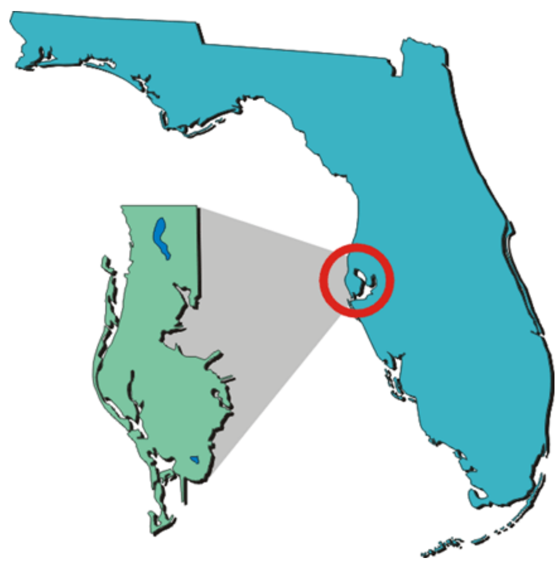
Pinellas County Metropolitan Planning Organization (MPO)

Long-Range ATMS/ITS Master Plan

Prepared for

Pinellas County Metropolitan Planning Organization (MPO)



Prepared by

RENAISSANCE PLANNING GROUP

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LIST OF EXHIBITS

LIST OF ACRONYMS

%RMSE-Percent Root Mean Square Error
AADT-Average Annual Daily Traffic Volumes
ACM-Alternatives Comparison Module
AGM-Alternatives Generator Module
ATMS-Advanced Traffic Management System
CCC-Central Communications Center
CCTV-Closed-Circuit Television
CMAQ-Congestion Management and Air Quality Mitigation
CUTR-Center for Urban Transportation Research
DMS-Dynamic Message Signs
FHWA-Federal Highway Administration
GOPs-Goals, Objectives and Policies
HAR-Highway Advisory Radio
IDAS-Intelligent Transportation Systems Deployment Analysis System
IOM-Input/Output interface Module
ISP-Information Service Providers
ISTEA-Intermodal Surface Transportation Efficiency Act
ITS-Intelligent Transportation Systems
LOGT-Local Option Gas Tax
LRTP-2025 Long-Range Transportation Plan
MIST-Management Information System for Transportation
MOU-Memorandum of Understanding
MPO-Pinellas County Metropolitan Planning Organization
NHS-National Highway System
OPAC-Optimized Policies for Adaptive Control
PCC-Primary Control Center
PSTA-Pinellas Suncoast Transit Authority
RHODES-Real-Time Hierarchical Optimized Distributed Effective System
SAFETEA-LU-Safe, Accountable, Flexible, Efficient Transportation Equity Act
SIS-Strategic Intermodal System
SOP-Standard Operating Procedures
STP-Surface Transportation Program
TBRPM-Tampa Bay Regional Planning Model
TEA-21-Transportation Efficiency Act for 21st Century
TRIP-Transportation Regional Incentive Program
TS&MCC-Traffic Signal and Median Control Committee
VHT-Vehicles Hours Traveled
VMT-Vehicle Miles Traveled

EXECUTIVE SUMMARY

Intelligent Transportation Systems (ITS) is the application of emerging technologies that assist agencies in the operation/management of transportation facilities. They have shown to increase operational capacity, improve efficiency and enhance safety to the users. ITS covers all transportation facilities (vehicular, transit, pedestrian) and is commonly divided into subcategories. The subcategories are tailored to provide services in the areas of Advanced Traffic Management Systems (ATMS) for arterial and freeways, Advanced Traveler Information Systems and Advanced Public Transit Systems. It is important to coordinate the deployment and integration of all ITS technologies as they support services across ITS subcategories.

The objective of this document is to develop a comprehensive long-range ATMS/ITS master plan for Pinellas County. This master plan assesses several existing ITS studies conducted through a variety of agencies and consultants, documents a benefit/cost analysis using the ITS planning software called IDAS (Intelligent Transportation Systems Deployment Analysis System), assesses operations and maintenance requirements and identifies potential funding sources.

Existing ITS Studies Assessment

Several studies conducted through a variety of agencies and consultants have been performed that indicate an overall direction for ATMS/ITS in Pinellas County. The MPO began planning for ITS deployments in 1999, at which point they began evaluating the transition of the existing traffic signal system into an ATMS. Since then, the MPO has actively participated in the planning, design and implementation of ITS. Numerous studies were conducted and were reviewed as part of this project. In summary, the reviewed documentation provides a path that has guided the deployment of a homogeneous and standardized ATMS. The recommendations and directions of the previous plans, studies, and policies remain valid. The following have been completed or is being pursued:

- Conducted technical and feasibility studies for current ATMS/ITS projects
- Drafted an interagency agreement (or MOU) for a countywide partnership
- Created an emergency response preemption policy for fire/rescue
- Developed and adopted ITS goals, objectives, and policies (GOPs)
- Has begun updating the fairly antiquated signal system to adaptive control
- Has begun installing the following recommended ITS initiatives:
    - Incident management systems
    - Incident detection/verification
    - Regional multimodal traveler information systems
    - Dynamic message signs
    - Telephone-based traveler information system
    - Web/Internet-based traveler information system
    - Traffic surveillance – CCTV
    - Traffic surveillance – detector system
    - Information service provider center

In 2001, the Pinellas County Metropolitan Planning Organization (MPO) adopted ITS into the 2025 Long-Range Transportation Plan and established an ITS Advisory Committee to coordinate ITS efforts within the county. The ITS Advisory Committee is comprised of representatives from Florida Department of Transportation (FDOT) and other city and county stakeholders. The ITS Advisory Committee developed a 2025 ITS corridor map to depict a phased implementation plan for ITS within Pinellas County. However, no formal analysis has been conducted to determine the feasibility of implementing ATMS beyond the first phase of designated corridors.

Benefit/Cost Analysis

The benefit/cost analysis utilized the ITS planning software called IDAS to document benefits for the deployment of ITS along the 2025 ITS Corridor Map developed by the ITS Advisory Committee. The IDAS model was used to evaluate four alternatives for the following ITS services:

- Traffic adaptive control
- Incident detection/verification
- Co-location of traffic management and emergency services
- Traveler information systems (Note: dynamic message signs were the only component included in the modeling effort because IDAS yielded unusual results when trying to incorporate other broader traveler information systems, such as 511 telephone/web services and highway advisory radio.)

There are other ITS elements that the MPO considers to be part of the overall ITS Program, such as pedestrian safety features, emergency preemption, transit systems, and parking information systems. However, the pedestrian safety and parking information elements cannot be accurately analyzed through the IDAS program. The transit systems were not analyzed in IDAS because the additional coding effort and data requirements were beyond the scope of work.

Physical roadway network characteristics and traffic volumes were inputted from the 2025 Tampa Bay Regional Transportation Planning Model (TBRPM) to develop a baseline condition for the IDAS analysis. The baseline scenario was validated against the output of the TBRPM. As part of the alternative development, results from the TBRPM were evaluated to determine if additional corridors should be added to the analysis. The results showed no changes were required. The alternatives were developed to follow the current geographical deployment of ITS, as established by the 2025 ITS Corridor Map. The alternatives analyzed included:

- **Alternative #1** – Geographically covering Phase 1 funded projects with traffic adaptive control, incident detection/verification, and DMS.
- **Alternative #2** – Geographical coverage to include all of Phase 1 (funded and unfunded) with traffic adaptive control, incident detection/verification, and DMS.
- **Alternative #3** - Geographically covering Phases 1 and 2 with traffic adaptive control, incident detection/verification, and DMS.

