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Northeast Florida Rural Transit Intelligent Transportation System

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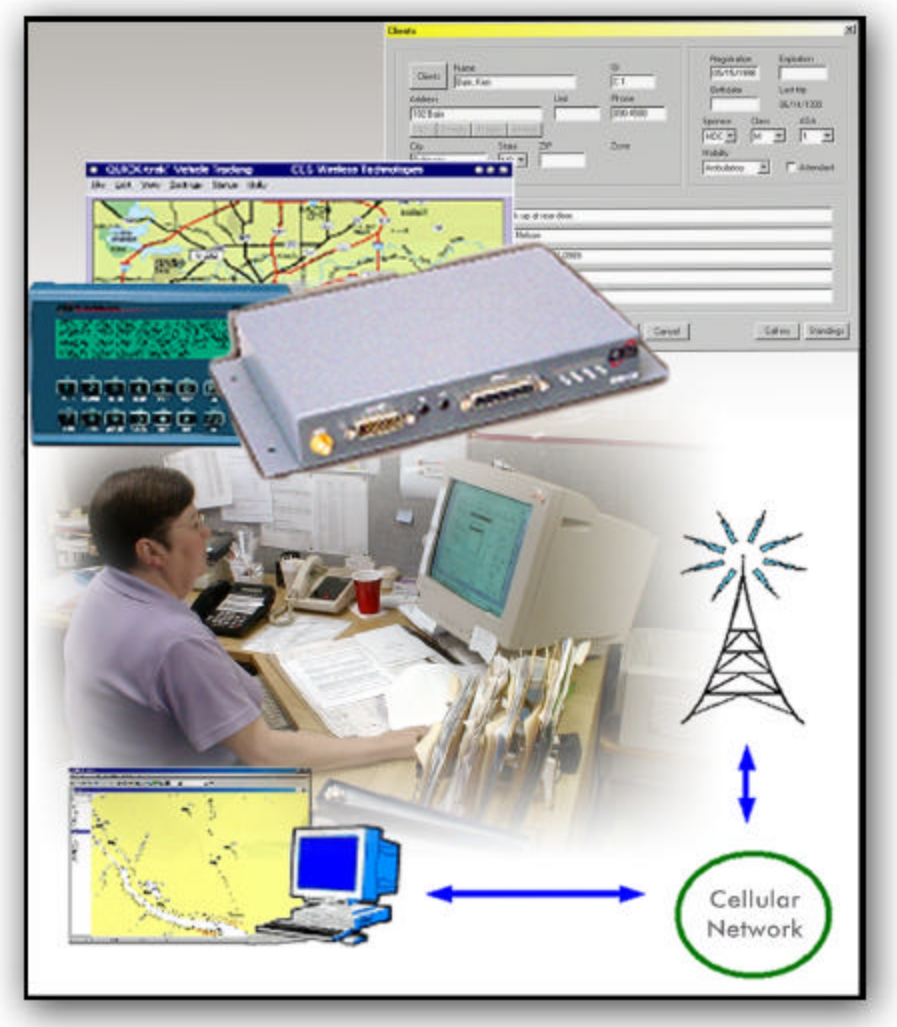
Volpe National Transportation Systems Center
Office of System and Economic Assessment
Service and Operations Assessment Division

Final Report
February 2003



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The Northeast Florida Rural Transit Intelligent Transportation System (ITS) project was a demonstration of ITS deployment by four rural Community Transportation Coordinator agencies. The objective of the project was to test and evaluate the effectiveness of technologies including mobility management software applications, Geographical Information Systems, Global Positioning Satellite-based Automatic Vehicle Location systems, Mobile Data Terminals, and electronic applications (email, web-based information) for rural transportation operations. The project's most profound effects were related to productivity.

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METRIC/ENGLISH CONVERSION FACTORS

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LENGTH (APPROXIMATE)

1 inch (in)	=	2.5 centimeters (cm)
1 foot (ft)	=	30 centimeters (cm)
1 yard (yd)	=	0.9 meter (m)
1 mile (mi)	=	1.6 kilometers (km)

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1 square yard (sq yd, yd^2)	=	0.8 square meter (m^2)
1 square mile (sq mi, mi^2)	=	2.6 square kilometers (km^2)
1 acre = 0.4 hectare (he)	=	4,000 square meters (m^2)

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1 ounce (oz)	=	28 grams (gm)
1 pound (lb)	=	0.45 kilogram (kg)
1 short ton = 2,000 pounds (lb)	=	0.9 tonne (t)

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1 fluid ounce (fl oz)	=	30 milliliters (ml)
1 cup (c)	=	0.24 liter (l)
1 pint (pt)	=	0.47 liter (l)
1 quart (qt)	=	0.96 liter (l)
1 gallon (gal)	=	3.8 liters (l)
1 cubic foot (cu ft, ft^3)	=	0.03 cubic meter (m^3)
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1 meter (m)	=	3.3 feet (ft)
1 meter (m)	=	1.1 yards (yd)
1 kilometer (km)	=	0.6 mile (mi)

AREA (APPROXIMATE)

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1 square meter (m^2)	=	1.2 square yards (sq yd, yd^2)
1 square kilometer (km^2)	=	0.4 square mile (sq mi, mi^2)
10,000 square meters (m^2)	=	1 hectare (ha) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gm)	=	0.036 ounce (oz)
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1 tonne (t)	=	1,000 kilograms (kg)
	=	1.1 short tons

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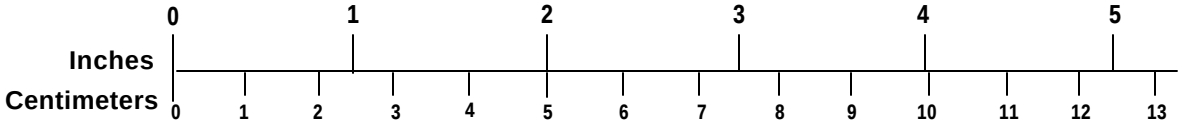

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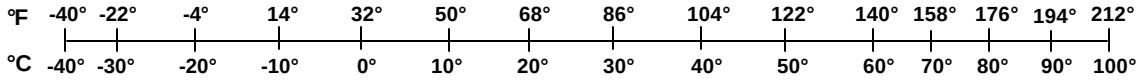

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EXECUTIVE SUMMARY

The Northeast Florida Rural Transit Intelligent Transportation System (ITS) project is a demonstration of ITS deployment in four rural Community Transportation Coordinator (CTC) agencies. The objective of the project is to test and evaluate the effectiveness of technologies including mobility management software applications, Geographical Information Systems (GIS), Global Positioning Satellite (GPS)-based Automatic Vehicle Location (AVL) systems, Mobile Data Terminals (MDTs), and electronic applications (e-mail, web-based information) for rural transportation operations. Specific problems to be addressed by the project are:

- Low productivity of paratransit services
- Need for increased administrative efficiencies
- Lack of inter-county trip coordination
- Lack of intra-county trip coordination
- High cost of long-distance, out-of-county trips.

The Florida Commission for the Transportation Disadvantaged is administering the project. Phase I, involving the CTCs in Flagler (Flagler County Transit), Putnam (Ride Solution), and St. Johns (St. Johns County Transit) counties, was initiated in 1998. In late 1999, Phase II was launched with the addition of the Marion (Marion Transit Services) and Alachua/Levy CTCs and Ocala/Marion's Metropolitan Planning Organization (MPO); however, Alachua/Levy County chose to end its participation in the project in early 2001. The systems used in Alachua County have been migrated to the CTCs in St. Johns and Union County. Training is ongoing in Union County and implementation is not completed.

This report describes the evaluation of the rural transit ITS demonstration project. This evaluation is being conducted by Battelle under the direction of the Volpe National Transportation Systems Center with funding provided by the U.S. Department of Transportation Joint Program Office for ITS. The evaluation is based on the framework specified in the Evaluation Plan (*Northeast Florida Rural Transit ITS Evaluation Plan*, May 2001).

The goals, evaluation measures, and hypotheses to be tested are displayed in Table ES-1. The impact of ITS features on the mobility, efficiency, and productivity of rural paratransit service was of particular interest. Also of interest was ITS needs assessment and planning, decision-making, and the lessons learned in project deployment and implementation. The evaluation is based on detailed interviews with all the participating CTCs and analysis of data contained in the annual and quarterly reports submitted to the commission by the agencies. The lack of quantitative data resulted in a more qualitative evaluation than that proposed in the Evaluation Plan.

Pre-Deployment Operations and Constraints: Flagler, St. Johns, and Marion used a DOS-based scheduling system, which was woefully inadequate for their needs. Putnam also used a DOS-based system, but it had been created specifically for the agency and the CTC was satisfied with its operation. Putnam's operations also differed from the other participants. Known as Ride Solution, Putnam operated a flex-route based system with a published schedule and transfers at selected bus stops. The CTC was further along in the implementation of ITS

technology, and the ITS demonstration continued a state-funded Automatic Vehicle Location (AVL) systems project launched in 1994. All participating CTCs expressed a desire to reduce the person-hours associated with the billing of trips to the respective funding agencies.

ITS Objectives: The following program objectives were identified as immediate priorities to be addressed by the ITS project:

- Improve scheduling operations by creating tighter driver assignments and reducing the workload associated with daily scheduling, call intake, and driver-manifest creation;
- Synchronize dispatch and scheduling operations to reduce the dispatcher's workload by providing better information to the dispatcher;
- Automate billing into an electronic operation;
- Improve workforce management including driver assignments; and
- Improve vehicle maintenance strategies.

Technologies Selected: Flagler and St. Johns counties selected ParaLogic®, a GIS-based routing software, and Marion County followed suit when it joined the project. In addition, the three CTCs invested in new hardware and software upgrades and updated the Local Area Network servers. Flagler and St. Johns also purchased a cellular-based AVL system for trial purposes and installed the systems on several buses. The CTC in Putnam (Ride Solution) chose to advance the goals of its earlier project to use AVLs to improve schedule adherence. Ride Solution chose to procure a combined AVL and MDT system for the project.

Implementation Challenges: Implementation challenges included delays in procurement of the systems, lack of training that delayed acceptance by staff, problems in migrating from the old system to the new system, hardware and software support issues, Medicaid billing interface changes, and radio communication for the AVL/MDT systems.

Deployment Status: As of January 2002, Flagler, St. Johns, and Marion completely migrated to the ParaLogic® software system. Ongoing revisions are being made by the vendor to ensure the CTCs needs are met. Additional features like batch processing for scheduling, route optimization, and route selection are available on the system but need to be tested and verified before use in daily operations.

Putnam installed all the AVL/MDT units as of November 2001. As of January 2002, the pre-trip vehicle inspection and payroll management were fully functional. Schedule compliance and billing features are currently being implemented. Currently, only Medicaid riders have ID cards. Non-sponsored riders will be issued cards to track productivity from shared rides.

Table ES-1: Northeast Florida Evaluation Goals, Measures, and Hypotheses

Goal Area	National ITS "Few Good Measures"	Surrogate or Alternative Measures	Hypotheses
Mobility	• Reduction in delay • Reduction in travel time variability • Improvement in customer satisfaction	• Advance time required to schedule trip • Pick-up window • Wait time for pick-up • Customers/trips served • Customer complaints	• Scheduling/routing efficiency will increase, thus: - Reducing trip times - Allowing trips to be scheduled with less advance notice - Decreasing the size of the pick-up window - Reducing pick-up wait time • More customers can be served (for a given cost) as a result of increased operating efficiencies • Improved level of service will reduce customer complaints
Efficiency	• Increases in throughput or effective capacity	• Vehicle miles per trip • Revenue miles/vehicle miles • Average trip/driver hour	• CAD software will produce more efficient route designs for intra-county trips • Improved operating efficiencies will increase system throughput/capacity
Productivity	• Cost savings • Job satisfaction	• Staff time per task (calls, scheduling, etc.) • Cost per trip • Cost per vehicle mile • Reimbursement for human service contracted service • Staff acceptance	• Through more effective scheduling, dispatching, and fleet control, the overall staff time requirements and hence cost per unit of service provided will decrease • Because of better coordination, some trips or trip segments can be shifted to fixed-route transit, thus reducing system-wide costs • New software can show where additional service routes can be developed • New software can facilitate the billing and reimbursement for contracted trips • The APTS technologies will be viewed as beneficial by agency staff in assisting them with their jobs

Post-Deployment Operations: The following changes have taken place operationally in Flagler, St. Johns, and Marion since the inception of the ITS project:

- *Flagler*: The scheduling software is an important component in daily operations in call intake, scheduling, and dispatching. The billing module of the software is being used extensively. Extensions to the module are being planned. Flagler also procured an AVL system for tracking out-of-county trips. Due to the decrease in out-of-county trips, Flagler has not yet found a suitable use for these AVL systems. The software's capabilities for planning and route optimization are not being deployed to the fullest.

- *St. Johns*: St. Johns operates similarly to Flagler in terms of call intake, scheduling, and dispatch. The billing operations are still not fully automated. The installation of the Medicaid billing module is expected soon. The AVL systems purchased are not yet in use, although the new fixed route with deviations system in St. Augustine (Sunshine Bus) is a potential application.

- *Marion*: Marion County CTC had significant problems in shifting to the ParaLogic® software due to old hardware and frequent system lock-ups. The module for Medicaid billing is used but still needs some refining as subcontractors are invoiced only for one leg of a round trip by the software. Currently, scheduling and intake operations are performed in a manner similar to Flagler and St. Johns.

- *Putnam*: The dispatch operation has improved with the dispatcher having the ability to add a passenger pick-up remotely to the MDT. The AVL/MDT system is also being used to record driver's run times. The system is interfaced with a GIS application provided by Visual Risk and the dispatcher can look at the exact locations of the vehicles in the county. Medicaid rider trip times, co-payments, and mileages are logged by the MDTs for billing information. These data then interface with the billing program, which submits bills to Medicaid electronically.

Evaluation Results — The project's most profound effects were related to productivity. As hypothesized, through more effective scheduling, dispatching, fleet control, and billing, overall staff time requirements decreased. Effects in the areas of mobility and efficiency were not as pronounced largely due to slow implementation and acceptance.

The project improved the operations of all the CTCs. The greatest impact has been the improvement in the daily operations of Flagler and St. Johns CTCs. Flagler and St. Johns reported a reduced workload for scheduling, better billing, tighter assignments for drivers, and more efficient dispatch. Table ES-2 lists the changes in workload due to deployment of the software for Flagler and St. Johns CTCs.

Table ES-2: Reduction in Workload in Flagler and St. Johns

Changes in Workload	Flagler		St. Johns	
	Before	After	Before	After
Trips per day (Estimate)	125-150	250-300	250-300	450-500
Intake Operators	2	2	4	2
Time to Schedule the day's trips	4-8 hours	1-2 hours	4 hours	1-2 hours
Dispatch	Heavy workload due to will-calls	Reduced workload due to return trips being scheduled and synchronization with the scheduling software	Heavy workload due to will-calls	Reduced workload due to return trips being scheduled and synchronization with the scheduling software
Billing		Medicaid Billing has been automated. Mileage calculations are from the GIS based system. Overall, the billing process has become reliable and less intensive	1 Full Time Equivalent (FTE) Employee	Same as Flagler. There has also been a reduction of 0.5 FTE for billing.

Marion CTC still has problems with the software including frequent lock-ups of the computer system, less than optimal scheduling, and incorrect subcontractor billing, and has not had an efficient migration to the new systems. Some of these problems are technological and require solutions from the software vendor. Marion also will have to make operational adjustments to effectively utilize the technology.

The CTC in Putnam County has started to effectively integrate the AVL/MDT system with the scheduling and dispatch operations. Currently, the pre-trip driver inspection and driver time reporting are fully functional and other functions are actively being implemented. The full effects of the ITS systems are not yet realized as the implementation process is still underway.

The need for inter-county coordination, which was one of the primary goals of the project, has been greatly reduced. The inter-county trips did not grow as estimated due to the increased availability of medical facilities in each county. However, the project led to improved informal cooperation between St. Johns and Putnam CTCs for occasional trips between the counties. The selection of different technologies and the different directions of the project in Putnam and other CTCs also reduced the opportunities for trip coordination.

The CTCs continue to serve a very valuable need in the community, a need that is increasing every year. The ITS project has been the catalyst for operational changes and administrative improvements, and has enhanced the ability of the CTCs to manage these changes.

The quantitative effects of the ITS project are hard to document due to a lack of appropriate data and the presence of various confounding factors. The Annual Operating Report (AOR) data is not detailed enough for a quantitative benefit-cost or trend analysis.

Based on the interviews and the site visits, there is hope for the utilization of existing or additional ITS technologies in the participating counties. All counties have realized the potential of technology to improve operations, and the lessons learned from this project will improve the implementation of the next phase.

Lessons Learned and Recommendations — The following are some of the important lessons learned and recommendations for the future:

- *Implementation* — Phased implementation running over several months is preferred to overnight installation. The installation at the CTCs was followed by a steep learning curve and caused frustration with the project. It is recommended that operators be exposed to the software in a training environment prior to installation. The implementation of the ITS systems has taken longer than expected due to the users' inexperience with a Graphical User Interface (GUI) based environment, little or unfocussed training, and problems with the software. It is expected that familiarity with the software would hasten the implementation and acceptance of the new systems.

- *Hardware* — The hardware capabilities must be examined prior to implementation and decision-making. Applications like mapping, automated billing, and scheduling demand significant computing power and frequently the existing hardware infrastructure is not capable of efficiently performing these tasks. Attempts should be made to procure the new hardware at the same time as installation of the new software systems.

