Technical Memorandum No. 3

Florida's Intelligent Transportation Systems Strategic Plan Update

New National and Statewide Intelligent Transportation System Initiatives

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Version 1

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List of Acronyms

AAA ..... American Automobile Association
ADUS ..... Archived Data User Services
APC ..... Automatic Passenger Counter
APTS ..... Advanced Public Transportation Systems
ATIS ..... Advanced Travel Information System
ATMS ..... Advanced Transportation Management System
ATSS ..... Airborne Traffic Surveillance Systems
AVL ..... Automatic Vehicle Location
BRT ..... Bus Rapid Transit
CBP ..... Customs and Border Protection
CCTV ..... Closed-circuit Television
CEI ..... Construction, Engineering, & Inspection
CEU ..... Continuing Education Unit
CFP ..... *Cost Feasible Plan*
CITE ..... Consortium for ITS Training and Education
CVO ..... Commercial Vehicle Operations
DHS ..... Department of Homeland Security
E-911 ..... Enhanced 911
EFP ..... Electronic Fare Payment
ETC ..... Electronic Toll Collection
FDLE ..... Florida Department of Law Enforcement
FDOT ..... Florida Department of Transportation
FEEDS ..... Florida Engineering Education Delivery System
FHP ..... Florida Highway Patrol
FHWA ..... Federal Highway Administration
FIHS ..... Florida Intrastate Highway System
FMS ..... Fleet Management System
FTC ..... Florida Transportation Commission
FTP ..... *Florida Transportation Plan*
FTPN ..... Florida Transit Planning Network
FY ..... Fiscal Year
GPS ..... Global Positioning System

HOT ..... High-Occupancy Toll
HOV ..... High-Occupancy Vehicle
ISTEA ..... *Intermodal Surface Transportation Efficiency Act*
ITE ..... Institute of Transportation Engineers
ITN ..... Invitation to Negotiate
ITS ..... Intelligent Transportation System
ITSA ..... Intelligent Transportation Society of America
LPR ..... License Plate Reader
MPO ..... Metropolitan Planning Organizations
NHI ..... National Highway Institute
ORT ..... Open Road Tolling
PCB ..... Professional Capacity Building
PDH ..... Professional Development Hour
PT ..... Public Transportation (Forum)
PTO ..... Public Transit Office
R&D ..... Research and Development
RAPTS ..... Resource for Advanced Public Transportation Systems
RD&T ..... Research, Development, and Testing
RFP ..... Request for Proposal
RITE ..... Research, Integration, Training, and Education (Forum)
ROO ..... Regional Operating Organization
RTE ..... Florida's Turnpike Enterprise
RTMC ..... Regional Transportation Management Center
RWIS ..... Road Weather Information System
SAFETEA ..... *Safe, Accountable, Flexible and Efficient Transportation Equity Act of 2003*
SR ..... State Road
SUL ..... Special-use Lane
TDM ..... Transportation Demand Management
TEOO ..... Traffic Engineering and Operations Office
TOC ..... Traffic Operations Center
TSP ..... Traffic Signal Priority
USCG ..... United States Coast Guard
USDOD ..... United States Department of Defense
USDOT ..... United States Department of Transportation
VDOT ..... Virginia Department of Transportation

1. Purpose

The purpose of this document is to present the findings of the technical memorandums[1] referenced herein and developed to explore new intelligent transportation system (ITS) trends, technologies, and initiatives at the state and national level. Because of their impact on the future of ITS, these topics will have bearing on the Florida Department of Transportation's (FDOT) effort to fulfill the vision, goals, and objectives identified in *Florida's Intelligent Transportation Systems Strategic Plan*, referred to herein as the *ITS Strategic Plan.*

The primary purpose of the *ITS Strategic Plan* was to present a 20-year vision for ITS in Florida and to recommend strategies to achieve this vision. The original document included four main ITS goals, which were consistent with the mission and goals of the FDOT's *2020 Florida Transportation Plan* (*FTP*). These four ITS goals were:

- Safe transportation for residents, visitors, and commerce;
- Protection of the public's investment in transportation;
- A statewide, interconnected transportation system that enhances Florida's economic competitiveness; and
- Travel choices to ensure mobility, sustain the quality of the environment, preserve community values, and reduce energy consumption.

First adopted by the FDOT in 1999, the *ITS Strategic Plan* was designed to guide the FDOT, Florida's metropolitan planning organizations (MPOs), and local governments in the planning, development, and deployment of integrated, multimodal ITS services. Although the vision and goals for ITS have not changed significantly since then, the recommended strategies for accomplishing this vision have. These strategies and their supporting documentation form the basis for the update of the *ITS Strategic Plan.*

[1] Refer to the ITS General Consultant's project Web site to review all supporting update documentation. Copies of these issue papers and other pertinent information are available online at http://floridaits.com/Strategic_Plan.htm.

2. Background

The documents summarized in this *Technical Memorandum* were developed based on the results of the ITS Section's research on the latest state and national trends, technologies, and initiatives, and the subsequent determinations regarding the feasibility of implementing them in Florida's ITS Program during the next three years. These particular topics were examined for several different reasons. First, they were not recognized in the original *ITS Strategic Plan* and have since gained statewide or national importance as potential ITS deployment areas. Some of these initiatives serve to implement new state or national policies. Others were considered because they required a greater level of detailed review before being developed as future ITS projects.

Each of the initiatives was explored fully in its own individual document, including the latest research and the implications for Florida's ITS vision and strategies. Where technology issues are addressed, the documents describe the advancements that have taken place and how such technology could be applied to solving transportation problems or enhancing an ITS function. Other documents address policy or program topics, and offer guidance on how the FDOT can best implement the initiatives.

3. Homeland Security

With the establishment of the United States Department of Homeland Security (DHS) and the signing of the *Homeland Security Act of 2002*,[2] one emphasis of national transportation programs is to secure the country's critical infrastructures. *Technical Memorandum No. 3.1*, *Homeland Security*, identifies ITS applications that may provide security improvements for Florida's critical infrastructures, and reviews existing ITS-related homeland security efforts in Florida. It also discusses funding opportunities that enhance and support homeland security for the planning, deployment, and operation of ITS. The recommendations are consistent with the *National ITS Program Plan's Homeland Security and ITS Supplement*[3] and include recommended security guidelines developed as part of the *Regional Transportation Management Center (RTMC) Security White Paper*.[4]

Five broad areas are identified for ITS homeland security application: preparedness, prevention, protection, response, and recovery. In many regards, Florida is leading the nation in its approach to each of these five areas by virtue of the security component of the *i*Florida Model Deployment Project, which is taking place in the Orlando area.[5]

The Florida Department of Law Enforcement (FDLE) is the lead agency for homeland security in Florida. The FDOT has established lines of communication with the FDLE and works closely with that agency on homeland security matters of common interest. Still, the FDOT's participation in security operations may be limited by legal and budgetary considerations.

In terms of funding sources, additional research is needed to determine whether any new programs are available under the *Safe, Accountable, Flexible and Efficient Transportation Equity Act* (*SAFETEA*) *of 2003*, the six-year federal legislation that authorizes $247.4 billion in transportation expenditures through fiscal year (FY) 2009. Other funding may be available through the DHS and its constituent administrations. To date, much of this funding has been directed toward first responders, aviation, and ports.

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[2] United States Department of Transportation, *Homeland Security Act of 2002,* PUB.L.NO. 107-296, 116 STAT. 2135 (2002).

[3] Intelligent Transportation Society of America, *Homeland Security and ITS – Using Intelligent Transportation Systems to Improve and Support Homeland Security – Supplement to the National ITS Program Plan: A Ten-Year Vision* (September 2002). Available online at http://www.itsa.org/research.html.

