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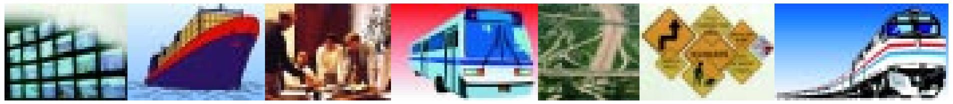
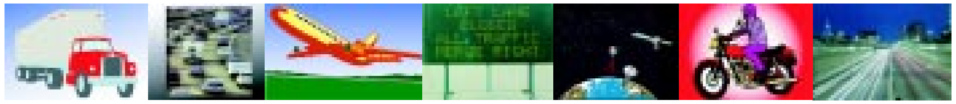


Florida's ITS Planning Guidelines

Integration of ITS into the Transportation Planning Process

State of Florida
Department of Transportation
Office of the State Transportation Planner
in Cooperation with
the Metropolitan Planning Organization Advisory Council
www.dot.state.fl.us/planning

June 2000



FLORIDA'S ITS PLANNING GUIDELINES

INTEGRATION OF ITS INTO THE TRANSPORTATION PLANNING PROCESS

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
OFFICE OF THE STATE TRANSPORTATION PLANNER
IN COOPERATION WITH
THE METROPOLITAN PLANNING ORGANIZATION ADVISORY COUNCIL
WWW.DOT.STATE.FL.US/PLANNING

JUNE 2000

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EXECUTIVE SUMMARY

The integration of Intelligent Transportation Systems (ITS) into the transportation planning process is mandated by the 1998 Transportation Efficiency Act (TEA-21). Each Metropolitan Planning Organization (MPO) area in the state is required to develop an ITS element to their Long Range Plan to be consistent with the National ITS Architecture.

ITS should be viewed as a new set of tools for addressing transportation management and operational needs. Very simply, ITS is all about real-time information gathering, analysis, and dissemination; and ITS represents the integrated application of advanced information, electronic, communications and other technologies to address surface transportation problems.

Among the unique features of transportation planning practice in Florida is the overlaying of the transportation concurrency provisions of our state's growth management regulations on top of the federally prescribed metropolitan planning process. Planning for ITS needs to be integrated with the concurrency management requirements, and also can contribute to meeting its provisions.

While much has been written about the potential for ITS to improve overall efficiency of the transportation system, comparatively little has been written on the impacts of ITS in terms of the sustainability of the transportation system. The most significant underlying feature of ITS project planning is for ALL

transportation agencies to acknowledge the importance of ITS as a tool for solving transportation problems.

In order for the integration of ITS into the transportation planning process to be meaningful, beneficial, and permanent, transportation planners must be willing to fully commit to and engage in new consensus-building activities for ITS, such as:

- Promote ITS integration and incorporate into regular job duties
- Actively participate in meetings of the local ITS Subcommittee of the MPO Technical Advisory Committee
- Make ITS consensus-building presentations to other agencies, businesses, and community groups
- Regularly communicate with elected officials and management to secure ITS commitments of cooperation, funding, and overall support
- Work to develop partnerships with the private sector, where appropriate
- Ensure the project development process is consistent with the regional ITS architecture, and that ITS-related projects or enhancements are assessed and compared in a consistent equitable manner
- Promote continuing communication among participating agencies and private sector partners
- Maintain credibility with elected officials and the public by keeping a "customer orientation" with the delivery of ITS projects (i.e., provide evidence that a useful service is being provided)

- Keep a “problem-solution” emphasis with the application of ITS
- Realize that ITS must work in coordination with other problem-solving approaches, not in competition with them

INTRODUCTION

Much of the early interest in and deployment of ITS has been stimulated by federal funding, rather than through a systematic planning process at the local or state level. Development of ITS has not always been clearly connected to a transportation problem or need, or well integrated with the range of other existing transportation strategies and programs. As a result, there has been a general lack of understanding regarding the benefits of "connecting" ITS to the transportation planning process.

Due to recent initiatives at the Federal level and within the Florida Department of Transportation, the mainstreaming of ITS into the transportation planning process is occurring. Issues and general direction to achieve this mainstreaming were developed in cooperation with the FHWA Division Office in Tallahassee and the Metropolitan Planning Organization Advisory Council and are presented in the Department's ITS Strategic Plan and in the Integration of ITS into the MPO Transportation Planning Process Issue Paper. These ITS Planning Guidelines represent a further effort to refine the previous work providing direction to integrate ITS into all aspect of Florida's transportation planning and growth management process. The purpose of the ITS Planning Guidelines is to provide general direction to local and state planners for why, when, and how to consider ITS, even what ITS applications to consider. The benefits of ITS integration into the planning process are anticipated to lead to an increase in the likelihood of successful transportation projects, and improvement in overall transportation system efficiency through successful ITS applications.

The ITS Planning Guidelines treat ITS as an integral element in all aspects of the transportation planning process. Specifically, these guidelines address the following planning issues:

- Consistency with the National ITS Architecture
- Incorporation of ITS User Services
- Relationship of ITS with Mobility Management Plans
- ITS Considerations for Corridor Studies
- ITS Planning Impacts on Concurrency Management
- Implications of ITS for Sustainable Transportation and Economic Growth
- Comparison of ITS with Non-ITS Improvements

CHAPTER 1
INCORPORATING ITS USER SERVICES INTO THE TRANSPORTATION PLANNING PROCESS

1.1 FEDERAL MANDATE

The integration of ITS into the transportation planning process is mandated by TEA-21.[1] Each MPO area in the state is required to develop an ITS element to their long range plan to be consistent with the National ITS Architecture. MPOs will have to identify the local stakeholders in this process and solicit input from them. Conformance with this requirement will become part of the Federal certification process for the MPOs.[2]

"Interim Guidance on Conformity with the National ITS Architecture and Standards" is discussed in detail in the next chapter, including a checklist of questions to be addressed for conformity. Final rulemaking is expected in late June 2000. Until the final rulemaking is issued (and for areas without a regional ITS architecture), the interim guidance provides an approach for ITS considerations in transportation planning for a metropolitan region, where it is suggested that the size of the region would not be smaller than the size of the metropolitan planning area boundary.

[1] Public Law 105-178, Sections 5201-5213, June 9, 1998.
[2] FDOT's ITS homepage at http://www.dot.state.fl.us/planning/systems/sm/its.html

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1.2 STATE POLICY

The Florida Department of Transportation realized the importance of having a vision that incorporates ITS programs in the 2020 Florida Transportation Plan. It is the state's policy, as stated in the ITS Guiding Principles of the Statewide ITS Strategic Plan, that "funding priorities should favor those ITS projects which are consistent with state and national ITS architecture and standards".

1.3 ITS IN THE MPO PLANNING PROCESS

The key to incorporating ITS services into the regional transportation planning process is not to create a separate process, but rather to fully integrate ITS activities into the planning process. In urbanized areas greater than 50,000 in population (which includes over 90 percent of the population in the state of Florida) Metropolitan Planning Organizations are responsible for conducting the transportation planning process. Current federal statutes require incorporation of seven factors into the planning activities of Metropolitan Planning Organizations.[3] These seven factors can be addressed by the application of a number of ITS User Services, described later in this section of the ITS Planning Guidelines and shown in Table 2.

[3] Public Law 105-178, Section 1203-f, June 9, 1998.

1.3.1 MPO Roles in ITS

According to the Florida Statewide ITS Strategic Plan, the MPO's role is to identify projects where ITS can be integrated projects funded in individual agency work programs, in the Long Range Plan, and the Transportation Improvement Program (TIP). The level of MPO involvement will vary depending on staffing, expertise, and funding. Involvement will also depend on the existing and projected future demand for ITS user services within the urbanized area, and the current involvement and expertise of other local area agencies. MPO roles in the ITS process can include:

- Integration of ITS into the transportation planning process
- Maintain inventory of current ITS projects/applications
- Database management, data collection coordination, information clearinghouse
- Performance monitoring and reporting
- Identification of stakeholders and providing forum for input
- Develop ITS strategic plan and regional architecture
- Funding coordination, including identification of public-private and public-public partnerships
- Project priority setting-inclusion in TIP
- Ensure conformity with national and statewide architecture and standards

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1.3.2 The Unified Planning Work Program (UPWP)

The program describes all transportation planning activities to be undertaken within the region, along with appropriate budget information. It also includes descriptions and budgets related to special planning studies that may be undertaken, including major investment studies, corridor studies, and any other technical studies that may be undertaken by the MPO as part of the transportation planning process. As it relates to ITS planning, the UPWP should also contain all the MPO's ITS planning activities, including the identification of studies to develop alternative funding strategies for ITS deployment.

1.3.3 Long Range Transportation Plan

MPOs are also responsible for preparing a long range transportation plan, which forecasts transportation demand, transportation needs and cost feasible improvements over a twenty-year planning period. ITS can have a vital role in both the financially constrained transportation plan and in the long range plan vision. For example, ITS enhancements to conventional transportation improvements can be developed to reduce the project's life-cycle costs as well as maximize the use of existing facilities and services. ITS features can be considered as separate projects or in conjunction with capacity projects. When costing out ITS projects for the cost feasible plan, the life cycle cost should be used.

1.3.4 Transportation Improvement Program

MPOs are also responsible for preparing a TIP that balances priorities and production schedules with available transportation funding for the next five years. The TIP is essentially a program of projects that allocates funding resources to specific project development and construction activities. The TIP project development process defines the priorities of the local area for the implementation of ITS. ITS enhancements can reduce life-cycle costs and maximize utilization of existing capacity without building additional lanes or new roads. ITS projects in the TIP must be consistent with the regional architecture and must normally be defined as ITS projects.

1.3.5 Air Quality

Air quality non-attainment areas (those areas failing to meet the National Ambient Air Quality Standards) and maintenance areas are also required to perform a conformity analysis to demonstrate that approved transportation plans and programs conform with the current and future attainment of the air quality standards. ITS promotes overall transportation system efficiency. For example, in Colorado regional use of ITS has reduced average travel time by 20 percent, which is equivalent

to an annual emission reduction of one million kilograms of carbon monoxide.[4]

1.3.6 Traffic Data Collection/Traffic Surveillance

MPOs make extensive use of data reflecting current conditions. These data are especially important for purposes of calibrating models used to forecast future conditions. They are also extremely important for purposes of the congestion management systems and for prioritizing projects in the Transportation Improvement Program. Advancements in sensor and communication technologies would greatly enhance the process by making it much easier to monitor existing conditions. Many times traffic performance data is not kept up to date because of the labor-intensive nature of traditional data collection. ITS technologies can accomplish more robust sampling more often at less cost in the long run.

1.3.7 Forecasting Impacts of ITS

To perform its necessary function, MPOs are required to forecast anticipated levels of development and economic activity at least twenty years into the future. These forecasts form the basis of defining anticipated future transportation system requirements. Anticipated ITS impacts also need to be defined and evaluated. Two ITS planning analysis (benefits

[4] *MPO Monitor*, a newsletter published by the Association of Metropolitan Planning Organizations, January/February 1999.

forecasting) tools have been developed to date; *SCRITS* and *IDAS*.

SCRITS (SCReening for ITS) is a spreadsheet analysis tool for estimating the user benefits of Intelligent Transportation Systems (ITS). It is intended as a sketch-level or screening-level analysis tool for allowing practitioners to obtain an initial indication of the possible benefits of various ITS applications. It is not intended for detailed analysis.

SCRITS was developed in response to the need for simplified estimates in the early stages of ITS-related planning, in the context of either a focused ITS analysis, a corridor/subarea transportation study, or regional planning analysis. *SCRITS* was developed based on the following principles:

- The analysis results should be compatible with transportation analyses conducted using other types of tools, such as travel demand models or simulation applications. For this reason, a number of the analyses in *SCRITS* require the user to provide baseline data from other local sources. For example, an analyst may use the output from a regional travel demand model (e.g. vehicle miles of travel (VMT) and vehicle hours of travel (VHT)) as input to *SCRITS*.
- The analyses of various ITS applications should then be conducted that "pivot" off these VMT and/or VHT values to estimate differences that would occur in VMT and/or VHT if those ITS applications were employed. This approach ensures that the results will be comparable to other analysis methods that are possibly being used in corridor/subarea or regional studies using the same travel demand model. However, some of the ITS applications require independent estimates of changes in VMT, VHT, or other statistics.

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- The analysis should be adaptable to regional, corridor, facility, and subarea scales. Some analysts may desire planning-level estimates that cover the entire region. Others may wish to focus on an individual facility. *SCRITS* has been designed with flexibility for the user to specify the geographic/facility coverage, but the analyst must provide the baseline data consistent with the areas/facilities being analyzed.
- The analysis should produce estimates of benefit on a daily basis. These estimates should be expandable to an annual basis to enable calculations of economic benefit and comparisons to cost. *SCRITS* is therefore designed around daily analyses. Peak hour or peak period analyses are limited to ramp metering, which is targeted mainly to those periods.

The analyst must recognize that there is a great deal of uncertainty regarding the effects of ITS applications. For example, few regions have good data on average duration of traffic incidents or the amount of delay caused by those incidents. In addition, little is known about the degree to which incident management strategies impact the duration of incidents or motorists' choices to change their mode, route, or trip timing. Although information is improving, many assumptions are required to conduct analysis of ITS applications. Even more sophisticated methods will be subject to many of these same uncertainties. This is why users of *SCRITS* should strongly consider conducting sensitivity analyses to a range of input assumptions.

