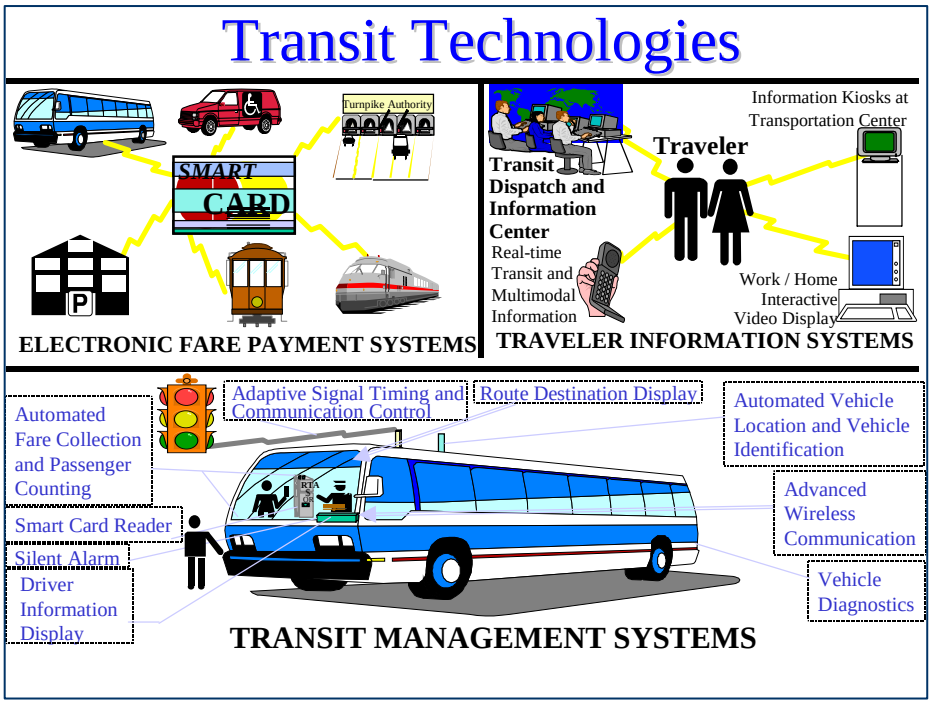
Intelligent Transportation Systems
Transit Technology Fact Sheets
Overview

September 2007

Problem: General Managers and other public transit administrators asked the FTA to provide direction as to which of the many transportation technologies to invest.

Purpose: Provide a summary of the most basic and useful technologies for different types of transit agencies.



How Were the Core Technologies Determined?

- Representatives from 8 transit agencies formed the Core Technology Review Team
- The Review Team examined the full set of transit technologies.
- The Review Team identified lists of most needed technologies for each service type (this is the **Core Suite of Technologies**).
- The Review Team considered which technologies produced synergies when combined.

Fact Sheet Products:

1. Technology Fact Sheet
    - General Transit Overview
    - Fact Sheet by Mode
2. Modal Fact Sheet
    - Core Suite Overview
    - Individual Technology Fact Sheet
    - Technologies by Modal Size

Fact Sheet Layout:

- Why Use this Technology?
- What Transit Problem can Technology Address?
- Technology Overview
- Common Technology Combinations
- Factors to Consider
- Benefits and Costs
- Transit Agency Deployments and Contacts
- Additional Resources

Transit Modes Covered:

- Fixed Route Bus
- Demand Response Service
- Rural Transit
- Human Services Transit
- Rail Transit (Commuter, Heavy, Light)
- Ferryboat

Intelligent Transportation Systems (ITS)
Transit Core Technologies

There are **11 technologies** or systems that constitute the full Transit Core Suite of Technologies. These 11 technologies are considered the most basic and useful technologies for public transportation agencies to deploy. Note that not every technology is deemed a "core" system for every transit mode.