[4] Jasper, Keith (PBS&J), *White Paper: Regional Transportation Management Center (RTMC) Security, Version 3* (June 2003). FDOT Contract No. C-7772.

[5] More information regarding the FDOT's *i*Florida Surface Transportation Security and Reliability Information System Model Deployment Project is available online at http://www.iflorida.net/.

The FDOT, like most state departments of transportation, collects a significant volume of real-time information, such as video, vehicle sensor data, traffic counts, and probe information. Generally speaking, this information is not archived. In part, this is to avoid the workload and potential legal implications of third parties seeking access to this information. However, the potential value of such information to law enforcement and security agencies in detecting suspicious behavior is enormous. Consequently, serious consideration should be given to affording legal protection for information archival, perhaps in locations adjacent to sensitive facilities or critical infrastructures.

Whether the transportation system is the target of an attack or the means by which an attack is carried out, it will likely be the same means for conducting evacuations and delivering logistical responses. Most case study analyses following the September 11, 2001, attacks identified communication as an area needing improvement. Since then, improvements in communication have been made both nationally and in Florida. It is an area in which the FDOT and its operational components have much to offer and, consequently, underscores the FDOT's need to be a major player in the homeland security arena. An integral part of this involvement is the need for interagency discussions, security simulations, and real exercises, as well as an ongoing training program for key staff. Not only will this ensure that the FDOT is ready to respond, it will serve as a valuable outreach to nontraditional partners in better understanding the FDOT's resources and capabilities.

The transportation system as a whole includes land, sea, and air components. Each component has its own vulnerabilities and associated threats. In addition, the movement of goods and people frequently occurs in a series of stages involving several modes. This provides multiple opportunities for terrorists to strike at a particular group or commodity, and creates additional targets in the form of intermodal facilities and connectors. From an FDOT perspective, this has several important implications. For example, while a container ship arriving from an international port falls under another agency's jurisdiction, a container from the vessel, when transferred to truck or train, will be of interest to the FDOT if it is attacked or if it contains weapons. This underscores the need for interagency coordination and intelligence sharing in the tracking of sensitive loads throughout the supply chain, in ensuring that coordinated actions will prevent attacks, and in responding to attacks should they occur.

Similarly, the functional interfaces between modes may represent avoidable weaknesses in the operational management of the transportation system, particularly between transportation partners that are not traditionally interoperable. For example, a mass evacuation of trucks from a seaport or of passengers from an airport, or a security incident that results in the temporary closure of an airport or seaport, may require the advance planning of the FDOT's major and immediate operational management personnel. Once again, there is no certainty that any such response will coincide with the operating hours of the FDOT's responding centers, potentially resulting in suboptimal resource availability.

An additional consideration is that many airports and seaports now rely on ITS technologies for security and traffic management functions. Florida leads the nation in the application of security measures at deep-sea ports. While the primary motivation for these measures was initially focused on criminal activity within seaports, their impact has nonetheless resulted in an increased use of ITS technologies in port security operations. Considerable potential exists for port authorities to "reinvent the wheel" when it comes to ITS architectures, and many opportunities for interoperability and resource sharing between these agencies and the FDOT could be overlooked.

Much of the nation's focus since September 11 has been on the protection of critical infrastructures. Within transportation, the major emphasis continues to be on airports and air travel. At a national level, seaports are seen as the next priority, particularly the possible ease of entry of undesirable people and weapons. International borders have also witnessed a general tightening of entry requirements for both people and goods. Florida, like other states, has its own critical infrastructure in the form of bridges, tunnels, and traffic operation centers (TOCs). Quite apart from the immediate injury and loss of life that would potentially follow an attack on a critical infrastructure, the loss of such an infrastructure for an extended period of time will cause an ongoing disruption that can have an equally devastating impact on Florida's economy and mobility. This is particularly true in situations where the loss of a bridge interrupts waterborne traffic, as well as vehicular traffic. Given the economic importance of Florida's tourism industry and the contribution of seaports to local, regional, and national commerce, the FDOT's most critical infrastructure must be protected for broader reasons than the management of peak commuter flows. Once again, this highlights a need for stronger relationships with nontraditional partners, such as port authorities, the United States Coast Guard (USCG), and United States Customs and Border Protection (CBP).

Regional transportation management centers are the brains of Florida's highway network, capable of multiple functions for managing day-to-day operations and emergencies. The FDOT's *RTMC Security White Paper*, referenced previously, identified the characteristics of different types of attacks, both cyber and physical. The *White Paper* recommended a four-phase action plan that focuses primarily on the first of the five areas detailed in *Section 2* for the application of ITS to homeland security, with the objective of improving preparedness.

The four phases outlined in the action plan include research; vulnerability and threat assessments; recovery and business continuity plans; and implementation activities. The potential role of RTMCs in responding to an attack is enormous, as was witnessed by the command-and-control role the Virginia Department of Transportation's (VDOT) Smart Traffic Center played in the minutes, hours, and days following the September 11 attack on the Pentagon. Protecting these valuable assets in Florida is clearly an important priority.

The Federal Highway Administration (FHWA) public safety and security program is taking many initiatives to enhance the role of transportation agencies in homeland security. Florida is already a leader in the implementation of some of these initiatives, as evident with the *i*Florida Model Deployment Project. The FHWA's objectives, such as fostering partners, improving interagency communications, and coordinating with the United States Department of Defense (USDOD), certainly command Florida's attention. Current activities include bridge security; a reduction in telecommunication vulnerabilities; cargo security; and the integration of voice, data, and video demonstrations.

The *Homeland Security Technical Memorandum* reviews the status of various transportation security initiatives underway in Florida and nationally. Through the *i*Florida project, Florida is already at the leading edge of several initiatives of national significance and lessons learned during the coming three years will benefit similar applications in Florida.

Subject to available funding, it is highly recommended that the FDOT adopt the four-phase action plan detailed in the *RTMC Security White Paper*, but expand it to include the broader range of topics noted above. This will enhance the FDOT's preparedness in the event of a homeland security emergency. In addition, lessons learned from the *i*Florida project should form the basis for further development of a statewide approach to homeland security, with ITS services and technologies providing a vital element in the effort to meet these critical safety and security objectives.

4. Regional Operating Organizations

Effective operation of transportation systems requires functional, organizational, and interjurisdictional coordination and cooperation. With many of today's transportation challenges being regional in nature, solutions to various critical issues involving incident and event management, traveler information, and evacuation management lie in the creation of a partnership among Florida's operating agencies to address these regional concerns.

These types of partnerships, sometimes referred to as regional operating organizations (ROOs), have been created nationally, as well as in Florida. ROOs provide a regional, institutional, and organizational framework for the management and operation of ITS. This framework not only addresses transportation challenges, but provides a mechanism to facilitate interagency cooperation through coordinated solutions. In Florida, the concept of ROOs has emerged as plans for statewide ITS deployments have been developed. Districts 2, 4, and 5 have already implemented successful ROOs. The Districts' ROOs are discussed in *Technical Memorandum No. 3.2*, which was prepared as part of the 2003 update of the *ITS Strategic Plan*.

Metropolitan planning organizations were originally expected to play a major part in ITS deployments because of their existing role and experience in bringing various jurisdictions together for planning purposes. In early 2000, it became evident that the focus of many MPOs did not include transportation operations. As a result, informal organizations began to take shape, later evolving into ROOs. Typically, there are several common factors driving the establishment of ROOs:

- Recognition of a critical regional need;
- Meeting the need only through interagency cooperation;
- Visionary and influential leadership; and
- Availability of funding.

Key benefits of ROOs include the ability to bring together transportation, public safety, and emergency management operators to provide more effective, integrated management of incidents, disasters, and emergency evacuations. ROOs aid in the establishment of new sources for transportation funding, and in the regional control of major roadway and transit assets. Through multiagency coordination and real-time information dissemination, construction and incident-related delays are being reduced.