Some of the primary applications of *SCRITS* may include the following:

- Approximation of user benefits for the evaluation of transportation alternatives in corridor/subarea studies, regional planning studies, other types of transportation studies
- Approximation of user benefits for ITS strategic planning
- Sensitivity analysis of the benefits of ITS applications to certain input assumptions

SCRITS does not include an evaluation of every possible ITS application. Rather, 16 different applications are identified for inclusion in the spreadsheet (e.g., variable message signs, AVL for buses, ramp metering, closed-circuit TV, etc.).

The primary measures of effectiveness calculated by *SCRITS* vary by individual application, but generally include the following:

- changes in VHT (for most applications)
- changes in VMT, where applicable
- changes in emissions (CO, NOx, HC), where applicable
- changes in vehicle operating costs, where applicable
- changes in energy consumption, where applicable
- changes in the number of accidents, where applicable
- economic benefit and benefit/cost ratio (for most applications)

SCRITS is a free download and can be obtained from the following website: http://www.fhwa.dot.gov/steam/scrits.htm

IDAS (ITS Deployment Analysis System[5]) is an ITS sketch planning analysis tool, designed for transportation planners from MPOs and state DOTs for use in the estimation of the impacts, benefits, and costs resulting from the deployment of ITS components. *IDAS* operates as a "post processor" to travel demand models and although a sketch planning tool, *IDAS* incorporates the modal split and traffic assignment output associated with a traditional planning model.

Developed by Federal Highway Administration, *IDAS* quantifies the impacts of ITS infrastructure improvements throughout a transportation network. It focuses on how an ITS project or projects effect:

[5] Source: IDAS Brochure, Federal Highway Administration, May 2000.

- the frequency and magnitude of recurring and non-recurring congestion
- travel time and throughput on all the links and nodes in the analysis area
- public safety
- environmental factors such as emissions and noise
- energy consumption and overall vehicle operating costs
- agency efficiency and system reliability

IDAS has a number of additional features such as:

- calculates benefit cost ratios
- develops inventories of ITS equipment needed for deployment
- evaluates alterations in the staging of improvements
- provides documentation for transition into design and implementation

IDAS can be purchased from the Center for Microcomputers in Transportation (McTrans) at University of Florida, 512 Weil Hall, PO Box 116585, Gainesville, Fl 32611-6585; Tel: (352) 392 0378; Fax: (352) 392 3224; Email: mctrans@ce.ufl.edu; http://mctrans.ce.ufl.edu/.

1.3.8 Refining the MPO Committee Structure to Incorporate ITS

In carrying out their responsibilities, MPOs act as the primary forum for transportation decision making by local elected

officials. Generally, MPOs make extensive use of advisory committees that reflect various stakeholder interests. Typically the MPO includes a technical advisory committee comprising representatives of local government planning departments, traffic engineering departments, transit operators, port authorities, aviation authorities and others. The technical committee normally assists the MPO staff in defining issues and proposing solutions for consideration by the MPO members. In addition, MPOs typically have citizens advisory committees, which encourage lay citizen participation in the planning process. Many MPOs include special advisory committees for issues such as bicycle and pedestrian concerns, air quality issues, economic development issues and other issues that are of local concern and need.

The key for MPOs to fully integrate feasible ITS into both the planning process and selection of projects is to assure that identification and assessment of ITS is given full consideration throughout the planning process. If ITS is to be given full consideration, elected officials and technical staffs must be aware of all of the available ITS tools (User Services). One possible method of enhancing this objective might be the creation, within the current MPO structure, of an ITS subcommittee similar to the bicycle/pedestrian subcommittees that currently exist in most MPOs. This subcommittee can function as a technical advisory group, stakeholder group, or both. The purpose of an ITS subcommittee would be to assure that ITS is not overlooked throughout the planning and project implementation process. This subcommittee can be a subset of the existing technical advisory committee (TAC) members, who also have the expertise in identifying and evaluating the costs and benefits of suitable ITS applications. On the other hand, if the expertise is not contained within the existing TAC, a separate ITS subcommittee should be assembled. In either case, ITS subcommittee members will be required to keep informed and educated to be able to identify, evaluate and recommend the best ITS solutions.

The concept of a special ITS subcommittee is not new. At the request of the state departments of transportation of Maryland, Virginia and the District of Columbia, the Washington Region ITS Task Force was formed in January 1997.[6] This ITS Task Force has provided a regional forum for advice and information sharing on ITS projects and issues. This Task Force reports directly to the MPO Board, and advises the MPO Board on all ITS-related matters. Over 30 transportation and public safety agencies from around the Washington, DC region participate on the ITS Task Force. The Task Force is one of the most functionally diverse of the MPO's committees, including participation from local, regional, state, and federal agencies, as well as significant representation from the private sector (which is critical along with multi-modal agency representation). The Task Force also has a number of accomplishments to date that have fostered feasible ITS deployment in the area.

[6] "Inside View of ITS at a Metropolitan Planning Organization", Andrew Meese, May 14, 1998, page 3.

In Florida, at METROPLAN ORLANDO, the Metropolitan Planning Organization for the Orlando Urbanized Area has created an Intelligent Transportation Systems (ITS) Subcommittee of its Transportation Technical Committee (TTC). The role of the ITS Subcommittee is to investigate and report on specific ITS topics of interest to the Orlando Urbanized Area. Members of the Subcommittee are designated from the TTC membership annually; broad representation from jurisdictions and agencies in the area is encouraged. The Subcommittee convenes quarterly meetings to discuss ITS projects, deployment activities and emerging products and services. Typically, a status report on an ITS project in the area is featured on the agenda for discussion. A report of the meeting is provided to the TTC during its monthly meeting. The Subcommittee played an active role in selecting an ITS Study Steering Committee to review the progress and work on the Metro Orlando ITS Plan, the deployment plan and system architecture for the area. Additionally, the Subcommittee has created the *Cutting Edge* newsletter and adding an ITS link to the METROPLAN ORLANDO Web site. The Subcommittee has also been successful in modifying the funding category in TIP for Congestion Mitigation Systems (CMS) to include ITS.

The Miami-Dade ITS Coordinating Committee was created as a Standing Committee of the TPC. The ITS Committee was initially comprised of representatives from the Miami-Dade

MPO, FDOT, Public Works, Tri-Rail, Department of Environmental Regulation and Management (DERM), Dade County League of Cities, Miami-Dade Transit Agency (MDTA), and FIU's Lehman Center for Transportation Research. Today it has representatives from Miami Dade Information Technology Department (ITD), Broward Company MPO, Florida's Turnpike District, Miami-Dade Expressway Authority, Miami International Airport, and the Port of Miami. The Committee has participated in the preparation of the County's ITS Plan, supported advancement of ATIS projects and consistent with its intent of coordination, signed a Memorandum of Understanding to facilitate interaction among participating agencies at regional levels. The Committee has evolved from an initial reviewing role to more dynamic leadership, with current efforts focused on advancing a local public/private agreement for Fiber-Optic Network sharing.

Newly-formed ITS subcommittees should reflect a broad, diverse collection of stakeholders in ITS. Consideration should be given to adequate representation from the private sector (as mentioned previously), as well as consumer groups including the local citizen advisory committee, chambers of commerce, the media, and all affected groups.

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1.4 Integration of ITS and the Transportation Planning Process

A common way to approach ITS planning is to characterize and focus on the "building blocks" of ITS deployment, or User Services, that best address specific transportation mobility and safety needs. Users can include vehicle drivers, pedestrians, multi-modal passengers, fleet operators for passenger and freight, and network operators (those organizations responsible for monitoring and controlling transportation systems).[7] There is a wide range of ITS User Services that could be incorporated into transportation solutions developed by MPOs. Table 1 illustrates a listing of the 31 currently recognized User Services, grouped by "bundle" or functionality. Each User Service is also checked for applicability to statewide, regional or corridor architecture (and does not imply any particular priority). User Services denoted by an asterisk are not expected to be provided by the public sector, but can certainly provide a public benefit.

[7] "User Acceptance of ITS Products and Services", Charles River Associates, March 1996.

Table 1 – ITS User Services

User Service Bundle	User Service	Statewide	Region	Corridor
Travel and Traffic Management	En-Route Driver Information	✓	✖	●
	Route Guidance		✖	●
	Traveler Services Information	✓	✖	●
	Traffic Control		✖	●
	Incident Management		✖	●
	Emissions Testing and Mitigation		✖	●
	Travel Demand Management		✖	●
	Pre-trip Travel Information	✓	✖	●
	Ride Matching and Reservation		✖	●
	Highway-Rail Intersection	✓	✖	●
Public Transportation Management	Public Transportation Management	✓	✖	●
	En-Route Transit Information		✖	●
	Personalized Public Transit		✖	●
	Public Travel Security	✓	✖	●
Electronic Payment	Electronic Payment Services	✓	✖	●
Commercial Vehicle Operations	Commercial Vehicle Electronic Clearance	✓		
	Automated Roadside Safety Inspections	✓		
	On-board Safety Monitoring*	✓		

User Service Bundle	User Service	Statewide	Region	Corridor
Commercial Vehicle Operations	Commercial Vehicle Administration Processes	✓		
	Hazardous Materials Incident Response	✓	✖	●
	Commercial Fleet Management*	✓		
Emergency Management	Emergency Notification and Personal Security*		✖	●
	Emergency Vehicle Management		✖	●
Advanced Vehicle Safety Systems	Longitudinal Collision Avoidance*			●
	Lateral Collision Avoidance*			●
	Intersection Collision Avoidance*			●
	Vision Enhancement for Crash Avoidance*			●
	Safety Readiness*			●
	Pre-Crash Restraint Deployment*			●
	Automated Vehicle Operations*			●
Information Management	Archived Data Function	✓	✖	●

Sources: Florida Statewide ITS Strategic Plan and Saving Lives, Time and Money Using ITS-ITS America.

It is can be assumed that as new technologies emerge, their innovative application to transportation will expand this list of potential applications. As mentioned previously, the list of ITS

User Services noted in Table 1 is highly related to the seven planning factors identified under TEA-21, as seen in Table 2. For example, several of the ITS technologies specifically promote economic vitality by improving commercial vehicle operations. Many of them address safety and security issues, personal and freight mobility, environmental and energy issues, and system preservation. They are also fully multi-modal addressing highways, public transportation, and freight issues. In many cases, there are direct correlations between the planning factors and ITS User Services. Table 2 also identifies ITS user services that could address concurrency management requirements.

Table 2 – Correlation Between TEA-21 Planning Factors/Growth Management Concurrency Requirements and ITS User Services

ITS User Services	TEA-21 Planning Factors							
	Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity and efficiency	Increase the safety and security of the transportation system for motorized and non-motorized users	Increase the accessibility and mobility options available to people and freight	Protect and enhance the environment, promote energy conservation, and improve the quality of life	Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight	Promote efficient system management and operation	Emphasize the preservation of the existing transportation system	**Growth Management/Concurrency Requirements**
En-Route Driver Information			X		X	X	X	
Route Guidance			X		X	X	X	
Traveler Services Information			X		X	X	X	X
Traffic Control			X	X	X	X	X	X

ITS User Services	TEA-21 Planning Factors							
	Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity and efficiency	Increase the safety and security of the transportation system for motorized and non-motorized users	Increase the accessibility and mobility options available to people and freight	Protect and enhance the environment, promote energy conservation, and improve the quality of life	Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight	Promote efficient system management and operation	Emphasize the preservation of the existing transportation system	**Growth Management/Concurrency Requirements**
Incident Management		X	X		X	X	X	X
Emissions Testing and Mitigation				X				X
Travel Demand Management			X	X	X	X	X	X
Pre-Trip Travel Information			X		X	X	X	
Ride Matching and Reservation			X	X	X	X	X	
Highway-Rail Intersection		X			X	X	X	
Public Transportation Management			X	X	X	X	X	X
En-Route Transit Information			X		X	X	X	
Personalized Public Transit			X	X	X			X
Public Travel Security		X	X					
Electronic Payment Services	X		X	X	X	X		X
Commercial Vehicle Electronic Clearance	X		X		X		X	
Automated Roadside Safety Inspections		X	X	X	X	X	X	
On-Board Safety Monitoring		X				X	X	
Commercial Vehicle Administration Processes	X	X			X	X	X	
Hazardous Materials Incident Response		X		X	X	X	X	
Commercial Fleet Management	X		X		X	X	X	X
Emergency Notification and Personal Security		X					X	
Emergency Vehicle Management		X				X	X	X

ITS User Services / **TEA-21 Planning Factors**	Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity and efficiency	Increase the safety and security of the transportation system for motorized and non-motorized users	Increase the accessibility and mobility options available to people and freight	Protect and enhance the environment, promote energy conservation, and improve the quality of life	Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight	Promote efficient system management and operation	Emphasize the preservation of the existing transportation system	**Growth Management/Concurrency Requirements**
Longitudinal Collision Avoidance		x				x		
Lateral Collision Avoidance		x				x		
Intersection Collision Avoidance		x				x		
Vision Enhancement for Crash Avoidance		x				x		
Safety Readiness		x				x		
Pre-Crash Restraint Deployment		x				x		
Automated Vehicle Operations			x	x	x	x		
Archived Data Function					x	x		x

Beyond this listing, an important use of ITS technologies is in the actual planning process itself, especially in the area of data collection activities. There have been recent demonstrations of the use of Global Positioning Systems (GPS) technology to measure vehicle-operating speeds. High-speed, high-resolution video technologies have also been employed to determine average vehicle speed, as well as to determine vehicle occupancies. Vehicle detection technologies are improving all the time. The Florida Department of Transportation as well as local government is making greater and greater use of automated traffic data collection methods, including advanced loop detectors, laser or infrared-

based devices and video detection (optical character recognition for license plates) of vehicles. In the state of Florida, the potential use of ITS technologies to facilitate hurricane evacuations is very real. Florida DOT is creating and enhancing its centralized data gathering capabilities to include both permanent count telemetry stations along with video cameras throughout the state that can be accessed from key points of emergency management activities.