- *Customized Deployments* — Paratransit agencies that are providing similar services may have completely different operating policies and staff capabilities. The same technology that works well in one county might not necessarily translate to the next without customization. It is necessary for every agency to assess technology based on an operational analysis of its system. However, an agency should be willing to change and/or modify its operations to improve the utilization of the selected technology.

- *Training* — Peer-to-peer training was found to be an important component of the project's implementation.

- *Vendor Support* — Paratransit agencies need to ensure they have a responsive vendor with an appropriate service contract even if they choose an off-the-shelf product.

- *Cross-Training* — Despite automation, the scheduling and dispatch operations still depend heavily on the experience of the scheduler and the dispatcher. In order to maintain such expertise, the agency should cross-train all available office staff in the scheduling and dispatch operations using the new system.

In conclusion, the ITS project, while taking longer than expected, has been successfully deployed in all the CTCs except Marion. The scheduling software has not satisfied operational requirements in Marion. The CTC hopes to resolve these issues soon in order to experience the full benefit of the technology. All the administrators have embraced the technology and are committed to improving their operations. It is expected that the technology will continue to mature at all CTCs and the counties can better use the capabilities of ITS to improve efficiencies and mobility.

In addition, the participating CTCs are typical rural transit systems that are facing the challenges of innovation. These agencies can be industry leaders in championing ITS deployment and can provide peer-to-peer assistance. As the participants continue to benefit from this demonstration, the lessons they have learned will aid rural transit systems nationwide.

1.0 INTRODUCTION

The Center for Urban Transportation Research, a national transit research institute located at the University of South Florida, estimated that in 2000 there were more than 5.8 million transportation-disadvantaged persons in the state of Florida who were potential users of a coordinated transportation system. By the year 2010, an estimated 7.3 million persons will be potential users.[1] As the demand and cost of operations for these systems increase, it becomes imperative to develop and implement cost-effective, efficient, and timely improvements to existing coordinated transportation systems.

In March 1997, the Florida Commission for the Transportation Disadvantaged (CTD) submitted an application to the Federal Transit Administration (FTA) Office of Research, Demonstration and Innovation for a grant to oversee the installation and operation of paratransit Intelligent Transportation Systems (ITS). The grant was targeted for the designated Community Transportation Coordinator (CTC) agencies in three rural northeast Florida counties: Flagler, St. Johns, and Putnam. The Commission was awarded a $200,000 grant in September 1997. These CTCs were selected to participate, in part, because each county's population base was rural, each had large urban medical facilities located outside of its designated service areas, and their service areas were contiguous.

The project required the Commission to facilitate the installation of ITS mobility management software and hardware in the CTCs and evaluate the impacts of the technology. The CTC in each county received start-up funding to purchase personal computers and to test various ITS technologies including:

- Mobility management software applications;
- Geographical Information Systems (GIS);
- Global Positioning Satellite (GPS)–based Automatic Vehicle Location (AVL) systems
- Mobile Data Terminals (MDT); and
- Electronic applications (e-mail, web-based information) for rural transportation operations.

Approximately two years into the project, FTA awarded the Commission expansion funding of an additional $200,000. The Commission chose to increase participation by including two CTCs in contiguous counties (Marion and Alachua/Levy). Alachua/Levy chose to end its participation in the demonstration project in early 2001 for reasons explained later in this chapter and was not considered part of this evaluation.

1.1 Overview of Participating Counties

The CTD coordinates human service transportation services for all 67 Florida counties. Each county has a designated CTC. The CTC is responsible for the actual arrangement and delivery of transportation services, which are funded by various sources including Medicaid, the Transportation Disadvantaged Fund, and other grants. The CTC may subcontract with other

[1] Commission for the Transportation Disadvantaged – 2000 System Performance Report.

transportation service providers to serve transportation disadvantaged (TD) users. The funds available for the CTCs are typically inadequate to meet the transportation demands of potential users, and each CTC works with very tight budgetary constraints. ITS deployment is an innovative approach to increase productivity and efficiency in these systems. As noted, three CTCs (in Flagler, Putnam, and St. Johns Counties) were initially selected for the project. The map of the region is shown in Figure 1-1.

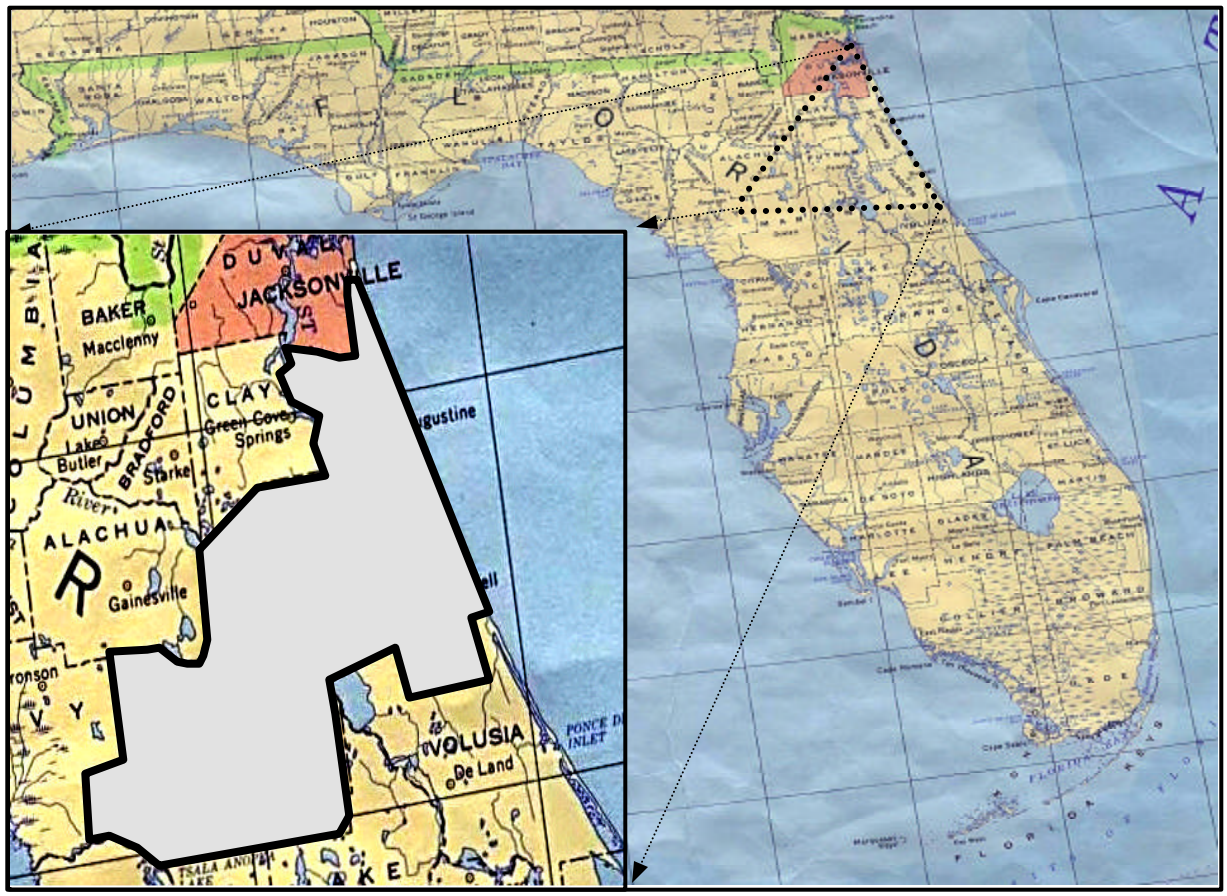


Figure 1-1: Area Covered by Counties Included in the Project

With additional funding, two other CTCs (in Alachua/Levy and Marion Counties) were added. When Alachua/Levy County awarded its CTC contract to a different entity, it chose to end its participation in the project in early 2001. The new CTC already had a mobility management software tool, and the managers did not wish to migrate to the systems used in the other counties. The ITS components purchased for Alachua County are being transferred to St. Johns and Union County. The following sections describe the county demographics of each participating CTC and summarize the transit service provided.

1.1.1 Flagler County

Figure 1-2: Flagler County

Flagler County is on Florida's northeast coast and is bordered by St. Johns, Putnam, and Volusia Counties (Figure 1-2). Flagler is one of the fastest growing counties in Florida. Approximately 80 percent of Flagler County's population is in unincorporated areas. Flagler County does not include any major cities, and the major communities are Flagler Beach and Bunnell. The population is concentrated mainly along the beaches. Table 1-1 lists the demographic information for Flagler County.

Table 1-1: Demographics for Flagler County

Land Area[1]	485 sq. miles
Operating Environment[2]	Rural
Total Population (2001)[1]	54,964
Growth Rate (1990 to 2000)[1]	73.6%
Potential Transportation Disadvantaged (TD) population[2]	20,142
Total TD Individuals served in 2001[2]	2,845

Sources: 1. U.S Census Bureau, State and County Facts, 2. Commission for the Transportation Disadvantaged, 2001 Annual Performance Report (Jan. 2002).

The CTC for Flagler County is the **Flagler County Council on Aging and Senior Services** and its non-profit transportation subsidiary, **Flagler County Transport (FCT)**. FCT operates a 25-vehicle fleet Monday through Friday, from 7:00 a.m. to 6:00 p.m. Weekend service is scheduled as required. Five vehicles are lift equipped. As of 2001, there were 26 full- and part-time drivers, 3 operations staff, and 8 full- and part-time support employees.

FCT is a very rural, specialized transportation provider with a comparatively low volume of trips. There are no subcontractors. Medical trips are the highest priority followed by employment, education, shopping, and recreational excursions. In FY 2001, FCT provided 77,883 trips while traveling 574,794 vehicle miles, of which 505,819 were revenue miles. Twenty-four percent of the total trips were for medical visits, 34 percent for employment, 2 percent for educational/training/daycare, 21 percent for nutrition, and 19 percent for life-sustaining and other reasons.

1.1.2 Putnam County

Figure 1-3: Putnam County

Putnam County is east of Gainesville and north of Ocala, and is bordered by Flagler, Volusia, Marion, Alachua, Bradford, Clay, and St. Johns Counties (Figure 1-3). Approximately 75 percent of Putnam County's population is in unincorporated areas. The incorporated community with the greatest population is Palatka. All other communities in Putnam have a population of less than two thousand. The poverty level in Putnam County is high. Table 1-2 lists the demographic information for Putnam County.

Table 1-2: Demographics for Putnam County

Land Area[1]	722 sq. miles
Operating Environment[2]	Rural
Total Population (2001)[1]	70,880
Growth Rate (1990 to 2000)[1]	8.2%
Potential Transportation Disadvantaged (TD) population[2]	36,051
Total TD Individuals served[2]	6,865

Sources: 1. U.S Census Bureau, State and County Facts, 2. Commission for the Transportation Disadvantaged, 2001 Annual Performance Report (Jan. 2002).

The CTC for Putnam County is **ARC Transit Inc**, a subsidiary of Putnam County Association for Retarded Citizens (ARC), doing business as **Ride Solution**. Ride Solution's fleet includes approximately 42 vehicles of which 33 are in service. Thirty vehicles are lift equipped. Service is available Monday through Friday from 8:00 a.m. to 5:00 p.m. As of 2001, there were 31 full- and part-time drivers, 2 operations staff, 8 support employees, and 3 maintenance employees.

Ride Solution does not employ subcontractors. Trips include, in order of priority for demand response calls, life-threatening and routine medical visits, life-sustaining activities, work, education, business and recreational trips. In FY 2001, Ride Solution provided 135,922 trips while traveling 972,561 vehicle miles, of which 680,792 were revenue miles. Thirty percent of the total trips were for medical reasons, 19 percent for employment, 34 percent for educational/ training/daycare, 1 percent for nutrition, and 16 percent for life-sustaining and other reasons.

Ride Solution's operations are substantially different than those of the other project participants. Ride Solution operates primarily as a fixed route system with deviations (flex-route). This system functions in a demand-responsive environment by operating a set of feeder routes, which pick up riders from their door and transfer them to the fixed routes. This system requires

transfers between routes and consequently, on-time compliance and coordination among scheduled bus routes is very important.

1.1.3 St. Johns County

Figure 1-4: St. Johns County

St. Johns County is bordered by the Atlantic Ocean and by Duval, Clay, Putnam, and Flagler Counties (Figure 1-4). Eighty-two percent of the population lives in unincorporated areas. St. Augustine has the largest population of the incorporated places in the county. Table 1-3 lists the demographic information for St. Johns County.

Table 1-3: Demographics for St. Johns County

Land Area[1]	609 sq. miles
Operating Environment[2]	Rural
Total Population (2001)[1]	131,684
Growth Rate (1990 to 2000)[1]	46.9%
Potential Transportation Disadvantaged (TD) population[2]	39,443
Total TD Individuals served	3,840

Sources: 1. U.S Census Bureau, State and County Facts, 2. Commission for the Transportation Disadvantaged, 2001 Annual Performance Report (Jan. 2002).

The CTC is the **St. Johns County Council on Aging, Inc**., providing service as **St. Johns County Transit (SJCT)**. St. Johns County Transit operates a 39-vehicle fleet and is the sole provider of transportation disadvantaged service. Service operates 24 hours a day seven days-a-week, although the reservation line is available only between 7:00 a.m. and 5:00 p.m. on weekdays. There are 43 full- or part-time drivers, 3 operations staff, 7 support employees, and 1 maintenance employee.

SJCT is predominantly demand responsive with service routes designed around standing orders. The service provides medical trips for dialysis, oncology, and wheelchair patients in addition to trips for educational and nutritional purposes. In FY 2001, SJCT provided 153,771 trips while traveling 949,850 vehicle miles, of which 807,372 were revenue miles. Thirty-five percent of the total trips were for medical reasons, 26 percent for educational/training/daycare, 20 percent for nutrition, and 19 percent for life-sustaining and other reasons.

In addition, St. Johns County recently started operating a flex-route service called Sunshine Bus. The Sunshine Bus can be flagged down at any point along the route. The service also accommodates requests for deviations to and from the main route.

1.1.4 Marion County

Figure 1-5: Marion County

Marion County is south of Gainesville and is bordered by Citrus, Sumter, Lake, Volusia, Putnam, Alachua, and Levy Counties (Figure 1-5). The Ocala National Forest covers most of the eastern portion of the county. The incorporated community with the largest population is the City of Ocala. Ocala is home to two large hospitals, and there are a large number of medically related offices nearby or within the city. Table 1-4 lists the demographic information for Marion County.

Table 1-4: Demographics for Marion County

Land Area[1]	1,579 sq. miles
Operating Environment[2]	Rural
Total Population (2001)[1]	267,889
Growth Rate (1990 to 2000)[1]	32.9%
Potential Transportation Disadvantaged (TD) population[2]	118,896
Total TD Individuals served	5134

Sources: 1. U.S Census Bureau, State and County Facts, 2. Commission for the Transportation Disadvantaged, 2001 Annual Performance Report (Jan. 2002).

The CTC is the **Marion County Senior Services, Inc. (MCSS)**. A MCSS subsidiary, **Marion Transit Services (MTS)**, is the primary operator and there are three subcontractors. The City of Ocala in Marion County also has a fixed route service operated by SunTran. This service began in December 1998. MTS provides SunTran's complementary paratransit service required by the Americans with Disabilities Act (ADA).

MTS operates daily from 9:00 a.m. to 3:00 p.m., although trips can be reserved for other times and on weekends. MTS coordinates with three subcontractors for overflow, weekend, and stretcher services. As of 2001, MTS and its subcontractors have 89 full- and part-time drivers, 8 operations staff, 31 full- and part-time support employees, and 7 maintenance employees.

In FY 2001, MTS and its subcontractors provided 148,918 trips while traveling 1,758,224 vehicle miles, of which 1,137,656 were revenue miles. Seventy-seven percent of the total trips

were for medical reasons, 1 percent for employment trips, 2 percent for educational/ training/daycare, 13 percent for nutrition, and 7 percent for life-sustaining and other reasons.

1.2 Evaluation Approach

The evaluation of this project was conducted by Battelle under the direction of the Volpe National Transportation Systems Center with funding provided by the U.S. Department of Transportation Joint Program Office for ITS. This report evaluates the rural ITS demonstration project based on the evaluation approach described in *Northeast Florida Rural Transit ITS Evaluation Plan* (May 2001). The evaluation plan included the goals, the supporting hypotheses and measures, and the technical approach to performing this evaluation. The approach specified in the plan has been modified to account for the changes in the project and the lack of quantitative data. The approach has shifted to a more qualitative evaluation and will be described in Chapter 2.

Specific problems, identified initially, to be addressed by the project were:

- Low productivity of paratransit services;
- Need for increased administrative efficiencies;
- Lack of inter-county trip coordination;
- Lack of intra-county trip coordination; and
- High cost of long-distance, out-of-county trips.

The impact of ITS features on the mobility, efficiency, and productivity of rural paratransit service were of particular interest. The project participants anticipated that by automating scheduling, dispatching, and fleet control, customer satisfaction would increase and costs per unit of service would decrease. In addition, through coordination of inter- and intra-county trips, these rural counties could better utilize vehicles and operators. Coordination with other counties could enable transfers at scheduled meeting points, and allow an earlier return to in-county service for some paratransit vehicles. However, over the course of the demonstration project, changes in Medicaid reimbursement policies and the increased availability of medical facilities in the individual counties resulted in a decrease in the demand for inter-county trips. This issue ceased to be a major factor in the participants' operations.

The evaluators and the project administrators also identified the need to document the ITS planning process, project implementation, and the deployment of the selected systems. The evaluation methodology will be described in detail in Chapter 2.