ROOs enable agencies to share transportation data and software resources. Public agencies and private partners can combine resources to provide quality public and personalized transportation information services. For example, transit services can be improved through the implementation of a common "smart card" fare collection system across multiple transit operators.

A ROO can also become the focal point for addressing the integration and interoperability concerns regarding regional ITS services. A ROO can recommend the adoption of national ITS standards for the regional provision of traveler, incident/event, and toll data. *Florida's ITS Strategic Plan* provides MPOs with guidance in the planning, programming, and implementation of integrated multimodal ITS at the statewide, regional, or local level as appropriate. Although MPOs are provided ITS guidance, their legislated mission is transportation planning, policy, and program development, while a ROO's focus is on transportation operations. The MPOs have a key role in ROO partnerships because their support is needed to secure federal funding, and because they may be helpful in the ITS Section's work to maintain and update regional ITS architectures.

Florida's *Draft Rule 940 Procedures*[6] suggest that the MPO role regarding ITS remain focused on the architecture, planning, funding, and systems monitoring of ITS, but also suggest that the operational oversight of regional ITS be conducted through the development of ROOs.

The FDOT should take the leadership role in fostering the development of ROOs. It is recommended that the FDOT develop a statewide policy for the establishment of interjurisdictional and multimodal partnerships within a region. The goal would be to have each region's transportation system managed in a seamless, integrated fashion to optimize traveler satisfaction and system performance.

In addition, the FDOT should review national operational and organizational trends, and develop guidelines for the establishment of ROOs. It should coordinate with the Districts to identify its own role in defining ROO boundaries for statewide consistency. Other recommendations are as follows:

- The FDOT should determine the needs, required resources, and level of funding necessary to support this new initiative.

- Each FDOT District, in consultation with the appropriate local governments, agencies, and MPOs, should develop a plan to manage and maintain transportation operations. The operational plan could be further formalized in a regional concept of operations and utilized as an essential element of the regional architecture. This process will serve to further engage regional planning and operational stakeholders in strategic and tactical operational management functions.

[6] Quigley, Diane E. (PBS&J), *Florida Department of Transportation – Draft Rule 940 Procedures in Florida* (December 2003). FDOT Contract No. C-7772. Available online at http://floridaits.com/rule_940_implementation.htm.

- Each District should develop a ROO that will enable them to provide ITS services they plan to deliver over the next five years.
- The FDOT should establish incentives to encourage the agencies responsible for transportation system management and performance to work in a cooperative and integrated manner.
- The FDOT should initiate actions to add appropriate language to the *Florida Statutes* to address the "regionalization" of transportation operations.

5. Research and Development Program

Technical Memorandum No. 3.3, *Recommended Initiatives for an Intelligent Transportation System Research and Development Program*, contains information and recommendations for the formal establishment and definition of a statewide ITS research and development (R&D) program. This document defines the roles and responsibilities for participating agencies; identifies the R&D program objectives; and outlines funding and staffing requirements.

The FDOT has been involved in transportation research since the 1920s. Early research efforts were mainly highway oriented, but recently the FDOT has broadened its research areas, given the rapid development of new technologies, applications, and processes. To meet these ever-growing research demands and needs, the FDOT Research Center was established in 1989 and since then, more than 600 research projects have been initiated. The most recent R&D annual budget is approximately $12 million.[7]

The FDOT submits research need statements for 13 functional areas each year. The Research Policy Committee, which consists of the Research Center Director, State Highway Engineer, State Transportation Planner, and State Public Transportation Administrator, reviews the submittals and selects the finalists. FDOT employees may choose to work with university researchers in developing research funding proposals, but due to funding constraints, the Research Center cannot accept unsolicited funding requests from outside sources. The Assistant Secretary for Transportation Policy approves the final list of projects. Most of the research programmed through the Research Center is conducted by state universities. However, research partnerships are also formed with private consultants, other public agencies within Florida, and even other states, as in the case of national pooled-fund studies.

Since ITS was distinguished as a primary functional area in 2001, newly awarded ITS research has averaged about $500,000 per year. Prior to 2001, ITS projects were typically funded under traffic operations, safety, public transportation, and planning. Currently, there are nine active ITS research projects being contracted through the Research Center, with total funding of just over $1.76 million. This research covers a fairly wide range of areas, such as commercial vehicle operations (CVO), road weather information systems (RWIS), data warehousing, traffic simulation, and airborne traffic surveillance systems (ATSS).

[7] More information regarding the FDOT Research Center is available online at http://www.dot.state.fl.us/research-center.

One thing is clear: ITS research can cross over into and benefit many other functional areas, including Florida's Turnpike Enterprise (FTE) and the FDOT's Maintenance, Environmental Management, Public Transportation, and Safety offices. Given the ITS R&D activities that have taken place in Florida, coupled with national priorities and other state examples, several initiatives are recommended:

- Specific goals and objectives need to be formally established for ITS R&D in Florida. The ITS Section should develop and conduct a statewide survey with assistance from the ITS Florida Advisory Council to obtain input from state, municipal, industry, service operator, and R&D academia stakeholders. Priorities for ITS R&D that this survey establishes can also be used to identify anticipated future ITS training needs.

- Intelligent transportation systems should remain one of the functional research areas of the FDOT, but joint ITS research should be strongly encouraged within other functional areas as specific applications are identified.

- The ITS Section should establish a focused ITS R&D program across multiple functional areas. This program should be guided by the existing ITS Florida Advisory Council, slightly expanded to include ITS Florida™[8] members representing the FDOT Districts on a rotating basis, along with municipal leaders, ITS industry partners, service operators, first responders, and academia. The ITS Florida Advisory Council should convene an annual statewide workshop to report the previous year's research results and identify ITS R&D needs for the coming year. Strong consideration should be given to projects that also address Florida's statewide goals, as well as *National ITS Program Plan*[9] goals.

- The ITS Florida Advisory Council and the FDOT Traffic Engineering and Operations Office (TEOO) should aggressively pursue other sources of funding for ITS R&D, particularly federal grants, joint proposals with other states, and partnerships with the private sector and state universities. An initial goal should be to establish a $3-million-per-year program.

- The ITS Florida Advisory Council should revisit and formally evaluate the feasibility of a state research, development, and testing (RD&T) facility.

[8] ITS Florida is a trademark of the Intelligent Transportation Society of Florida, Inc.

[9] Intelligent Transportation Society of America, *National Intelligent Transportation Systems Program Plan: A Ten-Year Vision* (January 2002). Available online at http://www.itsa.org/research.html.

- The ITS R&D efforts should be coordinated with professional capacity building (PCB) efforts and ITS performance measurement activities. Florida ITS professionals should be challenged to be more innovative and their successful efforts recognized through the ITS Florida annual awards program.

- Florida should actively participate in the ITS America™[10] Research, Integration, Training, and Education (RITE) Forum as a means to share and exchange ideas for improved, more effective, and beneficial ITS R&D.[11] This Forum is expected to provide the best leads for those seeking timely, industry-wide ITS research results.

- The ITS Florida Advisory Council, with assistance from the TEOO, should annually publish and widely disseminate a report on the direct benefits gained from ITS R&D in Florida.

[10] ITS America is a trademark of the Intelligent Transportation Society of America.

[11] More information regarding ITS America's RITE Forum is available online at http://www.itsa.org/new.nsf/SiteMap!OpenPage.

6. Recommended Initiatives for an ITS Professional Capacity Building Program

Technical Memorandum No. 3.4, *Recommended Initiatives for an Intelligent Transportation System Professional Capacity Building Program*, contains information and recommendations that can be used to develop and promote a structured training curriculum for ITS professionals throughout Florida. The document defines participating agency roles and responsibilities, identifies specific training modules, and outlines opportunities for funding assistance and training logistics support.