In addition to potential within MPO areas, certain ITS technologies can also be applied in rural areas. Outside MPO boundaries, Florida DOT is primarily responsible for carrying out the transportation planning process, in consultation with elected officials representing local governments. However, many of the technologies and methods previously cited are equally relevant to transportation planning activities in rural areas. Some examples include demand-responsive transit, emergency response coordination, roadside messaging particularly adjacent to major site attractions, and multi-modal coordination of freight movement.

1.5 Growth Management/Concurrency

Florida also has a very well established state-mandated growth management process, which requires all units of local government to prepare comprehensive plans. Included in these plans is a transportation element, which is required to determine future transportation needs and solutions within each local government jurisdiction. Activities related to preparation of the local government comprehensive plan are generally well coordinated with MPOs for those local governments within urbanized areas.

An important part of Florida's growth management process is the concurrency requirement, which mandates that level of service standards be established for various types of public facilities, including transportation, and that adopted level of service standards be maintained as new developments are approved. Transportation concurrency has been particularly problematic for many local governments and increasingly there are new and innovative methods being used to measure level of service and define concurrency. In addition to measuring level of service on a link by link basis, some of these methods have adopted definitions of concurrency based on district wide averages of facility performance, performance characteristics averaged across multiple facilities in an indicated corridor, and in some cases combining transportation capacity and utilization across various transportation modes.

ITS technologies for continuous vehicle tracking in all modes (passenger cars, transit, commercial trucking, and rail freight) can be applied to create other disaggregate performance measures for concurrency. For example, individual vehicle dwell times could be automatically monitored by mode over time to detect inefficiencies caused by congestion. The specific location and duration of these bottlenecks could be automatically identified and ranked by severity to better focus funding for capacity improvements. These same vehicle-tracking capabilities could also help to relieve congestion caused by non-recurring congestion (incidents), by

providing for a more timely verification of and response to incidents.

Finally, ITS enhancements consistent with the regional ITS Plan should be able to be counted toward meeting concurrency requirements. Impact fees collected under concurrency requirements can also be considered for funding regional ITS needs.

Chapter 2
Consistency with the National ITS Architecture

Intelligent Transportation Systems (ITS) should be viewed as a new set of tools for addressing transportation management and operational needs. Very simply, ITS is all about real-time information gathering, analysis, and dissemination; and ITS represents the integrated application of advanced information, electronic, communications and other technologies to address surface transportation problems.

ITS advancements in information technologies are changing how transportation services are being provided throughout Florida, and across the nation. Electronic toll collection, weigh-in-motion and electronic credentialing for commercial vehicles, real-time transit fleet tracking, and automated incident detection are just some of the examples of new innovations in transportation systems and services deployed over the last decade. If ITS is planned and deployed in a coordinated, integrated fashion the flow of usable information can be translated into a more efficient operation and utilization of the entire transportation system. Most importantly, ITS supports national and community transportation goals that stress developing solutions that can optimize use of the existing transportation system.

MPOs and operating agencies will be playing a formal role in the creation of a regional ITS architecture. Very simply, an architecture identifies boundaries and participants, describes activities or functions, and defines roles and relationships.[8] The national ITS architecture is intended to provide the guidance for local and state governments to identify and maximize transportation system integration opportunities that work best for their areas. The "regional" architecture will define the regional strategy for transportation system operations and management by seeking to build a consensus on ITS system needs and information sharing between these systems.

2.1 Architecture Hierarchy

ITS Architecture is the future plan that shows how all the various ITS elements, products, services, and technologies will be brought together to meet the needs, issues, problems, and objectives of mobility, safety, and travel efficiency.

The Florida Department of Transportation is in the process of developing a statewide ITS architecture to assure compatibility for delivering ITS user services between and among its districts. Progress on the statewide architecture can be monitored on http://www.jeng.com. The statewide architecture will be based on the National ITS Architecture, but will be more explicit in defining some ITS user services such as Commercial Vehicle

[8] Introduction to National ITS Architecture and Consistency Policy, One Day Seminar workbook prepared by ITS National Architecture Team.

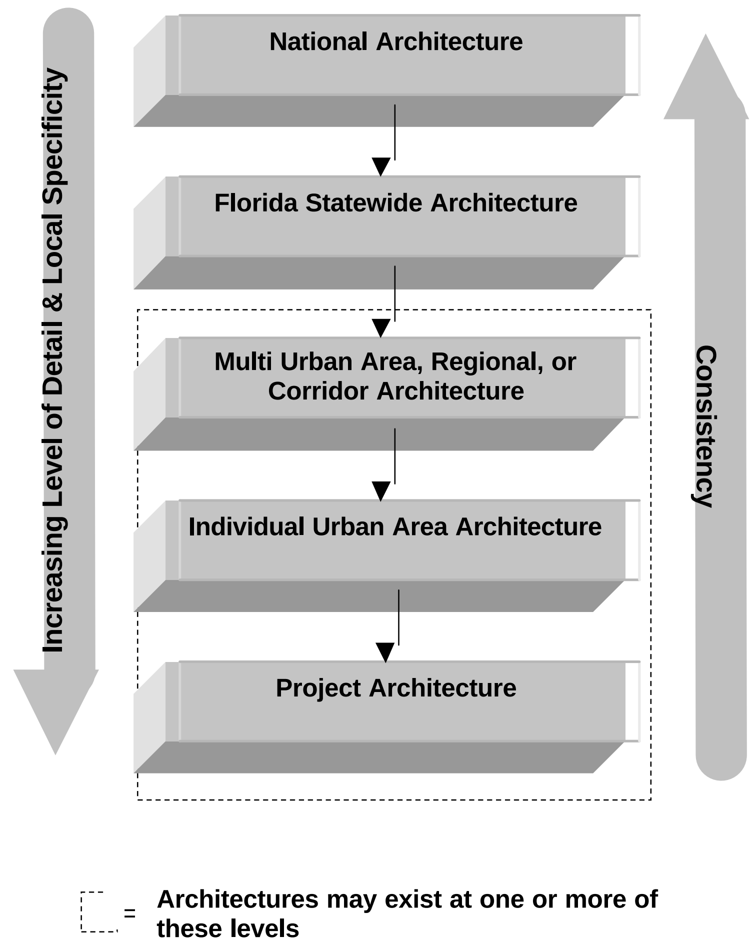
Operations (CVO), emergency evacuations, tourist guidance, and other rural/inter-urban applications that are naturally best suited for statewide implementation. The statewide architecture also defines and supports the interfaces for the information flows between regional and corridor architectures.

Within the statewide architecture, each region and/or corridor would also develop and maintain their own respective architectures to identify specific data needs, functional requirements, standards and interfaces. For example, Florida's Turnpike, I-95, I-75, I-10, and I-4 corridor architectures will each traverse several FDOT District or regional architectures. There may be a single architecture for an entire District, or there may be multiple architectures for each urban area within a District. The corridor architectures would generally be in greater detail than regional or district architecture, but have to be compatible with each. For example, traffic monitoring/incident detection along the entire I-95 corridor will have to be able to interface and share real-time information with the region and each District it passes through.

Furthermore, project-level architectures (the most detailed architecture) for each of the examples noted above will have to be integrated with the regional/corridor, and District architecture to assure compatibility and maximize user and operator benefits. There may also be cases where an ITS project architecture does not need to be part of or compatible with any corridor, regional, or statewide architecture. These cases would be governed by local

operating requirements and standards. Figure 1 illustrates the relative comparison between each level of ITS Architecture.

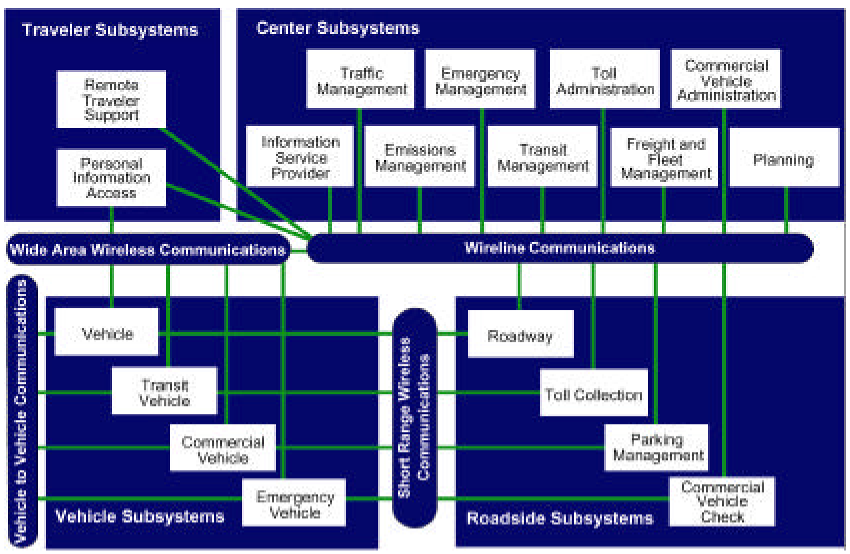
Figure 1- Architecture Hierarchy



2.2 Review of National ITS Architecture

The National Intelligent Transportation Systems Architecture is a generalized framework for developing and deploying ITS. Figure 2 depicts the inter-relationship of all the ITS subsystems defined to date. An area does not have to implement everything shown here; in fact most areas do not. Whatever ITS subsystems are selected, the "blueprint" for an integrated system of ITS is provided in Figure 2. Within a regional context, the basic requirements for ITS information sharing and dissemination are clearly identified within the architecture.

Figure 2 – ITS National Architecture Subsystems



Source: *The National Architecture for ITS: A Framework for Integrated Transportation* into the 21st Century, USDOT - ITS America CD-ROM, 1998.

2.3 Applicability to Local ITS Planning and Deployment

In October 1998, the Federal Highway Administration and Federal Transit Administration issued Interim Guidance related to conformity/consistency with the National ITS Architecture and emerging ITS standards.[9] The intent of the Interim Guidance is to foster ITS integration, encourage the incorporation of ITS into the transportation planning process, and focus on projects with the greatest potential for affecting regional integration. The Interim Guidance applies to ITS projects receiving funding from the Highway Trust Fund, including the Mass Transit Account, even when the ITS component is part of a larger project. All ITS demonstration projects and earmarks are also applicable to the Interim Guidance.

On May 25, 2000, a Notice of Proposed Rulemaking (NPRM) was issued[10] as a follow-up on the previous Interim Guidance. The NPRM reiterates the Interim Guidance, but also highlights the following:

- ❖ All ITS projects should conform to the local area or regional ITS architecture.

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[9] Interim Guidance on Conformity with the National ITS Architecture and Standards.
[10] Statewide Transportation Planning; Metropolitan Transportation Planning; Proposed Rule, issued by FHWA/FTA on May 25, 2000.

- ITS will become part of the transportation planning process through the locally defined ITS integration strategy and participation of key operating agencies.
- Adjacent MPOs in the same region need to have mechanisms for coordination, and formal memorandums of agreement among participating agencies are needed.
- In order to clearly substantiate the need for ITS projects, they need to be in LRPs and TIPs before federal action can be taken on them.

2.4 Checklist of Questions for Conformity

The Interim Guidance reflects input received from a broad array of Federal, State, local and private sector transportation stakeholders through a series of national forums. The simplest way to apply this guidance is through a series of questions (contained within the 32-page Interim Guidance document) that serve as a basic checklist for conformity. These questions serve as reminders of the key issues that must be addressed during ITS planning and project development. For example, when a regional ITS architecture has not yet been developed, as is the case for many metropolitan areas in Florida, the following questions as a minimum are to be addressed. These questions relate to the desired functions and information exchange depicted in Figure 2.

- Which components from the National ITS Architecture (refer to Figure 2) are applicable to the project?

- Does the project design indicate the extent of information exchange between specific agencies?
- Has consideration been given to incorporating additional information flows, as appropriate to the project, in anticipation of future needs? If so, which information flows?
- What technology and operating agreements have been reached between the affected parties?
- How has the potential for future expansion and information sharing opportunities been kept flexible through the project design process?
- Which existing design standards and communication procedures, as appropriate for the project, have been identified? (Refer to the local ITS Architecture Plan if one has been adopted, or the USDOT ITS Standards Web page at http://www.its.dot.gov/standard/standard.htm.)

