*White Paper*

# Technology and Public Transportation Operation and Management

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# INTRODUCTION AND BACKGROUND

As more intelligent transportation systems (ITS) products become available as "off-the-shelf" or otherwise standardized products, advanced technologies are becoming feasible options for smaller urban or rural transit providers and human service agencies. Many types of transit-related technologies can be valuable in transit coordination efforts, depending on the aspects of transit operations that are being planned as coordinated or cooperative efforts:

- Transit information databases and software
  - Route and schedule information
  - Customer/client data
- Transit scheduling/dispatching software, both fixed-route and demand-responsive
- Fare cards/smart cards, automated billing and accounting
- Vehicle location and communication systems
  - Mobile data terminals
  - Real-time location and vehicle arrival information
- Operations management
  - Performance data
  - Operations analysis
  - Service planning

*Advanced technologies are becoming feasible options for smaller urban or rural transit providers and human service agencies.*

## Purpose and Organization of the White Paper

This paper summarizes recent research on the uses of technologies to enhance transit operations, and examines the needs that technology solutions can address to facilitate regional coordination of public transportation services. The remainder of this paper is divided into two sections. The first section summarizes the basic categories of transit technologies and provides examples of how technologies are being used by transit agencies in the United States. The second section describes steps in the selection and implementation of transit technologies, summarizes recommendations and "lessons learned" from case studies, and lists resources for further information.

# USES OF TECHNOLOGY IN TRANSIT COORDINATION

Transit ITS technologies can benefit transit operations by helping to improve efficiency, flexibility, convenience, safety, and security. These technologies can similarly benefit coordinated efforts. When considering transit technologies, whether they will be used by one agency or several, it is important to first consider the needs of the public transportation system.

## Transit Technologies

Transit technologies—hardware, software, and product packages—are continually evolving, and any comprehensive list of available products is soon out of date. The following list of technologies is only a summary of the common product types currently on the market.

### Traveler/Passenger Information

Regional transit information systems can be a valuable tool for transportation providers who are trying to pool resources, facilitate transfers, or identify gaps in service. If made available online or by telephone, regional transit information is also useful to transit riders for finding and interpreting route, schedule, fare, and other necessary information from several transportation providers across an area.

*When considering transit technologies, it is important to first consider the needs of the public transportation system.*

Multi-provider transit information systems can be as simple as in-house databases or may incorporate other technologies such as scheduling and real-time information. Some regions in the United States have implemented regional public transit information as part of either "511" (travel/transportation information) or "211" (human services information) telephone services.

### Scheduling Software

Scheduling software is generally divided into: 1) fixed-route packages that help to plan routes, schedules, and rosters for fixed-route transit; and 2) demand-response tools that enable or automate the scheduling of demand-response transit trips. Fixed-route and demand-response software were once mutually exclusive products that were not designed to be used by the same transit provider (or group of providers), but with increased demand for multi-modal transit solutions, this is beginning to change.

### Accounting and Management Software

A variety of software packages are available to track and manage financial data, vehicle inventories and maintenance records, human resources information, planning information, and other operations functions.

### Fare Media

Bar codes, magnetic stripe fare cards, and "smart cards" with embedded microchips provide ways to easily identify passengers, collect fares, and record trip data.

### Automatic Vehicle Location

Most automatic vehicle location (AVL) systems now operate using GPS technology, and many communicate vehicle position using the same radio systems that are used for voice and data communications between vehicle operators and dispatchers.

### Communication

Radios, cell phones, and mobile data terminals (MDTs) are some of the many options for communicating between transit vehicles and dispatch centers. Systems may also wish to incorporate communication channels that link transit vehicles with emergency services ("mayday" systems) when needed.

## Case Studies

The following case studies show a few examples of how advanced transit technologies are being used in regional transit coordination.