1.3 Report Organization

The remaining chapters of this report are as follows:

- Chapter 2 summarizes the evaluation goals, the technical approach reported in the evaluation plan, and the data sources used in the evaluation.
- Chapter 3 describes the evolution of the ITS demonstration project with particular emphasis on pre-deployment systems, ITS needs assessment, the decision-making processes, the functional capabilities of the selected technologies, and the operational changes in each of the counties.
- Chapter 4 presents the results of the ITS deployment in terms of operational, financial, and administrative changes affecting the goal areas of productivity, efficiency, and mobility.
- Chapter 5 discusses the lessons learned by the participants and recommendations for the future.
- Chapter 6 provides project level conclusions.

2.0 EVALUATION APPROACH

The rural transit ITS demonstration project is an element of the U.S. Department of Transportation's national ITS program. As such, there are both national and local goals for the evaluation of the rural ITS Project. National ITS evaluation guidelines specify a "few good measures" that can form a common basis for evaluating projects (See *TEA-21 Guidelines for the Evaluation of Operational Tests and Deployment Projects for Intelligent Transportation Systems (ITS)*, April 2002). At the local level, additional goals have been identified. The following sections describe these goals.

2.1 National ITS Program Goals

The National ITS Program identifies five goal areas that ITS projects might address:

1. Improve the *safety* of the nation's surface transportation system;
2. Enhance the personal *mobility* and the convenience and comfort of the surface transportation system;
3. Increase the operational *efficiency* and capacity of the surface transportation system;
4. Enhance present and future transportation *productivity*; and
5. Reduce *energy and environmental costs* associated with traffic congestion.

Three of these goal areas – mobility, efficiency, and productivity – are directly relevant to the rural transit ITS Project. Increased public transportation use may have impacts on safety and on energy and environmental costs, but these goals are not of primary concern in this evaluation.

The purpose of the "few good measures" identified in the National ITS Program is to establish consistency and focus across evaluations of a wide range of ITS projects. Alternative or surrogate measures may also be defined based on the available data and expected benefits for a specific project. In the current evaluation, alternative measures are defined that relate specifically to the rural transit ITS Project.

2.2 Northeast Florida Rural ITS Project Goals

The following original goals for the project were identified:

- Increase the coordination of out-of-county trips;
- Improve trip and labor productivity through the use of up-to-date management, dispatch, and scheduling software;
- Reduce demand-response trips;
- Increase trip capacity;
- Reduce pick-up and wait time;
- Reduce in-vehicle time;
- Minimize customer complaints; and
- Identify lessons that may apply to other rural ITS deployments.

Prior to deployment, the counties had different operating circumstances and levels of automation. All participants agreed that the addition of routing software would greatly increase their ability to control and forecast daily operations and to enable realistic estimates of coordinated out-of-county trips. The following potential project benefits were identified:

- Decreased out-of-county vehicle trips;
- Increased service level of intra-county trips;
- Decreased response time (smaller response window);
- Increased operating hours (added service where needed);
- Decreased administrative costs;
- Increased riders per vehicle;
- Better coordination of CTC routes with fixed routes (increase in transfers);
- Increased attractiveness of service to "choice" riders (increase in fare box revenues); and
- More accurate and timely billing.

However, as the project evolved, the goals and the expected benefits changed considerably. The number of inter-county trips did not grow as much as expected and the focus of the project shifted towards efficient management of intra-county trips. The participants and the evaluators agreed that the success of the project should be measured by factors beyond inter-county trips and also account for the productivity improvements, cost-effectiveness, and efficiency.

The revised goals were stated as follows**:**

- Improve trip and labor productivity through the use of up-to-date management, dispatch, and scheduling software;
- Increase trip capacity;
- Reduce pick-up and wait time;
- Reduce in-vehicle time;
- Minimize customer complaints;
- Identify potential coordination opportunities between participants; and
- Identify lessons that may apply to other rural ITS deployments.

The participants described the revised expected benefits as**:**

- Increased service level of intra-county trips;
- Decreased administrative costs;
- More accurate and timely billing;
- Decreased response time (smaller response window);
- Increased riders per vehicle; and
- Increased attractiveness of service to "choice" riders (increase in fare box revenues).

Table 2-1 combines the national and local objectives, the strategies to achieve them, and the measures that would be used in the evaluation to determine if the objectives were met. Despite the shift in focus away from inter-county trip coordination, the hypotheses and measures for the goal areas of mobility, efficiency, and productivity continued to be applicable.

2.3 Evaluation Methodology

Initially, the evaluation was primarily intended to perform a quantitative analysis of the progress of the CTCs in implementing the ITS system. While this approach is a direct and desirable method of measuring benefits, there are various problems associated with this approach for this project. There was very little quantitative data available before or during the course of the project because of a combination of factors: poor reporting capabilities; the extensive efforts required to get the system to work pushed data collection activities to the background; and the fact that the previous system was not designed to collect the type of detailed data required for the analysis. Also, the CTCs had differing levels of technology and varied capabilities for data collection and retrieval, and consequently the data available could not be aggregated.

One of the challenges in the evaluation of this project was the time period under review coincided with administrative and operational changes within the CTCs and in the state of Florida with regard to paratransit. Consequently, it became difficult if not impossible to isolate the benefits of the ITS systems. For example, during the same period as the project, St. Johns switched to a service route concept which improved their operations significantly. In addition, changes were instituted in the Medicaid billing interface which resulted in significant programming costs to the CTCs. The focus of the evaluation shifted in part to determining how the ITS systems helped the CTCs manage or respond to these external factors.

Another challenge to the evaluation was that Putnam chose a different set of technologies from the set chosen by Flagler, St. Johns, and Marion. As a result, for some aspects such as scheduling and dispatching, the evaluation approach diverged in two directions - one for the Flagler, St. Johns and Marion counties and the other for Putnam. In evaluating other operations such as billing, all the counties were considered together.

The lack of accurate quantitative data and the presence of various confounding factors heightened the importance of the interview phase of the evaluation and diminished the emphasis on the analysis of operating and financial data. The interviews and observations of ITS systems in operations provided most of the information used to analyze the outcomes of the project such as productivity increases, improvements in the skills of the staff, efficiencies, etc. This information was combined with the available quantitative data to test the hypotheses in Table 2-1 to the extent possible. The data sources used in the evaluation are described in the next section.

Table 2-1: Northeast Florida Evaluation Goals, Measures, and Hypotheses

Goal Area	National ITS "Few Good Measures"	Surrogate or Alternative Measures	Hypotheses
Mobility	• Reduction in delay • Reduction in travel time variability • Improvement in customer satisfaction	• Advance time required to schedule trip • Pick-up window • Wait time for pick-up • Customers/trips served • Customer complaints	• Scheduling/routing efficiency will increase, thus: - Reducing trip times - Allowing trips to be scheduled with less advance notice - Decreasing the size of the pick-up window - Reducing pick-up wait time • More customers can be served (for a given cost) as a result of increased operating efficiencies • Improved level of service will reduce customer complaints
Efficiency	• Increases in throughput or effective capacity	• Vehicle miles per trip • Revenue miles/vehicle miles • Average trip/driver hour	• CAD software will produce more efficient route designs for intra-county trips • Improved operating efficiencies will increase system throughput/capacity
Productivity	• Cost savings • Job satisfaction	• Staff time per task (calls, scheduling, etc.) • Cost per trip • Cost per vehicle mile • Reimbursement for human service contracted service • Staff acceptance	• Through more effective scheduling, dispatching, and fleet control, the overall staff time requirements and hence cost per unit of service provided will decrease • Because of better coordination, some trips or trip segments can be shifted to fixed-route transit, thus reducing system-wide costs • New software can show where additional service routes can be developed • New software can facilitate the billing and reimbursement for contracted trips • The ITS technologies will be viewed as beneficial by agency staff in assisting them with their jobs

2.4 Data Sources

2.4.1 Interviews with CTCs

Interviews were conducted with key staff at all four agencies in two separate site visits. The first site visit (November 13-15, 2001) was a fact-finding mission to all the CTCs and was aimed at understanding the operations of the systems. This led to the development of a detailed questionnaire for formal interviews during the second site visit (January 17-18, 24-25, 2002). Personnel interviewed included call takers, dispatchers, operations supervisors, and project managers. The questionnaire for the interviews is provided in Appendix A. Appendix B includes the names and titles of personnel interviewed. Agency staff were asked to assess the extent to which each agency's expectations for the ITS deployment were met. The interviews provided a clear understanding of the similarities, needs, differences, and operations of each participating CTC.

2.4.2 Annual Operating Data Reported to the Commission

All the CTCs are supposed to report a wide range of data to the Commission for the Transportation Disadvantaged at yearly intervals. While the Annual Operating Reports (AORs) are a very useful tool for analysis, there are some problems associated with using just the AORs. The accuracy of the data prior to the ITS project and the assumptions made in reporting the data are not known. A preliminary analysis of the data revealed that the trends fluctuated wildly between years. Also, CTD changed the reporting format in 1998 and some data elements were found to be inconsistent. This data set has been used in the evaluation to complement the interview responses.

2.4.3 Quarterly Reports

The four CTCs provide quarterly reports to the Commission. The information provided in these reports includes status of the project, problems being encountered in operations, interactions with the technology vendors, and the general opinions on the project.

2.4.4 System Data

Each CTC was asked to provide database information from the scheduling program. These data then could be aggregated into monthly information which could potentially provide more information about the system. Marion CTC already collected such monthly data and this template was suggested to Flagler and St. Johns. The database information was made available from Flagler but in a format that required significant database manipulation for marginal benefits. Also, due to a system crash in St. Johns, similar data could not be collected. Putnam used a different scheduling program not amenable to this type of analysis. The role of system data has been restricted to explaining any shifts in the database trend lines for Marion alone.

3.0 PROJECT DESCRIPTION

All the participating CTCs perform a very valuable service to the community. A significant number of riders depend entirely on the transit system for their medical, shopping, and employment transportation needs. At the outset of the project, each CTC worked to offer a high standard of service within a multitude of constraints such as limited funding and outdated technologies for software and hardware. The CTC staff indicated during the evaluation interviews that the ITS project represented a vehicle for improving their administrative efficiencies and changing their operations to better manage demand.

3.1 Pre-ITS Deployment Operations and Constraints

Prior to the inauguration of the ITS deployment project, each CTC had a unique operating model for scheduling, dispatch, billing, and transit management. The CTCs were in different stages of development and maturity in terms of managing the demand on their system. In fact, these differences played a vital role in determining the type of ITS systems deployed in the counties. The pre-deployment operations of each of the four counties are summarized below:

3.1.1 Flagler

Flagler County Transit used a very basic DOS-based scheduling software tool to track and manage transit requests. This software was not Y2K compliant and had extremely limited reporting capabilities. The scheduling software was not configured to account for best route optimization, and the end result from the software was a list of client pick-ups sorted by time but not by address. The hardware was outdated and very unreliable.

These factors combined to make scheduling a very labor-intensive process, requiring repetitive and stressful work, to schedule approximately 125-150 trips a day. Since clients were allowed to call up until 5:00 p.m. to book rides for the next day, the process of scheduling was never complete during a regular business day. There were two full-time employees who handled intake, scheduling, and dispatch depending on the requirements. The entire process of scheduling, error checking, and printing the drivers' manifests took anywhere from five to eight hours. One of the major faults of the scheduling system was that the standing orders had to be manually input every day into the system by the scheduler. The process did not require advance scheduling of the return trip and operated on a principle of "will-call." This essentially meant that the client would let the transit agency know when the return trip was needed and the dispatcher would keep track of the bus status and coordinate pickups. As expected, this practice placed a large burden on the dispatcher. The dispatcher worked off a piece of paper and would scratch out names as they were assigned.

All the billing was done manually and involved intensive paperwork. The mileage for the fare calculation was determined by the odometer readings noted by the driver for each client. This method was unreliable. Each client's trip length data was then manually entered into the billing system.

3.1.2 St. Johns

St. Johns County Transit experienced major administrative and managerial changes just prior to the beginning of the ITS project. These changes influenced SJCT's interest in the ITS project and in the need to improve operations. Prior to the ITS project, SJCT used the same system as Flagler to schedule trips and manage calls and faced all the problems experienced by Flagler County Transit. SJCT scheduled about 250-300 trips per day. There were four full-time intake operators dedicated to recording requests from clients and one full-time scheduler responsible for the next day's schedule. Starting at noon, it took four hours to generate schedules for the next day. All the return trips were scheduled based on the "will-call" principle, as in Flagler County. The staff reported that, prior to the ITS project, the system was very inefficient and functioned as a "Taxi Service." The drivers were given a manifest at the beginning of the day and the staff had to recreate this information on a separate log to enter Medicaid number, mileage, co-pay charges, etc. Due to high turnover of key transportation personnel, existing staff had limited recognition of pertinent records and files. Billing, Medicaid verification, and mileage calculation were unreliable and needed improvement.

3.1.3 Putnam

Ride Solution, the CTC of Putnam County had a completely different operating model than the other three counties involved in the project. At the outset, the agency was much further along in technological innovations. Ride Solution has been working with the flex-route format since 1988. Subscription services for agencies such as the Association of Retarded Citizens and the Council of Aging were combined with dialysis schedules to arrive at a basic subscription schedule. On top of this basic schedule, the random demand responsive trips were layered in such a manner to reduce cost and increase multi-loading to obtain the daily operating schedule. The flex route system allowed for a reduction in operating expenditures and enabled Ride Solution to expand the service to the general public.

Ride Solution was already using an effective DOS-based scheduling and dispatch software, developed by a consultant specifically for Putnam County. Ride Solution is the only system among the participants that regularly transfers clients from one vehicle to another. Therefore, schedule adherence was a more critical issue than it was for the other counties. As in the other counties, billing for the trips had to be done manually and was very paper intensive. Ride Solution envisioned this ITS project as a continuation of work begun in 1994 with an AVL service development grant funded by Florida DOT. The 1994 project was designed to give Ride Solution more control over payroll and to automate billing of Medicaid using card swipe technology. Ride Solution anticipated that the ITS demonstration would allow it to continue to pursue the original project goals, and to operate its flex route service more efficiently through greater control over schedule adherence.

3.1.4 Marion

Marion County is the largest county among the participants in the project. The need for efficient scheduling and dispatch is critical in Marion County due to the length of the trips. The CTC, Marion Transit Services, used the same scheduling software as Flagler and St. Johns and had similar problems. MTS also scheduled its three subcontractors for overflow, stretcher, and weekend trips. Three operators handled call taking with an additional employee for scheduling and dispatch each. Clients needed to call three days in advance to book a trip. Most return trips were scheduled as "will-call." The billing function was not integrated into one single system. The key concern for MTS was the fact that the existing scheduling software was not Y2K compliant. There were practices in place to ensure scheduling efficiencies, including the use of geographical considerations for setting up service routes. MTS drivers as well as subcontractors were provided manifests for the service routes that had time-ordered pick-ups assigned strictly to their vehicle, interspersed with random demand responsive trips.

3.2 ITS Objectives

Prior to the ITS project, operational studies were conducted in each of the counties by the CTD to identify potential problems and issues with the existing operations for scheduling, billing, dispatch, and administration. The operations of the CTCs in St. Johns, Flagler, and Marion closely mirrored each other, since they were all using the same scheduling software, and consequently, their needs were similar. However, Putnam operated a different type of service and had a different set of needs and expectations from the ITS project.

At project meetings on January 25, 1999 and July 19, 1999, participating agency representatives reviewed the experience of the three counties with the initial deployment in Phase I and discussed the parameters of next stage of deployment (Phase II). The deployment details and the phases of the project are described in the subsequent sections. The participants re-identified the goals, measures, and benefits expected from the project. These goals translated into the following operational objectives:

Scheduling: Flagler, St. Johns, and Marion CTCs expressed a keen desire to improve their scheduling software. All three CTCs needed an automated scheduling software that would be Y2K compliant, allow greater control to the intake operator, reduce scheduling time drastically, plan trips around standing orders, allow for data collection and route planning, be predominantly off-the shelf, and be based on a GIS platform for address geo-coding and routing. The software should also have the capability to print out drivers' manifests and produce reports. Ride Solution had no needs with respect to scheduling software because it was satisfied with its existing software. However, Putnam expressed a need for a system that would help its buses comply with the schedule for the flex route and be able to provide drivers with updated manifests during the course of the trip.

Dispatch: Flagler, St. Johns, and Marion needed the dispatch operation to be computerized and in sync with the scheduling function. This would allow the dispatcher to make changes to the daily manifests based on driver availability, client return trip information, no-shows, and additional trip requests. Putnam had different needs with respect to dispatch. It required the

ability to perform true Computer Assisted Dispatch (CAD), which makes it possible to display information such as vehicle status, condition, position, schedule adherence, operator, and incident information at the dispatcher's workstation. This software also could manage communications and assist the dispatcher in making operational decisions.

Billing: Trip billing is an essential function of a CTC. Funding for trips can come from various federal and state sources including Medicaid, Transportation Disadvantaged (TD) Fund, Older Americans Act, Head Start, or other agencies such as Developmental Services, Council of Aging, etc. The CTC has to ensure that the appropriate agency is billed for a trip for the exact mileage, which needs to be tracked for each trip. The billing for the month then has to be invoiced to the agency for payments in the prescribed format based on its billing requirements and policies. Medicaid prefers electronic billing of trips, which necessitates that the billing software contain a Medicaid billing interface. In addition, the CTC has to keep track of farebox revenues and co-payments by clients. The CTCs also are responsible for verification of client eligibilities for a particular service. All the CTCs wanted to reduce the workload and the paperwork involved with the billing process. The expressed need was to automate the billing process by combining the trip details, client data, and invoice formats into a "single click" operation.

