4. Technology Assessment

A technology study for KAT was prepared in 2005. That work provides the basis for this chapter as much of the information is germane and tied to the construction of Knoxville Station. One of the projects recommended in the plan was the installation of automatic vehicle locater technology on throughout the system. A Request for Qualifications (RFQ) has been issued and a vendor and final technology is anticipated to be determined by the end of 2009.

Overview

Intelligent Transportation Systems as applied to transit represents a comprehensive approach to applying information technologies to transit to improve customer service and reduce system capital and operating costs. A good source of information about the range of ITS technologies for transit can be found at the Transit ITS Impacts Matrix Web site (http://web.mitretek.org/its/aptsmatrix.nsf/framemain/OpenFrameSet) (Figure 4-1). Typically, ITS includes the following technologies related to transit:

- Automatic Vehicle Location (AVL);
- Communication Systems;
- Geographic Information systems (GIS);
- Automatic Passenger Counters (APC);
- Operational Software and Computer Aided Dispatching Systems (OS/CAD);
- Advanced Traveler Information Systems (ATIS):
- Electronic Fare Payment Systems (EFP);
- Traffic Signal Priority (TSP); and,
- Vehicle Diagnostics and Intelligent Vehicle Initiative (IVI).

Most bus-only transit systems are "inching" their way forward in application of ITS because of the costs and variability of the technologies. Nevertheless, with the rapid increase of technological capabilities in all areas (phones, PDAs, voice actuation, etc.), it is important that transit systems take advantage of these capabilities where possible to improve their customer service and operational efficiency.

