# Communications Technologies Fact Sheet: Fixed Route Bus

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## Technology Overview

Communications technologies facilitate interaction between drivers, dispatchers, emergency response and other personnel involved in transit and transportation operations. A comprehensive system that combines various communication technologies, including those that transmit **voice, text, data,** and **video,** will allow seamless communication among all personnel, vehicles, facilities, and data systems, and often across modes. **Digital radio**, **cellular** and **other wireless networks** may be utilized to transmit data in addition to voice. Pre-programmed text messages, that minimize voice traffic over the radio network, can be sent between drivers and dispatchers using a range of devices. **Mobile data terminals (MDTs)** provide two-way text based communication and the ability to upload data collected during a bus run.

**Use Communication Technologies to:**

- Perform dispatching instructions and transmit schedule adjustments.
- Provide emergency and incident response.
- Enable route deviation and dynamic rerouting.
- Facilitate communication between the bus operators and dispatchers, supervisors, or other transit staff necessary for fixed route bus operations.


**Large** fixed route bus transit agencies (those operating 100 or more buses) often install both voice and text communication devices. The use of MDTs for standard communication purposes minimizes reliance on voice-based communication in large, urban areas where bandwidth is often scarce. Voice communication is still used in cases when pre-programmed MDTs messages are insufficient. However, a voice-only network is usually sufficient for the communication needs of most **small** fixed route bus transit agencies (those operating fewer than 100 buses).

## Common Technology Combinations

### Daily Operations

**Communications** and **automatic vehicle location (AVL) systems** are used by fixed route bus agencies to monitor on-time performance, reduce bus bunching, and improve schedule adherence. **AVL** is often integrated with **mobile data terminals** (**MDTs)** to allow for the real-time transfer of location data. Dispatchers also use **computer aided dispatch and scheduling (CADS)** software to determine optimal operations and then connect with drivers using a voice or text communications network.

### System and Service Planning

Data collected by **MDTs** can be aggregated and analyzed for longer-term planning and service adjustments. Such data are more powerful when combined with geographic data from an **AVL** system and depicted using **geographic information system** (**GIS**) software.

### Safety and Security

**Communication** systems can be installed with a dedicate channel for emergency response. **MDTs** can include a pre-programmed emergency message that when integrated with an **AVL** system will provide the location of the distressed vehicle. In addition, a **silent alarm** or **CCTV camera video feed** from the transit bus or a bus facility to the operations or security center will utilize the communications network, which must be configured to handle streaming video.

## Factors to Consider When Deploying Advanced Communications Technologies

There are a number of factors that officials from fixed route bus transit agencies should consider when considering deployment of any advanced communications systems or components. Among those items to consider within planning, implementation, and integration tasks are:

### Planning

- Develop a well-structured procurement plan with performance oriented-requirements and thorough specifications.
- Involve staff from various departments and outside stakeholders such as contractors.
- Visit peers at other transit agencies or government agencies, especially local peers, to explore communication system integration or joint deployments
- A wireless infrastructure should be shared in a regional context to minimize duplication and costs.
- For agencies that are currently using or contemplating deploying multiple technologies on their buses, ensure that any communication network has sufficient channel or bandwidth to handle the voice, text, data, or video transfer from the current, expanded, or new bus technologies. The communications network is the common component for all of these systems.

### Implementation

- Perform rigorous testing of entire system to identify gaps in cellular or radio coverage.
- Consider installing back-up systems to ensure undisrupted communication in case of primary system failure.
- Equip background communications software and support system with virus, firewall, and other security protection.
- Expect a learning curve as drivers and dispatchers develop efficient communications techniques and learn to utilize the full functionality of the communication devices.
- Test the level of noise generated from any communications device with regard to the aesthetic nature on the bus riders and the impact to the customer's trip quality.

### Integration

- Develop standard data-exchange protocols to be able to add compatible equipment from multiple vendors and to operate on different bandwidths and with a variety of communication technologies.
- Separate the communication components from any proprietary AVL/CAD/MDT systems to allow for open standards, which improve the ability to incorporate other technologies and enables easier system expansion. Agencies should look for such a deployment to allow for modular implementation and easy upgrading of other technologies
- Involve representatives of the transit agency's Information Technology (IT) department. Transit bus communications should be linked to the IT network, not a separate system. This will ensure that the IT staff has reviewed the requirements and specifications and has signed off and budgeted appropriate staff to provide internal technical support.

# Benefits and Costs

### Benefits

The majority of benefits accrue to transit users when communications improve reliability and on-time performance. Communications systems also enhance the safety and security of the bus operators and travelers. Communications technologies have not led to capital cost savings such as fleet reductions; however, operating cost savings are possible if communications systems are used to improve adherence to schedules and vehicle-use efficiency and to provide smooth data exchange.