A pioneer in providing ITS training for Florida's transportation professionals, ITS Florida was one of only three state ITS chapters in the country during the early 1990s that piloted a state-supported ITS training program under the direction of the United States Department of Transportation's (USDOT) Volpe National Transportation Systems Center.[12] During these early years, the FHWA Florida Division Office provided the seed money to start the training program. The FDOT and the University of Florida also assisted significantly.

Over the last several years, the ITS Florida training mission has intensified with the formation of the ITS Florida PCB Committee and a somewhat regular offering of courses. The ITS Florida PCB Committee has followed the national ITS PCB concept developed by the USDOT and FHWA, and a national survey identified areas of professional development needs. In January 2003, the ITS Florida PCB Committee completed the development of a business plan for the PCB program. The plan's basic components identified 15 training modules that were based on the Florida ITS community's needs and FDOT ITS deployment priorities. The 15 modules are:

- General ITS Introduction;
- Procurement and Funding;
- Management and Operations;
- Telecommunications;
- Construction, Engineering, and Inspection (CEI);
- Performance Measures and Evaluation;
- Traffic Engineering Using ITS;
- Maintenance;
- Contract Management;
- Transportation Planning;

[12] More information regarding the USDOT Volpe National Transportation Systems Center is available online at http://www.volpe.dot.gov.

- System Engineering;
- Legal Issues;
- Value and Impacts of ITS;
- Electronic Payment Systems; and
- Traveler Information.

The ITS Florida PCB Committee created module sponsorship opportunities and incentives; outlined a program for training delivery; and developed an operating budget. The proposed training schedule called for three deliveries of each module per year around the state. Sponsorship opportunities were offered at different levels, including program and module sponsorships, and one for the delivery of a single module. If all sponsorships had been picked up, the program would have been capable of generating a modest revenue. The program also incorporated a provision for professional development hours (PDHs) and continuing education units (CEUs).

Unfortunately, sponsorship interest could not be generated. Consequently, the ITS courses now offered are limited in variety because the PCB program has no funding. Atlantic Scientific, Inc., and PBS&J are conducting the only courses being offered. Other providers include the Institute of Transportation Engineers (ITE) and the FHWA's National Highway Institute (NHI). The FDOT has sponsored and conducted several courses, some offered during ITS Working Group meetings.

According to those directly involved with ITS Florida PCB activities to date, program sustainability and growth will require a cooperative effort among all previously participating agencies, including ITS Florida members from academia, and more volunteers from private sector members. The consensus also favors ITS Florida taking the lead in managing and coordinating the PCB program. However, it must be recognized that ITS Florida is *not* an operating agency and, therefore, cannot be the organization responsible for carrying out the program without some source of revenue.

To ensure the sustainability of Florida's ITS PCB program and meet future ITS training demand, the FDOT could assume a leadership role in discussing possible partnerships with other national ITS training organizations, such as the University of Maryland's Consortium for ITS Training and Education (CITE).[13] Other issues revolve around course marketing, training logistics, offering the right course level, and identifying participation incentives. A reasonable training delivery target would be one PCB event every month at a cost of about $10,000 per event. One consideration for this recommendation would be whether the ITS PCB program should be revenue-based.

[13] More information regarding CITE is available online at http://www.citeconsortium.com/index.html.

Given the aforementioned history of Florida PCB events and activities, and the availability of ITS training and continuing educational resources nationally, the following initiatives are recommended for Florida's ITS PCB Program:

- ITS training and education should be viewed as an individual responsibility for continuing professional development. However, the FDOT TEOO should assume the leadership in this area, with guidance from the ITS Florida PCB Committee.

- The TEOO's first action should be to request that the ITS Florida PCB Committee conduct and document a formal assessment of the appropriate training courses for each ITS professional level and to make recommendations for Florida's ITS PCB Program. This should include program funding needs; course marketing; training logistics; course content; incentives for developing and conducting new courses; and specific roles and responsibilities for ITS PCB agency partners. The TEOO and ITS Florida members should use this assessment and its findings to develop and support an ITS PCB business plan. The TEOO should then consider funding for the individual courses.

- The newly reorganized ITS Florida PCB Committee should be fully supported and guided by its membership in the development, coordination, and management of a statewide ITS training and education program that fulfills the specific needs of Florida's ITS professionals. In this regard, the Committee should conduct a statewide survey to identify ITS training and educational needs.

- The business model for a successful statewide ITS training and education program should stimulate PCB program enthusiasm, sustain active participation of instructors and attendees, and encourage innovation in ITS training content and delivery and content. The FDOT should view the ITS PCB Program as a "break-even" activity that recovers the costs incurred for course development and delivery.

- The FHWA Florida Division, the FDOT, and ITS Florida academia should all play a much more visible and active role in program marketing and training logistics, such as furnishing training venues, equipment, and course advertising at no cost.

- Such incentives as free ITS Florida membership should be provided to qualified private and public sector volunteers who take leadership roles in course development or delivery. ITS Florida's academia should fully explore the utilization of the Florida Engineering Education Delivery System (FEEDS) as a training delivery medium. Additionally, project managers of current Florida ITS deployments should be identified and invited to share their experiences.

- The spirit of professional volunteerism that PBS&J and Atlantic Scientific exhibit should be formally recognized and eagerly supported by both public and private sector ITS agencies. Besides encouraging member experts to step forward and be course developers or instructors, ITS Florida should identify and recruit nationally recognized experts as trainers to generate even greater enthusiasm and participation.

- To heighten the priority and distinction of ITS training and education, the ITS Florida Advisory Council, with guidance from the ITS Florida PCB Committee, should evaluate the benefits of an ITS qualification or certification process for Florida ITS professionals. This evaluation should be conducted and the findings presented to the FDOT.

7. Vehicle Probe Studies

In December 2001, an FDOT document was developed entitled *Innovative Traffic Data Collection*.[14] It presented an analysis of various innovative methods used to collect traffic sensor data and the potential applications for these methods in Florida. The main focus of the analysis was the application of various data collection methods for the Florida Intrastate Highway System (FIHS). *Technical Memorandum No. 3.5*, *Vehicle Probe Studies*, represents additional analyses and recommendations regarding that document.

Over the past two years, the FDOT TEOO has conducted research on a number of travel-time data collection techniques, including the use of toll transponders, license plate readers (LPRs), and commercial vehicle transponders as probes. However, with the advent of the Enhanced 911 (E-911) mandate, several new technologies are available that utilize cellular telephones as probes to collect travel-time data. These include global positioning systems (GPS) and other cellular network-based applications. *Technical Memorandum No. 3.5* considers these and other options to determine the feasibility of their application in Florida, and to recommend future strategies for implementation. These core actions will be incorporated in the update of the *ITS Strategic Plan*.

Due to the continually increasing travel demand on Florida's roadway system, traditional infrastructure management programs focusing on roadway expansion are becoming incapable of keeping congestion within tolerable levels. In its place, state, county, and local transportation agencies are being forced to examine alternative techniques for managing and operating existing infrastructures. Among these alternative techniques are advanced traffic management systems (ATMS), advanced traveler information systems (ATIS), and archived data user services (ADUS). However, for these applications to have a noteworthy impact, access to the best available traffic data is required, including both quality and geographic coverage.

Traffic data collection has traditionally been performed by the public agencies responsible for managing traffic flow, responding to incidents, carrying out planning activities, and maintaining roadway surfaces. Technologies traditionally deployed for traffic data collection include inductive loop detectors, closed-circuit television (CCTV) cameras, and other fixed-location surveillance devices. Unfortunately, the high cost of deploying and maintaining this surveillance equipment has precluded most agencies from collecting real-time data on roads other than certain freeway portions and a few important arterials, thereby significantly limiting the equipment's usefulness for operations and management purposes.