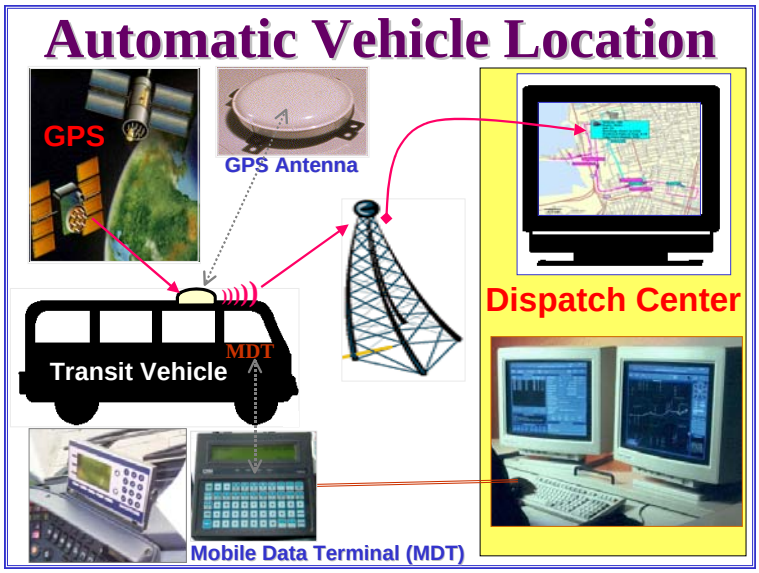
This list was developed through a cooperative effort of the Federal Transit Administration (FTA), the U.S. Department of Transportation's John A. Volpe Center, and the ITS Public Transportation Forum, a committee jointly sponsored by the Intelligent Transportation Society of America (ITS America) and the American Public Transportation Association (APTA).

TRANSIT CORE TECHNOLOGY [✓]	TRANSIT MODE						
	Fixed Route Bus	Demand Response	Rural Transit	Human Service	Rail Transit	Ferry Boat	TOTAL MODES
1. Automatic Vehicle Location	✓	✓	✓	✓	✓	✓	6
2. Communications	✓	✓	✓	✓	✓	✓	6
3. Traveler Information	✓	✓	✓	✓	✓	✓	6
4. Data Management - GIS	✓	✓	✓	✓	x		4
5. Computer-Aided Dispatch & Scheduling (CAD)	✓	✓	✓	✓			4
6. Maintenance Tracking	✓	✓		✓	✓		4
7. Electronic Fare Payment	✓	✓	x	x	✓	x	3
8. Security Cameras / System	✓		✓		✓	x	3
9. Weather Information System					✓	✓	2
10. Advanced Passenger Counters	✓				x		1
11. Traffic Signal Priority	x				✓		1

x = Secondary Technology for Modal Agency to consider after Core deployed

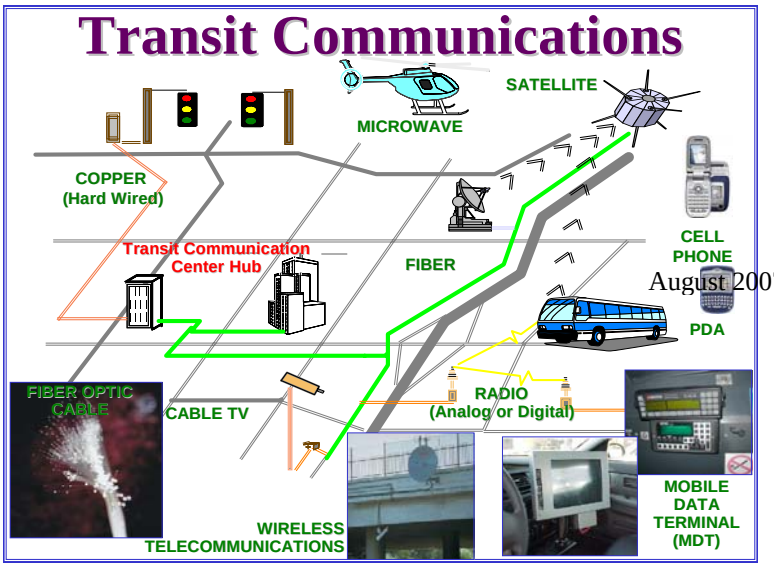
Automatic Vehicle Location (AVL):

An AVL system is a computer-based vehicle tracking system that uses a specific location technology (usually Global Positioning Satellites – GPS) and a method of transmitting the location data (via a traditional radio frequency or a cellular-based communications system) from the vehicle to a dispatch center. This enables the public transportation agency to monitor the real-time position of its vehicles.