Figure 4-1
Transit ITS Matrix

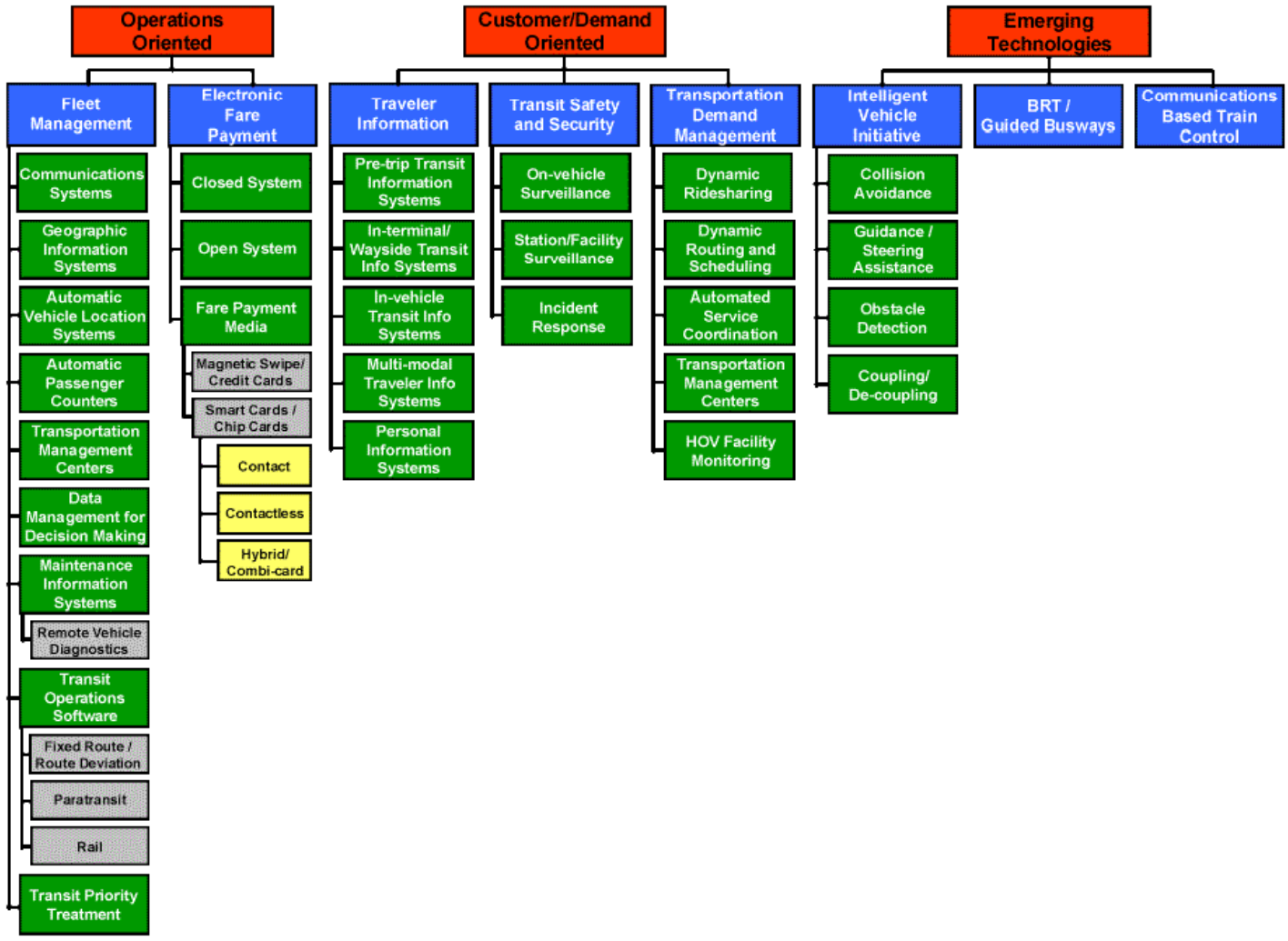

Table 4-1 provides a narrative assessment of typical ITS technologies related to transit.

Table 4-1
Typical ITS Technologies Related to Transit

Technology	Functions	Benefits
Automatic Passenger Counter	Collects data on time and location of passenger boardings and alightings.	Useful in service planning, which may increase operating efficiency of the system.
Automatic Vehicle Location (AVL)	Tracks the real-time location of vehicles using mobile data terminals (MDT) and a global positioning system (GPS).	Accurately shows location of all equipped vehicles in fleet. Easily identifies location of vehicle in event of emergency. Can assign vehicle for pick-up that is closest to requested trip.
Communications	Voice and/or digital communication between drivers and dispatch.	Provides communication between the drivers and central dispatch.
Customized Spreadsheets/Databases	Stores information on clients, trips, schedules, and other business operations.	Increase in efficiency and reliability of data collection. Improved maintenance and record keeping.
Demand-Responsive Transit Software	Expedites call-taking, collects and maintains client and vehicle data, and generates reports.	More efficient service coordination, improved staff performance, more effective dispatching and increased safety.
Transit Operations Software	Automates transit functions, including scheduling/dispatch (assigns trips to vehicles), route planning, service monitoring, and data acquisition.	More efficient service coordination, improved staff performance, more effective dispatching and increased safety.
Electronic Payment Systems	Passengers pay for trips with electronic cards (smart cards).	Speeds up boarding and collects passenger and trip data.
Geographic Information Systems (GIS)	Displays fleet/route information on a map on a computer screen.	More efficient trip request processing and improved security and schedule productivity.
Maintenance Software	Stores and reports vehicle maintenance and repair data.	Effective maintenance tracking.
Silent Alarm System	Vehicle driver can silently notify central dispatch of an accident, crime or emergency.	Increases passenger and driver safety.
Mobile Data Terminal (MDT)	On-board computer that communicates with central dispatch the locations of passenger boarding/alighting.	More efficient service coordination, improved staff performance, improved service quality.
Palmtop Electronic Device	Electronically stores/updates vehicle schedules and provides the updated manifests to the drivers.	Eliminates faxing of paper manifests.
Personnel Management Software	Stores, processes, and reports payroll benefits, hours worked, and personnel information.	Reduces data-entry and paperwork.
Traveler Information Systems	Provides pre-trip and in-vehicle information.	Informs passengers of delays or other trip related information.

As noted in Chapter 1, KAT provides over 3.2 million passenger trips per year in Knoxville. Table 4-2 presents an overview of KAT. Table 4-3 presents other organizations with which KAT may coordinate.