- ***Bus-stop.org:*** This website was created in the late 1990s as a demonstration project to promote coordination among transit providers in the Dallas-Fort Worth area.[1] The website (no longer being updated) allowed users to search for transit options by county, by type of service, or by service agency name. The website provided contact information and basic rider information for each participating agency. Each participating agency could update its own information using a database personal identification number (PIN) for access.[2]
- ***North Central Texas Council of Governments (NCTCOG) Transportation Provider Inventory:*** This searchable web-accessible database provides transit provider contact information, including provider websites. Similar to bus-stop.org, the inventory offers a "clickable" map of area counties as one search option for finding the transit providers that operate in each county.[3]
- ***Transtar, Los Angeles:*** This transit trip planner was one of the earliest systems to allow a transit passenger to plan a full transit trip itinerary using multiple transit providers within a geographic region. The system was first developed in 1988, and was custom-programmed to accommodate data from multiple transit providers.[4]
- ***511 Transit and TransLink, San Francisco:*** 511 Transit is one component of the San Francisco Bay Area's 511 Travel Information System. The website offers an on-line trip planner and real-time train arrival information for the Muni rail system, while the toll-free telephone service provides information on the 40 transit providers that are part of the system. TransLink "smart" fare-cards, usable on buses, trains, light rail, and ferries in the nine-county San Francisco Bay Area, were introduced as a pilot program in 2002, and are being re-launched as a permanent option for Bay area transit riders in 2006.[5]

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[1] Bus-stop.org, website of North Texas Transit Cooperation Association (NTTCA). http://www.bus-stop.org
[2] *Telephone interview with Erika Lissberger, SPAN/NTTCA, February 5, 2002.*
[3] NCTCOG Transportation Provider Inventory website, http://www.nctcog.org/trans/data/tpi/map.asp, downloaded June 2006.
[4] Higgins, L. and Gilliland, C. One-Stop Transit Information: Guidelines for Development of Regional Transit Information Systems in Texas. FHWA/TX-03/4233-1, Texas Transportation Institute, College Station, Texas, 2002.
[5] 511 Transit Website, http://transit.511.org/index.asp, downloaded March 2006.

- ***211 InfoLink, Orange County:*** 211 InfoLink is available as a website and as a toll-free telephone number, providing centralized information on all human service agencies in Orange County, California. Transportation options for older adults, persons with disabilities, and other county residents are listed in the 211 on-line directory, with contact information given for each of the transit providers.
- ***Cross County Transit, North Carolina:*** This Web-accessible database allows human service agencies (or the general public) to enter requests for non-emergency out-of-county medical trips. Transit providers also enter information on upcoming out-of-county trips. Trip coordinators match trip requests manually with upcoming trips, forwarding potential trip matches to the transit providers. Transit providers then make trip arrangements with passengers.[6,7]
- ***St. John's Council on Aging, St. John's County, Florida:*** Two Federal Transit Administration (FTA)-funded ITS grants ($200K each) paid for the implementation of transportation management software, geographic information systems (GIS), AVL, and MDTs in St. John's and four other counties in Florida. The ITS systems have allowed the participating agencies to increase the number of trips served (doubling the trip capacity in St. John's county) while reducing the number of full-time staff required.[8]

*Case studies such as these provide real-life experience that can serve as a basis for implementing use of advanced technology options.*

- ***Suburban Mobility Authority for Regional Transportation (SMART), Michigan:*** SMART uses an Internet-accessible real-time demand-response scheduling system. The system is accessible by local social service agencies and other community partners, who can schedule rides for their clients on SMART.[9]
- ***Puget Sound Mobile Data Communications Project:*** This demonstration project tested an AVL system that included bus and rail vehicles from multiple transit agencies in the Puget Sound region of Washington. The system used a combination of GPS-based and dead-reckoning AVL technologies, and provided real-time location data to Busview, a Web-based display accessible by transit agencies and the general public.[10]

- ***The Capital Area Rural Transportation System (CARTS)*** provides rural, urban, and medical transportation in a nine-county area, in addition to coordinating with other area agencies that

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[6] TCRP Report 105: Strategies to Increase Coordination of Transportation Services for the Transportation Disadvantaged. Transportation Research Board, Washington, D.C., 2004.
[7] Cross County Transportation website, http://www.cctransit.org/, downloaded May 2006.
[8] U.S. Department of Transportation Rural ITS case study, http://www.its.dot.gov/rural/CaseDetails.asp?ID=18, downloaded June 2006.
[9] *ITS Transit Case Studies: Making a Case for Coordination of Community Transportation Services Using ITS.* http://www.ugpti.org/pubs/html/dp-171/index.php
[10] The Mobile Data Communications for Bus and Rail Automatic Vehicle Location Demonstration Project. University of Washington, 2003.
http://depts.washington.edu/trac/bulkdisk/pdf/SoundTransitMultiModalReport-13.pdf, downloaded June 2006.

provide human service transportation. CARTS has become known for its effective use of advanced public transportation systems (APTS) technologies to improve passenger service, including demand-response transit scheduling software, voice and data communications, and AVL. One challenge that CARTS faced was communicating with its vehicles across a large, mostly rural area where cell phone service can be unreliable. A partnership with the Lower Colorado River Authority (LCRA) provided a solution; CARTS now uses mobile data terminals that operate on LCRA's radio network. CARTS credits the success of its technology program to its "baby steps" approach to adding new systems; the transit system makes sure that each new technological element is working smoothly before adding the next element.