Transit Communications:

Communication systems are any technology used to pass information from one user to another user in a useable form via wire, radio, laser, or other links. Typical basic transit communication starts with the conventional land mobile communication (primarily the analog radio). Communication systems can now be used to transmit voice, text, data, and video, while advanced communication systems are now enabling remote vehicle control.



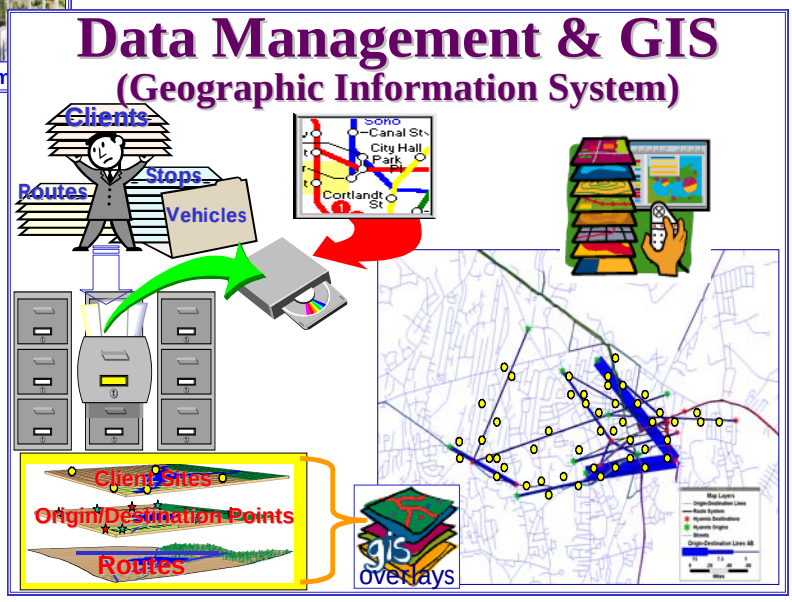
August 2007

Traveler Information:

Traveler Information Systems (TIS) enable the transit customer to receive travel information regarding the transit mode or other modes that the traveler may take. **TIS** include a broad range of computer and communication technologies, ranging from a customer service phone line to the ability for the traveler to obtain automated trip planning assistance and real-time transit and traffic information over a variety of media.

Data Management and GIS (Geographic Information System):

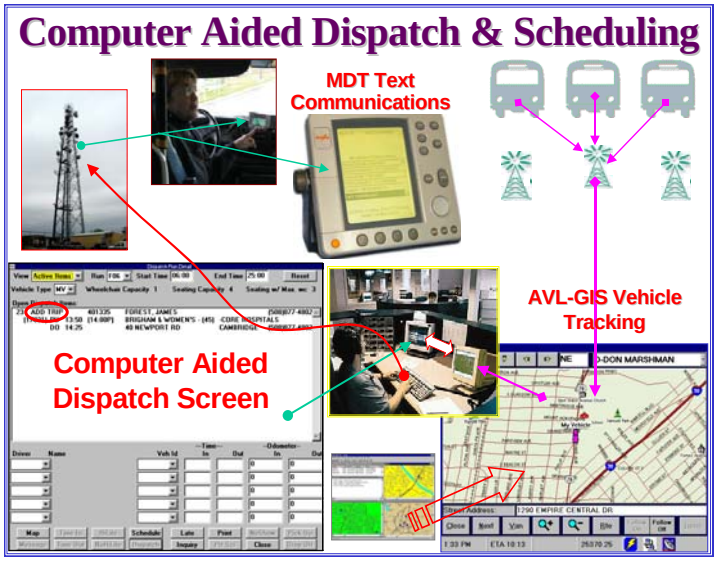
Data Management Systems incorporate technologies to allow a transit agency to gather, manage, report, and store (archive) any desired set of data relating to clients, schedules, trips, and billing. **GIS** is a computer mapping application that displays and analyzes the spatial relationship of the different data such as vehicle routes, trip pick-up and drop-off points, transit stops, streets, landmarks, and terrain characteristics. GIS is often used to graphically display AVL data.