[14] Ciccarelli, Armand J. (PBS&J), *Technical Memorandum No. 1 – Innovative Traffic Data Collection: An Analysis of Potential Users in Florida*, *Version 1* (December 2001). FDOT Contract No. C-7772. Available online at http://www.dot.state.fl.us/trafficoperations/its/its_default.htm.

Recently, there has been an increasing interest in the many types of innovative data collection technology that potentially offers the opportunity to quickly and cost-effectively expand data collection coverage and quality. One technological area of particular interest utilizes location information collected from wireless telephone networks that include a large number of handsets combined with computerized street maps to measure the time it takes to travel from one area to another.

To move beyond the research stage, it will be necessary to develop a concept plan for the development and use of travel-time data collection systems in Florida. This concept plan should:

- Establish a vision and purpose for travel-time data collection, including how it will support operations, planning, and traveler information (e.g., 511) applications.
- Determine the facilities for which travel-time data will be collected, the density of coverage, and the required data quality parameters.
- Utilize existing corridor plans the FDOT has developed to assist in selecting the technology used to collect travel-time data along the corridors involved for each facility and determine the communication method to be used to transfer data to the appropriate location(s) for real-time aggregation and analysis. Technology selection should be based on the extent to which the corridor concept is supported, the technology's cost-effectiveness, and the results of the implementation of risk analysis.
- Utilize a project architecture and concept of operations to ensure that the data collected is properly computed, stored, shared, and used. Identify the modifications to the regional architecture and systems that are needed so travel-time data can be incorporated in local operations as desired.

As the technology underlying the "cell-phones-as-probes" data collection concept becomes increasingly mature, the FDOT should consider conducting concept testing with one or more of the vendors that have demonstrated an ability to make their technology work. Any vendor selected should have existing agreements in place with at least one of the larger wireless carriers. As mentioned earlier, this technology has the potential to be highly disruptive in nature, having a significant impact on the way traffic data is collected in the future. Getting involved in the testing of this technology now will make the FDOT one of only a handful of state DOTs taking a leadership role in the development of this field.

8. Recommended Initiatives for Mainstreaming Advanced Public Transportation Systems

Technical Memorandum No. 3.6 contains information and recommendations that can be used to establish and promote a coordinated and comprehensive effort regarding the use of ITS in transit operations. This paper describes a more active role for the ITS Section in supporting the development and deployment of advanced public transportation systems (APTS) in Florida, including a process for integrating the FDOT Public Transit Office (PTO) APTS efforts with ITS Section efforts.

Some efforts have already begun. The ITS Section will help provide engineering services for the Resource for Advanced Public Transportation Systems (RAPTS) program through an agreement with the FDOT PTO. Types of ITS deployments where engineering support may be provided include computer-aided dispatch systems; radio and communication networks; traffic signal priority (TSP) systems; fare and payment systems; and security and surveillance systems.

There are several factors that necessitate the application of ITS in Florida transit operations. The 25 urban transit systems in the state provide 195 million trips annually. These systems are constantly under pressure to increase ridership and reduce costs. Efficient management of limited resources, effective deployment of services, and safety and security of these systems are inherent goals of all transit agencies. Therefore, a number of APTS technologies become very appropriate for consideration and application, including:

- Electronic payment systems;
- Fleet management systems (FMS);
- Advanced traveler information systems;
- Transportation demand management (TDM) systems; and
- Transit safety and security systems.

Based on the current statewide APTS survey of 31 transit systems, which consisted of 25 urban and six rural systems, six systems have fully operational automatic vehicle location (AVL) systems, 10 have electronic fare payment (EFP) systems, and two have fully operational automatic passenger counter (APC) systems.

One of the most comprehensive APTS projects in Florida involves a joint county and state partnership between Broward and Palm Beach counties and FDOT District 4. A detailed master plan for this program identifies projects to improve transit operations by integrating existing components and priorities with future needs. The master plan also addresses the existing and proposed communication system for future APTS compatibility. A password-protected Web site has been established as a means of continuous communication among all project partners.

Given the APTS activities that have taken place in Florida to date, coupled with the perspectives offered by transit experts, and current APTS activities in the Districts and the FDOT PTO, the following initiatives are recommended to mainstream APTS in Florida's ITS Program:

- The FDOT ITS Section should develop and conduct, through each District PTO representative with assistance from the Florida Transit Planning Network (FTPN) as needed, a statewide survey to clearly define statewide APTS needs and priorities. To the greatest extent possible, the ITS Section must prioritize the Florida needs that are aligned with national APTS priorities, such as EFP systems, FMS, TSP, and bus rapid transit (BRT).

- The FDOT should reevaluate all District ITS architectures to clarify APTS components, then begin to specify and prioritize APTS projects. Local and regional APTS projects can best be identified within the anticipated cost feasible plan (CFP) for nonlimited access systems. Each local ITS committee must include transit representation.

- The FDOT must increase awareness of services the RAPTS program offers and enhance RAPTS' APTS planning and project management services with technical engineering expertise. Also, the FDOT should assist RAPTS in organizing and conducting scanning missions, and publishing Florida APTS case studies.

- The FDOT PTO central office staff should expeditiously complete its work on identifying signalized intersections eligible for TSP; review this work thoroughly with District ITS engineers to seek concurrence and programmed funding; and establish a continuous working relationship in ITS between each respective District ITS engineer and PTO manager.

- The ITS Section should encourage and invite regular APTS information exchange opportunities at ITS Working Group meetings, and include APTS activities in individual District progress reports.

- The FDOT should encourage joint APTS procurements, deployments, and evaluations. To assist with this promotion, consideration should be given to adding a full-time PTO staff person in the TEOO's ITS Section. This person should work closely with central and District PTOs.

The RAPTS program and the FTPN should become active participants in the Intelligent Transportation Society of America (ITSA) Public Transportation (PT) Forum, establishing a leadership role in the coordination and integration of APTS development and deployment between state and local governments.

9. Intelligent Transportation System Information Privacy Policy

The collection, analysis, fusion, and dissemination of information is one of the primary roles of ITS. The accurate and timely dissemination of this information creates value for individuals, the traveling public, and those agencies that manage transportation using ITS components. The primacy focus of this information is to improve travelers' safety and security; reduce travel times; and enhance individuals' ability to deal with highway incidents and events. Travel information is collected from many sources, some from the infrastructure and some from vehicles, while other information comes from transactions that involve interaction between an infrastructure and a vehicle, such as electronic toll collection (ETC) transactions. As with all forms of advanced information technologies, the privacy of individuals must be respected at all times.

The purpose of *Technical Memorandum No. 3.7* is to identify and address the key privacy policy issues related to the information collected from ITS components, and to recommend future actions or strategies for ensuring individual privacy while collecting and disseminating data vital to ITS operations in Florida.

There is a direct relationship between privacy laws and privacy policies. Privacy laws govern an activity, while privacy policies dictate a plan of action. Current privacy law is a patchwork of federal and state statutes, as well as federal and state judicial opinions. The "right" to privacy as a matter of law in the context of transportation on public roads and other facilities is limited.

Florida government's privacy policy is clear concerning why information is collected, how it is used, the policies that control public access to the information, and whether it is disseminated to other entities. In contrast, what are not clear are Florida laws and policies that address the appropriate level of privacy protection for individuals whose information is collected from ITS components. This situation may be remedied by creating a strategic plan to address an ITS right-to-privacy policy, as well as developing appropriate legislation and structured outreach programs to improve public awareness about the purpose and function of ITS and the data these systems collect.

