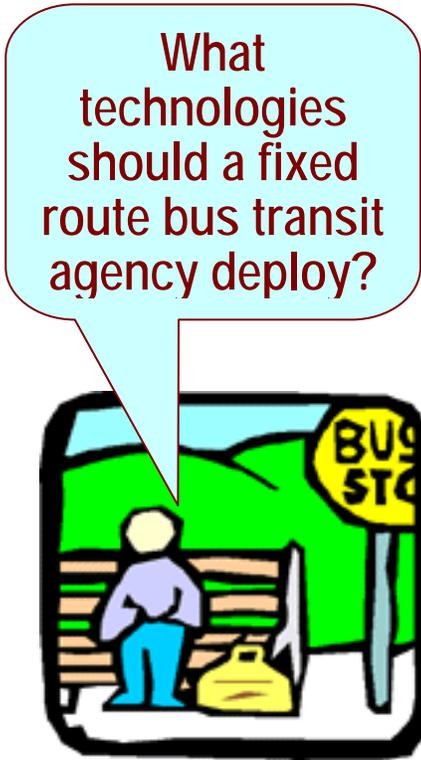




Intelligent Transportation Systems Core Technologies for Fixed Route Bus Transit Agencies September 2007



FIXED ROUTE BUS Core Technologies

Automatic Vehicle Location (AVL)
Maintenance Systems*
Electronic Card Payment
Automatic Passenger Counters*

Geographic Information System (GIS)*
Security Cameras
Wireless Communication Network
Text-Based Communication*
Traveler Information Website
Data Management Software
Automated System Planning & Scheduling Software*

* = Core Technology for Large Bus Agencies ONLY

FIXED ROUTE BUS DATA

SERVICE AREA	Nationwide	Bus service is the only fixed-route service available in all but 60 metropolitan areas	
# AGENCIES	2,000 (Approx.)	# VEHICLES	80,000
VEHICLE LENGTH SIZE RANGE	Small = 18'	Large = 60' (articulated bus)	Most Common = 40'
AGENCY SIZE STANDARDS	Large = 100+ vehicles		Small = less than 100 vehicles
# AGENCIES BY SIZE OPERATING IN US	100 Large Bus Transit Agencies		1,884 Small Bus Transit Agencies

Source: 2004 National Transit Database

FIXED ROUTE BUS CORE TECHNOLOGIES

TECHNOLOGIES AND SYSTEMS	SMALL BUS AGENCY (<100 VEHICLES)		LARGE BUS AGENCY (100+ VEHICLES)	
1) Automatic Vehicle Location	✓	Basic AVL system (e.g., commercial internet-based) for planning or real-time operations	✓	More advanced system with extensive integration, especially with communications and scheduling systems for real-time operations
2) Wireless Communication Network	✓	Voice only network for small agencies and expanded communications for dispatching and incident response functions		
3) Text-Based Communications	NOT A CORE TECHNOLOGY		✓	Utilize Mobile Data Terminals (MDT); preserves voice channel
4) Traveler Information Website	✓	Static route, schedule, contact info on website	✓	Trip Planner, in addition to extensive transit info
5) Data Management Software	✓	Very basic data spreadsheet and storage	✓	More advanced system with data integration and voluminous data levels from AVL
6) Geographic Information System	NOT A CORE TECHNOLOGY		✓	Integrate GIS with AVL to graph real-time info for both operations control and security
7) Automated System Planning and Scheduling Software	NOT A CORE TECHNOLOGY		✓	Integrate real-time vehicle tracking with scheduling software and Trip Planner
8) Maintenance Systems	NOT A CORE TECHNOLOGY		✓	Focus on asset management within garage environment, including monitoring of life-cycle costs & inventory needs
9) Electronic Card Payment	✓	Intelligent farebox with data storage (off-the-shelf tech)	✓	Magnetic, closed system with intelligent farebox
10) Security Cameras	✓	Cameras used for basic events recording with no real-time connections	✓	Part of security system that integrates AVL, silent alarms and wireless communications
11) Automatic Passenger Counters	NOT A CORE TECHNOLOGY		✓	Deployment on 10% of fleet sufficient for sampling purposes

NON-CORE SECONDARY TECHNOLOGIES TO CONSIDER FOR FIXED ROUTE BUS TRANSIT

A) Traffic Signal Priority	X	Deploy if used by other transit in metropolitan area	X	Develop along transit corridors; Most applicable to Express Bus or Bus Rapid Transit
B) Incident Management	?	Small agencies are involved in IM thru coordinated communications	X	Expand interoperability of all systems, especially internal and external communications

HOW MUCH DOES THE FIXED ROUTE BUS CORE TECHNOLOGIES COST?