Computer Aided Dispatch and Scheduling (CAD):

Transit-specific software that incorporates transit routes, schedules, any trip orders, and vehicle assignments to allow dispatchers to know where the transit vehicles are located, which enables dispatchers to more efficiently dispatch trip requests or to better maintain

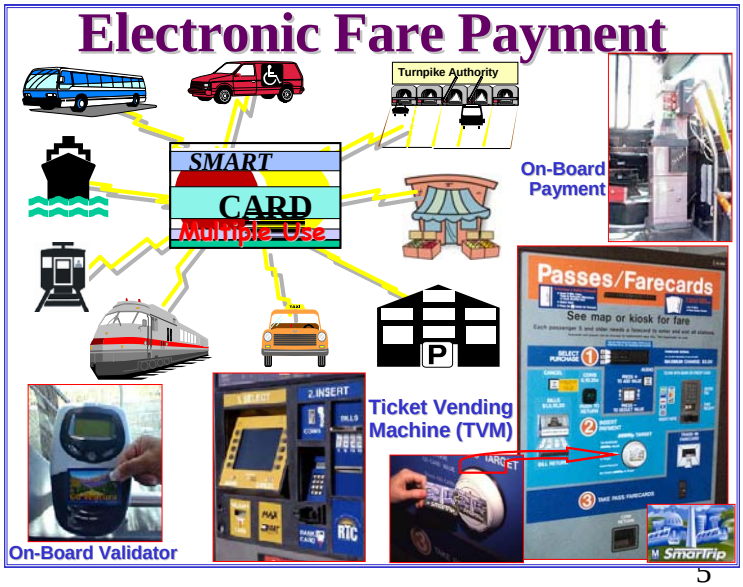
service and respond to disruptions, such as a disabled bus. **CAD** is often integrated with AVL, GIS, and MDT technologies to provide advanced real-time system capabilities.



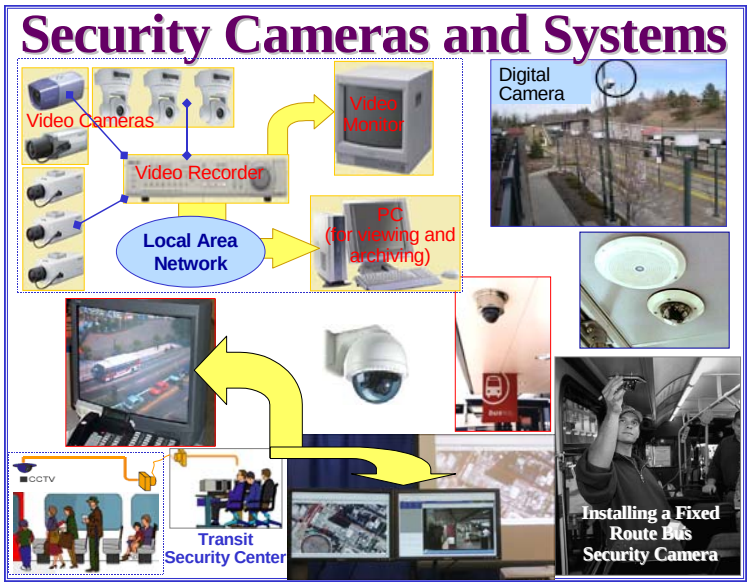
Maintenance Management: In-vehicle diagnostics system that monitors conditions of transit vehicle components, especially the engines, and provides failure warnings. Out-of-tolerance conditions may be passed on to dispatch in real-time using a radio data connection between the transit vehicle and central control or downloaded during vehicle servicing at the transit garage. This system includes software that manages the maintenance records of each transit vehicle and parts inventories. This type of system is also known as Vehicle Component Monitoring, Automatic Vehicle Monitoring, and Maintenance Tracking.