Additionally, under the Interim Guidance for Conformity, an overall approach for ITS consideration in transportation planning is suggested. This approach can be summarized as follows:

- Engage a broad range of stakeholders
- Identify needs that can be addressed by ITS
- Describe existing and planned ITS enhancements (ITS components added to conventional transportation improvements) of the physical system
- Define a regional ITS architecture (where a “region” is defined by the area that as a minimum incorporates the metropolitan planning area boundary)

- Define operating requirements of the regional transportation system
- Coordinate ITS with all planned improvements
- Develop a conceptual phasing schedule
- Develop regional technology agreements and standards that assure all parts of one system work with all other systems
- Identify ITS projects that are consistent with the regional goals and objectives adopted by the local transportation planning organizations

2.5 ITS Training

It is strongly recommended that users of the ITS Planning Guidelines take advantage of the ITS training seminars and short courses that are available. Originally developed by the USDOT Volpe National Transportation Systems Center under the ITS Professional Capacity Building (PCB) seminar series, this training is now offered through ITS Florida. The training includes seminars in:

- ITS Awareness
- ITS and the Transportation Planning Process
- ITS Telecommunications
- ITS Public/Private Partnerships

Short courses are available for:

- One-day Introduction to the National ITS Architecture

- Two-day Application of National ITS Architecture
- One-day Florida ITS Architecture Development

For more information on ITS seminars and short courses, contact should be made to:

ITS Florida
P.O. Box 116585
Gainesville, FL 32611-6585
Tel: (352)-392-7575, extension 224
E-mail: its-fl@ce.ufl.edu

2.6 Value of Consistency in Design and Architecture for ITS System Integration

The need for integration of transportation into a seamless service for movement of people and goods is increasing. Transportation subsystems are becoming more sophisticated, there are more stakeholders to satisfy, and there is more interdependence among organizations that are responsible for providing mobility and safety within a region.

Very simply, consistency with the ITS National Architecture will clearly define those transportation services envisioned to be provided within the region. Also, a common vocabulary for integration can be established within organizations, between organizations, with contractors, among users, and with counterparts across the state and nation. Integration will assure that the "whole" benefit of ITS investment will be greater than just the sum of the "parts".

There are more direct benefits to be realized by using the ITS National Architecture as the guide for integration consistency. Some of these benefits can be lower design cost, reduced project development time, orderly and efficient expansion, and lower risk.

2.7 Achieving and Monitoring Consistency in ITS Design and Architecture

It is important to remember that the National ITS Architecture only assists in the development of regional architecture and definition of appropriate ITS User Services or needs. It provides only a starting point in ITS deployment that will undergo continual refinement as the region grows and transportation policy and priorities change. Integration will only be achieved and sustained by interlocal agreements among all the major stakeholders. As new transportation improvements and services are recommended each year, they each have to be viewed as a system component, not autonomously. In order to maintain consistency and maximize benefits of ITS investment, each project review must go through the list of Interim Guidance questions (previously noted).

2.8 Coordination with Statewide ITS Strategic Plan

Although a statewide plan, the ITS Strategic Plan for Florida is intended to "provide the Florida Department of Transportation's District offices and local government officials with the overall

guidance necessary for the development of regional and local ITS programs, strategic plans and architectures that will lead to ITS deployment plans".[11] The Plan directly relates to all of the Modal Plans identified by the Florida Transportation Plan, and emphasizes the management and operational guidance to assist each of these modal plans in reaching their goals.

According to the Statewide ITS Strategic Plan, each MPO should:

- ❖ Add a step to consider ITS in all stages of the multi-modal transportation planning process
- ❖ Facilitate institutional and inter-jurisdictional cooperation in ITS
- ❖ Recognize and seize opportunities for including ITS as an integrated element with traditional infrastructure improvements
- ❖ Seek out and encourage advocates for ITS
- ❖ Focus on integration and regional architecture as the key for developing ITS
- ❖ Evaluate public involvement plans for application to disseminating ITS information
- ❖ Encourage ITS partnerships with the private sector

2.9 Useful Steps in Planning for ITS

The Interim Guidance previously discussed also provides a checklist of questions to assist agencies in the early planning stages of ITS

[11] *Florida's Intelligent Transportation System Strategic Plan,* Final Report-August 23, 1999, page iii, prepared by PB-Farradyne, Inc.

projects. The following list of questions should be addressed as a minimum:

- What activities have been initiated to engage regional and local ITS stakeholders?
- What non-traditional, public and private partners need to be brought into the process?
- What system management and operational needs have been identified through regional planning activities?
- What existing and planned ITS projects have been identified or are under consideration in the region?
- Have operating requirements for the planned ITS projects been identified?
- How will planned ITS projects be coordinated with other "conventional" transportation improvements?
- Has a deployment-phasing schedule been developed?
- Have regional technology agreements been established where needed? (i.e., who will be responsible for maintenance and operations?)
- Have capital cost and potential funding sources for planned ITS projects been identified?

2.10 ITS Integration into Long Range Plans

Local governments are overwhelmed with the challenge of just maintaining existing facilities. A linkage for the implementation of ITS within already restrictive budgets is not easily accepted. MPOs are also perplexed with how to implement an ITS architecture,

since they are not implementing agencies. Florida MPOs are just beginning to address ITS in their long range planning efforts in a variety of ways as exemplified below.[12]

- Brevard County MPO incorporated ITS technologies in their 2020 Long Range Plan as part of Transportation Control Measures (TCM) improvements for certain sections of the roadway system. According to the plan, "many roadways that could be widened were designated for less intrusive TCM improvements due to neighborhood preservation concerns." ITS technologies listed as TCM include motorist information and incident management. The transportation management planning task of the UPWP states that ITS was and will be used as a management tool and as a resource for developing and monitoring transportation data.
- Lee County MPO 2020 Transportation Plan for Fort-Myers-Cape Coral Metropolitan Area was adopted in 1995 and amended June 20, 1997. Preserving and maximizing efficiency of existing transportation facilities is discussed as a high priority "ISTEA factor". In this context, traffic congestion management systems were explicitly considered in the development of the 2020 Plan. Lee County adopted the use of electronic toll collection technology in November 1997 and variable toll pricing in August 1998 as part of their congestion-pricing program.

[12] Since TEA-21 was authorized in June 1998, Long Range Transportation Plans done prior to that date typically do not include any significant mention of ITS planning. However, not all of the MPO LRTPs were available for this comparison.

- Pinellas County MPO adopted their Long Range Transportation Plan (LRTP) in December 1998, and revised it May 1999. One of the goals of the plan focuses on transportation system efficiency and travel demand management. The objective is to protect roadway capacity, optimize operating efficiency and reduce travel demand through the application of system management and demand management strategies. In this context, two policies were adopted (1.6.2 and 1.6.3). These policies state that the MPO shall develop an ITS plan for Pinellas County that conforms to the regional and national ITS standards; and supports the implementation of ITS strategies that are consistent with LRTP goals, objectives and policies. Chapter 6 of the plan deals with system efficiency and travel demand management. One of the transportation system management activities discussed is ITS. Pinellas County has a number of small, isolated ITS applications in operation including computerized signal control, and automated bus fare payment systems, speed advisory warning system and video surveillance cameras on the Skyway Bridge. FDOT's District 7 ITS Strategic Plan recommends several ITS projects for potential implementation in Pinellas County; however, no specific details about these projects are discussed in the LRTP. Noteworthy is the fact that the 1999/2000 UPWP includes ITS applications in the subtask of transportation system management planning as a component of short-range planning.
- Broward County LRTP was adopted December 1998. One of the goals of the LRTP is to provide a transportation system that serves transportation needs in a cost-effective manner. In

addressing this goal, utilizing TSM is stated as one of the objectives. Noteworthy here is that ITS Planning and Coordination is one of the tasks in the systems planning section of the 1999/2000 UPWP.
- Miami Urbanized Area MPO adopted their 2020 Long Range Plan in May 1999. ITS is not included as part of this plan, however, there does exist a separate ITS Plan for Miami-Dade county that was initially approved by the MPO Governing Board in February 1997, and updated in June 1999. The initial ITS Plan served basically as a comprehensive inventory of existing ITS activities and identified ITS application objectives for the greater Miami area. Most importantly, this was the first plan of its kind to be adopted by a local government in Florida. The ITS Plan Update identifies ITS "enabling" projects that will form the basis for a regional ITS architecture. ITS integration is stressed throughout the ITS Plan Update.
- West Palm Beach MPO adopted its LRTP in December 1998. ITS and TCM are addressed briefly in Chapter 7 of one technical report that discusses 2020 cost feasible plans. Similarly, ITS and TCM are discussed in Chapter 5 of another technical report that addresses interim transportation plans.
- Hillsborough County MPO adopted its 2020 LRTP in November 1998. Included is a section that explains what ITS is, examples of ITS projects and the benefits of ITS. The Plan states "where appropriate, we will encourage the use of Intelligent Transportation Systems approaches and technologies." The MPO has identified a TASK (3.5) in its UPWP for ITS planning. The objective of the task is to

develop a process that will incorporate the Regional Architecture, developed by District 7, into the Long Range Transportation Planning Process. The MPO is in its early stages of developing its ITS Plan for Hillsborough County. The LRTP has a ten-year timeframe for planning and funding of ITS.

MPO involvement in ITS is becoming more evident. A recent survey conducted by the Association of Metropolitan Planning Organizations (AMPO) found that two-thirds of the large MPOs (greater than one million population) have ITS Task Forces and 60 percent have ITS staff. Half of the large MPOs have prepared some sort of ITS strategic plan, and most have a "basic familiarity" with the National ITS Architecture and are using it during the planning process.

ITS Planning Guidelines

Chapter 3
Role of ITS in
Congestion Management Systems

3.1 Concept Considerations for ITS Application

Federal laws require that those urbanized areas greater than 200,000 in population prepare congestion management systems. Florida statutes extend this requirement to all MPOs.[13] Congestion Management Systems (CMS) are specifically designed to monitor current congestion levels, forecast future congestion levels, and develop planned programs to ameliorate anticipated travel deficiencies. CMSs can also be viewed as a tool to change travel behavior and help existing transportation facilities operate more efficiently by providing transportation system performance information in such a fashion as to maximize all mobility options for people and goods. In Florida, the state's Mobility Management Process (MMP) is synonymous with the CMS process. ITS provides the means to implement the continuing evolutionary path of technology to upgrade the mobility management process for system performance information.

One can look at transportation system performance information in two ways. First, *static* information over various points in time is used to determine mobility needs, priorities or measure resulting

[13] Florida Statutes, sections 339.115, 339.175, and 339.177.

benefits of previous investments in mobility improvements. Second, *real-time* information is used for the detection and management of recurring and non-recurring congestion. *Static* information, for the most part, relies on traditional data gathering methods to calculate and compare aggregate mobility performance measures. For example, these types of daily and peak period measures should include the following:[14]

- Person-miles traveled (per lane mile)
- Vehicle-miles traveled (per lane mile)
- Truck-miles traveled (per lane mile)
- Person-trips
- Average travel time
- Average travel speed
- Percent corridor heavily congested
- Percent travel heavily congested
- Duration of heavy congestion

These types of *static* performance measures, when compared over time, can provide reasonable indicators of system mobility. They can also be used to guide overall system planning strategies (or goals) for multi-modal mobility. Additionally, using attitudinal surveys, Broward County includes an element of monitoring person movement at major employment centers in order to screen feasible site-specific Transportation Demand Management (TDM)

[14] FDOT Recommended Mobility Performance Measures for Corridors & Systems, July 21, 1998.

options.[15] The MMP should examine the feasibility of ITS in providing even better mobility performance information to decision-makers, operating agencies, and system users. Table 3 lists alternative, or complimentary, ITS technology categories that can enhance traffic performance data collection.

Table 3 – ITS Technology Applications for Data Collection

Technology Category	Application
Video-based	License plate imaging and matching, through optical character recognition, can capture individual vehicle movements (origin-destination patterns and speeds), which can also be retained for multiple reviews of more detailed data on occupancy, classification, and density.
Transponder-based	In areas that offer electronic tolling, individual vehicle speeds can also be monitored outside of immediate toll plaza environment with the installation of additional reader antennas. Automatic vehicle location transponders can monitor continuous vehicle movement (separation of speeds by segment of travel).
Roadside sensor-based	Inductive loops, laser radar, acoustic, or microwave sensors can be installed as needed to enhance "aggregate" count, speed, and classification data

[15] Broward County Congestion Management System-Scope of Work, prepared by Department of Strategic Planning & Growth Management Transportation Planning Division, April 1994.

3.2 ITS Applications for Gathering Mobility Performance Measures

ITS brings *real-time* monitoring and reporting capability to system performance measures. Information on current conditions can be provided to travelers, not just shared among operating agencies. If this information is timely, reliable, and understandable, better trip-making and operational management decisions can be made resulting in reduced congestion.

ITS technologies (e.g., video-based optical character/image recognition, and wireless communication/tracking such as cellular and global positioning satellite systems) allow for *real-time* traffic information gathering for individual, or disaggregate, vehicle movements. Besides incident detection and management, this capability can also lend itself to the creation of perhaps more discriminating mobility performance measures such as:

- vehicle occupancy (at major downtown entry/exit points to monitor the effect of strategies to reduce single occupant vehicles during peak periods)
- traffic density (gaps between vehicles during peak periods along major commute corridors)
- person movement (combining vehicle occupancy with vehicle speed during peak periods)
- vehicle delay (duration and location of stopped time per trip, particularly for trucks)
- coefficient of speed variation (freedom of individual vehicle movement over different hours of the day)

Data collection, once thought to be very labor-intensive, can be automated and occur on more of a regular basis with potentially more robust sampling. Now the challenge becomes identifying the most appropriate ITS applications for satisfying the most needed monitoring and performance data collection and reporting requirements of the MMP. The resulting benefit, besides improved data collection and reporting, will be better management of overall mobility and assessment of improvements to mobility.