- **Alternative #4** - Geographically covering Phases 1, 2, and 3 with traffic adaptive control, incident detection/verification, and DMS.
- **Alternative #5** - Geographically covering Phases 1, 2, and 3 with traffic adaptive control, combined incident detection/verification response (co-locating traffic and emergency services at a central communications center), and DMS.

The IDAS modeling effort produced results in terms of performance measures and benefits. The performance measures showed that as ITS deployments were expanded geographically, the roadway network would operate more efficiently and safer. Alternative #5 (full-build out) yielded:

- 7.3% decrease in vehicle hours traveled
- 1% increase in speed along all roadways
- 7.0% decrease in fatalities due to secondary accidents
- 19.8% decrease in incident related delays
- 15.2% decrease in fuel consumption
- 10.8% to 16.3% decrease in emissions

In order to estimate benefits, IDAS relies on user-defined parameters that describe how much improvements result from ITS deployments and the benefits in dollars. IDAS default values for these parameters are based on ITS deployments across the nation. These parameters were adjusted to local conditions, as well as, to be conservative for the analysis. Costs for the ITS deployments were estimated separately from recent ITS construction bids and conservative assumptions. Both the benefits and costs were annualized to 2005 dollars.

The benefit/cost ratios ranged from 7.95 for Alternative #1 to 11.76 for Alternative #5. Alternative #5 (11.76) yielded a 35% increase in the benefit/cost ratio over Alternative #4 (8.68). Therefore, co-locating traffic and emergency services will significantly increase the benefits associated with deploying ITS.

Implementation Plan

A methodology for evaluating the current phasing of ITS deployments was applied to develop a recommended implementation plan. It distributes the benefits based on use of each facility by the public. The benefits from Alternative #5 were distributed across each roadway segment proportionate to the vehicle-miles traveled on the respective roadway segment. The benefits by roadway segment were then divided by the annualized deployment costs for that specific district to yield a benefit/cost ratio. This methodology provides a direct relationship between the customers (represented by VMT) traveling along ITS corridors and the benefits on the links with ITS improvements. This is a high-level analysis and is not intended to reprioritize any operational needs considered during the development of the current phasing. It is understood that the current phasing was developed based on local knowledge of the operational needs of the transportation network, which would override any slight differences in benefit/cost ratio.

The recommended changes include the following and the final phasing is depicted on the following page:

Phase 1 to Phase 2

- 66th St. N./SR 693 from Gulf Blvd. to 46th Street
- Sunset Point Rd. from Belcher Rd. to McMullen Booth
- 54th Avenue N. from 66th St. N. to I-275

Phase 2 to Phase 1

- Bryan Dairy from Seminole Blvd./Alt. US 19 to Roosevelt Blvd./SR 686
- Roosevelt Blvd./SR 686 from Ulmerton Rd./SR 688 to Gandy Blvd./ 4th St. N./ SR 694
- SR 686 from 49th Street to Ulmerton Rd./SR 688
- Tampa Rd./SR 584/SR 580 from East Lake Rd. to County Line
- Curlew Rd./SR 586 from McMullen Booth to SR 584/Tampa Rd.
- Main St./SR 580 from McMullen Booth to SR 584/Tampa Rd.

Phase 2 to Phase 3

- Alt. US 19/SR 595/Pinellas Ave. from Klosterman Rd. to Pasco County Line
- Tampa Rd. from Alt. US 19/SR 595/Palm Harbor Blvd. to Belcher Rd.
- Curlew Rd./SR 586 from Alt. US 19/SR 595/Bayshore Blvd. to Belcher Rd.
- Drew St./SR 590 from Alt. US 19/SR 595/ Ft. Harrison Ave. to Belcher Rd.
- Main St./SR 580 from Alt. US 19/SR 595/Broadway to Belcher Rd.

Phase 3 to Phase 2

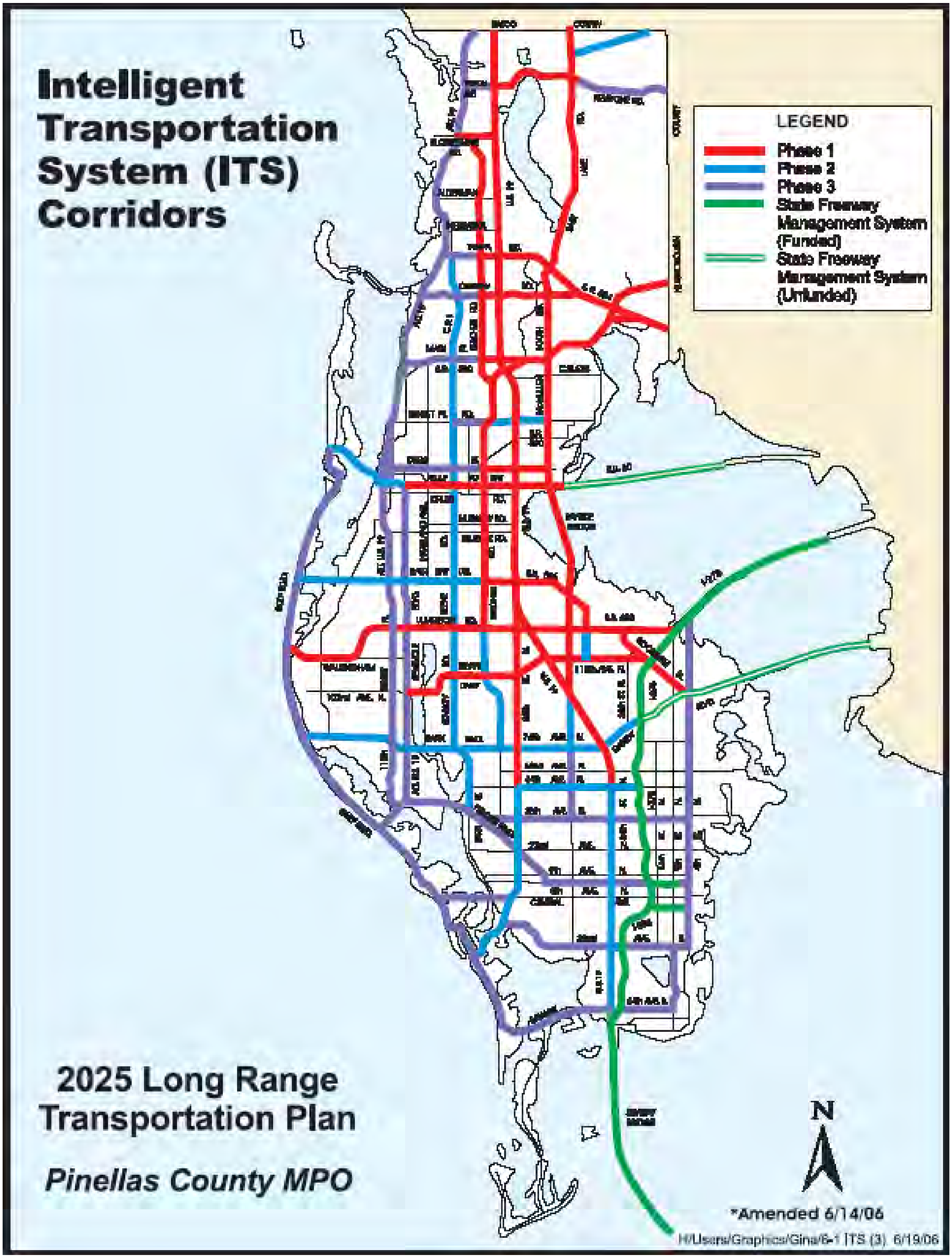
- Starkey Rd./Keene Rd. from Tyrone Blvd./Alt. US 19/SR 595 to Tampa Rd.
- Belcher Rd. from Ulmerton Rd./SR 688 to Park Blvd.