Electronic Fare Payment: Electronic Fare Payment and Collection Systems are automated means of collecting and processing fares that enable customers to use a variety of mediums (magnetic stripe cards, smart cards, credit cards, tokens, cash) to pay for transit trips, while simplifying the fare collection for the transit providers. It is possible for the bar codes on a fare media to be configured to enable automated passenger identification for billing purposes. Advanced payment systems also allow for multiple uses of the cards used to pay the transit fare.

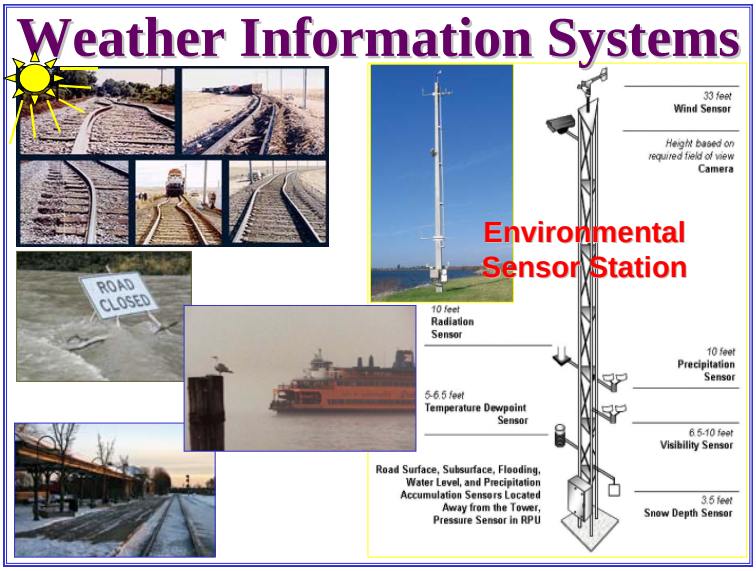
Security Cameras and Systems:
Security systems are technologies that enhance the security (and possibly safety) of transit customers, personnel, equipment, and facilities. Technologies include radio communications, silent alarms, covert microphones, closed circuit television (CCTV) cameras (also known as video surveillance), AVL and other equipment that assist transit agencies in monitoring and responding to situations on board vehicles, along the routes, and at transit facilities.



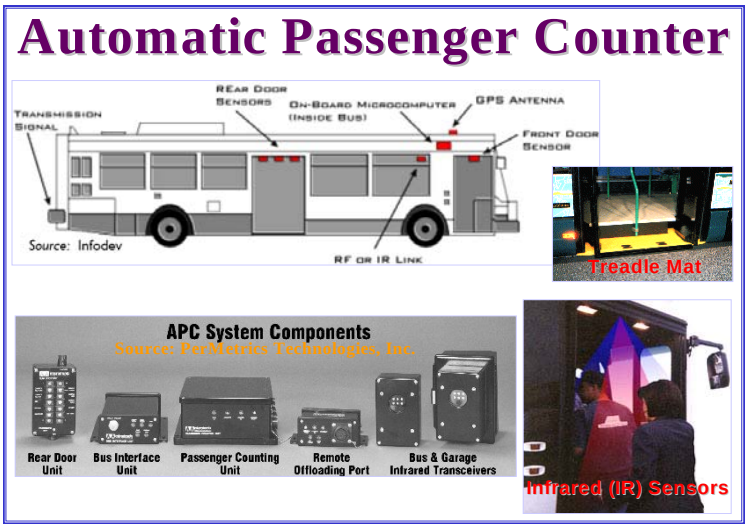
Weather Information Systems:
Systems that provide weather information



