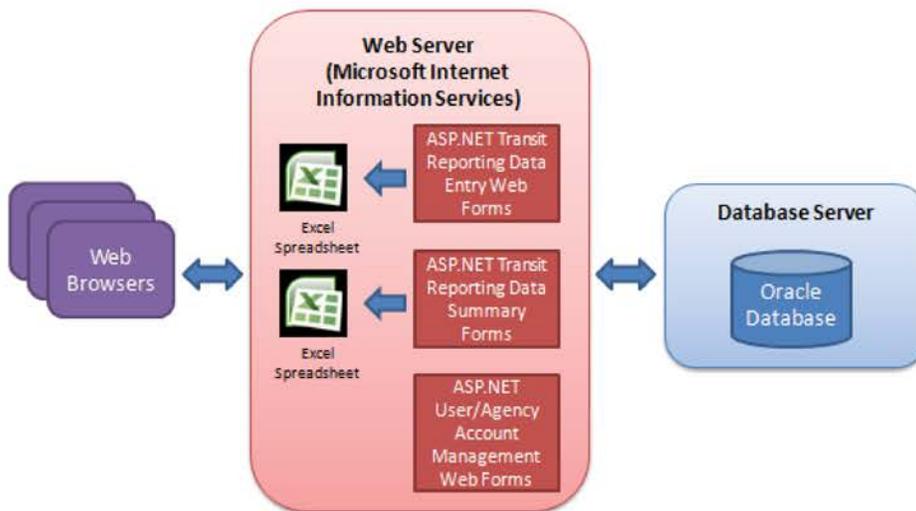


Figure 28. TxDOT Software Component Interaction

Hardware Used

PTN-128 requires, at a minimum, a single server class machine for hosting the website containing the data management and data reporting components and another server class machine for hosting the data storage component. In order for users to connect to the system, both these machines must be accessible from an Internet-based network. Access to the system is controlled through username and password authentication.

Considerations should be made on the database server regarding hard disk storage space for historical reporting. PTN-128 currently stores and makes accessible all of the data collected since development in 2007.

Because Texas is a large state, there are currently 194 active transit data providers accessing the system and entering data. In states with fewer providers, the hardware and, in particular, the data storage requirements could be much less.

IT Support Requirements

Currently, TxDOT contracts with the Texas Transportation Institute to host and support the IT functions of the system. Because the system is centralized, IT support for the software and hardware is typically limited to the two machines hosting PTN-128. Typical support functions include database backups, software patch management, and basic user support queries. Support activities for the entire system typically account for less than one day per month of IT staff time.

Training Resources

TxDOT provides a PTN-128 reporting manual to transit providers and periodically offers a one-day training course for users. All transit providers and TxDOT public transportation coordinators initially attended a two-day training session on data collection and reporting using the PTN-128 system when first launched.

12.1.2 Alabama Department of Transportation

The Alabama Department of Transportation (ALDOT) uses the Transit Reporting System (TRS) to allow ALDOT and other statewide agencies to report, track, and share transit reporting data. The system allows agencies to file their reports in a web-based, client-server environment and gives ALDOT employees the ability to manage the reports through an administrative program running on the user's computer. The administrative program allows ALDOT users to file, view, edit, and print reports

online, and track reports that are past due. The TRS allows users to generate and view the following reports:

- 5309/5310 Quarterly Report
- 5309/5310 Annual Operational Expenditures Report
- 5309/5310 Annual Monitoring Report
- 5310 Purchased Transportation Quarterly Report
- 5310 Purchased Transportation Annual Operational Expenditures Report
- 5311 Quarterly Report
- 5311 Semi-Annual DBE Report
- Past Due 5309/5310 Quarterly Report
- Agency Listing Report
- Vehicle Listing Report
- ALDOT User Listing Report
- Agency User Listing Report

To use the TRS, users must have a username and password for logging in. ALDOT employees with administrative privileges for the TRS are able to manage account information from the TRS forms.

History and Development

The TRS was fully developed in-house by ALDOT and is currently supported by ALDOT computer services personnel. Prior to this client-server based system, transit reporting was accomplished using paper forms submitted to ALDOT. Reports were manually generated by ALDOT personnel.