Phase 3 to Phase 1

- Countryside Blvd. from Belcher Rd. to Main St.

The estimated capital cost was developed at a high level for the benefit/cost analysis and to determine the feasibility of deploying ITS along the ITS Corridors identified by the ITS Advisory Committee. Communications costs are significant relative to the overall costs and can influence the number of corridors funds. Pinellas County has successfully used existing conduit for fiber optic communications in the McMullen Booth ATMS Project. A conceptual design will help identify the availability of existing conduit, which would better refine these costs for programming funds. It is recommended to conduct a conceptual design for communications, as well as other field equipment, along the corridors to refine the estimated costs before programming funds. The following is the cost by recommended phase for arterials only. The FDOT Freeway Management System (Courtney Campbell and Gandy Blvd) and Centralized Communications Center are not included.

- Phase 1 (unfunded only) - $25,804,520
- Phase 2 - $20,697,600
- Phase 3 - $43,349,320


Intelligent Transportation System (ITS) Corridors
LEGEND
Phase 1
Phase 2
Phase 3
State Freeway Management System (Funded)
State Freeway Management System (Unfunded)
2025 Long Range Transportation Plan
Pinellas County MPO
N
*Amended 6/14/06
H/Users/Graphics/Gina/6-1 ITS (3) 6/19/06

Additional recommendations include the consideration of using the local county-owned radio for disseminating traffic information. This is a low-cost alternative to deploying additional DMSs along arterials. The signs used to alert the motorists are less intrusive than DMS, and the motorists can receive more information via radio than from DMS postings. Consideration of a service patrol program along the US 19 corridor and other major corridors is recommended. FDOT District Six (Miami-Dade County) has deployed such a pilot program along the US 1 corridor, and the initial results have been very positive.

Operations and Maintenance (O&M)

The MPO has adopted the concept of a unified ATMS system that includes a primary control center. The primary control center will manage the ATMS/ITS corridors and potentially be located in the programmed central communications center. The *Pinellas Countywide ATMS Requirements Document* defined a concept of operations for the primary control center. The concept of operations envisioned a proposed staffing structure that included the following:

- Management team
- Primary control center manager
- Primary control center assistant manager
- Information systems engineer (network engineer)
- Public information specialist
- ATMS/ITS operators
- Administrative staff

The *Pinellas Countywide ATMS Requirements Document* focused on the primary control center and did not address ATMS/ITS-specific maintenance staff. It is assumed that Pinellas County, the City of Clearwater, and the City of St. Petersburg have adequate staff for maintaining the traffic signals. They are also assumed to have adequate resources for addressing signal timing adjustments as needed. However, additional staff will be required for maintaining the fiber optic communications, CCTV, and DMS.

Establishing adequate management support is critical to the success of the ATMS/ITS operations and maintenance. Therefore, it is recommended that key personnel be hired prior to the completion of Phase 1 (funded). The key personnel include the PCC manager, the network engineer, the public information specialist, and the maintenance supervisor. This covers all aspects of the ATMS/ITS program to ensure cohesiveness in the overall operations and maintenance activities. Additional funding for operations and maintenance by phase includes:

- Phase 1 (funded) – $763,670
- Phase 1 – $1,070,100
- Phases 1 and 2 – $1,549,860
- Phases 1,2, and 3 – $2,005,250

Additional staffing requirements by phase are presented in the table below.

Position	Cumulative Total Personnel			
	Phase 1 (Funded)	Phase 1	Phase 1 & 2	Phase 1,2, & 3
PCC Manager	1 full-time	1 full-time	1 full-time	1 full-time
PCC Assistant Manager	0	0	1 full-time	1 full-time
Network Engineer	1 full-time	1 full-time	1 full-time	1 full-time
Public Information Specialist	1 full-time	1 full-time	1 full-time	1 full-time
ATMS/ITS Operators	2 full-time and 2 part-time	2 full-time and 2 part-time	6 full-time	6 full-time
Administrative Staff	0	0	1 full-time	1 full-time
Maintenance Supervisor	1 full-time	1 full-time	1 full-time	1 full-time
Maintenance Technicians	0[1]	3 full-time	4 full-time	5 full-time

[1]Note: Assumes the contractor, as part of the initial installation, will cover initial maintenance under warranty for one year.

Possible Funding Sources

Possible options for funding the projects are available through a myriad of federal, state, county, municipal, and possibly private sector sources.

In addition to capital funding, system operations and maintenance costs are eligible for federal funds. Pinellas County is eligible for such funding through Surface Transportation Program and National Highway System funds. In the past, Pinellas County was eligible for Congestion Management and Air Quality Mitigation (CMAQ) funds. However, these funds are no longer available because of the current "attainment" status regarding air quality.

The Transportation Regional Incentive Program (TRIP) provides an incentive for regional planning, to leverage investments in regionally significant transportation facilities (roads and public transportation), and to link investments to growth management objectives. The percentage of state matching funds provided from the TRIP will be matched on a dollar-for-dollar basis by eligible funds or eligible in-kind sources. TRIP funds may be used to fund up to 50 percent of the non-federal share of the eligible project costs.

Local county and municipal funding sources include the Local Option Gas Tax (LOGT), transportation impact fees, the "Penny for Pinellas" infrastructure surtax,

grants, ad valorem taxes, and general funds. Local revenues are expected to increase considerably, particularly with the addition of the "Penny for Pinellas" tax. In addition to the LOGT, other revenues are expected to be derived from taxes, licensing and permitting fees, charges for services/public safety and transportation, interest earnings, rents, surplus/refunds, and reimbursements (which are included as a primary funding source for operation and maintenance projects). The municipal governments fund operation and maintenance programs using their share of the LOGT and general funds, including ad valorem taxes, proceeds from the sale of assets, interest earnings on investments, franchise fees, utility service taxes, license and permit fees, intergovernmental state sharing, grants, public service district charges, leisure service user fees, fines, and forfeits.

Public/private partnerships represent another potential funding mechanism to support the ATMS/ITS program. These mechanisms may include traveler information and shared resource strategies.

1.0 INTRODUCTION

Pinellas County, though physically the second smallest county within the state of Florida, experienced a 76 percent increase in population over a 30-year period ending in 2000. At that time, the county boasted over 921,000 residents. This figure gives Pinellas County the distinction of having the most densely populated county in Florida. This high rate of population growth, coupled with high transportation demand, has resulted in a congestion-filled network of streets.

Intelligent Transportation Systems (ITS) is the application of emerging technologies that assist agencies in the operation/management of transportation facilities. They have shown to increase operational capacity, improve efficiency and enhance safety to the users. ITS covers all transportation facilities (vehicular, transit, pedestrian) and is commonly divided into subcategories. The subcategories are based on services, which include Advanced Traffic Management Systems (Arterials and Freeways), Advanced Traveler Information Systems and Advanced Public Transit Systems. It is important to coordinate the deployment and integration of all ITS technologies as they support services across ITS subcategories.

In 2001, the Pinellas County Metropolitan Planning Organization (MPO) adopted ITS into the 2025 Long-Range Transportation Plan and established an Intelligent Transportation System (ITS) Advisory Committee to coordinate ITS efforts within the county. The ITS Advisory Committee is comprised of representatives Florida Department of Transportation (FDOT) and other city and county stakeholders. The ITS Advisory Committee developed a 2025 ITS corridor map, but no formal analysis has been conducted to determine the feasibility of implementing Advanced Traffic Management Systems (ATMS) along the designated corridors.