- ***El Paso County Rural Transit,*** using a grant from the rural transit assistance program, is developing specifications for ITS applications that will not only be integrated into El Paso County's transit service but may also be deployed statewide. Project tasks have included extensive investigation into available transit technologies (hardware and software), evaluation of the compatibility of identified components, and development of recommendations and strategies for integrating technology systems into transit operations. A demonstration project will deploy a "Smart Bus" equipped with a system of ITS technologies. The 33-passenger Smart Bus is itself an advanced vehicle design, with features including a natural gas engine and an ADA-compliant low floor for wheelchair access. Sixteen Smart Buses, along with the ITS systems identified through the specification development project, will be deployed in El Paso County in 2007. Data will be collected to evaluate improvements in operational efficiency, schedule adherence, customer satisfaction, and other service elements.

# SELECTING AND IMPLEMENTING TECHNOLOGY FOR TRANSIT OPERATIONS

The selection of technologies to enhance transit operations should always begin with a thorough analysis of the transit system's operations, business practices, goals, and resources. The acquisition and implementation transit technologies should always be driven by the operational goals and identified needs of the transit system.

*In a coordinated effort between multiple agencies, factors to be considered in selecting appropriate technology will be more complex than they would be for a single transit provider.*

## Identifying Needs

The needs of a transit system are defined by the functions it needs to accomplish in day-to-day operations, such as bus routing, demand-response reservations, fare collection or billing, vehicle maintenance, and so forth. These needs will be affected by the geographical area served, the number of passengers, the types of transportation service provided, and the resources, structure, and organization of the system. In coordinated efforts, all of these factors will be more complex than they would be for a single transit provider.

TCRP Report 76, Guidebook for Selecting Appropriate Technology Systems for Small Urban and Rural Public Transportation Operators, identifies 12 typical transportation needs that transit technologies might help to address:

- More accurate, easier reporting and record keeping;
- More efficient service coordination;
- Safer, more accurate cash handling;
- Improved operations staff performance and productivity;
- More effective maintenance tracking;
- Clearer communications;
- More effective dispatching;
- Faster, more efficient trip request processing;
- Improved scheduling productivity;
- Improved service quality;
- Greater safety; and
- More accessible, more useful customer information. [11]

The ability of ITS systems to process and manage large amounts of data can make them ideally suited to coordinated transportation efforts, if the technologies are selected and implemented with coordination in mind. The following sections summarize some of the issues that should be considered when selecting ITS technologies for coordinated transit.

## ITS Architecture

An essential part of the planning process for acquiring and implementing transit technology systems is the development of an ITS architecture. An ITS architecture defines the functional elements of the planned system and how information will travel between them, and ultimately describes how technologies will be used in order to satisfy the transportation system's objectives. Many of the steps needed to develop an ITS architecture for a region are the same steps needed to develop coordination agreements and strategies among transportation providers and stakeholders:

- Identify stakeholders and regional needs;
- Inventory system/stakeholder resources, needs, and services/functions (also called market packages);
- Define connections and information flow between system elements; and

[11] *Guidebook for Selecting Appropriate Technology Systems for Small Urban and Rural Public Transportation Operators.* TCRP Report 76, Transportation Research Board, Washington, D.C., 2002. http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_76.pdf

- Identify ITS standards, decide on project sequence, and develop agreements for acquisition and implementation of technologies.[12]

*The National ITS Architecture serves as a guide, but regional ITS architectures should be tailored to fit regional needs and resources.*

The National ITS Architecture, established in 1994, provides a model for defining the functions, structure, information and communication requirements within an ITS system. The National Architecture also helps to define standards for technology interfaces and information exchange requirements. While the National ITS Architecture should be used as a guide and resource, regional ITS architectures can and should be tailored according to regional needs and resources, including available technologies and technology packages.[13] TxDOT's Regional ITS Architectures, developed for each of the TxDOT districts, include transit ITS architectures for all but the major metropolitan areas.