Inter-County Trip Coordination: One of the original goals of the project, inter-county trip coordination, ceased to be a priority due to a combination of circumstances. Inter-county trips were a concern for Flagler County at the beginning of the project due to the CTC exporting trips to Gainesville and Duval Counties. These trips were 90-100 miles long and required substantial vehicle and driver resources. Flagler County staff projected a continuing growth in the demand for out-of-county trips. However, as medical facilities and dialysis centers opened up in Flagler County, the initial estimate of inter-county trips turned out to be inaccurate. By the second year of the project, it was clear that Flagler would no longer be exporting trips for certain medical purposes. For example, before the ITS project, all patients requiring medical imaging, including MRIs, had to be transported to Gainesville. Currently, the imaging facilities are available at Palm Coast in Flagler County. Putnam provided services to Orlando, Daytona, Gainesville and Jacksonville prior to 1995. These long distance inter-county trips were reduced due a policy change necessitated by the Medicaid funding cutbacks in 1997-98. Currently, Putnam provides scheduled service to Gainesville twice a week and limited trips to Jacksonville. Trips to Jacksonville from St. Johns County involve limited coordination between SJCT and Ride Solution. The SJCT scheduler is aware of Putnam's route schedule and telephones her counterpart at Ride Solution to transfer passengers between the services. Marion County, a later entrant into the project, did not identify inter-county trips as a major issue.

Improved Manpower Management: All CTCs expressed an interest in greater control over scheduling and overseeing driver assignments, managing driver times, payroll management, and administration. It also was hoped that the ITS project would help either in reducing the staff time required for daily management or in using the existing staff hours to better manage the excess demand.

Vehicle Maintenance and Operations: Putnam expressed a need to improve the pre-trip inspection process. Drivers conduct these pre-trip inspections when they are assigned a bus at the beginning of the day. The task involves the visual inspection of a lengthy list of bus systems like tires, lights, brakes, etc. It was hoped that ITS would provide a method for drivers to complete this process using on-board equipment and transmit this data remotely to the central dispatch location. It was expected that the electronic checklists would provide data for better maintenance decisions.

Planning and Reporting: One of the problems expressed by Flagler, St. Johns, and Marion counties was the limited reporting capability of the old scheduling software. Also, there was a critical need in each of these counties to track the operating data and use the data for planning and updating the service routes. Putnam also needed technology that would enable it to monitor trip patterns across the county.

Computer Hardware System Improvements: Flagler, St. Johns, and Marion CTCs were operating on non-networked 486-based computer systems, which were woefully inadequate for the GIS software being planned. The need to build a server-based network with new computer systems was identified as a priority.

3.3 ITS Technology Decisions

At the outset of the project, ITS decision-making was a group effort, beginning in early 1998 with the initial deployments occurring in late 1998. The decision-making has evolved to a more CTC-centric approach, as the individual properties have a better understanding of their particular needs. The participants had many common requirements such as automating scheduling and call intake, increasing efficiencies in dispatch, and improved billing and reporting capabilities, but other needs were specific. In Marion County, it was essential that the technology accommodate subcontractor operations of the CTC. SJCT required that the technology account for round-the clock operations and stretcher trips. The technology proficiency and capabilities of the CTCs also varied significantly. Each CTC was given a sum of $60,000 to decide which technologies were best suited for their operations and to procure and deploy the systems. While attempts were made to obtain the same type of technology for all the CTCs, it became clear that the needs and requirements of Ride Solution were significantly different from the other three CTCs. Ride Solution was a strong proponent of using AVL systems integrated with MDTs for managing transit, whereas FCT and SJCT were interested in upgrading their scheduling and dispatch software to the latest technology available and did not see any immediate need for AVL-based systems. MTS, being a late entrant into the project, did not play a role in the initial technology identification. Consequently, this project evolved into two different sets of systems with Flagler, St. Johns, and Marion CTCs having similar technologies and Ride Solution going with an AVL-based concept. However, to ensure some interfacing capability and compatibility in the future, Ride Solution agreed to obtain a single license for the new scheduling software procured by the other counties. This license has since been returned to the commission for use elsewhere. Similarly, FCT and SJCT agreed to test cellular-based AVL systems which are not being used in daily operations at present.

3.3.1 Flagler, St. Johns, and Marion ITS Technology Decisions

Flagler and St. Johns required an automated system for scheduling. Due to economic constraints, it was hoped that the system would be predominantly off-the-shelf and non-proprietary. The system also needed to be based on a GIS platform, which would enable map-based planning and address geo-coding.

Based on these functionalities, various software products in the market were examined in detail. The major software products for paratransit management, while having a host of desirable features, were prohibitively expensive. Flagler identified a local Florida-based company called RouteLogic, which had a fixed route program in the market and was working on the development of a paratransit program called ParaLogic®. RouteLogic carried out a demonstration of the program in at the Flagler CTC, and the program was found to be an inexpensive product with excellent potential although it was still under development and needed significant customization. Both Flagler and St. Johns counties decided to select ParaLogic® as the scheduling and dispatch software, and Marion County followed suit when it joined the project. The key functionalities of the program are:

- Client information storage;
- Optimal scheduling based on controls specified by users including seating capacities, travel times, and load and unload times, including batch scheduling;
- Display schedules with mileage and travel times;
- Standing order scheduling;
- Comprehensive call intake functionalities including checks for double bookings;
- Display schedules with activities in time order;
- Enables easy updates of transfer, cancellations, and no-show trips;
- Transfer of trips from one route to another;
- Medicaid billing; and
- GIS Map-based routing, geo-coding of bus routes and client addresses.

Figure 3-1 shows the dispatch screen from the software. The Graphical User Interface (GUI) makes it easy for the dispatcher to transfer, delete, or edit the client trips.

In addition, all three CTCs invested in new hardware and software upgrades and updated the Local Area Network servers to new Pentium-based Windows NT servers with 64 MB memory upgrades to all the computers. Flagler and St. Johns also purchased a cellular-based AVL system for trial purposes and installed the systems on a couple of buses. However, the CTCs still have not found an appropriate use for this technology. Table 3-1 summarizes the costs associated with the technologies selected in the three CTCs. The difference in the software cost between Flagler, St. Johns, and Marion is due to the number of licenses purchased. Flagler and St. Johns purchased four licenses for the software, whereas Marion purchased nine licenses.

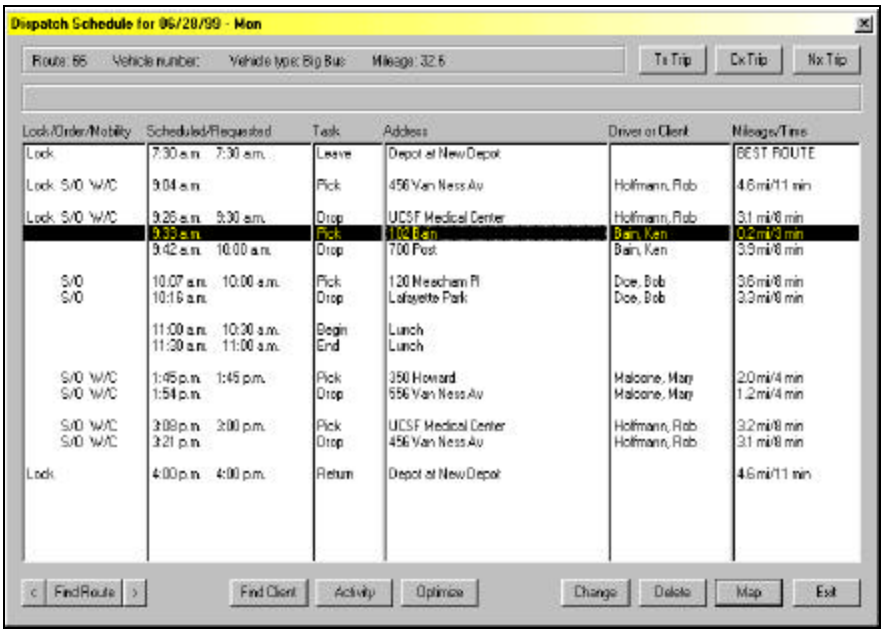


Figure 3-1: Dispatch Screen from ParaLogic®

Table 3-1: Cost of Technologies Selected in Flagler, St. Johns, and Marion (in Dollars)

Technology	Flagler	St. Johns	Marion
Software			34,045
1. Scheduling software licenses	9,166	7,500	Unavailable
2. GIS software licenses	8,450	8,472	Unavailable
Software upgrades and service contracts	7,055	6,222	2,260
AVL system	3,829	3,460	**Not procured**
Hardware (including cost of computers, equipment, installation costs)	14,140	22,341	22,515
Training and Labor	11,039	13,433	2,471
TOTAL	**53,680**	**61,430**	**61,293**

Source: Commission for the Transportation Disadvantaged

3.3.2 Putnam ITS Technology Decisions

The goals of Ride Solution's original 1994 AVL initiative were to improve control over payroll and automate billing of Medicaid trips (from card swipes). Ride Solution procured 13 prototype AVL units with a card reader set up to run on 12 volts. The intent then was to equip the rest of the fleet and provide ID cards for all the riders in the system. This plan was put on hold due to funding constraints in 1995. When ITS funding became available, Ride Solution decided to return to the earlier project goals and try to use AVLs to improve schedule adherence along the fixed routes operations. The AVLs were custom designed according to the specifications of Ride

Solution during the 1994 initiative. As the complexity of the system increased, it became necessary to look for an off-the-shelf product.

Ride Solution chose CES Wireless Technologies, a company based in Florida, as its AVL and MDT vendor (Figure 3-2). This intelligent messaging terminal allows a mobile user to report a status message to the base dispatcher by activating one of the front panel status keys. Each key has a predefined message associated with it. The driver can enter a numeric message into the MDT, e.g., fare amount, no shows, etc. The status messages and the numeric message then appear on the CES trak-DISPATCH™ computer monitor at the central dispatch point and/or can be transferred to a non-CES software system. This device has a 4 x 40 LCD display and a built-in GPS Automatic Vehicle Location module.

Source: CES Wireless Technologies website.

Figure 3-2: CES TRK-240 AVL+MDT Unit Used in Putnam

The card reader was upgraded to a new version supplied by Visual Risk. Table 3-2 summarizes the costs associated with Ride Solution's technology selections. This table does not include any Ride Solution labor cost, because adequate data are not available.

Table 3-2: Costs of Selected Technologies in Putnam

Technology	Cost in dollars ($)
AVL MDT System (35 units @ $1,300 each)	45,500
Base Station Equipment	15,000
Card Reader in Buses (35 units @ $150)	5,250
Visual Risk Software, Maps, etc. for AVL Dispatch	10,000 (approx)
TOTAL	**$ 75,750**

Source: Boyd Thompson, Ride Solution, personal communications

3.4 ITS Deployment

Phase I

The first phase of the rural transit ITS demonstration project extended from October 1997, when the Commission was notified of the FTA grant award, through October 1999. During this phase, the project managers initiated start–up activities as follows:

- Conducted operational studies of the participating CTCs to review each system's strengths and weaknesses and to identify changes that needed to be made prior to the ITS technology deployments;

- Formalized the institutional arrangements among the project participants, evaluators, and Commission project managers. This effort resulted in a Memorandum of Understanding (MOU) established in October 1998 that defined the roles of the Commission, the three CTCs, and an independent evaluator;

- Identified needed reporting and billing enhancements to ParaLogic®, that would enable the participants to comply with the Commission's reporting requirements;

- Installed the software at all three CTCs. One early objective of the demonstration was to determine the feasibility of interoperability in the areas of scheduling, dispatching, and routing to facilitate inter–county coordinated trips among all participants. Flagler County had the software fully installed and operational by September 1998. St. Johns converted to ParaLogic® in December 1998. Putnam County installed the software on a single workstation by October 1998, in order to interface with the other participants. However, as the need for coordination decreased, this license was given back to the county for use in other CTCs;

- Installed hardware and servers configured with Pentium II based Windows NT operating systems and upgrades to workstations as required;

- Facilitated training on the software and on enhancements in new releases; and

- Initiated procurement and installation of cellular AVL units in Flagler and St. Johns Counties and of new AVLs in Putnam County. The deployment in Flagler and St. Johns consisted of only a few vehicles and the AVLs are not in use.

Phase II

Phase II of the ITS demonstration project was inaugurated in October 1999 with award of an additional $200,000 FTA grant to the existing participants and two new CTCs, Marion and Alachua/Levy. In this phase, the project advanced to full implementation. For the original participants, Flagler, St. Johns, and Putnam Counties, the funding was directed at additional

hardware procurement and software upgrades. Putnam County's fleet-wide AVL/MDT deployment, begun in Phase I, was completed in Phase II.

Alachua/Levy and Marion Counties completed the procurement and installation of ParaLogic® software and required hardware, including computers, monitors, back–up battery devices for all workstations, servers, printers and updated networking (to Windows NT). In addition, vendor training on ParaLogic® took place in November and December 1999. Both counties began full implementation under the new system in January 2000. Flagler, St. Johns, and Putnam Counties provided a substantial amount of peer training and technical assistance on operation of the ParaLogic® software and troubleshooting. However, Alachua/Levy had to opt out of the project due to reasons mentioned earlier. The hardware and software has been transferred to Union County.

3.4.1 Status of Deployment

As of January 2002, Flagler, St. Johns, and Marion had operated the ParaLogic® software system for two years. Constant revisions are being made to the system to ensure the CTCs needs are met, especially with respect to Medicaid billing (RouteLogic has the module available for automatic billing for Medicaid but it is currently being used satisfactorily only in Flagler. St. Johns will be shifting to this module very soon. Marion CTC needs additional programming help to account for Medicaid billing from subcontractors). All the CTCs are in constant interaction with the vendors to fine-tune the operations of the systems. Additional features like batch processing for scheduling, route optimization, and route selection are available on the system but need to be tested and verified before use in daily operations.

Putnam installed all the AVL/MDT units as of November 2001. As of January 2002, pre-trip vehicle inspection and payroll management were fully functional. Schedule compliance and billing features are currently being implemented. Currently only Medicaid riders have swipe cards which are used to log trips automatically. These trips are then compiled for billing purposes. Non-sponsored riders will be issued cards to track productivity from shared rides. This stage of operations is in the planning stage and will be operational in the near future.

3.4.2 Major Issues and Concerns During ITS Deployment Phase

An objective of this evaluation is to describe the difficulties associated with implementing an ITS project. The issues and concerns might not be directly applicable to all transit systems, but the experience in Northern Florida can provide basic guidance to other rural agencies planning such a project. This project, while relying on supposedly off-the-shelf products, had its share of false starts, procurement problems, installation glitches, and training issues while trying to implement the systems. This section summarizes the problems faced by the CTCs during the installation and operational phases of the project.

Procurement: Flagler, St. Johns, and Marion did not have any problems with procurement. Their biggest obstacle was in making the decision about what software they needed and what hardware and network upgrades had to be made. The procurement of AVL systems by Putnam CTC was delayed by about 6 months due to the selected product not being on the state procurement list at the time.

Transferring from the Old System: The software vendor had put together a list of action items that must be completed to migrate from the old system to the new system. These items included identification of drivers and clients, geo-coding addresses and destinations, fleet information including seat capacities and wheelchair status, service route information, and travel times. This process of data scrubbing and preparing the database from the previous program was very time consuming partly because the existing personnel responsible for daily operations were not familiar with the "Windows" operating environment. This problem was exacerbated by poor hardware and frequent lock-ups of the software at all the CTCs. While St. Johns and Flagler have worked out the problems with the system, Marion County is still experiencing problems in migrating from the old system. The reasons will be examined in detail while discussing the evaluation results (Chapter 4).

Training Issues: One of the critical factors identified in the implementation phase was that the training requirements were underestimated. The training for the software was conducted by the vendor at the Flagler, St. Johns, and Marion CTCs. This training occurred along with installation, and the staff had an extremely difficult time in trying to learn the system while simultaneously trying to use it for daily operations. St. Johns found this method of training inadequate and conducted an additional 1-day course at their facilities at their own expense. All the CTCs expressed the desire for training to occur before installation. Concerns also included the need for ongoing refresher training, training in general computer operations in a "Windows" environment, and cross training between jobs. Putnam had to put forth tremendous effort to explain to the drivers using the MDT the reasons and the rationale behind using them. Typically, training the daily users of the system has taken more time than expected.

The Need for New Hardware: All counties stated that old hardware slowed down the smooth transition from the old system to the new system.

Software Customization and Support Issues: The selection of the scheduling software was made with the idea of a "plug and play" system. However, each of the three CTCs had unique requirements. St. Johns requires the ability to schedule stretcher trips and service on weekends. Marion has to print manifests and billing information for sub-contractors. The incorporation of these features in the software required significant interaction and programming support from the vendor. There have been numerous revisions (87 different versions, including betas and releases) of the software based on the feedback obtained from the three CTCs.

Medicaid Billing Interface Changes: In addition to the customization needed on a county basis, all of the CTCs required significant programming and interfacing effort when ConsulTec, the fiscal agent for Medicaid, changed the interface for electronic Medicaid billing. The greatest challenge was not in the programming for the interface but in finding the appropriate person in ConsulTec who could provide information about the nature of the interface.