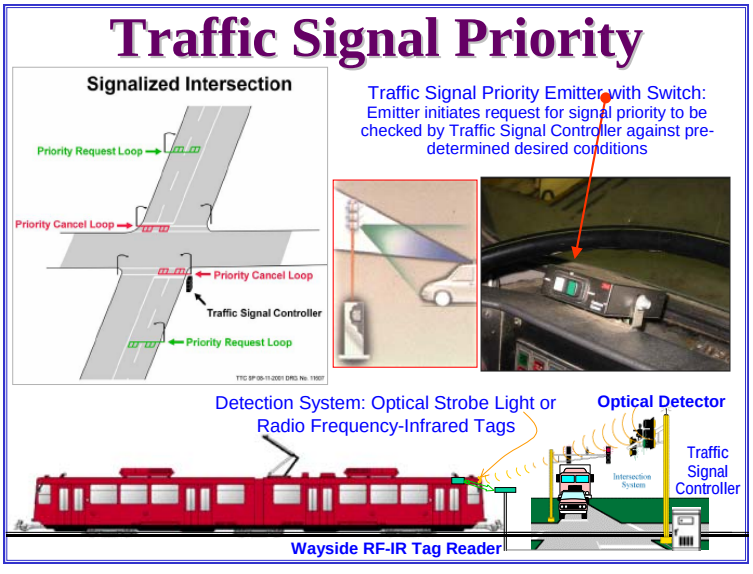
tailored to particular agency requirements, including current and forecast road, surface, or travel conditions (e.g., flooding, heat advisories, wind advisories, visibility, icing conditions, water temperature). These systems use sensors located at environmental sensor stations (ESS) to monitor the conditions. This information must be timely and accurate in order to be of significant benefit to transportation decision-makers.



Automatic Passenger Counter (APC): An on-board or in-facility data collection tool that automatically counts passenger boardings and alightings by time and location. APC technologies include treadle mats, horizontal or vertical infrared beams, or machine vision applications. APC data can be used for real-time service monitoring or service planning purposes.



Traffic Signal Priority (TSP): TSP systems (also know as Adaptive Signal Timing) are means of giving emergency vehicles (police, fire, ambulance) or high occupancy vehicles (especially light rail trains and buses) priority at traffic signals by truncating the red signal phase or extending the green phase in order to minimize the emergency or transit vehicle delay. The priority may be actuated manually (e.g., by the driver pressing a switch on the bus), or automatically (e.g., linked to an AVL system).



HOW MUCH DO THE TRANSIT CORE TECHNOLOGIES COST?