R.Y.D.E. (Reach Your Destination Easily) is a demand-responsive paratransit service in Kearney, Nebraska. As part of an effort to improve service quality in the Kearney region, R.Y.D.E developed a regional ITS architecture that incorporates routing and dispatch software, computer aided billing, AVL, and MDTs. R.Y.D.E. consulted the National ITS Architecture to identify applicable ITS standards for each of the technologies it was considering, and made sure that each piece of the planned technology system would be compatible with those standards.

Transit providers in the Central Puget Sound region of Washington State formed a committee to jointly develop a transit technology plan. The Regional Transit Technology Plan details the regional goals shared by stakeholders, desired outcomes of technology implementation, and planned technology initiatives.[14]

## Selecting Technologies

As stated previously, numerous technology products and packages are available within each of the broad categories (scheduling, communications, etc.). The Federal Transit Administration's *Advanced Public Transportation System State of the Art* report provides information on new and emerging technologies and trends in transit-related ITS systems. The latest version of the report was published in 2006.[15]

Table 1 summarizes some of the technology solutions described in TCRP's *Guidebook for Selecting Appropriate Technology Systems for Small Urban and Rural Public Transportation Operators* (see "Resources" at the end of this paper). The TCRP Guidebook provides a much more detailed set of tables that identify technology options based on the size of transit system.

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[12] Ripplinger, David. PowerPoint Presentation entitled "ITS Architecture in Rural Transit Systems: The Case of Kearney, Nebraska," North Dakota State University, 2004. http://www.itsmn.org/ruralits2004/presentations/Ripplinger.pdf#search=%22Regional%20Transit%20ITS%20Architecture%2C%20Kearney%2C%20Nebraska%22 , downloaded September 29, 2006.

[13] National ITS Architecture, Version 5.1 http://www.iteris.com/itsarch/ , downloaded September 25, 2006.

[14] Central Puget Sound Regional Transit Technology Plan. http://www.rttg.org/techplan/techplan.htm

[15] Advanced Public Transportation Systems: The State of the Art Update 2006. http://www.fta.dot.gov/documents/APTS_State_of_the_Art.pdf, downloaded October 2, 2006.

Table 1. Summary of Transit System Needs and Technologies.*

| Transit System Needs | Potential Technology Applications | |
|---|---|---|
| More efficient, easier reporting and record keeping. | • Customized spreadsheets and databases<br>• Personnel software<br>• Fare media | • Accounting software<br>• GIS<br>• Scheduling/reservation software<br>• MDTs |
| More efficient service coordination | • Customized spreadsheets and databases<br>• Fare media<br>• Passenger counters<br>• MDTs | • Radio/cell communications<br>• Accounting software<br>• GIS<br>• AVL<br>• Scheduling/reservation software |
| Safer, more accurate cash handling | • Customized spreadsheets and databases | • Fare media<br>• MDTs |
| Improved operations, staff performance, and productivity | • Customized spreadsheets and databases<br>• MDTs | • GIS<br>• AVL<br>• Scheduling/reservation software |
| More effective maintenance tracking | • Customized spreadsheets and databases | • Maintenance software<br>• MDTs |
| Clearer communications | • Enhanced telephone system<br>• Radio/cell communications<br>• MDTs | • AVL<br>• Mayday system |
| More effective dispatching | • Customized spreadsheets and databases<br>• Radio/cell communications | • MDTs<br>• Scheduling/reservation software<br>• AVL |
| Faster, more efficient trip request processing | • Customized spreadsheets and databases<br>• Enhanced telephone system | • GIS<br>• Scheduling/reservation software<br>• Internet website |
| Improved scheduling productivity | • Customized spreadsheets and databases<br>• GIS | • MDTs<br>• Scheduling/reservation software<br>• AVL |
| Improved service quality | • Customized spreadsheets and databases<br>• Enhanced telephone system<br>• GIS<br>• Scheduling/reservation software | • MDTs<br>• AVL<br>• Travel information systems<br>• Fare media |
| Improved safety | • Customized spreadsheets and databases<br>• Scheduling/reservation software | • MDTs<br>• AVL<br>• Mayday system |
| More accessible, more useful customer information | • Customized spreadsheets and databases<br>• Enhanced telephone system<br>• Scheduling/reservation software | • Traveler information systems<br>• Internet website<br>• Fare media<br>• AVL |

*Summarized from TCRP Report 76, *Guidebook for Selecting Appropriate Technology Systems for Small Urban and Rural Public Transportation Operators*.