Development of the TRS eliminated the need for paper forms and the manual process of querying the information to generate reports. Centralization of the data collection into a networked relational database provides a uniform data entry process and improves the quality of data collected.

Software and Architecture Used

Although data entered into the TRS system goes into a single, centralized database, ALDOT has developed and currently uses two similar interfaces for managing the data. The first interface is provided using a series of web-based forms that are accessible in a standard web browser. The other interface is an executable program that resides on an individual machine and does not utilize a web browser. While the features of both interfaces are very similar, the executable program provides some administrative functions that the web-browser interface does not. At the time this report was written, ALDOT was evaluating the possibility of migrating the

administrative features of the Windows forms application to the web-based application in the future.

For the web interface, TRS uses ASP.NET to generate the web forms and reports. The Windows interface uses Crystal Reports, a Windows software framework that runs on an individual user's machine. A screenshot of the data entry form for the 5309/5310 Quarterly Report from the Windows interface is depicted in Figure 29.

The screenshot shows a Windows application window titled "5309/5310 Quarterly Report". The form is organized into several sections:

- Agency Information:** Includes dropdown menus for "Agency:", "Reporting Period:", and "Report Filed By:", and a text box for "Date Filed:" with the value "7/18/2006".
- Operation Statistics:** Includes text boxes for "Total Passenger Trips:", "Total Passenger Miles:", and "Total Vehicle Miles:".
- Passenger Classifications:** Includes text boxes for "Total Elderly:", "Total Disabled:", and "Total Other:".
- Primary Trip Purpose:** Includes checkboxes for "Medical:", "Employment:", "Nutrition:", "Social/Recreation:", "Education:", "Shop/Personal:", "Home:", and "Other:".
- Other Information:** Includes a large text area for "Notes:".

At the bottom right of the form, there are "Save" and "Cancel" buttons.

Figure 29. ALDOT Example Data Entry Screen

In both the web and Windows versions of the interface, the data flows over the computer network into the centralized database (even though the Windows version must be installed on the individual user's machine). All information entered into the system is stored in a centralized Microsoft SQL Server database where the information is made accessible through both client-server interfaces. The client-server architecture of the ALDOT TRS is depicted in Figure 30.

Alabama Department of Transportation Transit Reporting System

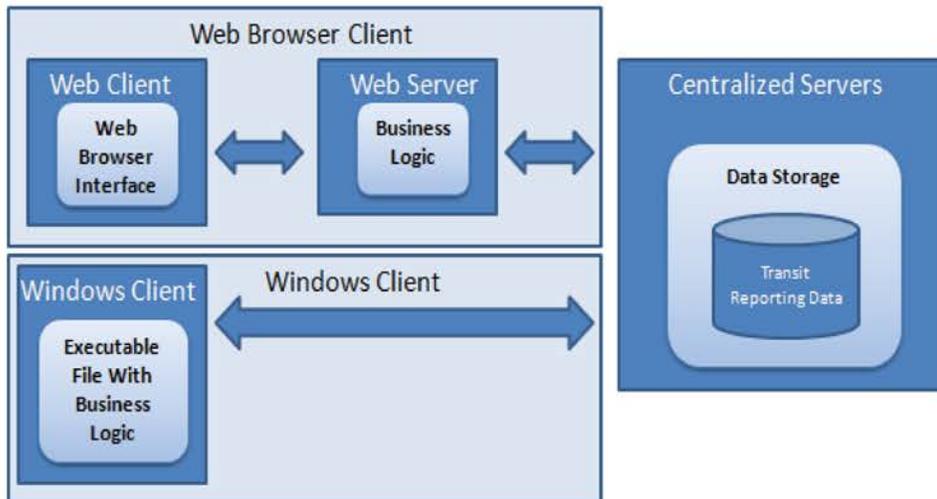


Figure 30. ALDOT Client-Server Architecture

Hardware Used

As in most client-server architectures, the hardware consists of a centralized server or servers for data storage and a series of client applications for accessing the data in the database. In the case of the TRS, centralized servers house the Microsoft SQL Server database and user machines house the client program for accessing the data.