In December 2004, the MPO updated the *2025 Long-Range Transportation Plan*[1] (LRTP). As part of this plan, management and operations were identified as a key to improving system efficiency and helping the MPO reach its objectives. The MPO has requested that a Long-Range ATMS/ITS master plan be developed in order to confirm the feasibility and prioritization of the 2025 ITS corridor map. The feasibility analysis utilized the ITS planning software called IDAS (Intelligent Transportation Systems Deployment Analysis System) to document benefits for the overall transportation roadway network.

1.1. DOCUMENT OBJECTIVES

The objective of this document is to supply the MPO with a planning tool for full implementation of an ATMS; provide for future operations and maintenance costs; and identify possible funding sources. This document was developed to support the County's LRTP[1], not to replace it. The analysis was conducted at a high level, and is not intended to address specific technical requirements for future deployments.

The primary ITS elements that were evaluated fall under the classification of ATMS. They included Traffic Adaptive Control Software, Incident Detection / Management and Traveler Information Systems. There are other ITS elements that the MPO consider to

be part of the overall ITS Program, such as pedestrian safety features, emergency preemption, transit systems, and parking information systems. However, the pedestrian safety and parking information elements cannot be accurately be analyzed through the IDAS program. The transit systems were not analyzed in IDAS because the additional coding effort and data requirements were beyond the scope of work.

1.2. DOCUMENT STRUCTURE

This section (section 1.0), presents a brief description of the county's needs. It also documents the county's acknowledgement of federal regulations, goals, objectives, and policies (GOPs) regarding ITS.

Section 2.0 of this document provides an overview of the MPO's decision processes that have brought them to the current LRTP[1]. It also presents a discussion of the chronological progression of the ATMS studies, interlocal agreements and policies. In addition, this section will compare all previous recommendations for the county against the currently programmed initiatives.

Section 3.0 describes the IDAS model and its functionalities as used for this project. As part of this project, four alternatives will be analyzed using IDAS. These alternatives are presented here as well. Finally, the results of each alternative are displayed, and the findings as they correlate to the project are identified.

A recommended ATMS implementation plan is presented in section 4.0 of this document. A combination of the results from the IDAS analysis and the existing LRTP[1] was used to provide the plan for a full buildout of the ATMS network. The costs for future projects are introduced in this section as well.

Section 5.0 discusses the present and future operations and maintenance (O&M) requirements for the county. This includes short-term and long-term O&M for the transportation managements centers (TMCs), and the respective staffing requirements.

Finally, section 6.0 of this document provides a list of possible funding sources for the county to consider in implementing the long-range ATMS/ITS master plan.

1.3. NEEDS ASSESSMENT

The LRTP[1] fully describes the county's transportation needs assessment. Within the report, it is clear that there is an increasing demand for capacity and connectivity to the county's transportation network. In addition, the cost for capacity improvement projects is rapidly escalating. Therefore, the county is being proactive in its efforts to address congestion by using alternative strategies, particularly advanced technology, to enhance mobility. ITS is a prime example of this approach; its main purpose is to make current infrastructure more efficient through capacity, demand and operations management; and at a fraction of the cost and completion time required for conventional capacity-building transportation projects.

1.4. CONFORMITY WITH FEDERAL REGULATIONS

The Pinellas County MPO develops plans, policies, and priorities that guide local decision making on transportation issues. In addition to the general MPO mandates,

the Pinellas County MPO acknowledges the necessity for compatibility and consistency with ITS Rule 940, which requires all ITS-related projects to conform to federal, state, and regional ITS architectures. Pinellas County was included in the regional architecture developed by the FDOT, with participation from Pinellas County stakeholders and approved by the MPO in March 2005.

1.5. ITS GOALS, OBJECTIVES, AND POLICIES

The planned transportation improvements detailed in the LRTP are prioritized to meet the goals, objectives, and policies (GOPs) of the MPO. The LRTP[1] documents five goals with specific objectives and policies for achieving these goals. These goals include:

GOAL 1. Provide for a safe and energy efficient “multi-modal” and “intermodal” transportation system that serve the transportation needs of Pinellas County while enhancing the quality of life for its citizens.

GOAL 2. Promote “livable community” concepts that allow people to travel freely and safely in the urban environment through non-motorized travel modes such as walking, bicycling and skating.

GOAL 3. Contribute to the economic vitality of Pinellas County through the provision of a transportation system that provides for the effective movement of people and goods to and from major employment centers and intermodal facilities.

GOAL 4. Ensure coordination of state, regional and local transportation plans.

GOAL 5. Develop and implement plans and programs that are responsive to the transportation needs and interests of Pinellas County citizens while raising public awareness about the role and responsibilities of the MPO.

While ATMS/ITS deployments will have a positive impact towards all five goals listed above, the MPO has classified the ITS related objective under Goal #1 in the area of transportation system management and operations. The ITS Objective is to “***Protect roadway capacity, optimize operating efficiency, enhance safety of transportation facilities and reduce congestion through the application of Intelligent Transportation Systems (ITS), system management and demand management strategies.***” The MPO has adopted the following policies to support this objective:

- *The MPO shall support the implementation of ITS strategies in Pinellas County that are consistent with Long Range Transportation Plan goals, objectives and policies.*
- *The MPO shall ensure that ITS projects are consistent with the countywide ITS architecture, and that the countywide ITS architecture is consistent with the national, state and regional ITS architectures.*
- *The MPO shall ensure coordinated ITS operations, primarily through the ITS Advisory Committee, which includes identifying and involving appropriate stakeholders in updating the countywide architecture and each proposed ITS deployment.*
- *The MPO shall facilitate agreements on the roles and responsibilities among ITS stakeholders, including agreements on organization/management, staffing, operations control, data sharing and protocol.*

- *The MPO shall partner with information service providers and other stakeholders to collect and distribute pre-trip and route guidance information, including available transit and ridesharing options, real-time roadway and parking conditions and directions to destinations.*
- *The MPO shall provide policy guidance, coordination and implementation funding to city and county traffic departments and the Florida Department of Transportation to reduce travel delays along I-275 and other major roadways in the county using ITS deployments that optimize traffic flow by observing and responding quickly to actual traffic conditions.*
- *The MPO shall provide policy guidance, coordination and implementation funding to the city and county traffic departments and the Florida Department of Transportation, emergency service departments and state and local police departments in their efforts to manage incidents using cooperatively developed incident response plans that are supported by ITS strategies capable of detecting incidents quickly.*
- *The MPO shall provide implementation support to the Pinellas Suncoast Transit Authority in focusing on improving operations using ITS strategies, such as computer-assisted control of vehicles, automated routing and scheduling, electronic driver and maintenance management, improved internal communication and bus rapid transit strategies.*
- *The MPO shall work with the Florida Department of Transportation to ensure that any future electronic fare and / or parking payment transaction technologies are compatible with the department's Sun Pass system.*
- *The MPO shall work with and support the Florida Department of Transportation as it deploys commercial vehicle operations technologies, such as electronic clearance and roadside safety inspection.*
- *The MPO shall provide policy guidance, coordination and implementation funding to emergency service departments in the county to develop an integrated emergency vehicle management system that is able to receive route guidance information from traffic and incident management systems.*
- *MPO shall coordinate with the Primary Control Center in archiving data collected by each of the ITS deployments in such a way that ensures the integrity of the data allows stakeholders to retrieve data and provides information needed by the MPO's Congestion Management System and other functions.*
- *The MPO shall ensure that decisions regarding traffic signal installations and median opening requests are balanced between impacts on surrounding neighborhoods and compliance with federal warrant criteria or applicable state and local roadway access rules and regulations.*
- *The MPO shall adopt the regional ITS architecture consistent with ITS Rule 940.*
- *The MPO shall develop and implement a process to ensure that all new projects comply with the regional ITS architecture.*
- *The MPO shall develop a Master Plan for countywide implementation of an Advanced Traffic Management System.*
- *The MPO shall ensure that interim ITS projects are implemented consistent with the long term concept of operations that includes coordinating and/or directing all ITS and related functions in a Centralized Primary Control Center.*
- *The MPO shall develop and implement a system for tracking projects (i.e., roadway construction, utility projects, drainage projects, etc.) that may influence roadway operations.*

2.0 EXISTING AND PLANNED CONDITIONS

Prior to assembling an ATMS/ITS master plan, it is important to research, analyze, and compare the results and recommendations of previous ITS reports and studies prepared for or by the county. This section provides the results of such an analysis.