ITS technologies utilize numerous field devices for traffic surveillance and vehicle tracking. These devices, their associated technologies, and the information they collect generally raise concerns regarding the motoring public's privacy. Equally great are the concerns associated with CCTV, ETC, and photo enforcement, all of which have the potential for misuse by law enforcement and transportation officials.

If ITS deployments for information collection and dissemination are to continue, operating agencies must directly confront the privacy issue, which is likely to become a greater problem as the installation of these systems becomes more widespread. A strong consideration should be given to the development of well-publicized ITS information privacy policies and standards. For example, privacy standards should require that all probe-based technologies (e.g., cellular geolocation, toll tag tracking, instrumented vehicles, etc.) be designed in a manner that ensures the absolute privacy of the vehicles and passengers being tracked. Standards should also ensure that raw data allowing the "recreation" of an individual vehicle's route not be archived.

In most cases, individuals are unaware that they are "on camera," or that the images obtained from CCTV traffic surveillance are neither recorded nor used for law enforcement purposes. Nonetheless, there is a rising concern among the general public that individual privacy is being violated by the increasing use of surveillance technology. To address this issue, the FDOT policy should be to recommend against the archiving of video.

In the long run, public acceptance and use of ITS services will depend on public confidence that the technology is not predatory or harmful. Respecting privacy fosters public support of ITS and adds to the consumer appeal of ITS services. The following recommendations are provided for the implementation of ITS information privacy policies and standards in Florida. The FDOT should:

- Develop a strategic ITS information privacy plan and standards that formally address ITS information privacy policy, legislation, and a structured outreach approach.
- Develop a cradle-to-grave policy for ITS data that specifically addresses data collection, analysis, access, security, archival, and retention duration requirements.
- Ensure that the ITS information privacy policy is legally sound and consumer friendly. One of the greatest obstacles to understanding legislation and policies is the ambiguous way in which these are written. To that end, some agencies provide summaries of the legalese that allow consumers to get a sense of what those collecting data and images do with that information. If they need more details, consumers can access the full policy.
- Write standard privacy and security-related templates for insertion in requests for proposals (RFPs) and invitations to negotiate (ITNs) to ensure consistency across Florida.
- Develop a structured public outreach program to inform the public about the uses of ITS devices on roadways and the actions being taken to protect individual privacy. Outreach programs should explain the safeguards against privacy violations and should include procedures that ensure the safeguards are working.

- Determine performance measures to gauge whether the public outreach program implemented is having the desired effect.

- Prepare a formal policy on the use of all ITS components that may be viewed as intrusive, including CCTV cameras and the *i*Florida variable speed limit signs. The policy should be distributed to and implemented by the FDOT Districts.

- Develop a standardized, comprehensive agreement among ITS agencies regarding the use of information obtained through ITS components.

- Consider requiring the development of a privacy impact statement, similar to the environmental impact statements already required under federal law, before an ITS program is implemented.

10. Automated Vehicle Monitoring and Enforcement

One of the primary roles of ITS is to utilize appropriate technology to help reduce traffic crashes and improve adherence to traffic laws. The use of photographic and electronic technologies as substitutes for traditional traffic law enforcement has become well publicized both inside and outside the United States. The goal of automated enforcement is to apply the technology in areas that have high crash sites and in other high-risk locations. It is also employed in situations where traffic law enforcement personnel cannot be utilized due to other police activities or where inherent onsite safety problems make traditional enforcement difficult.

Most automated enforcement laws apply to red light violations; however, some laws authorize enforcement for speed, and a few authorize enforcement for any offense for which automated detection is suitable. Automated enforcement laws vary significantly from state to state; some authorize enforcement statewide, whereas others permit its use only in specified communities. *Technical Memorandum No. 3.8*, completed during the 2003 update of the *ITS Strategic Plan,* identifies key automated vehicle monitoring and enforcement issues, and the legal and statutory impediments to the implementation of these strategies.

The use of automated enforcement technology can help communities enforce traffic safety laws by photographing the vehicles of drivers who intentionally enter an intersection after the signal has turned red, who illegally cross a railroad gate, speed, or who otherwise violate traffic laws. Specific legislation for automated enforcement has been passed in 15 states; 36 states[15] have chosen not to adopt any automated enforcement measures. Of the 15 states with legislation, two will repeal their laws over the next two years. Bills in Florida during the 2004 legislative session died in committee.

The goal and performance metric of automated enforcement technology is too often measured merely in violations detected. Current FHWA research, however, is focusing on the utilization of automated enforcement technology to decrease the occurrence and severity of crashes. Much of the data being collected references violations and the estimated number of crashes that automated enforcement technology has prevented. What appears to be missing is substantive data on the number of collisions at critical intersections that have been prevented due to the presence of automated enforcement technology. Ideally, data will need to be gathered at key intersections for periods before and after installations. Therefore, one may reasonably assume that the performance metric for automated enforcement eventually will be measured in collision reductions. The FDOT should consider using automated enforcement technology from a safety perspective, as opposed to a violation perspective. Initial actions for the FDOT ITS Program are provided based on this assumption.

[15] The totals include the District of Columbia.

Successful implementation of automated enforcement will require a significant outreach to the traveling public. Motorists are fully aware that there are critical intersections in Florida that have an excessive number of collisions. The addition of automated enforcement using ITS technologies at these intersections can provide the public with the safety and accountability desired by issuing citations to vehicle owners responsible for violations.

What the traveling public does not fully understand is the role of red light cameras and photo radar as safety devices. More often than not, the public sees these devices as surreptitious police tools able to capture and fine speeders and red light runners, who are unable to confront their electronic "accusers." The goal is to refocus the public's perception of these technologies from generators of citations and revenue to effective methods of reducing needless injuries and deaths caused by reckless drivers.

The strategy of how best to legislate and implement effective automated enforcement must be driven by a successful outreach program that focuses on "safety" versus "violations." It is generally accepted that safety is a value worthy of concern in planning ITS services because, in the long run, public acceptance of ITS' automated enforcement capabilities will depend largely on public confidence.

Technical Memorandum No. 3.8 reviews existing ITS automated enforcement legislation and makes recommendations for further FDOT action. The remainder of the document identifies key actions for the ITS Section to take regarding the implementation of automated traffic enforcement policies and standards in Florida. The FDOT should:

- Lead the research and development of a strategic ITS automated enforcement plan and the required standards. This strategic plan will specifically address the identification of best practices and major tasks to be performed.

- Determine the process for implementing automated enforcement in Florida. The two major alternatives are: (1) to develop automated enforcement legislation first; or (2) to include a strong public outreach program in the strategic plan based on safety concerns, followed by the establishment of demonstration sites at key intersections, the evaluation of the data, sharing the data with the public, and development of automated enforcement legislation last.

- Ensure that a major section in this strategic plan addresses the process of public outreach. A structured, effective outreach program will educate the public about automated enforcement policies, the methods used, and information on periodic evaluations of the technology's impact on compliance, public awareness, and safety.

- Determine performance measures to ensure that the public outreach program implemented is having the desired effect.

- Focus on applying the technology only at locations with high crash rates due to traffic violations and where it is impractical or unsafe to use traditional enforcement methods, or where traditional enforcement methods have failed to deter high crash rates.

- Consider involving a private partner for the automated enforcement public outreach program, such as the American Automobile Association (AAA), whose corporate headquarters are in Lake Mary, Florida. The AAA's Foundation for Traffic Safety[16] is a national leader in promoting safer streets and highways.

- Expand the FDOT's working relationship with the FHWA to develop an outreach and model deployment of automated enforcement technology. The goal of the deployment should be to reduce collisions at the most dangerous intersections in Florida.

- Develop a formal policy and public outreach plan for using automated enforcement technology to reduce collisions in a county or municipality. This formal policy should include the proper legal wording so that an automated enforcement pilot project can be presented to a county or a municipality for its approval and implementation.