Todd Allen of RouteMatch Software, Inc. recommends that customers consider the following questions as they select transit technologies:

1. How does the product apply—or not—to transit business practices? Are customers (stakeholders) willing to alter certain business practices (e.g., scheduling methods) to take advantage of the product's capabilities?
2. Have the customers had a thorough opportunity to investigate the various products available?
3. Are the customers willing to give and take between the product's price and capabilities to get the best match for their system?
4. Is the product/technology scalable? Will it grow to meet future business? What are licensing and upgrade requirements? Will the system/providers be coordinating with additional organizations in the future?
5. What are the computer literacy/training needs of transit staff? How much groundwork needs to be laid to transition staff into a different way of operating?
6. At the end of the day, will stakeholders be able to get the biggest bang for the buck?[16]

## Project Costs

ITS system costs depend on numerous parameters, beginning with the type of application. Computer-assisted scheduling software for small-urban or rural demand-responsive transit, for instance, is packaged and priced differently by three different software companies:

- By the number of transit vehicles in the system,
- By the number of trips provided daily, and
- By the number of counties included in the GIS database and by the number of workstations using the software.

In addition, each of these software packages includes some combination of additional features (such as a bar-code reader to track vehicles and mileage, or differing levels of scheduling automation). The estimated prices for these somewhat-similar systems range, as a result, from $25,000 to $50,000 in 2006. For larger systems, especially those also incorporating fixed-route transit, the prices increase. Real-time information systems, including AVL systems, will tend to push costs past the $100,000 range, though there are exceptions—the FleetASAP Internet-based vehicle location and communication system advertises a per-vehicle equipment cost of $200–300 (plus a $50/month connection service fee) that could bring AVL technology to smaller systems at a low cost.[17]

Elements to consider when estimating total cost for implementing new technologies include the following:

- Agency staff time for procurement, training, data entry, and ongoing operation of technical systems;
- Maintenance and technical support;

[16] Telephone interview with Todd Allen, Director of Business Development and Community Relations, RouteMatch Software, Inc., Raleigh, North Carolina, on June 28, 2006.
[17] "Fleet Management Made Affordable," *Community Transportation*, January/February 2000, http://www.ctaa.org/ct/janfeb00/fleet_mgt.asp, downloaded June 2006.

- Computer workstations and other hardware (purchases and/or upgrades); and
- Usage fees for communications.

The greater efficiency that technology solutions can bring to transit operations can sometimes result in overall cost savings. Most previous studies, however, recommend that transit providers and stakeholders focus on improved service first, then on potential cost savings. The cost benefits of transit technologies will vary from system to system, and may be long-term rather than immediate.

*Partnering with other agencies on technology systems can broaden benefits and pool funding sources to maximize resource availability.*

R.Y.D.E.'s coordinated regional service has saved an estimated $400,358 per year by lowering the cost to provide each trip. R.Y.D.E. attributes the success of the coordination effort to the increased operational efficiencies possible with the ITS systems that have been implemented.

Some additional information, including additional case studies, is available at the California Center for Innovative Transportation Website, which is listed in "Resources" at the end of this paper.

## Funding and Procurement

Consider partnering with other agencies on technology systems to broaden benefits and pool funding sources. Community Transit in Delaware County, Pennsylvania, provides an example: the transit system's partnerships with human service agencies and a regional medical center provided opportunities to apply for technology grants that would not have been available through traditional transit funding programs. The grants funded the implementation of MDT communication technology that transmits passenger information and pictures to vehicle operators to facilitate pickups, as well as an Internet-based trip request system used by the medical center to schedule client trips. [18]

Alternatively, consider group procurement—statewide or regional partnering to purchase multiples of the same software/system for multiple transit providers at a group rate. Where possible, manage procurement through the agency that has the least cumbersome procurement process.

The U.S. Department of Transportation's Intelligent Transportation Systems website provides an "ITS Lessons Learned" section; case studies submitted by transportation agencies summarize "lessons learned" about each stage of ITS implementation. Some issues addressed by the funding and procurement case studies include:

- Innovative financing for ITS,
- Finance plans that encourage participation from multiple agencies, and

[18] Op.Cit., Guidebook for Selecting Appropriate Technology Systems…, p. 6.