2.1. ATMS/ITS PROGRAM ASSESSMENT

The existing ATMS/ITS documentation were reviewed and recommendations were assessed and summarized. When feasible, key excerpts, such as executive summaries, are contained in Appendix A. The following narrative highlights the previous ATMS/ITS efforts and provides a history of ATMS/ITS in Pinellas County.

- **May 1999: *System Assessment for Clearwater, Pinellas County, and St. Petersburg.*** Recommendations focused on moving from a traditional jurisdictional traffic signal system to a regional ATMS system to present a seamless transportation network across jurisdictional boundaries. The use of dynamic message signs (DMS), highway advisory radio (HAR), and closed-circuit television (CCTV) was introduced. The report also acknowledged the need to conform to national architecture and emerging ITS standards.
- **February 2000: *ITS Architecture for FDOT District 7.*** This effort began to identify the information flows and coordination among local agencies within Pinellas County and the Tampa Bay region. Specific ITS services were identified, including center-to-center communication. The Tampa Bay Regional ITS Architecture was updated in 2002. An executive summary of the 2002 update is contained in Appendix A. In 2005, the stakeholders revisited the Tampa Bay Regional Architecture, which was also adopted by the MPO in 2005. The latest version has the following ITS services: Traffic Management, Transit Management, Traveler Information, Maintenance and Construction, Emergency Management, and Archived Data Management. For detailed information on information flows among agencies, visit http://www.consystec.com/florida/d7/web/_regionhome.htm.
- **March 2000: *Computerized Signal System Evaluation – Protocol-90 Communications Issues.*** This effort analyzed potential upgrades to the existing traffic signal system. Two potential upgrades were analyzed: having the existing proprietary signal system software manufacturer develop a new system, or replacing the existing central computer equipment with up-to-date technology. The base document is contained in Appendix A.
- **April 2000: *Recommended Evaluation Methodology and Assessment of Technology.*** First, an evaluation methodology was developed for the Traffic Signal and Median Control Committee (TS&MCC) to review various signal system vendors. The methodology used a utility/cost analysis. Utility measurements were developed and weighted by the TS&MCC. The results are Appendix A. The traffic adaptive traffic signal system technology was selected. Second, an assessment of technology was conducted. As part of this effort, regional coordination was advanced with the concept of an omnibus/virtual control center. The executive summary is contained in Appendix A.
- **October 2000: *SR 60/US 19 ATMS Feasibility Study.*** Once ITS earmark funding was obtained for SR 60 and a portion of US 19, a feasibility study was conducted for the ITS earmark funding. The feasibility study developed a project ITS architecture that involved stakeholders from transportation, police, and fire/rescue agencies. As part of the ITS

project architecture, local agencies identified the need to enhance operational efficiency through coordination and communication. The feasibility study developed a conceptual plan for ITS deployment along the corridor that included the application of a fiber optic communications network, traffic adaptive signal control, non-intrusive vehicle detectors, CCTV, DMS, and dynamic trailblazer signs. An implementation plan for the conceptual ITS design was also developed; it contained three stages of deployment. The recommended ITS deployment for this project is shown in the Pinellas Countywide ATMS Feasibility Study[2] exhibits 5.1 and 5.2 in Appendix A.

- **July 2001 (Modified in April 2003): *Program Statement on the Countywide Signal System.*** This effort documented the MPO adoption of the *Pinellas Countywide ATMS Requirements Document* and gave guidance on how to coordinate services and functions among agencies. It identified the need to develop protocols for the functioning of the traffic signals' recurring and nonrecurring conditions (e.g., special events). This document is contained in Appendix A.
- **October 2001: *Pinellas Countywide ATMS Requirements Document.*** The objective of this effort was to establish the requirements for the Pinellas countywide ATMS on three levels; operational (concept of operations), technical (functional requirements), and institutional. This document is contained in Appendix A. Key results from this effort included the following:
    - Recommended an organization structure and defined roles for a management team policy.
    - Recommended program staffing at a primary control center, and system equipment responsibilities.
    - Recommended a list of interagency agreements to support a countywide ATMS.
- **December 2001 (Updated in December 2004) Pinellas County 2025 Long-Range Transportation Plan.** In 2001, the MPO adopted Goals, Objectives and Policies regarding ITS. These were updated in 2004 and are previously described in section 1.5.
- **May 2002: *Pinellas Countywide ATMS Feasibility Study[2].*** An extension of the *Pinellas Countywide ATMS Requirements Document* and the *SR 60/US 19 ATMS Feasibility Study*, this effort developed a conceptual design for deploying ITS along the US 19, SR 688, and CR 611 corridors. The recommended deployment was estimated to yield a benefit-to-cost ratio of 6.57 to 1. The executive summary and maps depicting the recommended ITS deployment is contained in Appendix A.
- **June 2003: *Evaluation of Deployment Strategies – Pinellas County ATMS and Adaptive Control Systems.*** Traffic adaptive control strategies and systems were evaluated for the initial deployment of ATMS. A phased deployment was recommended to evaluate two separate systems {Optimized Policies for Adaptive Control (OPAC) and Real-Time Hierarchical Optimized Distributed Effective System (RHODES)} that were supported by Federal Highway Administration (FHWA). It also recommended *not i*ntegrating the new system with the existing proprietary system. The executive summary is contained in Appendix A.
- **January 2004: *Traffic Signal Preemption by Emergency Fire Service Vehicles Policy.*** In January 2004 an emergency signal preemption policy was adopted that defined the purpose, procedure for use, prohibition of use, and system management policies. There are 212 traffic signals currently equipped with signal preemption for emergency vehicles.
- **2006: *Countywide ATMS / ITS Traffic Signal Interlocal Agreement Between Pinellas County and The City of Clearwater.*** This executed agreement is for the coordination of installation and operation of ATMS and ITS countywide. It establishes roles and

responsibilities for each agency, and names the existing Pinellas County Traffic Control Center as the temporary PCC. It transfers traffic control jurisdiction of the ITS corridors from the City of Clearwater to Pinellas County. The City of Clearwater will transfer the operators and maintenance expense of the ATMS / ITS systems to the County as they transfer traffic control jurisdiction to Pinellas County. This document is contained in Appendix A.

In summary, the reviewed documentation provides a path that has been followed by Pinellas County as it moves toward a homogeneous and standardized ATMS. The recommendations and directions of the previous plans, studies, and policies remain valid as of the present time, even in light of significant technology changes that have occurred since these reports were written.

It should be noted that the MPO, Pinellas County, FDOT and local agencies have diligently followed the recommendations of these efforts, which is apparent from an assessment of the county's current ATMS/ITS deployments and studies. The following have been completed or is being pursued:

- Conducted technical and feasibility studies for current ATMS/ITS projects
- Drafted an interagency agreement (or MOU) for a countywide partnership
- Created an emergency response preemption policy for fire/rescue
- Developed and adopted ITS goals, objectives, and policies (GOPs)
- Has begun updating the fairly antiquated signal system to adaptive control
- Has begun installing the following recommended ITS initiatives:
    - Incident management systems
    - Incident detection/verification
    - Regional multimodal traveler information systems
    - Dynamic message signs
    - Telephone-based traveler information system
    - Web/Internet-based traveler information system
    - Traffic surveillance – CCTV
    - Traffic surveillance – detector system
    - Information service provider center

The MPO has actively participated and supported the progress of ATMS/ITS planning, design and implementation activities. A timeline of their involvement is presented in Appendix B.