- Withhold the introduction of any new or modified automated enforcement legislation until the technology has been proven to reduce the number of needless injuries and deaths caused by reckless drivers.

[16] More information regarding the AAA Foundation for Traffic Safety is available online at http://www.aaafoundation.org/home.

11. Value Pricing

Technical Memorandum No. 3.9, *Value Pricing*, researches national and statewide efforts in value pricing, and weighs the feasibility of pursuing or implementing these efforts as part of the ITS Program over the next three years. Several areas around the country, including Florida, have deployed or are considering the deployment of value-pricing programs, particularly in the area of dynamic ETC. Several local jurisdictions in Florida are examining the benefits of value-pricing strategies. Of particular interest is Lee County, where variable pricing has been deployed on two toll bridges. This area of ITS will be investigated further to determine its potential short- and long-term applications in Florida, and to recommend actions or strategies that the FDOT can implement over the next several years.

Value pricing, also known as congestion pricing or peak-period pricing, entails road use fees or tolls that vary according to the level of congestion. These fees are typically assessed electronically to eliminate delays associated with manual toll collection facilities. This concept of assessing relatively higher prices for travel during peak periods is the same as that used in many other sectors of the travel industry to respond to peak-use demands. Airlines offer off-peak discounts and hotel rooms cost more during peak tourist seasons. Road use charges that vary with the congestion level provide incentives for motorists to shift some trips to off-peak times, to less congested routes, to alternative modes, or to combine lower-valued trips with other trips. A shift in a relatively small proportion of peak-period trips can lead to substantial reductions in overall congestion. And, even though congestion charges create incentives for more efficient use of existing capacity, they also provide improved indicators of the potential need for future capacity expansion while generating revenues that can be used to further enhance urban mobility.

A number of value-pricing projects have been launched in the United States in recent years. The private sector led the way in 1995 by constructing new tolled express lanes in the median of State Route (SR) 91 in Orange County, California. Tolls there vary by time of day and congestion level to maintain an uncongested alternative along one of the most heavily traveled commuter routes in the country.

Under the Value Pricing Pilot Program and its predecessor, the Congestion Pricing Pilot Program established by the *Intermodal Surface Transportation Efficiency Act* (*ISTEA*) *of 1991*, value-pricing projects have been launched in San Diego, California; Houston, Texas; and Lee County, Florida. The California and Texas projects involve tolling on high-occupancy vehicle (HOV) lanes to make better use of available capacity. In San Diego, drivers of single occupant vehicles are allowed to use the HOV lanes on Interstate 15 by paying a toll that varies directly with the congestion level. In Houston, drivers of vehicles with two occupants can pay a fixed toll during rush hour to use an HOV lane on Interstate 10 that is otherwise restricted to vehicles with three or more occupants. This type of initiative has become known as high-occupancy toll (HOT), with shared facilities referred to as HOT lanes.

The Lee County project involves the use of peak and off-peak toll variations to provide motorists an incentive to shift travel out of the most heavily traveled times.

Other cities across the United States are evaluating the feasibility of value pricing to improve traffic flows and to enhance mobility. Several of these are expected to move toward implementation in the near future. Internationally, pricing projects have been implemented recently on a new beltway in Toronto, Canada; in three cities in Norway; on intercity toll roads in France; and in the central area of Singapore. In the United Kingdom, several cities are considering congestion-based projects similar to London's project, which has been in operation since 2003. The London project has successfully reduced the number of vehicle trips into central London, with fees raised by congestion charges used to fund additional bus service as an alternative mode of travel.

The London project is an example of open road tolling (ORT) in which on-street cash toll collection is replaced with the use of off-street tolling methods. ORT is a practice generating considerable interest in the United States due to growing travel demands; traffic congestion at toll plazas; and the physical, environmental, and cost issues of increasing capacity at toll plazas. Today's sophisticated electronic payment systems, such as ***SunPass***®[17] in Florida, provide a technology option that increases throughput without increasing toll lanes, provided that the customer service aspects of ORT (such as considering the needs of occasional users whose vehicles do not have electronic tags or transponders) are addressed. In London, ORT facilitates offering discounts to residents within the central city. Clearly, the flexibility for value pricing strategies in an ORT environment is immense, given the potentially large database of market information that can be assembled on program users.

In summary, typical objectives for value pricing include:

- Reducing congestion for those willing to pay;
- Achieving better use of special-use lanes (SULs);
- Raising revenues for transportation;
- Encouraging modal shifts and ride sharing;
- Encouraging fewer and shorter trips, and shifting trips out of peak periods; and
- Achieving reductions in overall congestion.

[17] ***SunPass*** is a registered trademark of the Florida Department of Transportation.

Given the relative newness of value pricing in the United States, and the potential challenges that its advocates face, the road map for moving forward over the coming years is emerging slowly. However, it is clear that the growth in traffic levels will continue, creating greater congestion overall and on key facilities in particular. Consequently, value pricing should be closely monitored by the FDOT in terms of legal, policy, technical design, technology, and public acceptance considerations. Specifically, the FDOT should pursue the following two initiatives related to value pricing:

- Review value pricing's feasibility across the state in terms of the traffic management benefits that may be derived under a variety of circumstances, such as estuarial river crossings, HOT lanes in metropolitan areas, and other key facilities. Such a review should investigate potential legal and technical issues related to implementation, as well as law enforcement operational issues related to violations. Much of the source material for this review should probably be derived from previous and ongoing initiatives, both in Florida and across the nation.

- Establish a multiagency task force to develop more detailed value-pricing concepts; highlight potential statewide policy and legislative requirements; and seek input from legislators, local agencies, organizations, and the traveling public. While the previous recommendation addresses the need to gather objective evidence on value pricing, the development of specific value-pricing initiatives will probably require a consistent approach across the state, and the need to engage such potential partners as toll agencies and the Florida Highway Patrol (FHP). If, as a result of the feasibility review, the FDOT believes there may be use for value pricing, it should establish a multiagency task force to develop more detailed concepts that can guide value-pricing projects in Florida.

12. System Monitoring and Performance Measures

Technical Memorandum No. 3.10, also developed during the 2003 update of the *ITS Strategic Plan*, reviews national efforts in developing performance measures. It analyzes the performance measures identified in the *Ten-Year ITS Cost Feasible Plan* (*CFP*)[18] and recommends actions for the design and implementation of a system monitoring program to measure and assess the performance of ITS deployments. Aside from reviewing Florida's experiences, the document summarizes initiatives documented by the FHWA and other nationally relevant entities concerning operational performance measures.

Transportation experts in Florida are seeking new ways to measure transportation system performance for the purpose of identifying and documenting the best alternatives for enhancing services to the public. Ideally, such performance measures should comprehensively describe the level of ease with which people and goods move throughout the system.

This was the objective of the Mobility Monitoring Program sponsored by the FHWA.[19] The agency sought to analyze and report mobility and reliability trends in urban areas using archived operational data; and to provide incentives and technical assistance for the implementation of data archiving systems to support performance monitoring applications.

The Mobility Monitoring Program highlighted the use of various measurements, such as the Travel Time Index, a ratio of travel conditions in the peak period to a target or acceptable travel condition. The Travel Time Index indicates how much longer a trip will take during a peak period on a given roadway. Another measure, the Percent of Congested Travel, is a system measure that quantifies the extent of congestion. A free-flow speed is used as a congestion "benchmark" and any period of travel on a road section that is less than the free-flow speed is considered congested.

While the FHWA concluded that these important mobility performance measures described an average level of congestion and mobility, other studies and surveys have demonstrated that travelers value not only the time it usually takes to complete a trip, but also the reliability in travel times. For example, many commuters will plan their departure times based on an assumed travel time that is greater than the average to account for this unreliability. Consequently, researchers contend that it is more appropriate to track several different types of reliability performance measurements, as well as the mobility measures described above.