3.3 Identifying Suitable ITS Applications for Mobility Management-Local Perspective

As of April 1999, about 40 percent of Florida's MPOs have been or are soon to be applying various ITS applications to assist with their mobility management process needs. It is interesting to see the variety of ITS applications as noted in Table 4, and these applications illustrate what other Florida MPOs may want to consider.

Table 4 – Florida MPOs with ITS for Mobility Management Process (MMP)

MPO	ITS Application for MMP
Charlotte Co.-Punta Gorda	• Video detection component for computerized signal study • Plans for video based traffic data collection
Jacksonville Urbanized Area	• ITS deployment study for Interstates • CMS Committee monitoring ITS impact on mitigating congestion
Lee County	• Automatic vehicle location system programmed for transit • US41 variable message sign system for incident management • Queue reduction at bridge toll plazas with electronic toll collection (LeeWay), including off-peak toll reductions to spread demand
Metroplan Orlando	• Intelligent bus stops for express buses on I-4 and recommended expansion to US 17/92 • Recommended advanced mode choice and advanced traveler information systems • Automatic vehicle location used for speed-delay runs
Miami-Dade	• ITS comprehensive plan • Plan for interactive kiosks for traveler information and soliciting public input during the transportation planning process • Proposed automatic vehicle location for traffic data gathering • Regional traveler information services • Electronic toll collection • Advanced traffic signal system
Pinellas County Sarasota/Manatee	• Automation of travel time monitoring • Demonstration project being designed for advanced traveler information along Siesta Drive. • Demonstration project being planned for video detection technology in Sarasota and Bradenton.

MPO	ITS Application for MMP
Volusia County	• Deland traffic management center can manage special events and emergencies remotely from notebook computer and modem • Daytona smart highway system (known as DASH) includes incident detection with cameras and variable message signs to assist in rapid response and management.
Palm Beach County	• Incident warning plan being developed for rail transit (Tri-rail) • Automated transit information system and route scheduling • Advanced Traffic Signalization System w/video surveillance planned
Broward County	• I-595 Dynamic Message Sign System • I-95 Dynamic Message Sign System • Intracoastal waterway Dynamic Message Sign System • Broward County Advanced Traffic Management System (ATMS) • Advanced Traveler Information System (ATIS) • Broward County Signal Master Plan • ITS operation facility Master Plan

Source: Mobility Management Process Summary by MPO, compiled by FDOT Systems Planning Office, April 19, 1999.

Volusia County has had their "DASH" (Daytona Area Smart Highway) incident detection and rapid response system fully deployed for a number of years. Miami-Dade, on the other hand, is just beginning the design and deployment of their regional traveler information system. Metroplan Orlando will be using AVL (automatic vehicle location) technology for speed-delay measurements, while Charlotte County-Punta Gorda has plans for video-based traffic data collection. Sarasota/Manatee seeks to examine ITS benefits through demonstration projects. Several

MPOs have applied ITS to improving the efficiency of transit operations.

3.4 CMS/MMP Linkages to ITS-National Perspective

CMS provide an important mechanism for establishing the linkage between the development of ITS products and services and the metropolitan planning process. A national study[16] that reviewed 16 fully operational and 12 interim CMSs to determine the potential role of ITS revealed the findings noted below. These findings can also serve as guidelines for MPOs in the development of an ITS architecture.

1. ITS is a strategy for improving transportation system operations.
2. ITS must be viewed in a regional context.
3. ITS should not be neglected for transit and intermodal applications.
4. ITS investment is best supported as a source of information for transportation system performance monitoring.

Among the many recommended ITS solutions for mobility management, this same study found the following five ITS applications to mobility management to be cited most frequently. Again, it is recommended that MPOs generally focus on these types of applications.

[16] A Review of Metropolitan Area Early Deployment Plans and Congestion Management Systems for the Development of Intelligent Transportation Systems, US Department of Transportation, Federal Highway Administration, Report #FHWA-JPO-98-001, September, 1997.

1. Improved freeway and arterial management systems with video surveillance for verification, and more detector (inductive loops, laser, acoustic) coverage for better congestion coverage, incident detection, ramp metering, and traffic signal system controls.
2. Improved motorist information and guidance with highway advisory radio systems, and changeable message signs.
3. Integrated traveler information centers and transportation management centers covering broader areas.
4. Improved communication capabilities (voice, video, and data) in support of transportation system operators and users with fiber optic backbone networks.
5. Increased on-highway assistance to motorists with additional and more functional motorist assistance patrols.

Each MPO must determine its own needs for ITS application. Applications may include automation of specific traffic data collection for MMP performance measures, systems for continuous monitoring/reporting of congestion information, or both.

ITS Planning Guidelines

Chapter 4
ROLE OF ITS IN CORRIDOR STUDIES

4.1 BACKGROUND

A corridor study is a subset of the more comprehensive metropolitan transportation system planning process. The 1998 Transportation Efficiency Act (TEA-21) eliminated Major Investment Studies (MIS) as a separate requirement and called for the integration of the requirement into the planning and National Environmental Policy Act of 1969 (NEPA) analyses, as appropriate[17].

According to the FDOT[18] criteria for the Development of the Florida Intrastate Highway System[19], FIHS, an action plan or master plan means

> "an FIHS Corridor Plan identifying both construction-oriented and traffic management capacity improvement techniques to bring a controlled access facility to FIHS standards. Multimodal and interim, low cost, and short-term improvements to protect the operation and safety

[17] Public Law 105-178, Title 1-subtitle C, Section 1308. June 9, 1998.
[18] *Florida Interstate Highway System Handbook*, Systems Planning Interactive Library CD-ROM, Florida Department of Transportation, 1998.
[19] FDOT Topic No.: 525-030-250-d Development of the Florida Intrastate Highway System.

> of the facility are included. Public involvement, and coordination with MPOs, transit operators, and other local government officials are integrated in this planning process. Model Action Plan Scopes at five levels of detail are available in the FIHS Handbook or from the Systems Planning Office."

Following the procedures outlined in the FIHS Handbook and based on the level of detail required for the particular corridor plan, ITS can be introduced early on in the planning process. The next section will detail steps taken to incorporate ITS into corridor studies.

In general, the corridor study process defines and evaluates high-cost and high-impact transportation alternatives from cost/benefit, environmental and community perspectives. Incorporating a mixture of ITS user services that are applicable in each multimodal transportation improvement alternative, evaluated by the MIS, broadens the spectrum of short- and long-term choices available to decisions-makers.

ITS user services may not be the sole solution to the capacity problem of a transportation corridor or sub-area. However, utilizing the appropriate mixture of ITS user services can increase the efficiency and enhance the safety of the system. In some cases the decision to utilize ITS applications along a section of the corridor instead of widening the highway can prove to be a more efficient option.

4.2 Steps for Incorporating ITS into Corridor Studies

As previously discussed, integrating ITS into the transportation planning process can be achieved by incorporating ITS in all stages of the process.[20] As required, the traditional Draft Environmental Impact Statement, DEIS, as outlined by the MIS Desk Reference[21] should be prepared. The focus of this subsection is not to alter the current corridor study procedures as carried out in the State of Florida but discuss ways to include ITS in all phases of the corridor study process. Another traditional element of the process is public involvement required throughout all phases of the corridor study process. Providing ways for the public to get involved in ITS-based enhancements and ways to get public-private partnerships established will be discussed separately in the latter part of this section of the ITS Planning Guidelines.

The challenge to incorporating ITS into corridor plans can be particularly clear in alternatives evaluation portion of the process. A study prepared for Virginia DOT on the I-64 corridor study,[22] provides an example of where a traditional planning study was modified to incorporate specific analytical and modeling procedures necessary to evaluate ITS improvements. The following procedures are excerpted from the study as key steps used to incorporate ITS into the corridor study evaluation process:

[20] Integrating Intelligent Transportation Systems within the Transportation Planning Process: An Interim Handbook, Federal Highway Administration, 1998.
[21] MIS Desk Reference, MIS training Course. National Transit Institute, 1996.
[22] Integrating ITS and Traditional Planning-Lessons Learned I-64 Corridor Study. Parsons Brinckerhoff and Associates. Federal Highway Administration, 1998.

- Select measures of effectiveness that could be applied to all transportation modes and types of improvements. Included measures of effectiveness that highlighted the performance of ITS strategies.
- Collect field traffic and roadway geometry data.
- Use traditional travel demand forecasting models to predict corridor demand.
- Apply "industry-standard" techniques to validate travel demand, estimate modal shifts, and develop peak hour volumes necessary to support conceptual design assumptions.
- Develop and integrated "macroscopic" traffic operations modeling framework to test the performance of ITS strategies as well as traditional roadway capacity/design improvements and management strategies.
- Establish the sequence of computational procedures for the traffic operations modeling framework.
- Analyze and test successive layers of ITS improvements before deciding which strategies should be carried forward into final evaluation.
- Develop cost estimates for the ITS strategies.
- Develop and present final evaluation results for the corridor alternatives.

4.3 Examination of Corridor Transportation Needs

When defining the mobility issues associated with the corridor, elements that lend themselves to ITS applications should be emphasized. For example addressing capacity improvements that pertain to incident or emergency management needs, nonrecurrent delays due to weather, peak-hour traffic management or any other elements that have the potential of ITS implementation.

- Goals and objectives should also be specified in an ITS context. Emphasizing such issues as increasing system efficiency, safety enhancements, added capacity with minimum intrusions, minimum environmental and social impacts, providing current information to traveler, etc.
- Setting qualitative and quantitative criteria for evaluation. Evaluation is done not only to compare a set of ITS strategies to another, but also to compare alternatives with or without ITS components.

  - Analysis tools for evaluation of alternatives that are available for use in corridor studies include: travel demand model, traffic simulation, sketch planning, emissions inventory models and carbon monoxide hot spot model.
  - Evaluation criteria are created through extensive multi-agency discussions and public involvement process.

4.4 Identifying All Reasonable Multimodal Alternative Strategies [23]

The do-nothing alternative is required by NEPA as a baseline for estimating environmental impacts. The physical and environmental characteristics of the study area are discussed. ITS elements that already exist and enhancements to these elements can be overviewed in this step. Cost effectiveness comparisons of the build

[23] MIS Training Course, National Transit Institute 1996

alternatives with the do-nothing alternatives are also required as part of cost-benefit analysis.

- The extent of ITS inclusion in this portion of the corridor study process depends on both statewide and regional Florida ITS architecture keeping in mind the existing and proposed ITS user services on the corridor.

Low cost options such as Transportation System Management (TSM) and Congestion Management Strategies (CMS) would be identified. These alternatives would represent the best solutions without new physical improvements. These low-cost options also represent the best opportunity for a comprehensive ITS plan. These options might be outlined with base level ITS or enhanced level ITS.

- Base level ITS may include the initial startup cost of a traffic management center and communications infrastructure as defined in the regional plan. The base level ITS options may not provide the required capacity improvements, however, combining several ITS strategies into an efficient and coordinated management and information system can significantly increase the overall efficiency of the system. As a minimum requirement, the expected ITS elements proposed within all the build alternatives should be outlined in low-cost options.
- Enhanced-level are the more advanced ITS services that involve high market penetration and private sector partnerships. This

level can list all ITS benefits that apply to that corridor in peak congestion conditions. Table 1 in Task 1 of this report lists ITS user services that are applicable in corridors. Services that pertain to advanced vehicle control and safety systems may be considered enhanced-level ITS.

It is recommended that all build options include base-level ITS. Other ITS applications that compliment and enhance each of the building alternatives and satisfy its goals should also be included, provided that the goals are stated in a manner that lends itself to the use of ITS.

- The cost of each ITS user service specified for a particular build alternative should be included in the overall cost of that alternative including that of operation and maintenance services.
- The transportation, social, economic and environmental impacts and proposed mitigation of alternatives should be summarized in a table.

4.5 Alternatives Analysis

Transportation Impacts:

If ITS strategies are to be compared on equal basis with traditional transportation improvement projects, a new set of evaluation tools must be incorporated in the corridor study process to capture the impacts of ITS on enhancing the efficiency of the transportation system.

- Forecasting impacts of ITS can be accomplished using previously described planning analysis tools (section 1.3.7): *SCRITS* and *IDAS*.
- Another practical methodology for evaluation, as documented in the Seattle I-5 North Corridor Study, is the Process for Regional Understanding and Evaluation of Integrated ITS Networks, (PRUEVIIN.)[24] PRUEVIIN is a modeling and simulation tool for assessing the sub-area response to time-varying conditions and the impact of real-time traveler information, along with more traditional corridor/regional improvements.
- Further research is being conducted to document evaluation methodologies used in different case studies.

Social and Environmental Impacts:

- ITS strategies mainly involve telecommunications network, computers, data processing equipment, smart cards, traffic and transit management, etc. Impacts of these strategies are virtually non-existent compared to construction impacts that include right-of-way acquisitions, relocations, land use patterns, wetland mitigation, water resources, noise and vibrations, and air quality.