IT Support Requirements

The ALDOT Transit Reporting System is supported by two ALDOT computer services programmers who are responsible for providing application user support and design modifications. Common support tasks include developing additional reports and debugging application errors. In addition, the assistance of other computer services staff such as network and database administrators is occasionally necessary.

Training Resources

The ALDOT TRS has been thoroughly documented with detailed instructions and screenshots of system forms and reports. The documentation is used as the training resource for new users.

12.1.3 Utah Department of Transportation

The Utah Department of Transportation (UDOT) uses the Public Transit Team's (PTT) online application to fulfill its transit data reporting system function. PTT

online allows agencies to submit an application online for FTA sections 5310, 5311, 5316, and 5317 funding. Once an agency has been granted funding, PTT online will allow the agency to fulfill regulatory reporting requirements online. PTT online is capable of reporting on a quarterly or annual basis.

History and Development

PTT was primarily developed in-house by UDOT IT personnel with the assistance of a consultant. Prior to this web-based system, transit reporting was accomplished using paper forms. Development of the PTT system has taken place iteratively over a four-year period and is still evolving. All development activities have been driven by the end users of the system.

Initially, the system could only be used to submit applications for funding. Through the development process, PTT has evolved into a full-featured reporting system that is used to report information to the NTD. The main benefit of the online system is that users have access to all of the reporting data in a centralized database. Using the web interface, users can create reports from the system on demand rather than having to request reports be manually compiled by UDOT personnel.

In addition, the system implements data quality checks to ensure that reporting is as accurate as possible. Automation of quality control measures is an ongoing development activity. Figure 31 shows a data quality notification that has been implemented into the PTT online system.



Figure 31. UDOT Data Quality Notification Example

Overall, PTT online has resulted in a savings of UDOT staff time by not requiring manual compilation of reports and has increased compliance through its use of automated data quality control.

Software and Architecture Used

UDOT uses a variety of tools from the Oracle Corporation as the software framework for the PTT system. The information entered into the system is stored in a centralized Oracle database. In addition, UDOT uses Oracle Application Express, a software framework for developing web pages that are integrated with the data in an Oracle database, to host PTT's web forms. Users can access all of the data entry forms and reports using a standard web browser. The Oracle products used in the PTT system are part of the standard set of tools that UDOT uses for other internal DOT systems. Figure 32 shows one of the 5311 forms used for vehicle utilization in the PTT online system.

5311 Vehicle Usage

Vehicle Utilization						
 Edit Vehicle Utilization						
	Year	Make	VIN	Total Actual Mileage	Miles In Quarter	Passenger Trips In Quarter
640	1997	Gillig	15GCB2010V1088313	237,123	4,512	12,345
641	1997	Gillig	15GBC2012V1088314	183,123	2,123	4,567
653	2002	Gillig	15GGB221421072237	198,123	3,456	5,678
654	2002	Gillig	15GGB221621072238	166,123	2,345	1,234
655	2002	Gillig	15GGB221821072239	56,123	1,589	987
656	2002	Gillig	15GGB221421072240	66,123	3,210	765
657	2004	Gillig	15GGB291941074350	111,123	953	91
658	2004	Gillig	15GGB291041074351	195,123	850	456
659	2004	Gillig	15GGB291241074352	186,123		
660	2004	Gillig	15GGB291441074353	74,123	3,210	3,698
Totals						
 1 of your vehicle(s) have no usage data entered. Click on the Edit Vehicle Utilization button above to navigate to the vehicle usage form.						

Figure 32. UDOT Vehicle Utilization Form Example

The PTT system employs a three-tiered architecture, with (1) a presentation tier for the end user, (2) a web server for hosting the data entry and reporting form logic, and (3) a database server for storing and retrieving the data. This three-tiered architecture is the standard architecture for providing web applications and data services throughout UDOT.

Access to the system is controlled through username and password authentication. User accounts are managed by PTT system administrators, and management does not typically require intervention from UDOT IT personnel.

Hardware Used

The hardware used in the PTT system consists of, at a minimum, a database server and an application server. Both of these items utilize shared resources within UDOT and are managed by UDOT IT personnel.