[18] Florida Department of Transportation, *Ten-Year ITS Cost Feasible Plan* (May 2004). FDOT Contract No. C-7772. Available online at http://www.dot.state.fl.us/trafficoperations/its/its_default.htm.

[19] The FHWA Mobility Monitoring Program is a cooperative study by the Texas Transportation Institute and Cambridge Systematics, Inc. More information is available online at http://mobility.tamu.edu/mmp.

An effective performance monitoring and measurement program will play a crucial role in the FDOT's achievement of its goals for the statewide ITS Program. Over time, performance measures will become the fundamental tools used to develop policies and allocate limited resources. The FDOT has previously identified a set of performance measures in the *CFP* that were based primarily on objectives identified in the *ITS Strategic Plan* and the FDOT's Mobility Performance Measures Program.[20] In addition, the Florida Transportation Commission (FTC) has asked the ITS Florida Advisory Committee to identify performance measures that assess the effectiveness and positive impacts that various ITS technologies are having on Florida's transportation system.

Efforts are underway to develop ITS performance measures for implementation in Florida. The following recommendations identify actions that can be taken to support performance measure design, implementation, and usage:

- Achieve consensus on performance measures to be implemented. A set of proposed performance measures was developed as part of the FDOT's *ITS CFP*. The FTC is also considering another set of ITS performance measures for use in Florida. No matter which measures are implemented, they should subscribe to the following criteria:
    - The level of success achieved pursuing the goals and objectives outlined in *Florida's ITS Strategic Plan* should be evaluated;
    - Metrics used should be based on a consensus of opinion; failure to do so may result in lack of use;
    - A baseline must be established against which future results are compared;
    - Implementation of any plan for ITS performance monitoring and measurement must be systematically organized so as to be consistently repeatable;
    - Implemented measures should not be considered final; their development should be an ongoing process; and
    - Implemented measures must utilize reliable, equivalent data sources.

[20] More information regarding the FDOT Mobility Performance Measures Program is available online at http://www.dot.state.fl.us/planning/statistics/mobilitymeasures.

- Seek to enlarge roadway sensor data collection coverage. To effectively utilize adopted performance measures for evaluating the statewide transportation network, it is first necessary to have access to sufficient data concerning roadway operations. Although the FDOT and other public agencies are beginning to make inroads pertaining to roadway data collection capability, a more coordinated effort is needed to ensure that sufficient data is available to support the development of a truly comprehensive picture of systemwide performance. In particular, enhancements in data collection capability will be required along both the FIHS and major arterial roads. To achieve this goal, the FDOT should work with its partners to:

  - Assess current data collection capabilities in Florida;
  - Determine where data collection capability is insufficient; and
  - Develop a plan for deploying supplemental infrastructure to fill the gaps; and
  - Standardize the data types collected by such a supplemental infrastructure to the maximum extent possible to establish the groundwork for objectively comparing roadway performance throughout Florida.

- Ensure that data collected from roadway sensors is archived and readily available for analysis. Much of the data collection infrastructure now deployed is not connected to archiving systems, or is not available in formats that can be readily utilized by a wide range of users. Consequently, the FDOT should work with other public stakeholders to expand the archiving of field sensor data, keeping in mind not only the need for storage, but also the need to make such data available in a standardized format. Such standardization will help promote the storage and analysis of data by a wider range of interested parties in both the public and private sectors.

- Improve the maintenance and calibration of data collection equipment and standardize the processes for managing "bad data." It is common knowledge that much traditional roadway-based data collection infrastructure suffers from significant service outages during which no data is collected or only bad data is generated. Some of the missing or inaccurate data are easy to detect and correct; others less so. In developing performance monitoring and measurement metrics, some consideration should be given to standardizing both the processes through which raw or fused data for performance evaluation is validated (i.e., inspected), as well as what actions are to be taken to manage such data quality problems. This effort should include the development of data quality guidelines to support data analysis.

13. Systems Integration, Tracking, and Reporting

The USDOT has set a goal to deploy integrated ITS infrastructures in 78 of the nation's largest metropolitan areas by the end of 2005. Specifically, the goal is for approximately two-thirds of these areas to achieve a high level of integration, and the remaining one-third to achieve at least a medium level of integration. The USDOT defines "ITS integration" as "the bridging of technical or institutional systems across system or jurisdictional boundaries." Integration may range from a simple agreement to share information between two adjacent agencies to the deployment of linked, interoperable systems across a multistate region. The rationale for ITS integration is that systems can be more effective when they operate in concert than when they operate separately.

Integration offers the potential for a synergistic boost in overall performance and effectiveness. For example, the process of coordinating traffic signals across jurisdictional boundaries can be automated by integrating the systems. Automation may save time for users and save money for public agencies. It may also improve traffic management during incidents, reducing secondary crashes and the costs associated with delays. Overall, ITS integration offers benefits to both the traveling public and participating agencies. In the same way that most travelers do not recognize jurisdictional boundaries, an integrated transportation system takes a network view of travel conditions in which different jurisdictions share infrastructure, information, and control. Such an integrated system can make full use of the interoperability between components to help agencies achieve greater safety and efficiency goals, and to achieve economies of scale.

Technical Memorandum No. 3.11, completed as part of this update of the *ITS Strategic Plan*, proposes a long-term strategy for integrating FIHS ITS deployments with local ITS services so they function as a seamless system. It identifies issues and barriers to ITS integration in Florida, and determines the impact of ROOs on integration. Additionally, the various ITS integration levels are discussed, along with recommended actions for the development of an integration tracking and reporting process to fulfill the national goal for integration of ITS. The FDOT's current FIHS deployment tracking system is being reviewed to determine if this application can be expanded to track existing and proposed ITS projects, and to measure integration at various jurisdictional levels beyond the FIHS, including tolling authorities and local agencies.

The extent to which ITS integration is achieved is more a factor of institutional considerations than technological constraints. The willingness of different public and private entities to work cooperatively determines the degree of integration along a spectrum, from shared information to coordinated control of system components. Integration occurs when those responsible for the management of transportation systems see value in integrating the systems. Those locations where integration has begun to make measurable progress have been able to promote its benefits.

The first step in the recommended integration approach requires utilization of the USDOT's ITS deployment tracking tool – the Turbo Architecture software – and expand it to include more metropolitan and rural areas, toll facilities, and statewide systems. Not only is this a ready-made tool that the largest areas are already familiar with, it will facilitate reporting of ITS deployments through 2005 and beyond if the tracking program is extended.

The second step of the two-part integration approach involves documenting the lessons learned at the regional level and communicating them to a statewide forum of similar regional consortia. (Refer to *Technical Memorandum No. 3.2*, *Regional Operating Organizations*.) Such a forum should be held to exchange best-practice experiences in the development of integrated ITS deployments. In particular, this forum should bring together those at the forefront of Florida ITS deployments with those who are still developing their respective ITS strategies. The FDOT should have a major role in this forum, both as a statewide agency and as a regional partner.

As the level of ITS deployment across the nation approaches the 2005 goals established by the USDOT in 1996, it is recommended that Florida address the need for similar goals to integrate ITS across the state, and to track and report such integration activities and the benefits derived. Therefore, the following recommendations are proposed for the promotion of ITS integration in Florida:

- Promote and facilitate the establishment of ROOs to advance integration at both the physical and institutional levels.
- With assistance from the ROOs and the FDOT District ITS programs, utilize the USDOT integration methodology and survey instruments to collect Florida integration information.
- Expand existing ITS deployment databases to include integration characteristics.
- Annually assess Florida's integration levels based on the USDOT metrics.