2.2. CURRENT ATMS PROGRAM

Through the ITS Advisory Committee and the TS&MCC, local agency partners developed a countywide ITS corridor map depicting three phases of ITS deployments (see exhibit 1). The ITS corridors and their phasing were developed based on local knowledge of traffic congestion and demands along major arterials within Pinellas County. They applied a systematic approach to covering the more critical corridors, while considering operational constraints. Exhibit 1 was adopted as part of the LRTP[1]. Phase 1 of the ITS corridor map includes the recommendations from the *Pinellas Countywide ATMS Feasibility Study*[2], with some modifications. These modifications include the following:

- SR 55/ 34th Street from 54th Avenue N. to 54th Ave S. was moved to Phase 2
- 66th Street from US 19 to Gulf Boulevard was added to Phase 1
- 54th Avenue from 66th Street to I-275 was added to Phase 1

Pinellas County's current programmed ATMS/ITS projects are listed in exhibit 2. There is over $41.3 million in funding for ATMS projects along the arterial network, of which $12.8 million is dedicated to a new Primary Control Center that will house both ATMS services and emergency services. Another $39.2 million is programmed (not funded) for expanding the ATMS network. Exhibit 2 also identifies $26.1 million ($21.3 million funded and $4.8 million unfunded) for ATMS along the freeways within Pinellas County.

Exhibit 1 - Pinellas County ITS Corridors – 2025 Long-Range Transportation Plan

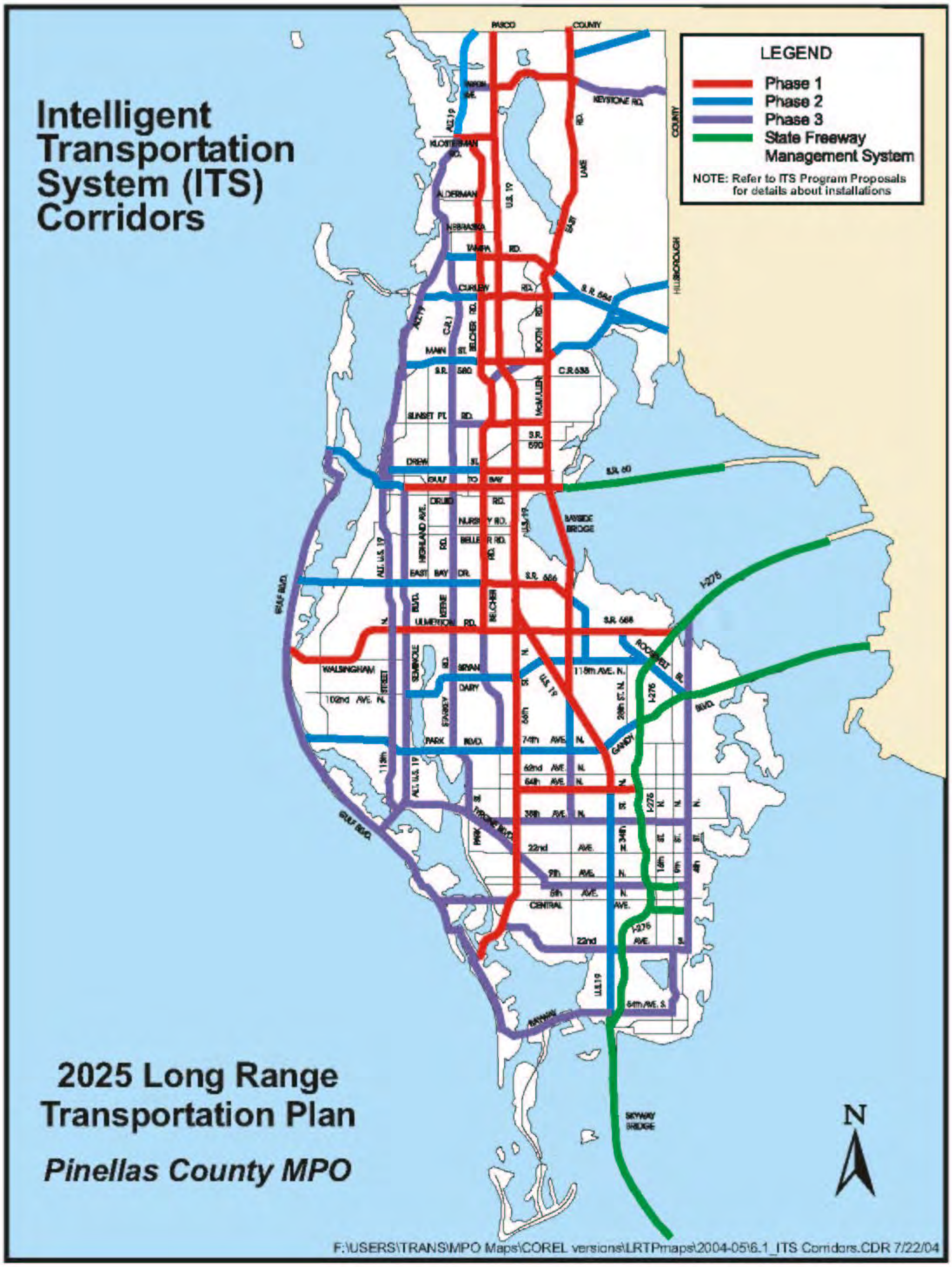


Exhibit 2 - Current Pinellas County ATMS/ITS Projects

Project	Cost	Equipment
Arterial Management System Projects		
S.R. 60 (Phase 1, Stage 1) - Hillcrest Ave. to Damascus Drive US 19 - Seville Blvd. to Haines-Bayshore Rd.	$5.5 million	Total 21 adaptive control signals, 7 CCTV cameras, 3 DMS, fiber optic Bayshore to Clearwater TOC, system software, and computer hardware
U.S. 19 (Phase 1, Stage 1) Beckett Way to Republic US 19/34th St. – St. Petersburg	$6.5 million	10 adaptive control signals, 13 CCTV cameras, 4 CCTV on 34th St. , 3 DMS, fiber in existing conduit, TOC system software and hardware – TOC modifications
McMullen Booth ATMS Project Early Fiber Project (Phase 1, Stage 2)	$800 thousand	Fiber installed in conduit, PC TOC to Drew St. and McMullen-Booth Rd., from SR 60 to Curlew Rd., Curlew Rd. from McMullen-Booth Rd. to US 19. East Lake Rd. from Curlew Rd. to Keystone Rd. Wireless connection Keystone Rd. to Trinity Rd., 6 CCTV cameras
C.R. 611 (Phase 1, Stage 2) Keystone to SR 60	$6.2 million	27 adaptive control signals, 14 CCTV cameras, 5 DMS
US 19 (Phase 1, Stage 2) Haynes Bayshore to 54th Avenue N.	$6.7 million	Install new fiber, 15 adaptive control signals, 12 CCTV cameras, 4 DMS, 8 system detector stations
US 19 (Stage 3) SR 60 to SR 580	$1.65 million	Complete the last portion of US 19 ATMS in Pinellas
SR 60 (phase 1, Stage 2) Memorial Causeway to Highland Ave. Drew St. and Cleveland St.	$6.3 million (unfunded)	To Be Determined
Pinellas County ATMS	$0.93 million	$250,000 for Maintenance and Operations of ATMS projects and $750,000 for converting existing mainframe to PC-based system
SR 688/Ulmerton Rd. Oakhurst to 119th Ave.	$0.2 million	Communications conduit and poles only, no ATMS devices.
US 19/34th St	$3.4 million (unfunded)	Based on Pinellas County Feasibility Study[2]
49th St.	$2.0 million (unfunded)	Based on Pinellas County Feasibility Study[2]
66th St US 19 to Corey Causeway	$7.5 million (unfunded)	Based on ITS Priority Corridor Map
Next Priority ATMS Corridors Project Limits to be determined	$20.0 million (unfunded)	Based on Pinellas County Feasibility Study[2] Note: $4.2 million federally funded through Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU)
ITS Primary Control Center / Centralized Communication Center	$12.8 million	Emergency Services Dispatch, back-up Emergency Operations Center, ITS Control Primary Center – Funded for 2008-2010.