Table 4-2
KAT Overview within Context of ITS Assessment

Category	Quantity or Cost	Comment
Annual ridership	3.2 million	Up from 2.2 million in 2001
Annual total operating cost	$12.54 million (FY2004)	
Number of fixed routes	25	
UT Service Ridership	1.1 million (FY2004)	Up from 572K in FY2003
UT Service Budget	$1.2 million (FY2004)	
Night/Sunday service	77k trips (FY2004)	Down three percent from FY2003
The Lift (paratransit service)	46,463 (FY2004)	Up 19.5 percent from FY2003
The Lift (paratransit service)	$1.01 million (FY2004)	
Downtown trolley ridership	471K (FY2004)	Down eight percent from FY2003
Downtown trolley cost	$494K (FY2004)	
Downtown trolley routes	4 + night route + campus apts. (campus to nearby neighborhood)	Added fully subsidized route for local student private housing in August 2004
Existing AVL	None	
Existing APC	None	
Type of farebox	GFI Cents-a-bill	Plans are to purchase electronic/card reading fareboxes
Existing maintenance software	Fleetmate (parts, work orders) and works with Gas Boy (fueling software)	Plans are to purchase advanced maintenance software
Customer information	Phone based	
Trip planning software	None	
Employees	262	
Organization	City Service/Has nine-member board appointed by the Mayor of Knoxville	
Coordination with other Agencies	Coordinates with ETHRA and CAC when possible. Under contract to provide bus service to UT.	

Source: KAT ITS Assessment, prepared for the Knoxville Knox County Metropolitan Planning Commission and Knoxville Area Transit, prepared by The Corradino Group, 2005

Table 4-3
Other Agencies with ITS Involvement

City of Knoxville (IT Department)	Currently have mobile data terminals and cameras on all police cars. Planning to install AVL on some cars.	The City of Knoxville IT department is responsible for KAT's computer hardware, software, and maintenance.
East Tennessee Human Resource Agency (ETHRA) (serves 16 counties)	Approximately 80 vans equipped with AVL	Representatives of ETHRA participated in the stakeholder workshop held for the study.
Knoxville Knox County Community Action Committee (CAC)	Approximately 21 vans equipped with AVL	Representatives of CAC participated in the stakeholder workshop held for the study.
Tennessee Department of Transportation (TDOT)	TDOT's new Transportation Management Center expected to open in 2005.	The Transportation Management Center will operate TDOT's Smart Way System, which will feature 70 cameras, 16 dynamic message boards, and a highway radio advisory system.

Recommended ITS Applications/Technologies for KAT

Based on collected information regarding KAT's needs and existing conditions, the recommended ITS applications/technologies that will assist KAT meet its objectives could be prioritized as follows:

- Automatic Vehicle Location (AVL): AVL is considered the backbone of all other ITS technologies discussed in this document and would provide KAT with several benefits including customer satisfaction. As discussed in this document, AVL provides real time vehicle locations that are used by almost all other applications. Without AVL, almost all other applications would be considered non-effective. As noted earlier, KAT is currently (Fall 2009) procuring AVL through an RFQ process.

- Emergency Alarm: While ideal implementation of emergency alarm technology should be implemented concurrently with AVL, this technology could conceivably be implemented independent of any other ITS technology and would provide some level of notification in cases of onboard emergencies. In a situation where no other ITS technology is implemented, especially AVL, activation of an emergency alarm on board the vehicle would alert dispatch center of a potential emergency situation on board the vehicle but locating the vehicle would require dispatchers to predict probable location of the vehicle based on its schedule rather than actual location.

- Mobile Data Terminal (MDT): In conjunction with AVL, this technology would enable text messages between operators and dispatch center and interface with other onboard ITS applications.

- Stop Announcement: This technology would assist KAT in its on-going difficulty of operator training and enforcement of announcing stops to passengers.

- Schedule Adherence: This technology would enable KAT to determine vehicle status and provide such information to its passengers and use it internally for effective route planning and scheduling. KAT should ensure that this technology is provided to its customer service personnel who typically answer customers' calls asking about vehicle status.