Radio Communication Challenges for MDT, AVL Systems: In Putnam County, the CTC transports 25 passengers at a time up to 4 times a day for a total of 200 pick-up and drop-off locations each day for certain regular trips for the Association of Retarded Citizens. Consequently, Ride Solution specified that the MDT needed to store a maximum of 350 pick-up and drop-off location pairs for each bus. The ability to download and edit a manifest of this size presented problems in air time, memory management, and work order coding that had previously not been seen by the makers of the system. One of the constraints was the speed of the radio modem (4800 baud), which restricted the amount of data that could be transmitted and received. The radio transmission has to allow for two-way voice transmissions, AVL signals, and MDT messages on a single channel. In order to make transmission times more manageable, the MDT manifests were edited to exclude passenger drop offs and any deviations in the route. All this information was retained on the paper manifests, and the MDT began to be seen less as a replacement for the paper manifests and more as a method of gathering accurate data. The process of uploading the manifests for the next working day to the MDT is currently initiated at 8:00 p.m. and takes about 2 hours. To prevent the vehicles' batteries from going dead during weekends, a timer was procured which turned off the radio after the upload was complete. An alternative method also is available in case of a vehicle-related emergency requiring uploading of trips to another vehicle. A dedicated key in the MDT initiates the download from the system. However, this places a severe strain on the communications backbone when done during regular business hours.

3.5 Post-ITS Deployment Operations

All the counties are well on their way to using ITS systems in the areas of automatic scheduling, dispatch, billing, and reporting capabilities. The following changes have taken place operationally in Flagler, St. Johns, and Marion since the inception of the ITS project:

Flagler: Service routes were developed based on the standing orders. The intake operators take the client's information and choose a service route based on their experience and knowledge. While it is possible for the software to pick the best route, the CTC finds it more satisfactory to use the scheduler's experience to assign clients to routes. The data entry is greatly reduced because most client information is already in the database as shown in Figure 3-3. The scheduling program assigns the pickups based on addresses and times in each service route. The scheduler then goes over the schedule to ensure tight assignments. The software allows the scheduler to shift riders to different routes in case the travel plans change or if there is an uneven assignment between vehicles. Once the schedule is finalized, the drivers' manifests are printed for pickup at the start of the business day. The dispatcher also has similar software and is able to respond to driver queries and changes resulting from no-shows or cancellations. Flagler schedules a return trip for every client thus ensuring that the dispatcher's role is eased considerably. The Medicaid billing module is being tested and the users are very happy with the results so far. Flagler has not yet found a suitable use for the AVL systems. However, there are plans to buy the new AVL system being developed by RouteLogic and use it for one of Flagler's other transportation programs.

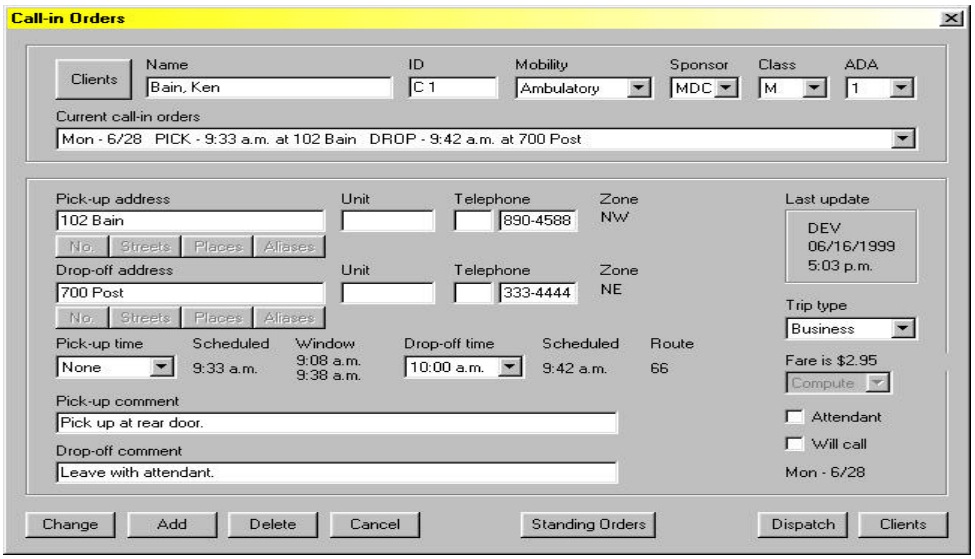


Figure 3-3: Reservation Screen

Reporting capabilities available from the software are being extensively used for Annual Operating Reports (AOR) and day-to-day management. A typical report layout is shown in Figure 3-4. This layout allows for the selection of desired columns, sorting capabilities, and basic querying functionalities.

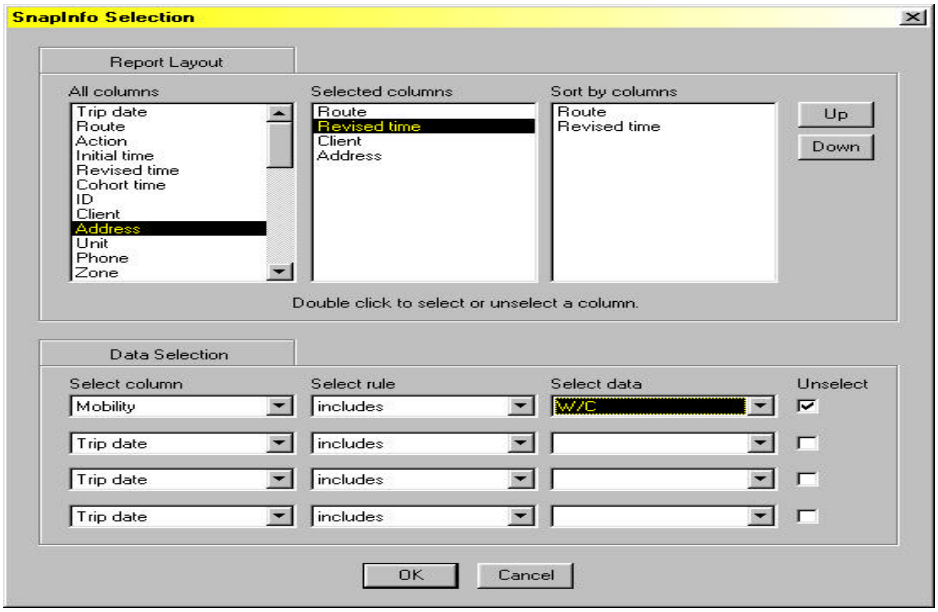


Figure 3-4: Sample Report Layout in ParaLogicÒ

The ability of the software to identify zones of trip generations, batch processing for scheduling, and the optimization capabilities are currently not being used in this county.

St. Johns: St. Johns operates along the same lines as Flagler in terms of call intake, scheduling, and dispatch. The managers were convinced that moving to a service route concept and using the scheduling software helped them stay in business. The billing operations are still not fully automated. The scheduling software is used to create a basic report using forms similar to the categories displayed in Figure 3-4, which is exported to Microsoft Excel for creating invoices. The installation of the Medicaid billing module is expected soon. The AVL systems purchased are not being used, although the new fixed route with deviations system (Sunshine Bus) is a potential application area.

Marion: Marion County CTC had the greatest difficulty in shifting to the software due to problems such as old hardware and frequent system lock-ups. The scheduling software would cause the computer system to fail if the scheduler and the call-intake operator worked on the system at the same time. Initially, this was attributed to old hardware, and Marion hired a consultant to provide suggestions for a new server and associated hardware. The problems, while decreasing in frequency, still continued to occur. Since restarting the system multiple times a day was found to be very inconvenient, it was decided that the call-intake operator would add clients to the service routes as they called in and let the software decide the schedules. The scheduler would subsequently check the schedules generated by the software. However, it was found that the schedules were very haphazard and not optimal. Currently, the call-intake operator makes a note of the call-ins on paper and the scheduler assigns these call-ins to routes based on knowledge of the county and the system. The scheduling features of the software are not being used at all yet. Unlike the other CTCs, Marion County has fewer standing orders (about 40 percent of total riders). Combined with the size of the county, the CTC finds it extremely difficult to assign return trips for clients and still operates on the principle of will-call. The module for Medicaid billing is used but still needs some refining as subcontractors are invoiced only for one leg of a round trip by the software. Marion has not had the same success using the software as the other two CTCs.

Putnam: Putnam already had a scheduling program, which subsequently was programmed to interface with the MDTs to provide drivers with manifest information. Currently, the data transfer to and from the MDTs is operational. The drivers indicate the actual pick up information of the clients to the base station via the MDT. Medicaid rider trip times, co-payments, and mileages are logged by the MDTs for billing information via card swipes and the drivers input the information for other riders. However, the interface between the trip data from the MDT and the billing program is not yet operational and the drivers still have to keep paper logs of the above information.

The dispatcher now has the ability to add a passenger pick up remotely to the MDT. The software would insert the new pick up at the right place in the schedule for the day. There are about 75 trip requests for same-day service. The dispatcher still uses voice communications to indicate additions to the manifests. It is expected that this feature will be deployed along with the interface to the billing program in the near future.

The AVL/MDT system also is being used to record drivers' run times. The driver punches a keystroke combination at the beginning of the run and at the end of the run. This sends a message to base indicating the start of the run and the end of the run, which can then be used for

payroll and administrative functions. The AVL system also is interfaced with a GIS application provided by Visual Risk, and the dispatcher can look at the exact locations of the vehicles in the county.

3.6 Next Steps

All CTCs are planning to upgrade to Windows XP and to complete the automation of the billing process. The CTCs identified the following plans for the continued application of ITS in their agencies.

St. Johns: The Medicaid billing module is expected to be functional soon. A tentative idea is to use Caller-ID during reservations to pull up clients' files automatically. The AVL systems could be of potential value in the Sunshine Bus service operated by the CTC.

Flagler: Flagler plans to re-analyze the service routes and see if they are still the most efficient routes. Currently, the CTC feels that it is using about 20 percent of the scheduling software's capabilities. Efforts are underway to use the excellent reporting capabilities of the software. The use of AVLs is being considered for programs like Meals-on-Wheels, operated by the Flagler County Council of Aging.

Putnam: The interface between the billing program and the MDTs is to be implemented next. Putnam would like to extend the use of the AVL/MDT system to ensure schedule compliance. Schedule compliance will be verified by identifying certain locations on the route where the driver sends the arrival time to the base station using the MDT. This phase, although a high priority, is currently on hold due to funding uncertainties. Currently, only sponsored (Medicaid) riders have ID cards. The non-sponsored riders will be issued cards in the near future to help measure increased productivity from shared rides. Improving communications between the different system components is essential. One of the challenges has been to get the radios, the computers, and the data transmission synchronized. The polling of the vehicles is being optimized to minimize bandwidth requirements while maintaining useful refresh rates for pinpointing vehicle location.

Marion: The immediate priority is to resolve the problem of Medicaid billing for subcontractors. This step would result in a reduction of 1 FTE. The CTC hopes that the vendor can modify the software to meet the needs of the agency for scheduling and billing. Batch scheduling using the software is critical for this county and is another immediate priority. Batch scheduling refers to the ability of the software to accumulate all the trip requests and schedule the pick up and drop off order automatically and optimally at the end of the day, as opposed to scheduling as the intake occurs during the day. This feature is still being beta tested in other CTCs. Since the pick up times cannot be provided at the time of the trip request call when using batch scheduling, a pick up window has to be provided by the call intake operator. Currently, the CTC provides a pick up window (two hours) rather than a specific time for any trip request so batch scheduling does not require a change in operations.

4.0 EVALUATION RESULTS

Chapter 2 described the goals and the hypothesized impacts of the ITS project. This project has had its challenges, pitfalls, and unexpected influences with regard to funding, billing, and technological issues. Despite the problems, the CTCs are unanimous in the opinion that the implementation of ITS has been a key factor in improving operations and a catalyst in bringing about institutional and administrative changes. This section identifies the specific benefits and tests the hypotheses stated in Chapter 2.

A key question most evaluations try to address is whether the ITS systems improved the operation of the agency. In this case, due to the changes in project philosophy and goals combined with changes in county demographics, an additional question must be addressed: What role did the ITS project play in helping the agency adjust to changes in operations and demand?

4.1 Goal Area: Mobility

Measures of mobility improvements include reduced pick-up time and advance reservation windows, reduced travel time variability, increased customers per trip, and improvements in customer satisfaction. The ITS project participants hypothesized that the software would increase scheduling and routing efficiency, that more customers could be served as a result of increased operating efficiencies, and that improved service would reduce customer complaints. The evaluation analyzed trip data reported in the Annual Operating Reports (AORs) and the responses to interview questions concerning perceived operational efficiencies and customer satisfaction.

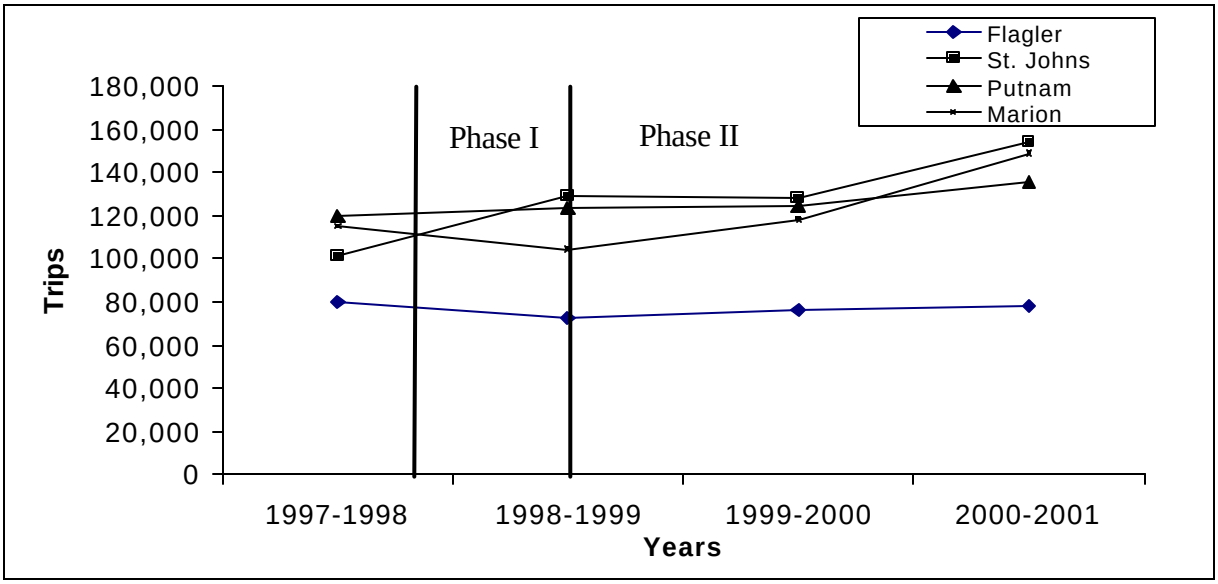
The total one-way trips per year are reported for all the counties in Table 4-1 and graphically shown in Figure 4-1.

Table 4-1: Total Trips Made by CTCs

Total Trips (July – June)	Flagler	St. Johns	Putnam	Marion
1997-1998	80,364	101,638	119,797	114,939
1998-1999	72,200	128,808	123,545	107,674
1999-2000	76,367	128,025	124,589	118,308
2000-2001	77,883	153,771	135,922	148,918
Change since 1997 (%)	-3.09	51.29	13.46	20.55**

Source: *Annual Operating Reports* submitted to the Commission for the Transportation Disadvantaged.
** The percentage change in trips for Marion County is from 1999-2000 since the ITS project was initiated during that year unlike the other CTCs.

The AOR data combined with the interview responses indicate that the CTCs are providing substantially more trips now than before the ITS project (1997-98). While the data for Flagler indicates that there has been a slight decrease in number of trips, interviews with the CTC indicated that this might be due to a reporting problem rather than any decrease in demand. The CTC also indicated that the reports produced by the software are more accurate and this might have reduced some overstated numbers in previous years. The increase in trips is greatest for St. Johns CTC. The change since 1997-98 is more than 50 percent. Interviews with the CTC indicated that the CTC went from being the worst CTC in the state of Florida to one of the best in the project time period. This drastic change was brought about by a new management team that implemented service routes and, most importantly, made the system reliable and more efficient. St. Johns indicated that the scheduling software helped significantly in managing the demand on the system and in implementation of the new policies. While there is no single cause for the ridership increase, Marion (Marion joined the ITS project only in Phase II) and Putnam also experienced increases in the use of the transportation service since the inception of the project.



Source: *Annual Operating Reports* submitted to the Commission for the Transportation Disadvantaged

Figure 4-1: Total Number of Trips Per Year for the Participating CTCs

The advance reservation requirements have not changed since the ITS project began. To book a ride, the client needs to call the previous day before 12:00 p.m., except in Marion, where the client needs to call three days in advance to book a ride. The interview responses indicated that the existing advance reservation requirements are very reasonable and cannot be reduced further except, perhaps, in Marion. There has not been a change in the pick up window for the clients. Riders should be ready one hour before pick up time, and the pick-up window is 45 minutes before to 15 minutes after. Marion has a wider pick up window of two hours, although it is often a precaution. To that extent, the ITS project has not improved client pick-up windows and advance reservation times. The CTCs have not yet started the use of the optimization routines in

the software for reducing pick-up windows by optimal scheduling. The system is still being perfected and no changes have yet been made to the pick-up window requirements based on the deployment of technology.

Most of the customer complaints are about the policies set by the CTC rather than the actual service provided. The reporting of complaints in the AORs is very inconsistent, partly because each CTC has different definitions of what constitutes a valid complaint. Remarkably, the reported number of complaints in a year rarely exceeds five. While a customer survey was outside the scope of this evaluation, the interviews with the operators indicated a high level of perceived customer satisfaction and a genuine desire on the CTC's part to ensure that the riders are satisfied. The CTCs had no data regarding customers/trip and travel time variabilities.

Additionally, the ITS project has had other mobility benefits, which are not easily quantified.

- A key benefit identified by Flagler CTC was the ability of the software to schedule multi-chained trips for clients.

- The software has helped Marion CTC to clearly demarcate the ADA zones for providing complementary paratransit service.