- Using configuration management to prioritize implementation activities.[19]

## General Principles/Lessons Learned

- Focus on desired outcomes—benefits to riders, operators, service efficiency—rather than "becoming enamored with technology itself." Identify the most pressing needs of the transit system and its users, then consider the technologies that may help to meet those needs.
- Use technologies that will be compatible with other commercial software and hardware systems (open or standardized architecture). Some custom-designed systems may become obsolete quickly if they require a specialized system in which to operate.
- Select "scalable" systems that can be expanded to add capacity or functional requirements without the need for a complete overhaul of the system.
- Introduce new technologies gradually—one system at a time rather than a massive overhaul all at once.
- Educate employees and the community on the new systems and their benefits.
- To ensure accurate information is available to users, a central person or staff should lead the task of maintaining and updating information for the system. Even if each agency has the ability to perform updates to its own section of the database, experience has shown that updates may not be made regularly without reminders.

## Recommendations

Recommendations appear in Table 2 on the following page. These recommendations focus on regional consensus and agreements relating to the functions, formats, and procurement of transit technologies. TxDOT would help to facilitate discussion and development of the following agreements in regions that are considering the implementation of transit technologies to assist in their coordination efforts:

- ***A regional consensus on the desired outcomes of technology implementation (relating to the coordination effort).*** Before deciding on particular technology purchases, stakeholders should agree on the needs that they want technology to help them meet, e.g. improved scheduling, easier data management, and/or improved communications.
- ***A regional ITS architecture.*** It may not be necessary for every transit provider/region to adopt the same technology package or purchase from the same vendor; however, for ITS technologies to be useful for transit coordination (and eligible for project funding under FTA grant programs), providers and other agencies will need to develop consensus on data sharing and formats, equipment needs, staffing needs and responsibilities, and potential changes to operations. Regional ITS architectures should conform as much as possible with the TxDOT

[19] ITS Lessons Learned Knowledge Resource. U.S. Department of Transportation, http://www.itslessons.its.dot.gov/its/benecost.nsf/LessonHome.

district-based ITS architectures[20]; TxDOT can help to compare regional ITS needs to the TxDOT district-based ITS architectures and even out any disparities.

- ***.Regional funding and procurement agreements, where practical.*** If multiple agencies decide to adopt the same technology packages, a group purchase may lower the price. Explore non-transit funding sources that may be accessible via coordination/partnerships with human service agencies in the region.

[20] Texas Regional ITS Architecture Home Page, http://www.consystec.com/texas/default.htm

Table 2. Recommendations.

| Issues/Constraint Category | Issue/Barrier/ Constraint/Specifics | Recommendation | Type of Action |
|---|---|---|---|
| Service Coordination | Varying systems for scheduling, reservations, resource management may impede coordination between agencies. | Regional agreement on desired outcomes (relating to the coordination effort) of technology implementation. | Coordination project<br>Policy development |
| Service Coordination | Varying systems for scheduling, reservations, resource management may impede coordination between agencies. | Regional ITS architecture, based on (or compatible with) TxDOT's regional (district-based) ITS architectures. | Coordination project<br>Policy development |
| New Purchases | Limited funds for technology purchases | Regional/multi-agency funding and procurement agreements. | Coordination project<br>Policy development |

## Additional Resources

In addition to the documents and websites referenced in this report, the following reports contain information and guidelines that may be helpful to transit systems that are considering technology implementation.

"ITS Decision: A Guide to Understanding and Applying Intelligent Transportation Systems." This website, maintained by California Center for Innovative Transportation at the University of California at Berkeley, provides information and case studies about ITS systems, including some of the technologies specifically suitable to transit. The website is located at http://www.calccit.org/itsdecision/.

TCRP Synthesis 57: Computer-Aided Scheduling and Dispatch in Demand-Responsive Transit Services.

*Guide for Acquiring Demand Responsive Transit Software and Technology*. This guidebook, developed by The Pennsylvania Transportation Resource and Information Network (PennTRAIN), includes checklists and interview guides for assessing system needs, vendor and product criteria, and cost information. Online at http://www.penntrain.net/NewFiles/PDF%20Files/SoftwareGuide.PDF#search=%22transit%20technology%20procurement%22.