- Video and Voice Recording: While video recording could be postponed at this time, voice recording and transmission should be implemented concurrently with AVL because of its benefits in ensuring operator and passenger security and relative ease of implementation without overburdening the radio communications bandwidth.

- Destination Sign: KAT's staff indicated that almost all of their buses are currently equipped with destination signs. Efforts should focus on examining technical aspects of these signs to determine if they could interface with AVL for ease of programming and utilization. If not, destination sign utilization could remain as it exists today.

- Trip Planning: This technology will contribute to overall customer satisfaction. KAT should ensure that this technology is provided to its customer service personnel who typically answer customers' calls asking about trip planning.

- Geographic Information System (GIS): Because the City of Knoxville already uses a GIS, KAT could utilize this existing technology to interface with its ITS applications. Currently, the Metropolitan Planning Commission (MPC) and Knoxville GIS (KGIS) operate in a partnership and share resources with KAT. A good example is the current (Fall 2009) implementation of the TDP recommendations outlined in this report. As KAT staff fine tune and begin the scheduling of the route modifications the KGIS system is being used to provide the updated routes.

- Automatic Passenger Counting (APC): This technology would enable KAT to determine passenger loading at each stop for effective planning of routes and schedule.

- Incident Report: This technology is relatively easy to implement and it provides benefits to KAT's efficient staff operation.

- Way-side Variable Message Signs: Because KAT is implementing a downtown transit center, this technology would be useful to passengers connecting to other routes or services at the center.

Human Resources

Human resources required to support ITS include trained personnel during the implementation and operation of the system. Implementation typically involves a project manager and an engineer to coordinate the project and verify compliance with specifications. Implementing ITS applications in transit agencies have traditionally resulted in more effective utilization of existing human resources. Examples include training road supervisors to utilize the system to effectively accomplish their duties in managing the vehicle's movement. Most of the benefits are realized by the agency's

management because of their ability to monitor and manage the operation and maintenance of vehicles in a more effective method. Dispatchers and operators also realize great benefits in performing their duties in a more effective manner.

Operations and maintenance of the systems require human resources that may not have been available to the transit agency prior to implementing ITS. Examples could include a full time network and system administrator. Such a person's responsibilities include the daily operation of the system programming, database management and maintenance. At the vehicle level, there might not be a need to add personnel if the maintenance personnel are trained to maintain the on-board equipment. The agency's existing infrastructure maintenance personnel also may cover infrastructure maintenance if they receive proper training.

Depending on funding and other logistical constraints, some transit agencies elect to purchase a service agreement from equipment vendors or other specialized private firms to handle all maintenance issues.

Some transit agencies are associated with another public entity, e.g. The City of Knoxville, and receive all maintenance support from this government body. The government body may be able to provide maintenance support to ITS applications as described above. However, from the perspective of KAT and how KAT operates as a unique entity, although part of the overall City government, it is felt that a dedicated employee on site at KAT would best address KAT's ITS needs. In addition, to take full advantage of the planning capabilities associated with ITS and GIS as mentioned above, it will be important that either KAT or the TPO have a staff person skilled in GIS who handles the GIS/ITS interface for planning purposes on a regular basis.

Because existing dispatchers and vehicle operators will be the users of the ITS system, they should not be considered as additional resources needed to operate the system. ITS systems have not contributed to any significant reduction or increases in dispatchers or vehicle operators at most of the transit agencies that have implemented ITS.

In summary, the human resource requirement for KAT to effectively support ITS applications should include a full time system administrator. The administrator should be experienced in the Information Technology (IT) area especially in the operating system and software associated with the ITS applications. The System Administrator duties will include the daily operation and maintenance management of the hardware and software. Examples of such duties include database updates, downloads, archiving, report design, handling of maintenance issues, programming of system parameters, importing/exporting of schedules, uploading and installing software upgrades and patches, and interfacing issues with external hardware/software. The System Administrator duties should also be complemented by a part-time position(s) to cover System Administrator responsibilities in cases of emergencies where the Administrator is temporarily not available (i.e. after hours, sick, vacation, etc). Although not necessarily an employee of KAT, there should be a staff resource at either KAT or the TPO to do planning level work with the data generated by ITS technologies.

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