TECHNOLOGY SYSTEM	COST RANGE LOW	COST RANGE HIGH	TECHNOLOGY RANGE ASPECTS (BASIC SYSTEM TO MOST EXTENSIVE)
1. Automatic Vehicle Location	$30,000	$12 M (million)	On-board AVL-GPS; Vehicle tracking integrated with Operations Control Center dispatching and security systems, includes AVL-GPS and MDTs
	MEDIAN: $200,000		
2. Transit Communications	$20,000	$8.1 M	Advanced PDA provides route guidance & interactive information; Dispatch Center hardware, digital radio, data computer, field communications hardware (voice –radio & data – MDT), in-vehicle hardware (including AVL-GPS)
	MEDIAN: $100,000		
3. Traveler Information	$40,000	$24.1 M	Voice recognition traveler info call-in phone line; Trip Planner with GPS tracking for real-time information
	MEDIAN: $100,000		
4. Data Management & GIS	$10,000	$2.3 M	Desktop GIS with basic database software; Transit Center software integration of vehicle tracking, GIS, scheduler, information storage (large, multimodal agency)
	MEDIAN: $140,000		
5. Computer-Aided Dispatch & Scheduling	$4,000	$5.6 M	Basic scheduling software; Integrated communications & scheduling system with AVL-GPS, radio modifications and scheduling software (large, multimodal agency)
	MEDIAN: $40,000		
6. Maintenance Tracking	$15,000	$2.2 M	Fuel dispensing management applications; On-board mechanical monitoring sensors that collect & transmit vehicle data to Operations Control Center
	MEDIAN: $100,000		
7. Electronic Fare Payment	$65,500	$204 M	Fare reader with AVL-based GIS & AVL-MDT tracking system (small agency); Full replacement of fare collection system with fare vending machines, smart card & magnetic readers, fare gate consuls, vehicle validating fareboxes (large agency)
	MEDIAN: $750,000		
8. Security Cameras & Security Systems	$10,000	$5.2 M	Multiple Black & White CCTV cameras installed; Advanced bus surveillance system with wireless technology for live video transmission to command center (large agency)
	MEDIAN: $340,000		
9. Weather Information	$10,000	$3.7 M	Most basic Environmental Sensor Station (weather station); Statewide deployment of 88 ESS, plus training, plus 2-year full service warranty
	MEDIAN: $45,000		
10. Advanced Passenger Counters	$21,500	$1 M	Add-on to advanced operating system with route scheduling and vehicle tracking components; Real-time data reporting linked to central control scheduling software and vehicle location devices
	MEDIAN: $350,000		
11. Traffic Signal Priority	$55,000	$10 M	Priority installation at 2 intersections, in-vehicle priority emitter on 10 vehicles; Loop detectors at 210 intersections along 2 long corridors with AVI sensors at controller cabinet for 150 transponder-equipped buses.
	MEDIAN: $300,000		

Standout Public Transportation Agencies Deploying ITS

AATA (Ann Arbor, MI)
BART (Oakland, CA)
Benecia Transit (Benecia, CA)
Cambria County Transit Authority (Johnstown, PA)
Capital Area Rural Transit System (Austin, TX)
Capital District Transit Authority (Albany, NY)
DART First State (Dover, DE)
Greater Cleveland RTA (Cleveland, OH)
Houston Metro (Houston, TX)
Indian River Council on Aging (Vero Beach, FL)
Intracity Transit (Hot Springs, AR)
King County Metro (Seattle, WA)
MARC (Maryland)
Metro Transit (Minneapolis, MN)
Moorhead Metro Area Transit (Moorhead, MN)
MUNI (San Francisco, CA)
New Jersey Transit (Newark, NJ)
South Florida RTA (Pompano Beach, FL)
Sun Tran / Van Tran (Tucson, AZ)
Tri-Met (Portland, OR)
Utah Transit Authority (Salt Lake City, UT)
Ventura CTC (Ventura, CA)
Virginia Railway Express (Alexandria, VA)
Wheels of Wellness (Philadelphia, PA)

Reference Documents for Transit Technologies

- Advanced Public Transportation Systems: State-Of-The-Art Update 2006 (March 2006), http://www.fta.dot.gov/documents/APTS_State_of_the_Art.pdf
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- Computer-Aided Scheduling and Dispatch in Demand-Responsive Transit Service – TCRP Synthesis 57 / Project J-7 (2004); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_57.pdf
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- Guidance for Developing and Deploying Real-Time Information Systems for Transit (April 2003); http://ntl.bts.gov/lib/23000/23600/23663/RTTIS_Final.pdf
- Handbook of Automated Data Collection Methods for the National Transit Database (October 2003), http://www.nctr.usf.edu/pdf/473-11.pdf
- ITS Applications for Coordinating and Improving Human Services Transportation – A Cross-Cutting Study (August 2006); http://www.itsdocs.fhwa.dot.gov/jpodocs/REPTS_TE/14140.htm
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- Transit Security Design Considerations (November 2004); http://transit-safety.volpe.dot.gov/security/SecurityInitiatives/DesignConsiderations/CD/ftasesc.pdf
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