Exhibit 2 - Current Pinellas County ATMS/ITS Projects (cont.)

Project	Cost	Equipment
Freeway Management System Projects		
Tampa Bay SunGuide Phase I I-275 (S.R. 93): 54th Ave. N. to Kennedy Blvd.	$8.5 million	8-DMS, 13-CCTV cameras, 46-vehicle detection stations
Tampa Bay SunGuide Phase II I-275 (S.R. 93): 54th Ave. S. to 54th Ave. N.	$5.2 million	10-DMS, 9-CCTV cameras, 19-vehicle detection stations
Tampa Bay SunGuide Phase III I-275 (S.R. 93): S. of Sunshine Skyway Br. to 54th Ave. S.	$7.6 million	4-DMS, 12-CCTV cameras, 24-vehicle detection stations
Tampa Bay SunGuide Phase IV Gandy Blvd. (SR 600):I-275 to Hillsborough County Line	$2.6 million (unfunded)	To Be Determined
Tampa Bay SunGuide Phase V Courtney Campbell Causeway (SR60): Bayside Bridge to Hillsborough County Line	$2.2 million (unfunded)	To Be Determined
Transit System Projects		
Fleet Management and Operations Automatic Vehicle Locators Transit Signal Priority	To Be Determined	Wireless Local Area Network communications, 2 Bus Rapid Transit routes and vehicles, transit vehicle tracking, transit fixed-route operations, transit maintenance and expanded transit signal priority
Fleet Management and Operations Automatic Passenger Counters	$0.6 million	20 units initially with 20-40 more
Electronic Fare Collection	$2.7 million (replaceme nt costs)	Passenger and fare management, Smart Cards, 196 fareboxes
Transit Traveler Information Systems Automatic Vehicle Locators Transit Traveler Information Systems	$4.1 million	191 mobile units, 2 monitoring stations, Transit Traveler Information System
Transit Security Systems	To Be Determined	Transit security CCTV cameras and recorders

2.3. OTHER ITS INITIATIVES

Other ITS services are currently planned for Pinellas County in the areas of public transportation and pedestrian safety. They are summarized below:

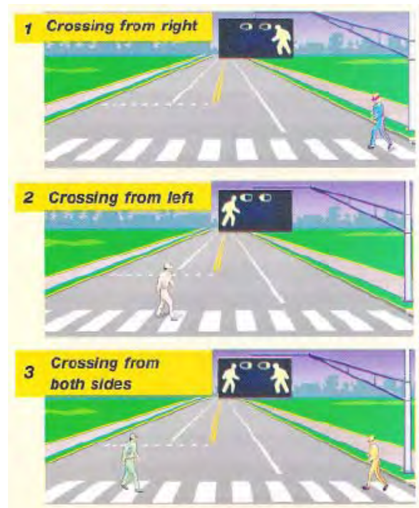
- Public Transportation: The Pinellas Suncoast Transit Authority (PSTA) is actively pursuing service delivery enhancements through ITS technologies. These technologies are grouped into three categories; *Fleet Operation and Management, Electronic Fare Collection, and Transit Traveler Information Systems.*
    - Fleet Management and Operations – This includes the following technologies:
        - Automatic Passenger Counter (APC) – The APC automatically records the number of passengers, time and location of each stop as passengers get on and off the bus. The PSTA will use this data to make changes to routes and schedules to better serve the transportation needs of Pinellas County.
        - Automatic Vehicle Locator (AVL) – AVL tracks vehicles to assist dispatchers in daily operations and management, especially when there is a need to re-route a vehicle around problem areas. This would also include scheduling and dispatching software to increase the efficiency, in all aspects, of transit operations. In the area of safety, this will help with emergencies (when a driver or passenger safety may be threatened). These systems support Transit Travel Information Systems by providing the data required to provide customers with real-time scheduling information.
        - Transit Signal Priority – This technology gives preferential treatment to buses at signalized intersections by holding the traffic light green longer or turns it green earlier for buses when needed (i.e., when a bus is running behind schedule).
    - Electronic Fare Collection – These system replaced coins and tokens with cards when customers pay for transit services. It helps reduce the expense of handling and protecting transit revenues, while providing a convenience to customers.
    - Transit Traveler Information Systems – They provide customers with static information for planning their trips, as well as real-time information on schedule adherence. These systems communicate real-time information to customers through various sources, such as DMS, in-vehicle announcements and kiosks.

  As shown in Exhibit 2, PSTA has identified $7.4 million in projects to support these initiatives. In addition, the PSTA is currently in the preliminary engineering phase of implementing these improvements along Central Avenue in the City of St. Petersburg.

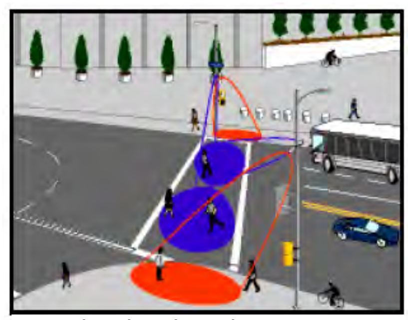
- Pedestrian Safety – This is the application of technologies to crosswalks to improve pedestrian safety. They are commonly referred to as "Smart Crosswalks". As part of the Tampa Bay Regional ITS Architecture project, the stakeholders identified the need to include "Smart Crosswalks" as part of the regional ITS architecture. The project team developed an ITS architecture market package to define how these technologies fit into regional ITS deployment. The market package is entitled "*Pedestrian Safety and Access*". The Pedestrian Safety And Access Market Package" located in Appendix A in the document entitled "Steps Toward Enhancing Pedestrian Safety". This document provides more detail on the technologies, information flows and requirements. The technologies to be considered for future deployment include:
    - Animated Eyes
    - Overhead signs
    - Pedestrian Detection Systems
    - Illuminated Crosswalks

  Although funding is not identified in Exhibit 2, the MPO considers these technologies to be an integral part of the ITS infrastructure and supports the deployment of "Smart Crosswalks" as needed. In fact, The City of Clearwater has installed these technologies at two locations and the City of St. Petersburg is in the process of installing Smart Crosswalks in the downtown area. In addition, the City of Clearwater has 59 intersections with Pedestrian Countdown signals.

Animated eyes to remind pedestrian to look both ways before crossing



Overhead signs to alert motorists when a pedestrian is crossing



Pedestrian detection systems – video/infrared/microwave

Crosswalks illuminate when pedestrians are present

3.0 BENEFIT/COST ANALYSIS

To further help the county support the direction and recommendations listed in section 2.0, the ITS Deployment Analysis System (IDAS) software was used to estimate benefits of current and planned ATMS/ITS projects. This section summarizes how IDAS was applied to the project, and the results of the effort. The following subsections provide an overview of IDAS concepts, alternatives developed for the analysis; IDAS model validation, IDAS model calibration, and results.