- Putnam's flex route system, which allows for a published schedule, provides about $350,000[2] worth of service to the general public using these buses at the published bus stops. The amount represents the fare that the Commission for the Transportation Disadvantaged would have paid the CTC if these riders were transportation disadvantaged who used the system as purely demand response. These riders also represent the existing demand for a transportation service in the region. While the extra service is not due to any ITS deployments, the CTC anticipates using the AVL/MDT system from this project as a critical tool in tracking such trips and trip patterns for reevaluating their service routes.

4.2 Goal Area: Productivity

Measures of productivity include savings in staff time per task, cost savings to the participating agencies, reimbursement of contracted service, and improved job satisfaction. The CTCs hypothesized that the ITS project would reduce the costs per unit of service through more effective scheduling, dispatching, fleet control, and the development of service routes. The technology would be viewed as beneficial by agency staff in assisting them with their jobs.

Productivity is by far the most improved area since the beginning of the ITS project. Flagler and St. Johns are extremely satisfied with the scheduling software. St. Johns is of the opinion that the new software is a vast improvement over the old software and provides an orderly progression from intake to dispatch. Marion is not satisfied with the scheduling software and

[2] Boyd Thompson, Douglas Ham, Jerome C. Zajic, *After the Gold Rush: Ride Solution and Rural Transportation, 2001*.

would like major improvements in the system. The productivity effects of the ITS project are listed below:

Intake: The staff time, measured in person-hours, required for intake has decreased from four full-time operators to two in St. Johns despite the calls per day increasing from about 150 per day to about 300. Since the beginning of the project, St. Johns has reduced its office staff from nine Full Time Equivalents (FTEs) to 4.5 FTEs. This has resulted in a savings of $58,500/year based on an average wage rate for intake operators ($6.25 per hour[3]). An additional 15 person-hours/month will be reduced due to the implementation of the Medicaid billing module of the software in the CTC. Flagler did not experience a reduction in the number of FTEs required for intake. However, the interviews indicated that the call intake process has been simplified greatly by the new software. Marion reduced the number of FTEs associated with reservations (3 FTEs to 1.5 FTEs, a savings of $19,500 per year), although these savings are not due to the software alone and the CTC would still like improvements in the software. Putnam did not change intake operations during the course of the project. Putnam also did not use the RouteLogic software, so no changes were expected.

Scheduling: The software has improved scheduling and dispatch tremendously in Flagler and St. Johns. The staff time for scheduling has been reduced from about 4-8 hours to approximately 2 hours while scheduling more trips per day. The scheduler's role has been reduced to checking for capacity, timing, and making changes as necessary. While the number of schedulers has not decreased (1 full-time scheduler before and after), the number of trips per day has gone up and the workload associated with the job has appreciably decreased. Marion still has problems with the scheduling software. The scheduling process takes about six hours. The size of Marion County's paratransit system (1,610 sq. miles, > 10,000 client records in database, 26 service routes) makes the system very inefficient and slow especially if the software is allowed to pick the service route. Right now, the intake operator assigns the service route to clients as they call in based on her knowledge of the system and the operating area. Also, the scheduling assignments from the software are not optimal and the scheduler has a difficult task of manually optimizing the assignments. The software also has been prone to frequent lock-ups. Marion would like to see the scheduling effort reduced to about half the current hours. Combined with improvements in billing, Marion expects a potential reduction of 1 FTE due to improvements in the software (a savings of $13,000/year). Putnam has not changed the scheduling algorithm since the beginning of the project. However, Putnam has integrated its existing scheduling software with the MDT system and it is possible to transfer the manifest information from the scheduling system to the MDTs.

Dispatch: Flagler and St. Johns reported a significant decrease in the workload of the dispatcher by changing their policy to schedule a return trip for every rider and ensuring that the only calls handled by the dispatcher were true will-calls and add-ons. While this was only a change in policy and could be done without any ITS systems, the new software

[3] Assuming an annual salary of $13,000 per year for call intake operators. Marion Transit Services, personal communications.

played a major role in enabling the implementation of the policy. The new software allowed for return trips to be easily assigned to service routes and allowed the dispatcher to move trips between routes when needed. Flagler reported that using a will-call method to schedule trips under the old system caused problems in terms of scheduling and consequently placed a heavy burden on dispatch. Putnam foresees using the MDT and the AVL system for the dispatch by remotely transmitting modified or new pickup and drop-off locations to the nearest bus available. The dispatcher now has the ability to input same-day trip requests (average of 75 per day) directly into the MDT in the correct order of pick-ups. This feature is expected to be deployed in the near future and is expected to be of great help in easing the driver's workload by eliminating paperwork. The AVL system also enables the dispatcher to locate the vehicles in real-time so that the dispatcher can make optimal decisions regarding driver assignments for pickups and drop-offs. The polling rate is currently being optimized to ensure that the vehicle locations are refreshed in a useful manner while ensuring that the communications infrastructure is not overloaded with data.

Billing or Reimbursement of Contract Service: Billing was by far the most paper intensive task prior to the implementation of the ITS project. The scheduling software in Flagler, St. Johns, and Marion now allows the CTCs to calculate mileage based on the geo-coded street addresses, a big improvement over mileage calculations based on odometer readings. One of this project's strengths has been the ability of the software vendors to customize the software based on the CTC recommendations. ConsulTec, the fiscal agent for Medicaid, changed its billing format during the course of the project. The vendor was able to produce an interface, which allowed for automated billing of Medicaid trips. The ability to electronically bill Medicaid trips is greatly appreciated by Flagler and Putnam. It is eagerly expected in St. Johns and will soon be functional. Marion County uses the automated billing module for Medicaid trips provided by the CTC, although there are errors when the billing module is used for sub-contractor billing as mentioned previously. In addition, the reporting features of the new system are used to produce reports and invoices for billing other agencies.

Route Planning: The systems deployed have not yet been used in route planning. The CTCs at Flagler and Putnam were of the opinion that the RouteLogic system has great potential for efficient mapping and identification of service routes. The MPO in Marion County is attempting to use the ridership data from the county CTC and the ParaLogic® software to identify potential trip origins and destinations for further expansion and optimization of the fixed route system (SunTran) in the City of Ocala.

Staff Satisfaction: While initial acceptance was slow due to frequent lock-ups in the system at all the CTCs, inadequate training, and lack of familiarity with a Windows-based operating environment, the staff in the three CTCs using the software are extremely pleased with the help provided by the software in daily operations and the potential of the as yet unused features. The drivers took some time to adjust to the new manifests in the three CTCs using ParaLogic®, but once the concept and the method of operation were explained, there were no problems. Putnam had problems with infrequent driver use of

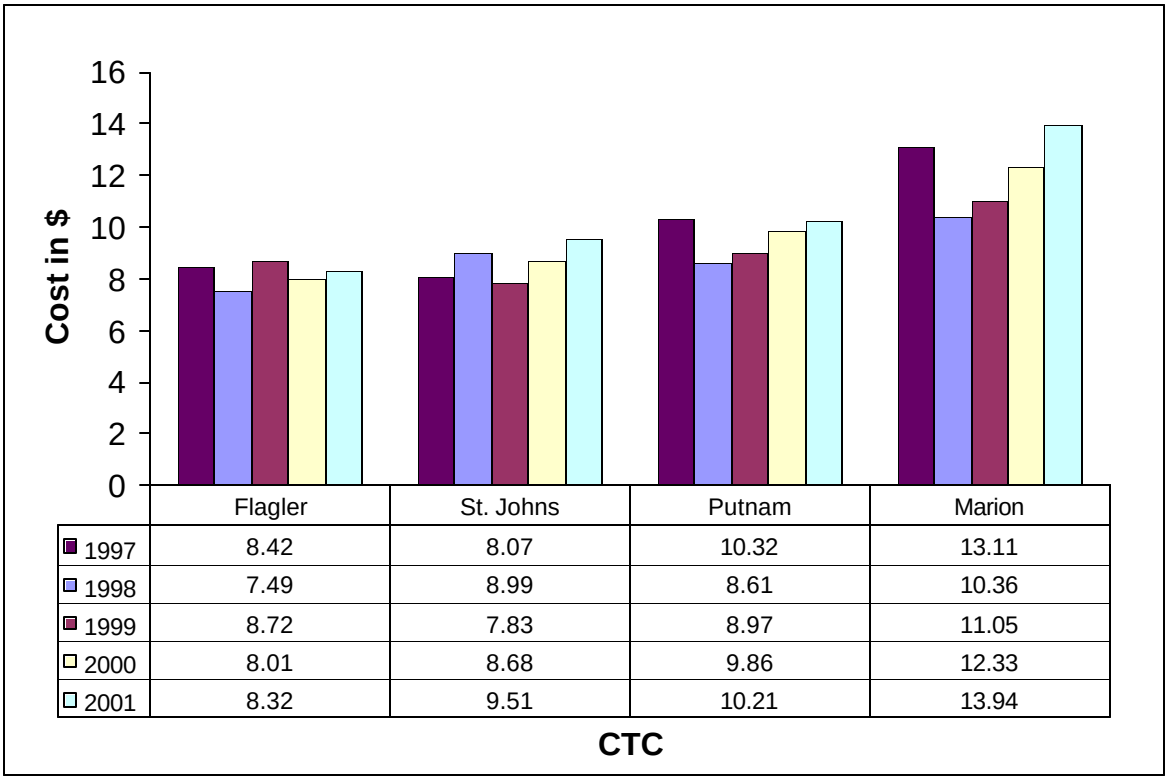
MDTs in the buses and had to resort to implementing an aggressive approach of disincentives to ensure compliance.

Payroll Management: Putnam has improved payroll management by using the login and logout on the MDTs as a time card. The data are then downloaded from the MDTs to the payroll program eliminating inaccuracies in drivers' time reporting.

Pre-Trip Inspection Process: The MDT also is used for performing a pre-trip inspection of the vehicle before the start of the day's first run. This requires the driver to complete a 30-point checklist by using pre-defined status keys on the MDT. The data from the completed checklist can be downloaded for maintenance purposes. This innovation reduces paper work for the driver and the maintenance crew.

4.2.1 Performance Indicators

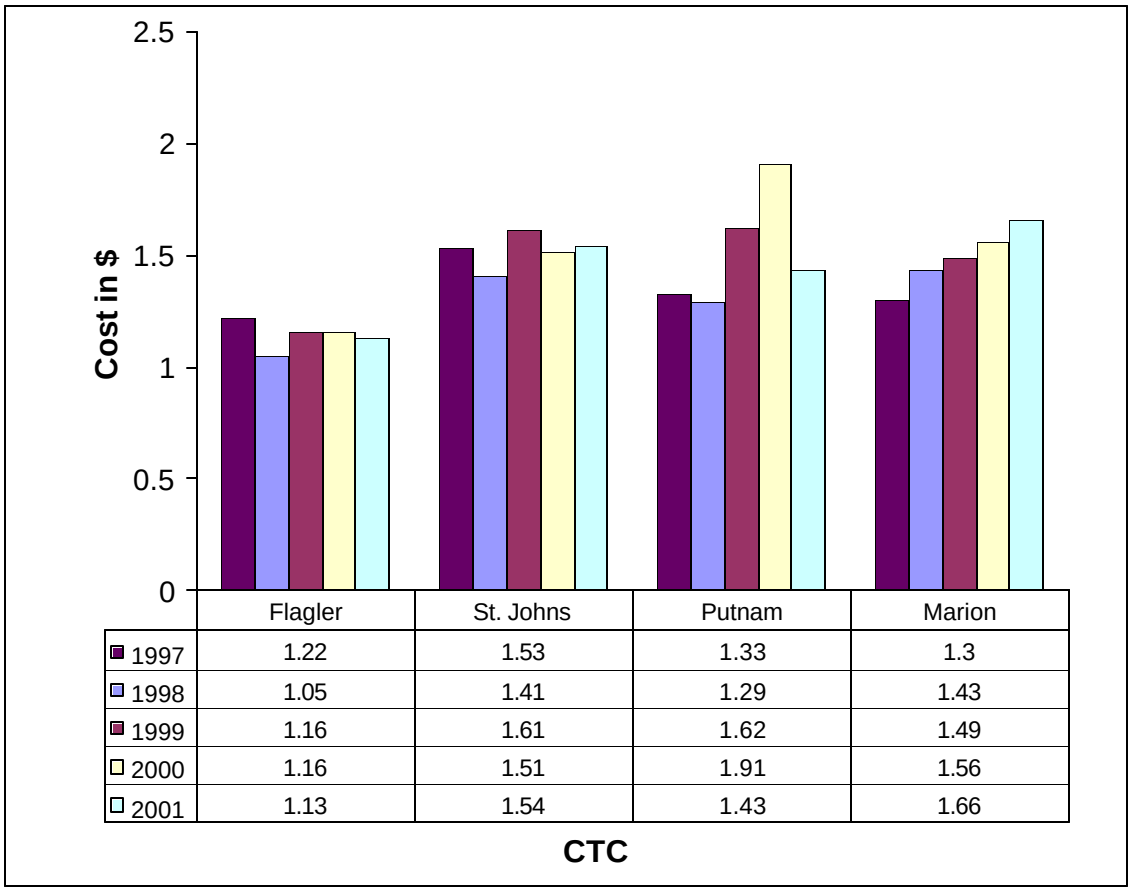
The operating costs per trip and per vehicle mile also are indicators of the productivity of the system. These costs are shown in Figures 4-2 and 4-3. No CTC reported a pronounced decrease in cost/trip or cost/vehicle mile as was expected, as operational costs have increased significantly due to higher insurance premiums, salary hikes, and increased demand.



	Flagler	St. Johns	Putnam	Marion
1997	8.42	8.07	10.32	13.11
1998	7.49	8.99	8.61	10.36
1999	8.72	7.83	8.97	11.05
2000	8.01	8.68	9.86	12.33
2001	8.32	9.51	10.21	13.94

Source: *2001 Annual Operating Review* published by the Commission for the Transportation Disadvantaged

Figure 4-2: Cost Per Trip



	Flagler	St. Johns	Putnam	Marion
1997	1.22	1.53	1.33	1.3
1998	1.05	1.41	1.29	1.43
1999	1.16	1.61	1.62	1.49
2000	1.16	1.51	1.91	1.56
2001	1.13	1.54	1.43	1.66

Source: *2001 Annual Operating Review* published by the Commission for the Transportation Disadvantaged

Figure 4-3: Cost Per Vehicle Mile

The operational expenses for the CTCs are listed in Table 4-2. As previously stated, the operational costs have increased over the years due to factors such as increased insurance premiums and maintenance expenses, which are external to the project. The labor costs have also increased since 1997-98 due to salary increases and increased hours resulting from a greater demand for the service. This increase is greatest for St. Johns, where the demand for the service increased tremendously during the project period and salary increases were provided to the staff. The proportion of labor costs to the total operating cost, however, has decreased in 2000-01 for three of the four CTCs since the deployment year (1998-99) as the CTCs became more familiar with the operation of the new system. Flagler and St. Johns experienced an increase in labor costs in 1998-99 and 1999-2000, which is in part due to the overtime hours put in by the operators and the installation problems faced. Putnam has experienced a consistent drop in the labor costs as a proportion of operational costs. Some of this reduction is attributed to the increased accuracies in the drivers' time recording. The remainder is accounted for by staff reductions at the CTC. Marion also has shown reductions in the labor costs as a proportion of operational costs. Most of the reductions in Marion are due to staff reductions since 1996.

Table 4-2: Operating Expenses and Labor Costs for the CTCs

	1996-97	1997-98	1998-99	1999-2000	2000-01
	Operating Expenses for the CTCs				
Flagler	$644,690	$602,102	$629,370	$612,064	$648,113
St. Johns	$833,763	$911,877	$1,009,164	$1,115,174	$1,461,658
Putnam	Unavailable	$1,031,739	$1,107,713	$1,228,704	$1,387,480
Marion	$1,781,189	$1,645,820	$1,547,622	$1,804,238	$2,151,064
	Labor Costs for the CTCs				
Flagler	$278,151	$303,875	$340,817	$347,747	$340,008
St. Johns	$378,861	$475,386	$506,471	$590,023	$764,324
Putnam	Unavailable	$496,130	$517,248	$580,941	$627,068
Marion	$1,157,367	$988,619	$814,736	$906,835	$1,052,615
	Labor Costs as % of Operational Costs				
Flagler	43.14	50.47	54.15	56.82	52.46
St. Johns	45.44	52.13	50.19	52.91	52.29
Putnam	Unavailable	48.09	46.70	47.28	45.19
Marion	64.98	60.07	52.64	50.26	48.93

Source*: Annual Operating Reports* submitted to the Commission for the Transportation Disadvantaged

The trip distribution by purpose is given as a percentage of total trips in Table 4-3. The data are from the AOR. As seen in the table, medical trips are an important reason for using the transportation services provided by the CTCs. Since almost all of these trips are medical non-emergencies and require a prior appointment, it is critical for the CTC to work with the medical service providers in the area for client referrals, client appointment rescheduling, etc. The process of custom fitting client appointments and slowly making clients aware of the published schedules has resulted in the lowering of Medicaid expenditures in Putnam County by $2.3 million since 1996.[4] The ParaLogic® software facilitates similar coordination in Flagler, St. Johns, and Marion by storing the medical facility information in the database. All the CTCs identified this as a very positive and important feature. The scheduling software has given the intake operators the ability to look at the daily schedule and work with the medical service providers to reschedule the appointment times of riders to better fit operations.

[4] Boyd Thompson, Douglas Ham, Jerome C. Zajic, *After the Gold Rush: Ride Solution and Rural Transportation, 2001*.