IT Support Requirements

UDOT IT personnel are responsible for the hardware support of the PTT system. A single in-house programmer interfaces with the end users and maintains the software originally developed by the consultant. In its current state, UDOT evaluates and implements minor changes to the system as requested by end users. Significant system enhancements would most likely be accomplished using an outside consultant under the supervision of UDOT.

Training Resources

The UDOT PTT application has been thoroughly documented with detailed instructions and screenshots of system forms and reports. Along with assistance from existing staff, the documentation is used as the main training resource for new users. A screenshot of the PTT online training document is shown in Figure 33.

Navigating within PTT Online

In order for an agency to access PTT Online, they will be given a distinct user name and password that will be used to logon to the application. The above URL will present a logon page where the username and password are entered. Once logged on the user will see their agency home page, seen below.

Quarterly Reporting

Your Quarterly Report for the period 01-OCT-2010 to 31-DEC-2010 is due on 15-JAN-2011.

Your agency has a **MISS** on this reporting requirement. You may wish to file this report soon.

Semi-Annual Vehicle Surveillance Report (due 16-OCT-10)

Vehicle	Reporting Due Date	Submitted	Action
1978 - 2008 - Ford		33 days PAST DUE	Click to create
0817 - 2007 - Ford		33 days PAST DUE	Click to create
7164 - 2007 - Chevrolet		33 days PAST DUE	Click to create

1-3

Preventive Maintenance Tracking

The mileage interval for Preventive Maintenance is listed in parentheses for each vehicle below.

- 4417 2007 Ford (5000) PM is current
- 1579 2005 Ford (5000) PM is current
- 7104 2007 Chevrolet (10000) was due PM @ 10,000 miles and currently has 15,300 miles which is 5,000 miles over due

Click here for PM Tracking Entry

Required Documents

As part of your contract(s) with UDOT PTT you are required to submit/maintain certain documents.

One or more of the documents that you submitted has been returned for changes.

Document	Returned Date
Annual Financial Plan	05-JUN-11

Click here to go to document management page.

Figure 33. UDOT Online Training Documentation Example

12.1.4 Iowa Department of Transportation

The Iowa Department of Transportation also uses a web-based system to manage, store, and report transit-reporting information. The system maintains quarterly and annual reports of transit operating statistics that can be submitted and reported through a web browser. Iowa DOT uses the information contained in the system for reporting to the NTD, although some NTD data must be gathered from sources outside the transit reporting system to meet the requirements of the NTD. Users of the system are required to have a login identifier and are managed by system administrators.

History and Development

Iowa DOT's transit reporting system was developed in-house by DOT IT staff. The previous method for reporting on transit statistics used Excel spreadsheets that were emailed to the transit data coordinator. The current system centralizes the data storage and collection process and simplifies the reporting for agencies.

Although the system uses the same hardware and software platforms that other Iowa DOT applications use, the system currently stands alone, meaning the system is not integrated with any of the DOT's accounting or grants-based systems.

Overall, the web-based system has improved the quality of data by implementing interactive error checking and has reduced the staff time necessary to produce reports by automating the process.

Software and Architecture Used

Iowa DOT's transit reporting system uses a centralized database to store agency transit data and a web-based interface for managing and reporting on the data. For the database, the DOT uses the Oracle relational database software that is already used in other Iowa DOT applications. Users can manage and view the transit reporting information through a web browser or desktop application. The web browser version uses the Microsoft ASP.NET software framework to display forms and reports to Internet users. The system can also be accessed by internal users with a desktop application developed in the Oracle reports framework. The Iowa DOT controls access to the system by managing user credentials.

The Oracle database software contains several mechanisms to ensure that quality control is implemented as the data are entered into the system. For instance, the system will check to see if there are more revenue miles than vehicle miles. If quality

checks fail, the user is notified immediately, reducing the amount of errant data that get input into the system.

Hardware Used

The Iowa DOT's transit reporting system utilizes existing DOT hardware resources to house the servers necessary for the database and web application frameworks. At a minimum, the system requires a single machine for the database server and another machine for the web application service. In practice, the database and web servers are spread across several different machines to enhance performance and to circumvent data loss in case of machine failures.

IT Support Requirements

The transit reporting application shares hardware resources with existing Iowa DOT programs and is thus maintained by internal IT staff as a part of statewide infrastructure. A single in-house programmer interfaces with the end users and maintains the application software and database schema. Minor changes to the system are evaluated and implemented by this programmer.