TECHNOLOGY SYSTEM	SYSTEM COSTS		TECHNOLOGY RANGE ASPECTS (BASIC SYSTEM TO MOST EXTENSIVE)
	AVG	MEDIAN	
1. Automatic Vehicle Location	\$2.4 M (million)	\$1 M	On-board GPS; Vehicle tracking integrated with Operations Control Center dispatching and security systems, includes AVL-GPS and MDTs
2. Transit Communications	\$2 M	\$160,000	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)
3. Traveler Information	\$2.1M	\$450,000	Voice recognition traveler info call-in phone line; Trip Planner with GPS tracking for real-time information
4. Data Management & GIS	\$475,000	\$175,000	Desktop GIS with basic database software; Transit Center software integration of vehicle tracking, GIS, scheduler, information storage (large, multimodal agency)
5. Computer-Aided Dispatch & Scheduling	\$325,000	\$40,000	Basic scheduling software; Integrated communications & scheduling system with AVL-GPS, radio modifications and scheduling software (large, multimodal agency)
6. Maintenance Tracking	\$320,000	\$100,000	Fuel dispensing management applications; On-board mechanical monitoring sensors that collect & transmit vehicle data to Operations Control Center
7. Electronic Fare Payment	\$13 M	\$1 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)
8. Security Cameras & Security Systems	\$730,000	\$500,000	Multiple Black & White CCTV cameras installed; Advanced bus surveillance system with wireless technology for live video transmission to command center (large agency)
9. Advanced Passenger Counters	\$370,000	\$200,000	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
A) Traffic Signal Priority (Non-Core Secondary Technology)	\$1.7 M	\$270,000	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.

Standout Fixed Route Bus Transit Agencies Deploying ITS

AGENCY NAME	LOCATION	# VEHICLES	CONTACT DEPARTMENT	KEY ITS DEPLOYMENTS
LARGE FIXED ROUTE BUS AGENCIES (100+ Vehicles)				
LAC MTA	Los Angeles, CA	2400	Info Systems	AVL, AC, TI, AVM, FP, S
WMATA (Metro)	Washington, D.C.	1457	Operations	AVL, AC, TI, GIS, CADS
PACE Suburban Bus	Arlington Heights, IL	650	New Tech	AVL, MDT, TI, GIS, CADS
Niagara Frontier TA	Buffalo, NY	321	Operations	AVL, AC, TI, GIS, CADS
Sound Transit	Seattle, WA	209	Operations	AVL, AC, TI, GIS, CADS
SMALL FIXED ROUTE BUS AGENCIES (<100 Vehicles)				
GET	Bakersfield, CA	79	Operations	AVL, AC, MDT, TI, CADS
Duluth TA	Duluth, MN	72	Operations	AVL, AC, MDT, TI, AVM
Beaver County TA	Rochester, PA	34	Transportation	AVL, MDT, TI, GIS, CADS
St. Joseph Transit	St. Joseph, MO	21	Operations	AVL, AC, TI, GIS, AVM, S
Glendale Dial-A-Ride	Glendale, AZ	8	Operations	AVL, AC, TI, CADS, FP
Key: AVL = Automatic Vehicle Location, AC = Advanced Communications, MDT = Mobile Data Terminals, TI = Traveler Information, GIS = Data Management & Geographic Information System, CADS = Computer Aided Dispatch & Scheduling, AVM = Automatic Vehicle Monitoring, FP = Electronic Fare Payment, S = Security/Safety System, WIS = Weather Information, APC = Automatic Passenger Counters, TSP = Traffic Signal Priority				

Reference Documents for Fixed Route Bus 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
- Best Practices for Using Geographic Data in Transit: A Location Referencing Guidebook - Defining Geographic Locations of Bus Stops, Routes and other Map Data for ITS, GIS and Operational Efficiencies (April 2005); http://www.fta.dot.gov/assistance/research/research_4611.html
- Electronic Surveillance Technology on Transit Vehicles – TCRP Synthesis 38 / Project J-7 (2001); <http://onlinepubs.trb.org/onlinepubs/tcrp/tsyn38.pdf>
- e-Transit: Electronic Business Strategies for Public Transportation (Volume 4) – Advanced Features of Transit Websites - TCRP Report 84 / Project J-0 (2003); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_84v4front.pdf
- Fare Policies, Structures and Technologies: Update – TCRP Report 94 / Project A-25 (2003); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_94.pdf
- Handbook of Automated Data Collection Methods for the National Transit Database (October 2003), <http://www.nctr.usf.edu/pdf/473-11.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
- Uses of Archived AVL-APC Data to Improve Transit Performance and Management: Review and Potential - TCRP Web Document 23 / Project H-28 (June 2003); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_webdoc_23.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
- Smartcard Interoperability Issues for the Transit Industry - TCRP Report 115 / Project A-26 (2006); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_115.pdf