[24] *Incorporating ITS into Corridor Planning: Seattle Case Study, Executive Summary, Final Report.* Center for Telecommunications and Advanced Technology, Virginia. Federal Highway Administration, June 1999. Published at http://www.itsdocs.fhwa.dot.gov/jpodocs/edlbrow/7c01!.pdf.

- ITS services are being used to help protect the environment. New ITS technologies emerging every day encourage travelers to use transit, reduce idling pollution at toll plazas and traffic signals, and enable to cost-effectively reduce the environmental impacts of the automobile. However, individual tripmaking could actually increase with ITS and the environmental impacts could increase. These tradeoffs have to be carefully monitored and balanced.

Financial Analysis:

- Federal monies favor corridor projects that promote the national ITS architecture.
- Attention should be paid to the allocation of capital costs of regional systems to the corridor. The business plan of the Florida ITS strategic plan should address issues concerning the regional and corridor cost splits. Since base-level ITS are recommended for inclusion in all build alternatives, the capital costs of ITS network maybe somewhat standard among all the build alternatives. However, enhanced ITS services costs should be itemized and trade-offs between alternatives should be noted in order that decision-makers are informed of all possible options.
- Operation and maintenance costs including life cycle costing should be used to compare costs of ITS alternatives with traditional build alternatives. Trade offs between costs of different components of alternatives should be described in a way that helps decision-makers screen alternatives.

- User costs that involve purchases of smart cards or transponders, for example, may be counted as a disbenefit when assessing costs of ITS services.
- Anticipated public-private partnerships should be detailed in this section. The extent to which the manufacturers would participate should be clearly noted. If such partnerships have already been established with existing ITS user services on the corridor, they should be noted and promoted in this section.
- Cost/benefit analysis are done in view of the goals and objectives outlined in Phase 1 that discuss not only capacity but issues such as safety, peak hour traffic management, system efficiency, emergency and incident management, commercial vehicle operations, etc.

4.6 Public Involvement in the ITS Planning Process

The Florida Statewide Strategic ITS Plan highlights the following steps to follow for including ITS in the public awareness/ involvement[25] process.

- Include ITS education, training and outreach for policy makers, the general public and technical staff
- Respond to special user needs of commuters, tourists, goods movement, pedestrians, bicyclists, and the elderly
- Identify and support ITS advocates/champions in local government, public agencies, academia, the private sector, and the general public

[25] FDOT Statewide Strategic ITS Plan – Final Report, August 1999. p.13

- Support continued ITS research and operational testing, and provide a systematic research program to evaluate emerging technologies, new systems, markets, and planning methods

4.7 REMINDERS

- The initial phase of the corridor study process where the problems are identified and when goals and objectives are established is the most crucial phase in incorporating ITS. The language used to articulate the problems and discuss appropriate solutions to corridor mobility issues can either promote ITS user services or exclude them.
- The private sector role is very important in ITS implementation and should be considered at the inception of the project. Interagency coordination (public-public partnerships) and public-private partnerships are important to the success of the process.
- Although ITS solutions may not relieve capacity problems on a corridor, the appropriate applications chosen with a vision and long-term benefit in mind will increase the efficiency and capabilities of the system.
- The relationship between the Florida ITS architecture, regional components of ITS network system and major corridors in Florida should be clear to all stakeholders.

CHAPTER 5
CONCURRENCY MANAGEMENT IMPACTS ON ITS PLANNING

Among the unique features of transportation planning practice in Florida is the overlaying of the transportation concurrency provisions of our state's growth management regulations on top of the federally-prescribed metropolitan planning process. As a result, planning for ITS needs to be informed by the concurrency management requirements, and can contribute to meeting their provisions.

Although the concurrency management requirements apply specifically to local governments, MPOs often play an important role in assisting local governments in carrying out the requirements of concurrency management. This is particularly so in those urbanized areas in which the county or city planning staff also serve as the staff to the MPO. Even when that is not the case, MPOs frequently assist local governments with monitoring current levels of service and with applying traffic forecasting models used to estimate future levels of service.

The concurrency provisions, as they have evolved over time, provide significant opportunities for ITS technologies. There are two principal functions ITS can play to facilitate the implementation of concurrency management systems:

- Assist in the basic data collection efforts to monitor existing levels of service
- Optimize the capacity of transportation infrastructure elements, thereby minimizing the potential for current and future concurrency violations.

5.1 THE ROLE OF THE LEVEL OF SERVICE STANDARDS IN CONCURRENCY MANAGEMENT

The 1985 Growth Management Act requires that local governments adopt level of service (LOS) standards, which form the basis of concurrency management systems. The purpose of a concurrency management systems then becomes one of assuring that the locally adopted level of service standards are maintained as new development occurs. Measures of effectiveness for determining level of service for transportation facilities differ based on the specific types of facilities, as indicated in Table 5.

Table 5 – Measures of Effectiveness for LOS Determination

Type of Facility	Measure of Effectiveness	Operational Parameter
Freeways Basic freeway Weaving areas Ramp junctions	Density Average travel speed Flow rates	Vehicles per mile per lane Miles per hour Vehicles per hour
Multilane Highways	Density	Vehicles per mile per lane
Two-Lane Highways	Percent time delay	Percent
Signalized Intersections	Average vehicle stopped delay	Seconds per vehicle
Unsignalized Intersections	Reserved capacity	Vehicles per hour
Arterials	Average travel speed	Miles per hour
Transit	Load factor	Person per seats
Pedestrian	Space	Square feet per pedestrian

Source: Transportation Research Board, Highway Capacity Manual

Most local governments in Florida have primarily relied on the Florida DOT's Standardized Level of Service Tables[26] to evaluate levels of service and potential concurrency impacts.

ITS can assist in concurrency management in two important ways:

- measuring system performance, and
- increasing the efficiency of the transportation system

[26] Florida Department of Transportation, Florida DOT Level of Service Manual

5.2 Florida Department of Transportation Maximum Lane Policy

An important consideration in local government comprehensive plans is the maximum lane policy adopted by Florida Department of Transportation. This policy provides that limited access highways in urbanized areas will consist of no more than ten lanes with six lanes available for general use and four lanes reserved for high occupancy vehicles or longer distance trips. It also provides that other state highways will be limited to six through lanes. This policy has clear implications for transportation concurrency, in that it indicates that concurrency problems cannot always be solved by the additional of lanes.

5.3 Measuring System Performance

Concurrency management systems typically consist of two important parts. The first monitors the existing condition of the transportation system and relates it to currently adopted level of service standards. Most local governments rely primarily on level of service standards for arterial highways to assess compliance with concurrency. Though the LOS measure for arterial highways is average travel speed, local governments have found it to be much easier to collect traffic volume data than average travel speed data. As a result, they have typically made use of tables in FDOT's Level of Service Manual. These tables use typical operational and control parameters to convert the Highway Capacity Manual measure of effectiveness for arterial highways, e.g. average travel speed, to a traffic volume. It is then possible to estimate the level of service based on the corresponding traffic volume data. The level-of-service tables are an excellent "first-cut" estimate of level of service. ITS data gathering technologies (e.g., video and transponder) can permit more disaggregate (individual vehicle) level-of-service monitoring.

The second part of an effective concurrency management system consists of a method to estimate and keep track of the additional trips anticipated from approved new development. Typically, applicants for development approval submit estimates of additional traffic volume generated by the proposed development, based on the traditional four-step transportation modeling process. By adding the anticipated new trips from the development to the current traffic volumes, it is possible to estimate the change in level of service resulting from the new development, and thereby its compliance with concurrency requirements. ITS technologies can also monitor variation in individual vehicle speeds before and after development.

Most local government concurrency management systems allow a project applicant the option of applying methods for estimating level of service that are more precise than the FDOT level of service tables. More precise analyses can be performed with FDOT's highway capacity analysis programs, such as ARTPLAN, or more complex traffic simulation programs. For determining current level of service, against which to benchmark, it is also possible to perform primary field data collection through speed

and delay runs that measure actual travel speed. This can provide a more accurate estimate of current conditions than can be obtained from any computer analysis program. ITS technologies can provide the means to collect more robust sampling of speed-delay data.

ITS technologies can be of substantial assistance to local governments and MPOs dealing with concurrency management, by facilitating the collection and monitoring of system performance data. As noted in an earlier section, measures of effectiveness for determining level of service include a range of factors, which are specific to the type of facilities being evaluated. For roadway measures such as density (vehicles per mile per lane), average travel speed (miles per hour), flow rate (vehicles per hour), percent time delay and average vehicle stop delay (seconds per vehicle), and data collection can be greatly facilitated through the use of ITS technologies.

5.4 Basic Traffic Volume Data

The most basic measure of transportation system operation (and concurrency conformity) has been traffic volume data. Over time, technology for this fundamental data collection effort has evolved from pneumatic tube counters to inductive loop detectors to photographic counting methods. These newer technologies represent some of the most time-proven elements of ITS. The ability to collect, store and analyze large volumes of traffic flow rate data can be, and to a large extent already is, assisting local governments in their concurrency management functions. The incorporation of "smart" traffic data collection equipment has greatly enhanced this process. We now have inductive loop detectors with associated "smart" software that are capable of measuring not only traffic volume but also vehicle speed as well as performing a vehicle classification function. As a result, detection technology allows us to measure not only traffic volume but also vehicle density as well as travel speed at a particular location.

Florida DOT has recently substantially upgraded its permanent count traffic program, with the addition of advanced technology loop detectors. This technology can be a tremendous resource for concurrency management systems, as it permits continuous and historical monitoring of traffic conditions. This represents a major improvement over classical traffic counting programs that typically monitored conditions at a specific location two or three days per year, factoring them with elaborate systems of traffic adjustment factors. Local governments and MPOs should consider supplementing FDOT's program of permanent traffic count locations with sites of their own.

5.5 Video-Based Techniques

Another recent innovation in the use of intelligent transportation systems for data collection has been the use of photographic techniques. In Florida and across the country we are seeing widespread implementation of real time camera surveillance. Of course camera surveillance has also been used to observe traffic conditions, and as an aid for incident response. Notably, Orlando

has installed over a dozen high level cameras along I-4 to monitor real time traffic conditions.

With the recent development of optical character recognition (OCR) systems, we have seen very successful applications for traffic data collection. Specifically, the use of OCR systems to record vehicle license plates at various paths along a facility has been shown to be an effective method of determining average vehicle operating speeds over a defined roadway length. Even more recently there have been articles in the popular press about the ability of high altitude satellite imagery to be used for traffic data collection purposes.

5.6 Continuous Vehicle Tracking

There also have been some excellent applications of various methods of vehicle tracking, which can be used for purposes of determining average travel speed, the primary measure of arterial level of service. This can be accomplished through onboard vehicle transponders working in concert with roadside receptors, as demonstrated in Houston; alternatively, onboard transponders can be used as they were in the Orlando TravTek demonstration. CUTR has performed a project in the City of Miami to demonstrate the application of triangulation using ground-based cell phone technology to vehicle tracking. These technologies allow virtually continuous tracking of vehicles, which can be readily converted to operational parameters such as vehicle speed.

5.7 Additional Considerations

Since the implementation of the 1985 Growth Management Act and its concurrency requirement, a number of local governments have applied innovative measures to evaluate levels of service that go far beyond simply measuring traffic volumes. Grouping roadways in a corridor to calculate a corridor level of service, averaging levels of service over a geographic areas, and multimodal evaluation measures are making their way into local government concurrency management systems. These evaluation techniques make it even more important to be able to collect performance data economically.

The City of Miami includes vehicle occupancy as part of their concurrency consideration. ITS can help in this regard, as demonstrated by a project in Hillsborough County that made use of artificial intelligence along with photographic techniques to observe vehicle occupancy.

These brief examples clearly illustrate the great potential for ITS technologies to be used to establish current conditions for purposes of concurrency management systems. Many of these same technologies have equal applicability to the work of Metropolitan Planning Organizations in developing and maintaining congestion management systems.

5.8 Increasing the Efficiency of the Transportation System

The underlying purpose of concurrency management systems is to assure that the transportation system is performing at a level that meets public expectations as defined by locally adopted level of service standards. ITS technologies have tremendous potential to enhance the operational performance of existing and new transportation systems, thereby making concurrency violations less likely. Also, referring back to Table 2, there are a myriad of ITS applications that have potential relevance to concurrency management systems by virtue of improving the operational performance of the transportation system.

Almost the entire range of travel and transportation management services, including in-route driver information, route guidance, traveler services information, traffic control and incident management can effectively distribute traffic to optimize overall system performance, and to minimize concurrency violations. ITS user services related to travel demand management such as pre-trip travel information and ride matching and reservation services have the potential to reduce peak period demands on the system and allow it to function at a higher level of service.

Services related to public transportation operations such as in-route transit information, personalized public transit and public travel security enhancement can effectively add to improved modal share for public transportation resulting in overall improvement to user levels of service. Electronic payment services for various automobiles and transit users can improve the operational efficiency of transportation systems.

Services related to commercial vehicle operations can minimize the adverse impact of large and hazardous vehicles on the operations of the transportation systems. All of these actions will serve to enhance the free flowing movement of vehicles thereby reducing risks of concurrency violations.