- The Ann Arbor Transportation Authority (AATA) reported an on-time departure rate nearly doubled over a two year period after the upgrade of its communication system, which included new MDTs
- The AATA also experienced a 70% drop in voice traffic with the installment of MDTs
- Denver's Regional Transit District (RTD) decreased early arrivals by 12% and late arrivals by 21% after deploying MDTs, AVL and an upgrade to their radio network

#### Other Possible Benefits

- Decreased emergency response time
- Improved customer satisfaction and ridership through better on-time performance
- Greater coordination with other regional transit / transportation providers with integrated or interoperable communications networks.

### Costs

Communication system deployment costs can incorporate many components, including dispatch center hardware and software, data computers, field transmittal devices such as radio towers and fiber optic cable, and in-vehicle hardware and software such as radio, MDTs, AVL-GPS and other integrated systems. When considering costs for a new communications system or system upgrades, do not forget to account for hidden costs. Factors such as driver and operator training, data storage, and equipment maintenance and support all should be considered as part of the cost of operation.

#### Equipment and Implementation

- Pierce Transit of Tacoma, WA paid $3,600 for the purchase and installation of each of its MDT units
- In 1999, AATA paid $9,106 per bus to install MDTs and related equipment on 75 buses and $200 per bus for the hardware components of an 800 MHz radio system.

#### Operations and Maintenance (O&M)

- Expect monthly or annual fees from equipment vendors for MDT system software support.
- Fees are also applicable for use of proprietary cellular networks.

#### Training

- For MDT staff training, expect an average of 4 hours of training for each vehicle operator.

## Communications Deployments by Fixed Route Bus Agencies

| Agency | Contact Information | Number of Vehicles | Context / Success of Deployment |
|---|---|---|---|
| Pace Suburban Bus (Suburban Bus Division of the Regional Transportation Authority) | 550 W Algonquin Rd<br>Arlington Heights, IL 60005<br>(847) 364-7223 | 705 buses | Intelligent Bus System (IBS) installed in 2005. All buses with MDT and supervisor vehicles have notebook computers that can have 2-way communications. |
| Niagara Frontier Transportation Authority (NFTA-Metro) | 181 Ellicott Street<br>Buffalo, NY 14203<br>(716) 855-7300 | 332 buses | Digital & trunked radio & MDT |
| Sound Transit<br>(Central Puget Sound Regional Transit Authority) | 401 South Jackson Street<br>Seattle, WA 98104<br>(206) 398-5000 | 209 buses | MDT and wireless data on/off load system at Central Base (part of Smart Bus deployment) |
| Golden Empire Transit District (GET) | 1830 Golden State Ave<br>Bakersfield, CA 93301<br>(661) 324-9874 | 79 buses | Digital & trunked radio & MDT |
| Beaver County Transit Authority (BCTA) | 200 W. Washington St.<br>Rochester, PA 15074<br>(724) 728-4255 | 34 buses | Digital & trunked radio & MDT installed in fleet in 2001. Update communications system planned. |
| St. Joseph Transit (The Ride) | 702 S. 5th Street<br>St. Joseph, MO 64501<br>(816) 233-6700 | 21 buses | Digital & trunked radio & MDT |

## Additional Resources on Communication Technologies (and ITS):

- Mobile Data Terminals: A Synthesis of Transit Practices – TCRP Synthesis 70 / Project J-7 (2007); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_70.pdf
- Real-Time Bus Arrival Information Systems Return-on-Investment Study (August 2006), http://www.fta.dot.gov/documents/Final_Report_-_Real-Time_Systems_ROI_Study.doc
- Advanced Public Transportation Systems: State-Of-The-Art Update 2006 (March 2006), http://www.fta.dot.gov/documents/APTS_State_of_the_Art.pdf
- Development of a Wireline Communication Design Guidebook for Intelligent Transportation Systems (October 2005); http://tti.tamu.edu/documents/0-4969-1.pdf
- Transit Security Design Considerations (November 2004); [Chapter 8 – Communications]; Report No. DOT-VNTSC-FTA-05-02 / FTA-TRI-MA-26-7085-05; http://transit-safety.volpe.dot.gov/security/SecurityInitiatives/DesignConsiderations/CD/ftasesc.pdf
- Characteristics of Bus Rapid Transit for Decision-Making (August 2004); http://www.nbrti.org/media/documents/Characteristics%20of%20Bus%20Rapid%20Transit%20for%20Decision-Making.pdf
- Handbook of Automated Data Collection Methods for the National Transit Database (October 2003), http://www.nctr.usf.edu/pdf/473-11.pdf
- Guidance for Developing and Deploying Real-Time Information Systems for Transit (April 2003); http://ntl.bts.gov/lib/23000/23600/23663/RTTIS_Final.pdf
- Real-Time Bus Arrival Information Systems – TCRP Synthesis 48 / Project J-7 (2003); http://www.fta.dot.gov/documents/Final_Report_-_Real-Time_Systems_ROI_Study.doc
- ITS Decision Website: Telecommunications (Last updated: 2003); Caltrans and California Center for Innovative Transportation at the University of California at Berkeley; http://www.calccit.org/itsdecision/serv_and_tech/Telecommunications/telecommunications_overview.html