Table 4-3: Trip Distribution by Purpose

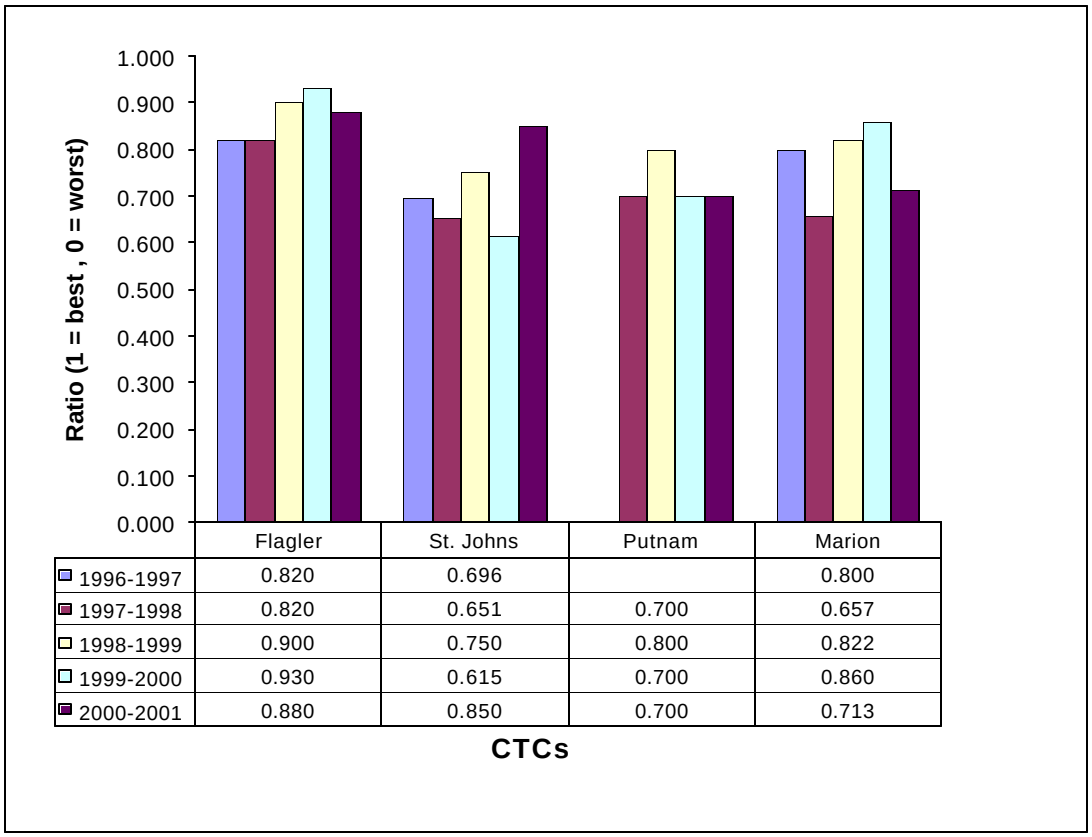
Trip Distribution by purpose (% of total trips)	Flagler					St. Johns				
	1996-1997	1997-98	1998-99	1999-2000	2000-01	1996-1997	1997-98	1998-99	1999-2000	2000-01
Medical	38	38	18	24	24	28	38	39	39	35
Employment	10	10	35	35	34	7	1	1	1	0
Education/Training/Daycare	8	8	1	1	2	10	34	32	32	26
Nutritional	20	20	26	22	21	25	5	27	26	20
Life-Sustaining/Other	24	24	20	18	19	30	22	1	2	19
TOTAL	100	100	100	100	100	100	100	100	100	100
	Putnam					Marion				
	1996-1997	1997-98	1998-99	1999-2000	2000-01	1996-1997	1997-98	1998-99	1999-2000	2000-01
Medical		29	29	30	30	71	47	57	66	77
Employment		20	17	19	19	1	2	2	1	1
Education/Training/Daycare	N/A	28	45	34	34	19	29	25	7	2
Nutritional		1	1	1	1	3	6	13	20	13
Life-Sustaining/Other		22	8	16	16	6	16	3	6	7
TOTAL		100	100	100	100	100	100	100	100	100

Source*: Annual Operating Reports* submitted to the Commission for the Transportation Disadvantaged

4.3 Goal Area: Efficiency

Efficiency and productivity are closely related. The factors differentiating the two for this evaluation are that efficiency focuses on external or passenger–related measures while productivity focuses more on internal or administrative measures. Measures of efficiency include the ratio between revenue miles and vehicle miles, trips per driver hour or vehicle miles per trip. The participants hypothesized that the software would produce more efficient route designs and lead to operating improvements that would help satisfy trip demand. Interview findings and operating data were analyzed to determine the project's impacts for this goal.

Better operations and technology generally have helped increase the revenue miles to vehicle miles ratio for the counties as shown in Figure 4-4. The improvement in the ratios is greatest for Flagler and St. Johns, the two CTCs where the scheduling software has been utilized most. The ratios in Putnam have been fairly steady since 1996, as Putnam has not changed its scheduling software. Marion has a more uneven trend, and this point was reinforced by interviews, which suggested that the implementation of the scheduling software and the associated problems caused a performance drop-off.

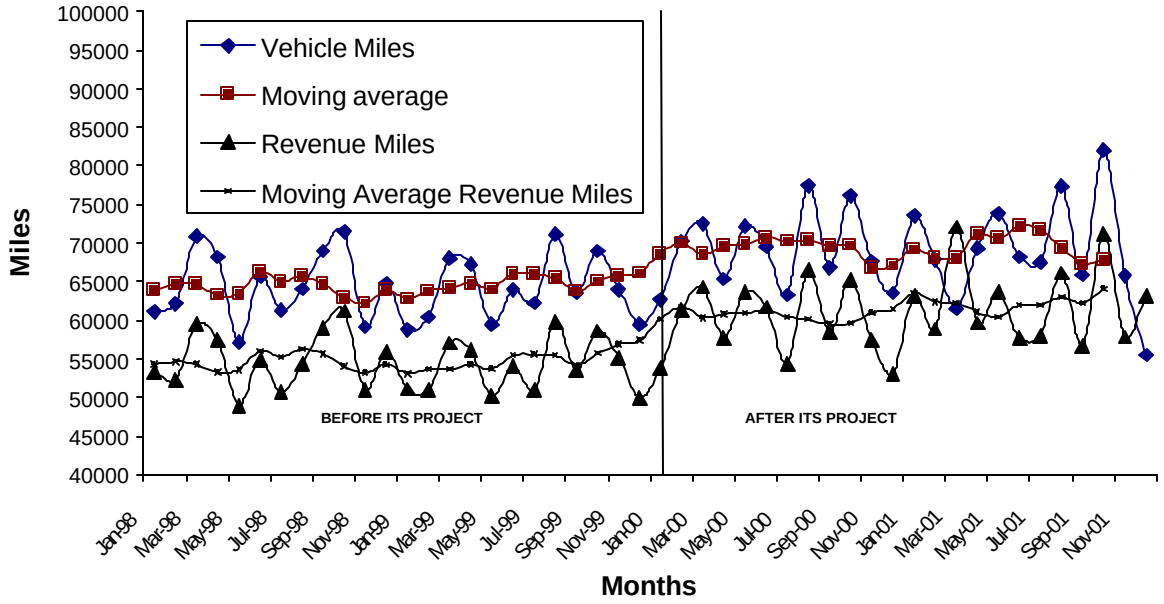


	Flagler	St. Johns	Putnam	Marion
1996-1997	0.820	0.696		0.800
1997-1998	0.820	0.651	0.700	0.657
1998-1999	0.900	0.750	0.800	0.822
1999-2000	0.930	0.615	0.700	0.860
2000-2001	0.880	0.850	0.700	0.713

Source: *Annual Operating Reports* submitted to the Commission for the Transportation Disadvantaged

Figure 4-4: Ratio of Revenue Miles to Vehicle Miles for all CTCs

To further analyze the trends in Marion County, the monthly data compiled by the CTC were used as shown in Figure 4-5. The vehicle miles and revenue miles are plotted for all the months from January 1998 to December 2001 along with the respective moving averages. The vehicle miles and the revenue miles traveled indicate the fluctuating nature of demand in this county. Interviews with the CTC revealed that the demand varies from season to season and very unpredictably as only 40 percent of the total ridership are standing orders. The moving averages indicate the slow growth in vehicle miles and revenue miles with the gap between them decreasing slightly when compared to the pre-ITS deployment months. This is promising as it is hoped that a final satisfactory implementation of the system can increase the efficiency substantially.



Source: *Internal Data from Marion CTC.*

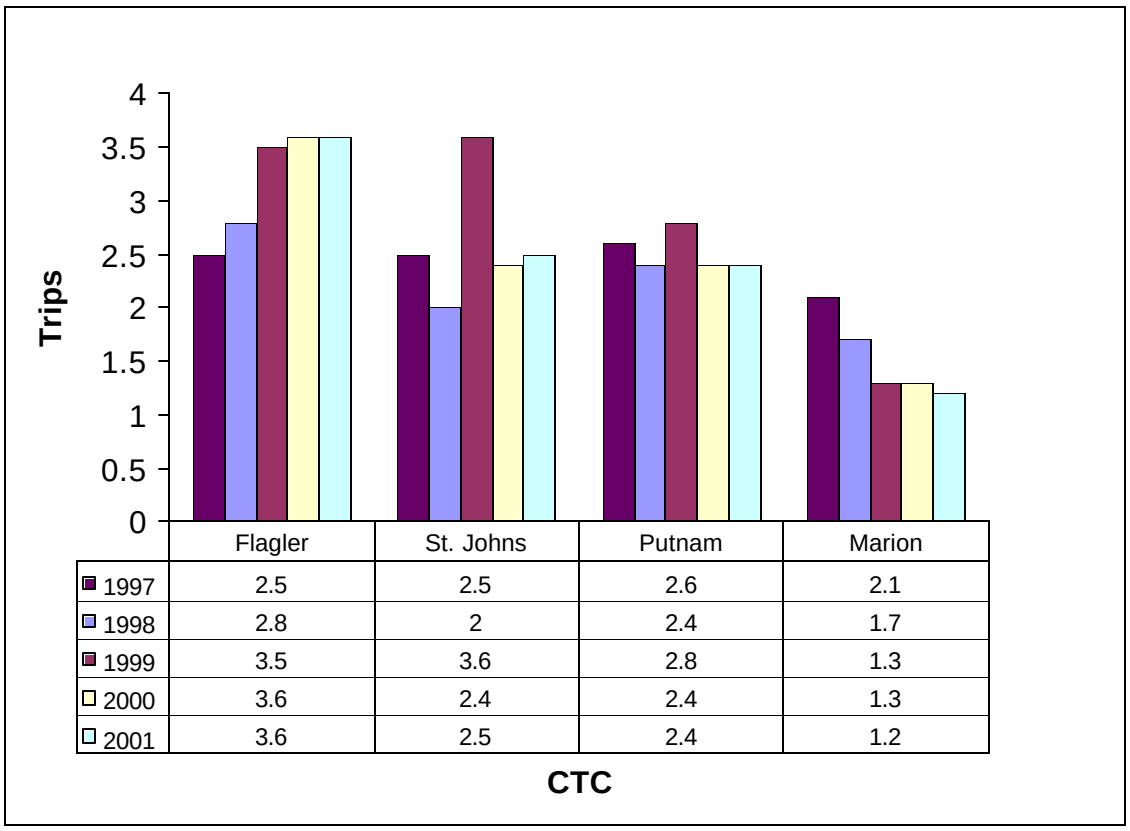
Figure 4-5: Vehicle Miles and Revenue Miles for Marion County

As can be seen from Figure 4-5, operating data in monthly intervals can reveal insights about the nature of the demand and trends during the ITS project. Concerted efforts were made to obtain similar data from Flagler and St. Johns for evaluation. Unfortunately, a computer system breakdown in St. Johns resulted in the CTC losing all the database information. Flagler sent the databases from the scheduling software from which monthly data were obtained. However, Flagler did not have access to pre-ITS deployment data, which made before and after comparisons impossible.

Another measure of efficiency is the trips per driver hour. This provides information on the scheduling and routing efficiency of the system. Care must be taken when comparing different CTCs because the county sizes and consequently the trip lengths are different. Figure 4-6 indicates the trips per driver hour from 1997 to 2001 for all the CTCs. Flagler shows constant improvements throughout the time period. The interviews revealed that these improvements are due to the scheduling software and an increased emphasis on efficiency among personnel. Putnam and St. Johns show uneven trends, and Marion County indicates a constant decrease during this time period. It is expected that Marion County would have a lower number of trips per hour because of the size of the county and correspondingly longer trips. The trips/driver hour for Marion has decreased steadily over the years. The two major reasons for these consistent reductions are:

1. About 77 percent of the trips are for medical reasons and Marion has been replacing old vehicles in the fleet with vehicles equipped with wheel chair lifts. Typically, these trips take longer to load and unload, leading to fewer trips per driver hour.

2. The CTC has started to provide ADA trips for the new fixed route service in Ocala. These trips also have significant loading and unloading times.

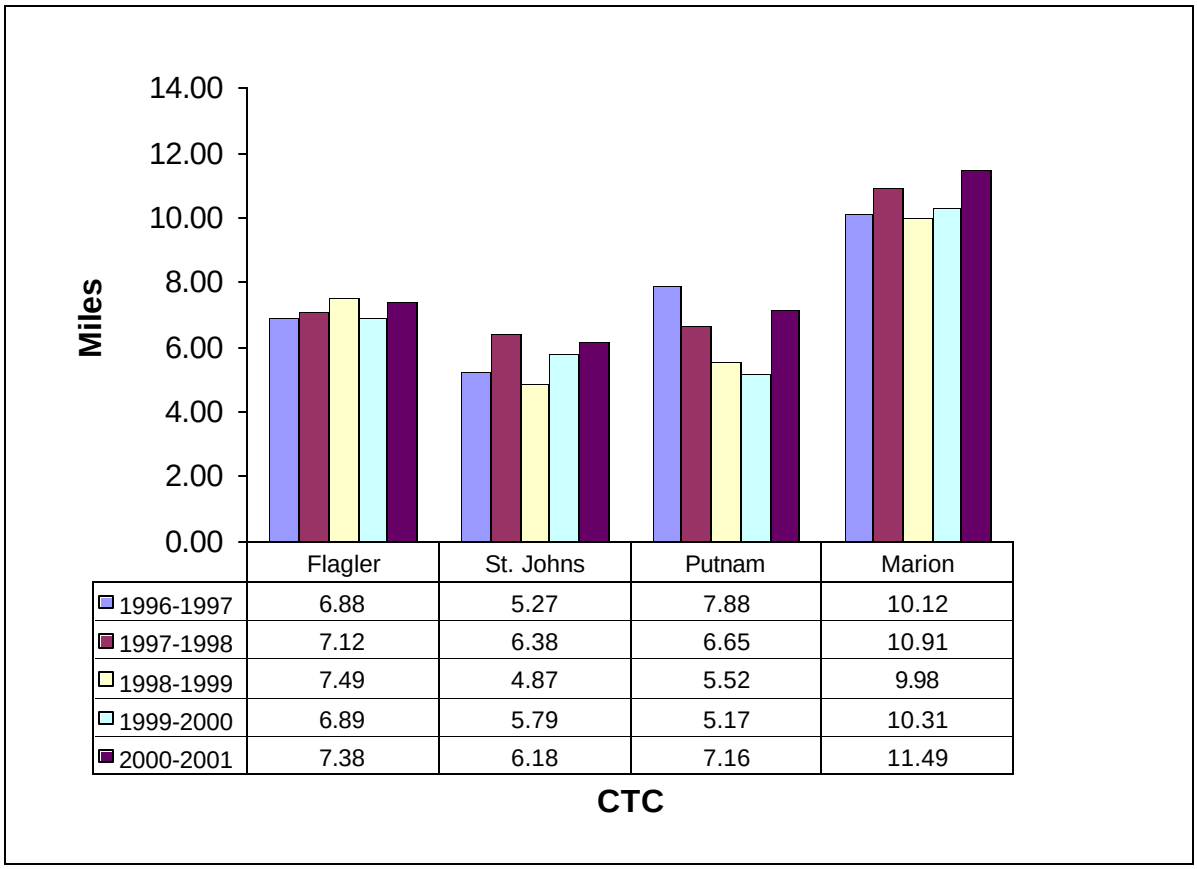


	Flagler	St. Johns	Putnam	Marion
1997	2.5	2.5	2.6	2.1
1998	2.8	2	2.4	1.7
1999	3.5	3.6	2.8	1.3
2000	3.6	2.4	2.4	1.3
2001	3.6	2.5	2.4	1.2

Source: *2001 Annual Operating Review* published by the Commission for the Transportation Disadvantaged

Figure 4-6: Average Trips Per Driver Hour

The scheduling efficiencies can be analyzed by plotting the vehicle miles/passenger trip for all the CTCs. This is shown in Figure 4-7. The trends for all the counties are steady with no significant increasing or decreasing trends except Putnam, which has a slightly decreasing trend.



Source: *2001 Annual Operating Review* published by the Commission for the Transportation Disadvantaged

Figure 4-7: Vehicle Miles/Trip

While the graphs do not demonstrate trends, the interviews indicated some improvements in operating efficiencies:

- Multi-loading of trips has increased with increased scheduling efficiency. Flagler reported a multi-loading increase of 1.6 passengers/vehicle hour since the inception of the ITS project (from less than 2 riders/hour to 3.6 riders/hour).
- St. Johns reported anecdotally that the trip runs are now very efficient and driver utilization has increased.
- Increased coordination is occurring among Jacksonville Transit Authority (JTA), St. Johns, and Putnam for welfare-to-work trips to Jacksonville. However, this coordination is a non-technical offshoot of the project.
- The Metropolitan Planning Organization (MPO) of Marion is attempting to use the same software as the CTC to plan the fixed route system in the City of Ocala based on the trip patterns of the Marion CTC riders and ADA riders.