Looking further into the future, specifically in the area of advanced vehicle control and safety systems, there is a potential for quantum increases in the capacity of transportation systems, as we currently know them. Components such as longitudinal and lateral collision avoidance systems, vision enhancement systems, pre-crash restraint deployment, automated highway system concepts and railroad safety enhancements collectively have the ability to dramatically increase throughput over existing transportation system elements.

Because of the recognized ability of ITS investments to improve the operation of the transportation system, local governments would do well to consider exaction credits and impact fee credits, for developer contributions to ITS infrastructure.

In summary, it is clear that ITS technologies can play a very important role in concurrency management systems. They can:

- Greatly facilitate the measurement of current systems performance
- Enhance the operational efficiency of the transportation system

It is important that local governments and MPOs be aware of these potentials and be prepared to address them as they look into the future at potential concurrency management problems and solutions. Specifically, local governments and their MPOs need to include the full range of ITS services in their toolkit of techniques to deal with congestion and minimize the negative consequences of concurrency violations.

CHAPTER 6
THE ROLE OF ITS IN SUSTAINABLE TRANSPORTATION AND ECONOMIC GROWTH

6.1 ITS AND SUSTAINABILITY

While much has been written about the potential for ITS to improve overall efficiency of the transportation system, comparatively little has been written on the impacts of ITS in terms of the sustainability of the transportation system. In one of the few papers on the subject, Barbara C. Richardson, uses a definition of sustainability as "... meeting the needs of the present without compromising the ability of future generations to meet their own needs". In this paper, she noted that... "While the goals of the National ITS Program might be met in the short term for the individuals who directly own or are exposed to ITS technology, the longer term consequences are unclear."[27]

Most discussions regarding ITS and sustainability relate to differentiating between the short-term impacts, which are generally seen as quite positive and the long-term impacts, which are more uncertain. Richardson notes that as ITS improves the quality of traffic flow, "...travelers become aware of the easing of previously

[27] Barbara C. Richardson, The Role of ITS in Sustainable Transportation, University of Michigan Transportation Research Institute, presented at the ITS America Annual Meeting, April 1999, Ann Arbor, Michigan. Published in the conference proceedings.

poor conditions. Some people will be induced to travel more because of the improvement of the quality of service.... As congestion eases, travel becomes easier and more travel may occur as a result....As travel increases, congestion, fuel use and environmental degradation increases." Richardson suggests possible short and long-term impacts of ITS technologies. In general, she indicates that ITS technologies aimed at improving public transportation operations will have positive impacts on sustainability both in short and long term. Similarly, measures primarily aimed at enhancing safety are expected to positively impact sustainability both in the short and long term. In general, she raises uncertainty about the long-term implications of advanced vehicle control systems and traveler information and traffic management systems on sustainability.

6.2 ITS AND AIR QUALITY SUSTAINABILITY

The issue of short-term versus long-term benefits has recently come to the forefront, largely as a result of requirements of the Clean Air Act Amendments. In responding to meeting the national ambient air quality standards, many metropolitan areas have included strategies aimed at smoothing traffic flow, which characteristically results in lower air pollutant emissions. These actions have included expanding the highway system to better accommodate growth, as well as traffic operations improvements, of which many ITS measures are a subset.

The Transportation Research Board (TRB), in 1995, issued a Special Report 245, *Expanding Metropolitan Highways: Implications for Air Quality and Energy Use*. Much of the report, which was overseen by a blue ribbon national advisory committee, dealt with the issue of short-term versus long-term impacts of transportation capacity increases. The report notes that "the key uncertainty is at what point the emissions increases from the new developments and traffic growth, stimulated by the capacity addition will offset the initial emission reduction gain from smoothing traffic flows". The report suggests that in less developed portions of metropolitan areas major highway capacity additions are likely to attract further development and increase motor vehicle use, while multiple small improvements are more likely to simply redistribute traffic from one facility to another.

The TRB through its National Cooperative Highway Research Program recently initiated a Project 25-21, Predicting the Short-Term and Long-Term Air Quality Effects of Traffic Flow Improvements. The purpose of the project is to develop a methodological approach to allow some of these questions to be answered on a project-by-project basis. However, the current state of the art is insufficient to provide compelling answers to these important questions. Nonetheless, transportation planners at the state level, at MPO's, and in local governments need to be aware of these issues related to sustainability.

6.3 ITS Impacts on Sustainability Caused by Redistribution of Growth and Induced Travel

A major difficulty in evaluating these impacts, based on current transportation planning methods, is caused by the static nature of current travel forecasting models. Specifically, trip generation is determined based on exogenous land use assumptions. The models will invariably show that more transportation capacity, whether in the form of capital improvement or operational efficiency such as ITS, causes a fixed number of trips to move more smoothly. The reality of the interactions between transportation system improvements and land use/economic development are not very well reflected in our current modeling system.

A major question with respect to capacity additions, whether achieved by new construction or operational improvements such as ITS technologies, is whether improved efficiency of the transportation system causes the redistribution of growth that would have occurred elsewhere or whether it stimulates productivity gains that results in new growth. This issue is highly debated at this point and an ultimate conclusion is uncertain. One argument contained in the TRB Special Report 245 states... "There is no empirical support for the proposition that highway capacity additions in regions that are already substantially developed make a measurable difference in overall levels of population or employment growth...thus providing capacity which simply accommodates more efficiently the inevitable new development."

With respect to ITS technology, the specific issue that needs to be addressed is whether the type of operational improvements resulting from ITS will induce additional travel to occur. The issue of induced travel needs to be separated from general growth in travel that will occur regardless of the quality of the transportation system, as a result of growing population and employment in Florida's metropolitan areas. To properly consider the impacts of ITS, the comparison needs to be between a future forecast with ITS and a future forecast without ITS. Only by doing this comparison can the implications of ITS be evaluated.

6.4 ITS Equity Issues Impact on Sustainability

An important element of the contemporary debate on sustainability relates to social equity. Virtually any transportation investment results in some people benefiting while others incur costs. In the case of ITS improvements, special care needs to be taken to encourage the participation in benefits by all elements of society. To the extent that ITS infrastructure is put into place that benefits only the wealthy, who are capable of affording the additional costs associated with ITS vehicular technology, the services may be seen as exclusionary. On the other hand, many systems such as incident detection and management and ITS related traffic control systems benefit all vehicles whether or not they have the ability to interface directly with a central control system.

Clearly ITS services in support of travel demand management and public transportation operations have a significant ability to benefit less affluent elements of society. ITS services related to commercial vehicle operations contribute to enhancing the overall productivity of society, resulting in lower costs and goods in the market place, which benefits all. Emergency management services as well as certain advanced vehicle control and safety net systems have the ability to benefit broad segments of society. As we deal with mobility issues of an aging population, services such as collision avoidance systems, vision enhancement and restraint deployment systems offer great promise.

Concerns of social equity in the transportation planning and project development process generally arise from lack of access to the decisionmaking process. Historically, lack of access to the process has resulted in disproportionately high and adverse impacts on many low-income or ethnic minority communities. To ensure the participation in the benefits of ITS improvements by all elements of society, transportation planners and other professionals should seek to engage the public in the decisionmaking process from project conception through maintenance. Several federal and state initiatives and other resources are available to provide assistance. The resources provide additional tools to help address questions of conformity. Chief among these is the community (social) impact assessment process. The process helps transportation planners and analysts consider the effects of proposed actions on the human environment and the quality of life. The community impact assessment process can be used to analyze potential social equity concerns of an ITS action. Along with other factors, consideration should be given to access to decisionmaking and information; disproportionate impacts; and cumulative impacts.

An effective outreach plan and public involvement process can help to ensure that information regarding the proposed action reaches all target audiences. Key elements to providing access is determining how the target audiences receive information and then using those media. This often means going beyond the traditional newspaper notice and public meeting. The outreach plan and public involvement should reach audiences where they live and in a manner appropriate to the audiences. For example, many recent immigrants to this country have origins in non-democratic countries. A public workshop sponsored by a government agency may not be appropriate for such a community. In general, make reasonable efforts to involve all potentially impacted populations equally and to bridge ethnic or cultural barriers that may obstruct access to the decisionmaking process.

Using the public involvement process and other community impact assessment techniques, planners and analysts work with affected communities to identify potential impacts of the proposed ITS action. If adverse impacts are identified, reasonable efforts should be made to address the impact in an equitable manner for all populations. Reasonable efforts may include avoiding the impact, finding alternatives that minimize the effects of the impact, or mitigating the effects of the impact. Planners and analysts also can use the proposed ITS action to enhance communities.

6.5 Other Factors Affecting Sustainability

The impact with the respect to sustainability depends not only on the ITS element, but also on pricing, public policy and on vehicle characteristics as well. For example, if automated highway systems, in which we might theoretically double the vehicular throughput rates on a given facility, were to become a reality, at first glance we might fear a doubling of the auto related air pollutants. However, during the same time period we potentially might make additional great strides in the efficiency of motor vehicles. Eighty-five miles per hour vehicles that run virtually pollution free are being talked about more and more. While this guidebook cannot provide clear answers, it can raise clear questions that need to be addressed and considered in the decision making process by transportation policy makers.

When evaluating ITS projects, transportation planners will need to consider both the short term and long term implications on sustainability. As noted, the primary issue to be evaluated is to what extent a particular ITS project will cause induced traffic, beyond that which would have otherwise occurred. To the extent that ITS actions facilitate mobility without inducing additional travel, they will have contributed to sustainability. This contribution will take the form of fewer air pollutant emissions, less noise, and reduced cost of transportation.

6.6 ITS AND ECONOMIC GROWTH

The deployment of ITS technologies can significantly benefit Florida's economy. To the extent that ITS technology allows our transportation systems to operate more efficiently, it can allow us to accommodate more economic growth without further degradation to the transportation system or the environment. By optimizing the efficiency of the system, we can better accommodate corporate relocations and expansions. A strong economy is very important to sustainability and especially to the economic sustainability of the least affluent members of society.

An excellent source on the economic impacts of ITS is a recent FDOT report, Economic Impact of Intelligent Transportation Systems in Florida—An Issue Paper.[28] Much of the information in this section is drawn from this excellent source. Of course good transportation is vital to Florida's economy. Whether it relates to the typical commuter's trip to work, the movement of freight across our state, or ease of access for tourists, transportation impacts every aspect of our economy. Economic benefits of ITS deployment can include improved safety, reduced congestion, better traveler information (which allows for more informed transportation decisions), reduced environmental impacts, and substantial cost savings.

[28] Economic Impacts of Intelligent Transportation Systems in Florida – An Issue Paper (Final Draft Report), Prepared for the Florida Department of Transportation by KPMG Peat Marwick, December 1998.

The above-referenced paper cites a number of categories of specific ITS applications that can benefit Florida's economy:

- Support of highway pricing initiatives/electronic toll collection
- Improved regional data collection and dissemination for transportation planning
- Opportunities for new service and product innovations
- Hurricane/flood/fire
- Restoration of capacity after disasters/major incidents
- Tourist travel information
- Resident travel information/reliability of employee arrival
- Traffic operations for draw bridges
- Reliability of good movement/impact on just-in-time delivery
- Management of traffic/travel information/electronic clearance at intermodal terminals/access to ports and airports
- More efficient allocation of existing highway capacity
- Incident management/special events traffic management
- Management of traffic under construction

The full paper offers detailed examples for each of these service types. It also suggests the possible economic impacts of ITS deployment in Florida. It estimates that direct benefits from transportation system efficiency gains (primarily travel time savings and accident reductions) could amount to $13 billion benefit over a 20-year period. Expected gains from rural applications and CVO would be additional.

Another potential contribution of ITS implementation is the image-enhancing result that may make the area more attractive to high technology businesses. For example, the current efforts to promote the I-4 Corridor for high technology microelectronics industry, may be enhanced by the addition ITS technologies in the corridor.

Clearly, ITS has major implications for Florida's economic health. Our competitiveness in world markets, our ability to attract tourists, and the health of our cities can greatly be enhanced by fully integrating ITS solutions into our transportation toolkit. MPO planners need to stretch their imaginations to include all possible creative solutions.

CHAPTER 7
RANKING ALTERNATIVE ITS INVESTMENTS AND PERFORMANCE MEASURES TO COMPARE ITS WITH NON-ITS IMPROVEMENTS

The most significant underlying feature of ITS project planning is for ALL transportation agencies to acknowledge the importance of ITS as a tool for solving transportation problems. Each agency must commit to incorporating ITS solutions into the traditional transportation planning process (not separate selection process for ITS projects), whereby ITS projects are identified and evaluated each year, as warranted, in direct competition with other projects for available funding.

7.1 RANKING ITS PROJECT ALTERNATIVES

While the ITS project planning process should be conducted at the same time as traditional project planning, somewhat different criteria are suggested for project selection and ranking. A proposed five-step process, similar to a TIP project selection process, can facilitate project selection, prioritization, and ranking of stand-alone ITS projects or conventional projects with ITS enhancements.[29] These five steps are illustrated in Figure 3, and described as follows:

[29] Excerpted from "Intelligent Transportation System Plan for Dade County", February 1997, pp. 19-22.