Training Resources

The Iowa DOT has a basic document describing each of the data elements that is input into the system. This document is provided as a resource to users of the system.

12.2 SUMMARY OF CASE STUDY FINDINGS

In all of the case studies, DOTs indicated that their systems were developed to fulfill the following functions:

- Provide a uniform interface for reporting the data.
- Centralize the data collection function and thus simplify reporting and data queries.
- Implement some level of automated quality control with the data entered into the system, therefore reducing errors.
- Manage access to the data by utilizing user login accounts.

All of the case studies showed that DOTs that have automated transit data reporting functions have similar system architectures comprised of a standard client-server model:

- The systems house the reporting data in a centralized database.
- The systems have their reporting and data entry business rules in a series of forms (typically hosted on a website).

- The systems present the forms to the user with a standard web-browser interface.

Figure 34 shows the standard architecture and data flows used by all of the DOTs.

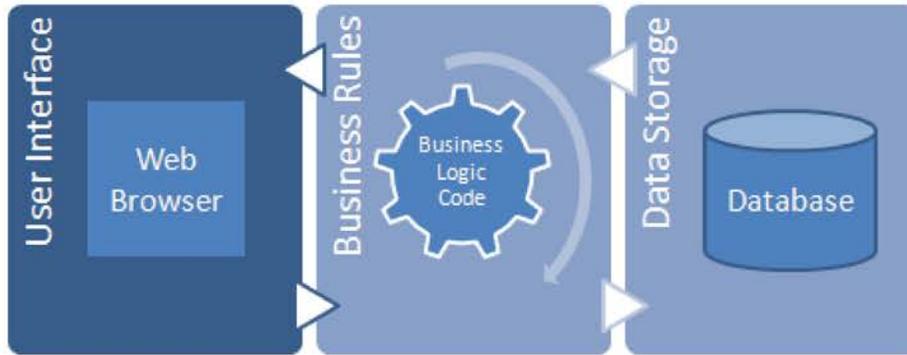


Figure 34. DOT Case Study Standard Architecture and Data Flows

Table 6 summarizes the software used by each of the DOTs in the case studies.

Table 6. Transit Reporting Software Component Summary

DOT Transit Reporting System	Data Storage	Business Rules	User Interface
Texas DOT PTN-128	Oracle Database	Microsoft ASP.NET	Standard Web Browser
Alabama DOT TRS	Microsoft SQL Server Database	Microsoft ASP.NET/Crystal Reports	Standard Web Browser/Windows Forms Executable
Utah DOT PTT	Oracle Database	Oracle Application Express	Standard Web Browser
Iowa DOT Transit Reporting System	Oracle Database	Microsoft ASP.NET	Standard Web Browser

Since the architectures are similar, the requirement for the hardware to support architectures is also similar. All of the case study examples utilize separate servers for data storage and for housing the business rules that are typically present on a machine hosting a web server. All of the systems allow users to utilize their own machines for interfacing into the transit reporting data.

IT support for the systems typically involves in-house DOT computer support staff for general hardware support (in the case of TxDOT, contractor support) and a single programmer for actual support of the application. Training resources for the systems

are provided in the form of user manuals with varying levels of detail. Existing staff members are also used as a resource for training.

12.3 DEVELOPING AUTOMATED TRANSIT DATA COLLECTION SYSTEMS

The previous section summarized the technologies used by several DOTs that have automated their rural transit data collection systems. The case studies provided by those DOTs can serve as an example for DOTs considering automating transit data collection. Based on the results of the case studies, essential characteristics for successful automated transit data collection have been determined.

A **transit data collection system** can be broken into several loosely coupled, logical components that work together to form the basis of a data collection framework. State DOTs that desire to establish similar automated data collection systems to the case study DOTs should consider the following five components as essential for successful implementation:

- Data Storage
- Data Entry
- Data Reporting
- Support
- Training

Consideration should be given to each of the five components during the design phase of planning the system. It should be noted that, in terms of importance, technology is secondary to the actual business processes in place and should be used to support the processes rather than drive the processes.

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