The quantitative effects of ITS deployment on efficiency are hard to see from the available AOR data for a combination of reasons:

- The CTCs are still working towards fine-tuning the system. Putnam has not yet used the MDTs and AVL systems for schedule compliance. Marion has yet to experience the full benefit of the software for scheduling and dispatch. St. Johns and Flagler are not using all the features of the system.
- The data reporting accuracies vary from county to county and from year to year.

This project has mainly improved the daily operations of the CTC staff and consequently their productivity much more than efficiency. It is expected that once the CTC are using all the features of the system, operating efficiencies should improve.

4.4 Evaluation Results Summary

The evaluation results are summarized as follows:

1. The project has had a very positive impact on the productivity of the system and has improved the scheduling, dispatch, and billing operations in Flagler and St. Johns by reducing the workload associated with these tasks. Table 4-4 summarizes the workload benefits of using ITS for these counties. Putnam is still in the early stages of fully utilizing the potential of the AVL/MDT systems. Marion, while experiencing frustration with the implementation of the system, is still optimistic about the potential of the technology.

Table 4-4: Reduction in Workload in Flagler and St. Johns County

Changes in Workload	Flagler		St. Johns	
	Before	After	Before	After
Trips per day	125-150	250-300	250-300	450-500
Intake operators	2	2	4	2
Time to schedule the day's trips	4-8 hours	1-2 hours	4 hours	1-2 hours
Dispatch	Heavy workload due to will-calls	Reduced workload due to return trips being scheduled and synchronization with the scheduling software	Heavy workload due to will-calls	Reduced workload due to return trips being scheduled and synchronization with the scheduling software

Table 4-4: Reduction in Workload in Flagler and St. Johns County (Continued)

Changes in Workload	Flagler		St. Johns	
	Before	After	Before	After
Billing		Medicaid Billing has been automated. Mileage calculations are from the GIS based system. Overall, the billing process has become reliable and less intensive	1 FTE	Same as Flagler. There has also been a reduction 0.5 FTE for billing.

Source: Interviews with the CTCs

2. Benefits in the areas of mobility and efficiency are difficult to quantify due to inadequate and sketchy quantitative data, but all the CTCs claim that the system operates at a higher level of efficiency and provides a better level of service to the riders.

3. Marion County still has serious problems with the software, although the CTC believes it is a substantial improvement over the previous system. The reason for the rough transition is part technological and part due to the operations of the CTC. The problems that require immediate attention include:

    a. Frequent lock-ups when the scheduler and the intake operator simultaneously work with the software;
    b. Incorrect electronic Medicaid billing for subcontractors, which results in the sub-contractors getting paid only for one leg of a two-way trip. This issue needs to be resolved soon as this would result in a savings of 1 FTE;
    c. The need to save scheduling time by successfully implementing the batch-scheduling module; and
    d. The scheduling algorithm needs to be improved to provide better driver and trip assignments. Currently, the algorithm does not provide close to optimal schedules, and the CTC does not use this module for daily operations. The two major reasons for less than optimal performance of the algorithm include the number of standing orders and the size of the county. The CTC and the vendor need to find an agreeable solution to this problem. As a starting point, the idea of scheduling return trips must be explored. While it is a difficult concept to implement in Marion, this holds great promise for more efficient scheduling as reported by the Flagler and St. Johns CTCs. Scheduling return trips also reduces the burden on the dispatcher.

4. Putnam has improved operations in payroll management and billing of sponsored riders through use of the MDTs and card readers. The improvements in operations will be realized to the full extent only in the next couple of years, as the implementation process was very slow. Schedule compliance and enhanced management of trips using the MDTs is planned. The AVL/MDT data are an excellent source for planning applications and will be used soon for determining service routes, monitoring non-sponsored trips, and vehicle maintenance.

5. AVL technologies have not yet played a role in the project in Flagler and St. Johns. The AVL systems are currently not being used in these CTCs. However, all CTCs are looking for ways to use these technologies.

6. Inter-county trips have ceased to be an issue and consequently, there is no pressing need for coordination between the counties. However, the ITS project has provided a good forum for institutional cooperation. This forum can continue to be used effectively for other issues that may arise in the future.

7. The CTCs continue to serve a very valuable role in the community, with the trip demand expected to consistently increase. The ITS project has been the catalyst for operational changes and administrative improvements and has enhanced the ability of the CTCs to manage these challenges.

8. The quantitative effects of the ITS project are hard to document due to a lack of appropriate data and the presence of various confounding factors. Data are not sufficiently available for a detailed quantitative benefit/cost or trend analysis.

9. Based on the interviews and the site visits, there is great hope for the continued and enhanced usage of ITS technologies in the participating CTCs. All counties have realized the potential of technology to improve operations, and the lessons learned from this project will improve the implementation of the next phase.

5.0 LESSONS LEARNED AND RECOMMENDATIONS

The participating CTCs had substantial differences in operational philosophy, expectations of ITS, and technical capabilities. What was common among all the counties was the need for a plug-and-play system that would fit their operations—an inherent contradiction. While it is possible to obtain a system with almost all the capabilities needed, some operations will have to be changed to adjust to the technology, leading to difficult choices. In that respect, it is more advantageous to begin an ITS project with a new CTC or a CTC undergoing operational review than with a mature and well-functioning system with set operational procedures. The CTC of St. Johns County experienced major administrative and managerial turnover that was essential for it to remain in operation, and the ITS project is viewed as the catalyst for the smooth functioning of the CTC today. The interviews and discussions with all the CTCs revealed valuable insights for ITS deployments in the future:

1. **Implementation** — The implementation of the ITS systems took longer than expected due to the users' inexperience with a Graphical User Interface (GUI) based environment, little or unfocussed training, and problems with the software. Phased implementation running over several months is recommended instead of overnight installation, which invariably is followed by a steep learning curve and frustration. This was especially true in Marion County and in cases of software upgrades.

   Also, the participating CTCs, while eager to learn the new system, found it extremely difficult to begin using the software while interacting with clients and drivers as part of daily operations. The participants learned that it was necessary to separate the training process from installation. They recommended that training take place in a simulated environment with the staff practicing call-intake, scheduling, and billing before a system is implemented and used. This simulation could help the agency identify problems before the actual implementation process.

2. **Technological Coordination** — Although intercounty coordination was an original objective of this demonstration, the participating CTCs did not define at the outset how the ITS components they intended to deploy would be coordinated. Buying AVL systems in Flagler and St. Johns and a RouteLogic license for Putnam, without determining the uses of the technology, resulted in a waste of resources. It is necessary to clearly identify in advance the need and the method for technological coordination among participating properties. It is possible for different technologies to communicate with each other if all the data flows are clearly defined between the systems.

3. **Hardware** — The CTCs stressed that trying to install new systems on old hardware and then shifting to new hardware should be avoided in future projects. Most useful features like GIS-based routing and batch scheduling in a multi-user environment are very computer-intensive and typically are not capable of being run on older hardware without system breakdowns. This was a major source of frustration in Marion, St. Johns, and Flagler. The hardware capabilities should be examined prior to implementation and decision-making. Attempts should be made to procure the new hardware prior to software installation.

4. **Realistic Expectations** — It is important to know the capabilities of the ITS system being procured. This helps in reducing the unrealistic expectations and in learning how to make operational changes to best utilize the system.

5. **Customized Deployment** — The participating agencies, while providing similar services, had very different operating policies and staff capabilities. This was especially the case in Marion County. The technology that worked well in Flagler and St. Johns did not translate to Marion without the need for customization. An agency interested in pursuing the deployment of ITS systems should undergo a thorough operational review. The review should result in a list of procedures and policies for the daily operations of the agency. This list needs to be checked thoroughly with the capabilities of the technology being selected. However, an agency should be willing to modify its operations to improve the utilization of the selected technology.

6. **Training** — All the CTCs agreed that inadequate training resulted in delays in implementation and acceptance. Transit agencies should be trained to use new software, and it would have been useful to train the staff at several of the participating CTCs in using the GUI environment and in the general use of computers.

   It would have been helpful to the Marion CTC to have observed the operations of the other counties using the new system and to compare it with their operations prior to installing the system. Working with peer agencies is recommended because it helps the interested agency identify operational similarities and differences and assess the ability of the ITS technology to handle those differences.

   Despite automation, the scheduling and dispatch operations still depend heavily on the experience of the scheduler and the dispatcher. The participating CTCs learned that it was essential to cross train all office staff in the scheduling and dispatch operations using the new system.

7. **Vendor Support** — One of the successes of the project has been the vendor's willingness to modify and accommodate the requests made by the CTCs during the course of implementation. Agencies must ensure they have a responsive vendor with an appropriate service contract, even if they choose an off-the-shelf product.

8. **Medical Community Coordination** — Coordination with the medical community to schedule appointments to better fit the available transportation service has been an invaluable tool to improve efficiencies in all the CTCs. This practice is recommended for all similar agencies.

9. **Data Collection and Evaluation —** The lack of accurate and substantive data made it difficult to demonstrate the success of this project. The participating CTCs uniformly credited the project as a factor in improving their operations. Without a baseline dataset, the degree to which gains in mobility, productivity, and efficiency were attributable to the ITS deployment could not be documented. From an evaluation standpoint, baseline data should be collected at the outset of future projects, and data collection methods for evaluating changes should be specified.

6.0 CONCLUSIONS

Deployment of ITS technology for rural transit systems offers opportunities to improve productivity, efficiency, and mobility in communities that have large transportation disadvantaged populations. For various reasons, some rural transit systems are reluctant to take advantage of these opportunities. As with the agencies participating in this project, many rural transit agencies are small, their budgets are constrained, the staff may not be technologically adept, and some staff may be resistant to change. One benefit of this project is that the participating agencies in many ways fit the profile of the typical rural transit system, and these agencies have succeeded in facing the challenges of innovation. Scheduling, dispatch, billing, and reporting operations have been improved by the project in all the CTCs. Flagler and St. Johns experienced the greatest benefits among the participants with reduced workload for scheduling, dispatch, billing and reporting. Marion, even though expressing frustration with the software, holds great hope for productivity improvements. Putnam is proceeding to integrate MDTs and the AVL systems more completely in daily operations.

This project is an excellent example of ITS deployment in rural paratransit, despite the change from its original goals. As the CTCs take advantage of the features of the software and the vendor continues to make improvements, additional benefits will accrue. Therefore, it is important for the CTCs to set new goals.

Each CTC should regularly assess its current operations to ensure that the technology is being employed effectively. For example, the CTCs could improve their use of the software's data collection and reporting features. Collection and analysis of operating data and performance measures can yield useful information on service quality and lead to the identification of potential operational improvements. This assessment could include identification of new service routes, travel time monitoring to determine if particular routes or particular locations are prone to delay, and schedule compliance. Each CTC should develop a plan to identify future ITS needs and prioritize them.

As additional rural transit systems look to ITS, the participants in this demonstration can be leaders in championing innovation and can provide peer-to-peer assistance. The knowledge these agencies have gained can be very helpful to other systems in the process of technology selection. This assistance also can help other transit agencies identify similarities and differences in operation and assess the capabilities of the technology before investing time and resources in its procurement and implementation. The Flagler, St. Johns, Putnam, and Marion CTCs will continue to reap the benefits of this demonstration project, and the lessons they have learned will aid rural transit systems nationwide.

APPENDIX A

RURAL ITS EVALUATION INTERVIEW/QUESTIONNAIRE/ DATA COLLECTION

INITIAL GOALS AND NEEDS OF THE GRANTEES

a. What were the initial goals related to the implementation of ITS technology? How have these changed over time?
b. What operational problems were the ITS technologies expected to solve?

PLANNING AND PROCUREMENT

a. How were the decisions made during the planning process? Did this change over time?
b. How were technological needs identified, prioritized, and addressed?
c. What technologies were selected?
d. What were the major obstacles in the decision making process? How did you resolve them?
e. What were the problems in procurement of the selected technologies? How did you resolve them?
f. In hindsight, what changes would you like to make to the decision making process?

IMPLEMENTATION

a. How were the major steps in the technology installation/deployment?
b. What difficulties were encountered? How did you resolve them?
c. How long did the implementation process take?
d. What level of interaction do you think is necessary with the vendor? What level of interaction was actually achieved?

TRAINING

a. What type of training was required for the new technologies?
b. What training was provided? Initial training? Refresher training?
c. Who provided the training?
d. Was the training adequate?
e. What was the cost of training to the agency? (Initial and ongoing)

TECHNOLOGICAL ISSUES—*We would like functional details on each technology deployed, and any items that were originally planned but not deployed.*

a. What functions of the technologies are used in normal operations?
b. What features are not used as frequently?
c. What features still need to be implemented by the vendor?
d. How much customization is required at each property?
e. Are you happy with the current working of the selected technology? With the potential of the selected technology?
f. Did you originally plan to procure items that were not deployed? What were they? Why did your plans change?
g. What are the current priorities?
h. What are the next steps?

OPERATIONAL INFORMATION

Quantitative Data requirements: Ideally would like to obtain annual data for 1997-2001. If particular performance indicators are unavailable, please suggest an equivalent.

a. Vehicle miles
b. Revenue miles
c. Driver hours
d. Ridership
e. Number of no-shows
f. Passenger trip length – Miles (Average, Longest trip, Shortest trip)
g. Vehicle trip duration – Hours/Minutes (Average)
h. Average vehicle ridership (or passengers/mile or equivalent indicator of productivity)
i. Passenger trip distribution by purpose (medical, work, recreational)
j. Passenger trip distribution by service type (stretcher, ambulatory, fixed route, demand responsive etc)
k. Number of out of county trips per year
l. Number of trip requests per day
m. Percentage of trip requests accommodated OR percentage of calls denied service
n. Percentage of passengers scheduled who call on the day of travel. Has this number changed?
o. Percentage of scheduled vs. open return trips
p. Staffing data—administrative and operational FTEs
q. Complaints (categorized if possible such as late trips, no shows, excessively long trips)
r. Commendations

Qualitative Data requirements:

a. How were trips scheduled before the scheduling software?
b. What were the requirements – staff, material for scheduling prior to scheduling software?
c. How long did it take to schedule a trip?
d. How was the dispatching of trips carried out prior to the project?
e. How were the drivers' manifests prepared prior to the project?
f. How long did the entire process of preparing drivers' manifests take?
g. How is the scheduling and dispatch carried out now?
h. Has there been a change in the advance reservation requirement?
i. Has there been a change in the pick-up window?
j. Did the software help in scheduling and dispatch?
k. Did the software help in identifying and implementing service routes? How? (Number of service routes before and after deployment)
l. Do you feel the system has improved?
m. If yes, what do you think are the greatest advantages of the system now?

(For Putnam only)

a. How have you used AVL technologies to improve operations?
b. What has been the greatest benefit due to AVL systems?
c. Driver utilization data for 1995-present, if possible.

BILLING INFORMATION

a. How was the fare calculated per trip prior to the ITS project?
b. How is the fare being calculated now?
c. How is the billing for Medicaid and other grants done?
d. What are your immediate needs with regards to billing?

FLEET INFORMATION (1997-2001)

Number of vehicles, % lift equipped, age of vehicles, mileage, seating capacity

FINANCIAL INFORMATION

Quantitative Data requirements: Ideally would like to obtain data for 1997-2001

a. Total funding for all operations
b. Funding distribution by source
c. Trip distribution by funding
d. Fare revenues
e. Total funding and sources for ITS project
f. Total operating expenses

g. Distribution of expenses
h. Project costs to date –hardware, software, training, data transmission costs

Qualitative Data requirements:

a. What are your greatest concerns regarding funding?

STAFFING ISSUES

a. What changes have taken place with respect to personnel since the inception of the project?
b. Has there been anyn change in the amount of time required for
   -intake/scheduling
   -dispatching
   -billing
   -other administrative functions?
c. How did the staff react to the technologies?
d. How did the responsibilities of the staff change as the project got underway?
e. What level of acceptance was found among the operators?

INSTITUTIONAL ISSUES

a. How much communication exists between the participants?
b. Did the level of communication improve over the period of the project?
c. Did the project affect operational cooperation between counties, such as in transfers to fixed routes? How have those standard procedures changed?
d. How many trips involve transfers between systems?

LESSONS LEARNED AND FUTURE GOALS

a. What are some of the lessons that you have learned from the implementation process?
b. What was the best decision or strategy that you employed related to the implementation of ITS technology?
c. What would you change if you had the chance?
d. What suggestions or advice would you offer other agencies interested in implementing ITS technologies?
e. What are the new goals of the ITS program? What are the goals for the transit service?
f. What are your plans for ITS implementation in the future?

APPENDIX B

LIST OF INTERVIEWEES

Flagler County Transit

1000 Belle Terre Blvd
Palm Coast, FL 32164

Steven Jones – Executive Director – 386–437–7300
Lorraine Toner – Operations Manager

St. Johns County Transit

11 Old Mission Avenue
St. Augustine, FL, 32084

Brian Nourse – Director of Operations – 904–823-4817
Christy Sandy – Operations Manager
Cathy Brown – Executive Director – 904–823–4812

Ride Solution (Putnam)

1209 Westover Drive
Palatka, FL, 32177

Boyd Thompson – Director of Operations – 386–325–9999
Myra Strange – Operations Manager

Marion Transit Services

1644 North East 22nd Avenue
Ocala, FL, 34470

Donna Cart – Director of Operations – 352–622–6573

Commission for the Transportation Disadvantaged

605 Suwannee Street, MS-49
Tallahassee, Florida
32399-0450

Edward I. Griffin (no longer with the Commission)