Step 1 – Project Identification

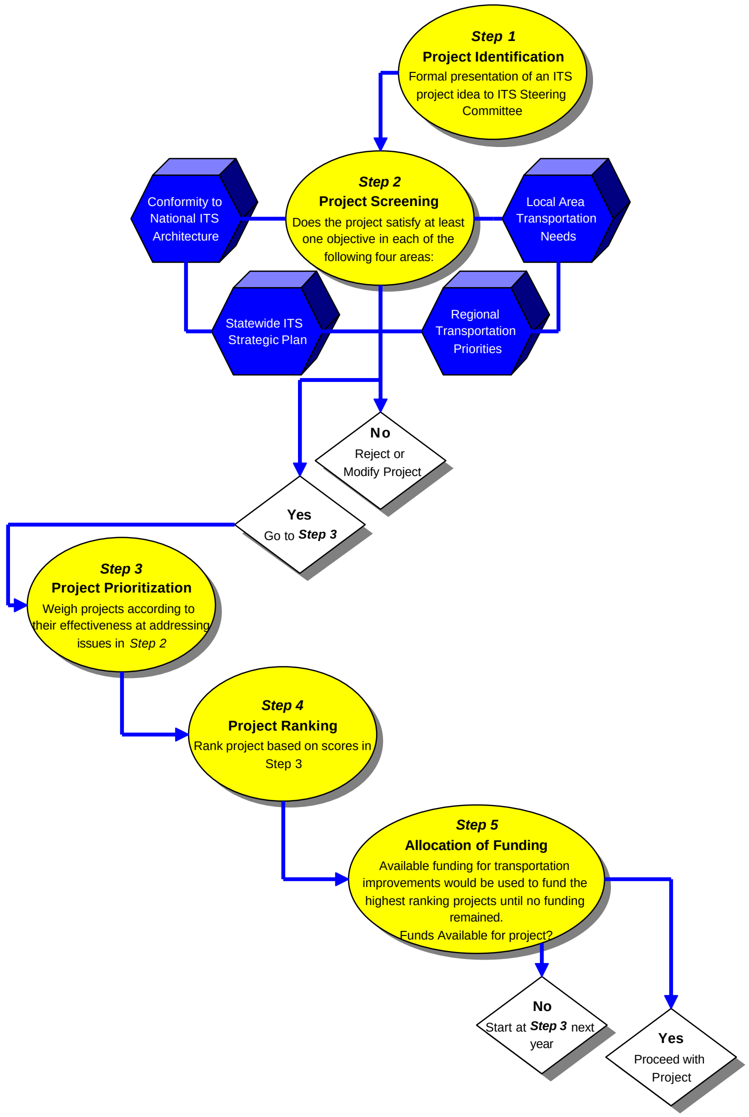
An ITS project proposal must be formally submitted to the local ITS Steering Committee for review and consideration. This proposal should include but not be limited to a detailed description of the project, life-cycle cost analysis (compared to conventional alternatives), and cost-sharing opportunities. Also, ITS projects generally have higher operating and maintenance costs associated with them.

For example, the cost analysis included for a ramp-metering project would be compared to costs for mainline widening. Likewise, capital and operating costs for electronic tolling would be compared to estimated costs associated with plaza expansion and increased labor/operating. Individuals, public agencies, or private companies can submit ITS projects.

Step 2 – Project Screening

The project selection step is intended to screen out ineligible ITS projects from those presented in Step 1. In order to "pass" the project selection step, the local ITS Steering Committee should consider four different sets of goals and objectives. More specifically, eligible ITS projects should clearly address at least one objective in each of the following four areas:

Figure 3 - Recommended ITS Project Planning Process



1. Conformity with National ITS Architecture, the Florida Statewide Architecture (for updates see http://www.jeng.com), or Regional Architecture
2. Florida Statewide ITS Strategic Plan
3. Regional Transportation Priorities
4. Local Area Transportation Needs

Under Conformity with National ITS Architecture, the checklist of questions previously noted in Section 1, as part of the Interim Guidance would be included[30]. Under Florida Statewide ITS Strategic Plan, objectives noted under the four goals of the Plan would be considered.[31] Objectives for Regional Transportation Priorities and Local Area Transportation Needs should be evident and familiar to all.

Step 3 – Project Prioritization

Again, if a regional architecture already exists, project priority would be based on adherence to the pre-determined phasing plan for implementation. Otherwise, this step identifies a set of qualitative and quantitative factors that will be applied to each project. Establishing weighting for each set of objectives noted in Step 2, times the number of objectives addressed in each area is strongly encouraged. For example, questions addressed under Conformity with National ITS Architecture could each be four points,

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[30] Federal Highway Administration, "Interim Guidance on Conformity with National ITS Architecture and standards," October 1998.
[31] Florida's Intelligent Transportation System Strategic Plan, Final Report, August 23, 1999, pp. 9-11.

objectives addressed under the Florida Statewide ITS Strategic Plan could each be three points, and so on. Expected benefits versus costs must be quantified for project comparison.

Qualitative factors can include consideration of such project characteristics as the project's relationship to specific corridor vs. area wide (general) needs, cost-sharing opportunities, level of support (interagency and the general public), time frame of importance (immediate, short-term, or long-term), degree of technical skill re-training needed for operations, etc.

Step 4 – Project Ranking

Factors previously identified in Step 3 would be applied equitably to each eligible ITS project to establish a rank order of importance. Those eligible ITS projects that are related to planning, research, development, and education/awareness of ITS would be ranked for inclusion in the Unified Planning Work Program. Those eligible ITS projects that are related to deployment would be ranked for inclusion in the Transportation Improvement Plan.

Step 5 – Allocation of Funding

Priority should be given to public/private partnership funded projects that are consistent with the adopted regional architecture and area priorities. Available funding for

transportation would be used to fund the highest-ranking projects (ITS and non-ITS combined) until no funding remained. Projects not ranked high enough in the current planning year would be re-considered beginning at Step 3 for the next fiscal year.

7.2 Potential Benefits and Costs for ITS

As previously mentioned in Chapter 4, there is an on-line ITS benefits and costs database that exists at http://idf.mitretek.org/its/benicost.nsf/frm/home. Also, under the U.S. DOT's ITS Electronic Document Library at http://www.its.dot.gov/welcome.htm, the 1999 Update for ITS Benefits can be found as document 8323. Several examples of estimated potential benefits to be realized for a number of ITS user services are shown in Table 6.[32] It should be noted that reported information on ITS benefits may be based on a limited number of references, and the assumptions and constraints placed upon interpretation of results may vary from project to project (thus the need for standard performance measures). This information is intended as a guide only.

[32] Intelligent Transportation Systems Benefits: 1999 Update, prepared by Mitretek Systems, Inc. under contract to USDOT, May 28, 1999.

Table 6 – Potential ITS Benefits

User Service	Range of Reported Benefits
Arterial Management Systems (1), (2)	• 8-20% reduction in travel time (1) • 20-43% reduction in crashes (2)
Freeway Management Systems (3)	• 15-50% reduction in crashes
Electronic Toll Collection	• 40-120% increase in vehicle throughput • 10-43% reduction in operating costs • Emission reductions of 72% for carbon monoxide, 83% for hydrocarbons, and 45% for oxides of nitrogen per mile of operation
Transit Management Systems (4)	• 4-9% reduction in required fleet size • 12-23% improvement in on-time performance
Incident Management Systems	• 55-76% reduction in incident clearance time
Emergency Management Systems	• 10-20% reduction in response time

Notes: (1) adaptive traffic signal system, (2) red light running enforcement, (3) ramp metering, (4) Automatic vehicle location/computer–aided dispatching

ITS component costs have also been included in the Mitretek database noted above. This cost repository includes a high and low value for capital and yearly operating costs, plus expected lifetime of each component to facilitate life-cycle cost analysis comparison with conventional transportation improvements. As with benefits data, this information is intended only as guide in ITS cost estimating. This database is periodically updated based on feedback received from across the country. Table 7 lists a few of

the ITS component costs contained in the cost repository that would be associated with some of the user services listed in Table 1.

Table 7 – Sample ITS Cost Elements

Subsystem/Equipment	Lifetime (years)	Capital Costs ($K)	O & M Costs ($K/yr)
CCTV Video Camera	10	$25-$50	$0.6-$1.7
Signal Controller Upgrade	20	$2.5-$10	$0.2-$0.5
Ramp Meter	5	$30-$50	$1.5-$3.5
Variable Message Sign	20	$65-$120	$2.8-$6
Electronic Toll Reader	10	$2-$5	$0.2-$0.5
Emergency Management Communications Software	20	$5-$10	$2.5-$5
Emergency Vehicle On-Board Communications Interface	10	$0.3-$2	$0-$0.02
Video Monitor for Incident Response	5	$2.7-$3.3	$0.135-$0.165
Integration Software for Signal Control	5	$180-$220	0
Integration for Electronic Tolling	20	$90-$110	$4.5-$5.5

It is very important to have benefits assessment and cost estimation for ITS projects be conducted and/or reviewed by experienced ITS Steering Committee members. Outside expertise may be required to assure reasonable ITS estimates for benefits and costs required for equitable project comparison.

7.3 Comparing ITS vs. Non-ITS Strategies

The Phoenix MPO has informally adopted a rating point system (which has been slightly modified in the example below) for comparing ITS with non-ITS projects. This comparison rating approach (to be utilized by the local ITS Working Committee, or subcommittee of the TAC) is fairly simple, relatively easy to apply, and a good starting point for application in Florida.

The system is based on assessing four characteristics of each project: (1) deployment priority, (2) congestion/integration, (3) cost, and (4) jurisdiction match.

A maximum of 100 points is awarded to each project according to the following point scale for each characteristic:

Deployment Priority (45 Maximum Points)

- 45 points for addressing all needs in entire area
- 35 points for addressing most needs in at least half the area
- 25 points for addressing a few needs in less than half the area
- 15 points added if project addresses special event traffic or high traffic generator

Congestion/Integration (30 Maximum Points)

- 0 to 30 points, based on resulting VMT/lane-mile ratio (0 for lowest and up to 30 for highest).

Cost Factor (15 Maximum Points)

- 0 to 15 points, based on VMT/cost (0 for lowest and up to 15 for highest). Projects for which VMT estimates are unavailable will be scored based on project cost only.

Jurisdiction Match (10 Maximum Points)

- 0 to 10 points, based on extent of matching funds from Federal and/or State (0 for no match and up to 10 for highest Federal match)

7.4 Suggested Performance Measures for ITS

The National ITS Program has highlighted five major goal areas, each with preferred measures of effectiveness.[33] The ITS Planning Guidelines recommend utilizing the same MOEs as follows:

Safety

- Reduction in overall crash rate
- Reduction in the rate of crashes resulting in fatalities
- Reduction in the rate of crashes resulting in injuries
- Improvement in surrogate measures (e.g., reduction in speeds during inclement weather, reduction in red light running, etc.)

[33] ITS Evaluation Resource Guide, FHWA Joint Program Office, February 3, 2000, Appendix A, pp.4-9.

Mobility

- VMT/lane-mile
- Reduction in travel time delay
- Reduction in travel time variability
- Increase in customer satisfaction (e.g., product awareness, expectations of product benefits, product use, change in behavior, realization of benefits, and assessment of value)
- Improvement in surrogate measures (e.g., improvement in working relationships between agencies responsible for providing mobility, improved agency operations, etc.)

Efficiency

- Increase in throughput or effective capacity of existing facilities (e.g., VMT/lane-mile)
- Extent of addressing local area needs (e.g., deployment priority)

Productivity

- Cost savings (before vs. after ITS installation, or compared to traditional transportation improvement)
- Extent of cost sharing with non-public funds

Energy and Environment

- Reduction in emissions
- Reduction in fuel consumption

ITS Planning Guidelines

CHAPTER 8
RECOMMENDATIONS AND NEXT STEPS

In order for MPOs to mainstream ITS into the transportation planning process, ITS subcommittees should be established in each area. ITS deployment should be based on satisfying local area needs, meeting concurrency management requirements, and addressing the seven TEA-21 planning factors. The deployment of ITS must follow a prescribed plan (or architecture) that defines how all the technologies and services will be brought together into a single, integrated system.

Mobility Management Plans (MMPs) existing in each MPO area can benefit by the systematic deployment of ITS, primarily because of the capability of ITS to include automated monitoring and performance reporting capabilities not previously available. Automated data collection and performance monitoring should be a component of all MMPs.

Sketch planning analysis tools exist today to estimate the expected benefits of ITS deployment. They should be applied in the early stages of the planning process to compare ITS with non-ITS improvements. Once deployed, ITS projects and enhancements must be monitored and appropriate measures of performance defined and reported.

Finally, in order for the integration of ITS into the transportation planning process to be meaningful, beneficial, and permanent,

transportation planners must be willing to fully commit to and engage in the following activities:

- Promote ITS integration and incorporate into regular job duties
- Actively participate in meetings of the local ITS Subcommittee of the MPO Technical Advisory Committee
- Make ITS consensus-building presentations to other agencies, businesses, and community groups
- Regularly communicate with elected officials and management to secure ITS commitments of cooperation, funding, and overall support
- Work to develop partnerships with the private sector, where appropriate
- Ensure the project development process is consistent with the regional ITS architecture, and that ITS-related projects or enhancements are assessed and compared in a consistent equitable manner
- Promote continuing communication among participating agencies and private sector partners
- Maintain credibility with elected officials and the public by keeping a "customer orientation" with the delivery of ITS projects (i.e., provide evidence that a useful service is being provided)
- Keep a "problem-solution" emphasis with the application of ITS
- Realize that ITS must work in coordination with other problem-solving approaches, not in competition with them

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