3.1. OVERVIEW OF IDAS CONCEPTS[3]

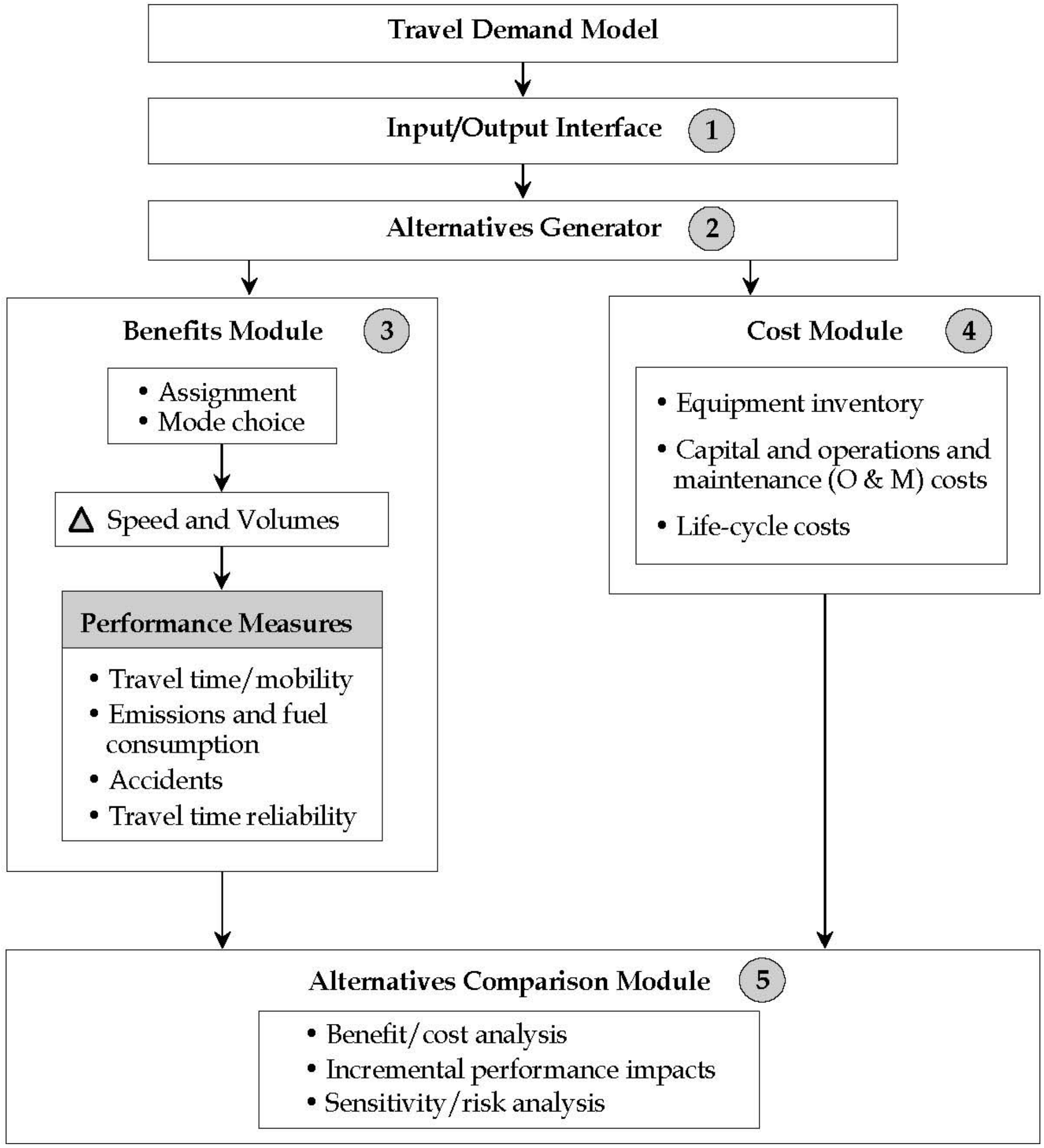
The IDAS software was designed to assist public agencies by serving as a high-level modeling tool that integrates ITS into the transportation planning process; it considers traffic assignment steps associated with traditional planning demand models. These steps are the key to estimating the changes that will occur in travelers' modal, route, and temporal decisions because of ITS technologies. IDAS is a sketch (high-level) planning tool. It is intended for use in alternatives analysis, and it is not geared to the level of detail examined in previous efforts (e.g., the *Pinellas Countywide ATMS Feasibility Study*[2]).

The set of impacts that IDAS evaluates includes changes in user mobility, travel time/speed, travel time reliability, fuel costs, operating costs, accident costs, emissions, and noise. IDAS captures these changes and converts them into monetary annual benefits. IDAS consists of five different analysis modules:

- An input/output interface module (IOM)
- An alternatives generator module (AGM)
- A benefits module
- A cost module
- An alternatives comparison module (ACM)

The interactions and dependencies of these modules are depicted in exhibit 3. Exhibit 3 also presents the flow of the IDAS modeling process. The benefits module is further divided into four submodules: travel time/throughput, environment, safety, and travel time reliability. Within each of these submodules, both the traditional benefits of ITS deployment (e.g., improvement in average travel time) and the non-traditional benefits (e.g., reduction in travel time variability) are estimated.

Exhibit 3 - Interaction of IDAS Modules



IDAS is intended to provide a tool for comparing the performance of several ITS options against "control" alternatives. The analysis hierarchy for IDAS consists of projects, alternatives, and ITS options, as defined below. These definitions provide the background necessary for a basic understanding of IDAS's structure, which is required to develop suitable alternatives.

- ***Project*** – A project is the highest level of the analysis hierarchy. A project is generally defined by a common set of overall travel demand determinants (e.g., nodes, links, and model centroid zone structure) and by a common year of analysis. A project may consist of one or more alternatives. A project can be defined, saved, and later retrieved. IDAS allows only one open project at a time.
- ***Alternative*** – An alternative is generally defined by a common set of outputs from a single travel demand model run. Any traditional infrastructure capacity improvements—such as additional highway lanes, freeway ramps, or transit lines—are typically represented in the travel demand model output. ITS improvements will be added to the alternative to create different ITS options.
- ***Control Alternative*** – Once the travel demand model data has been input into IDAS, a control alternative is created; it serves as the baseline for building and comparing ITS options. The control alternative does not contain any ITS components other than those previously deployed in the network. Each alternative has one control alternative. The control alternative is subjected to analysis procedures identical to those applied to the ITS option, thus allowing for meaningful comparison of results.
- ***ITS Option*** – An ITS option is an ITS deployment alternative that is to be compared against other options, as well as to the control alternative. An ITS option is defined by one or more ITS improvements. IDAS calculates the impacts and associated benefits, and the costs of the ITS option, in the IDAS benefits and cost modules. It then compares these estimates to the control alternative in the IDAS alternatives comparison module. Many ITS options can exist within an alternative.

IDAS provides a suite of ITS improvements and the benefits associated with each (based on national data). A summary of the available IDAS ITS improvements, with brief descriptions, is contained in appendix A.

3.2. ALTERNATIVE DEVELOPMENT

On June 22, 2005, the MPO held a workshop for stakeholders to develop alternatives for the IDAS modeling effort. A summary of the proposed alternative ITS improvements in IDAS was distributed for review by the stakeholders. At the workshop, the results of the ITS program assessment (section 2.0) were presented and discussed. IDAS provides the capabilities to evaluate individual or combined ITS improvements and geographical deployment. These two variables were used to guide the development of alternatives.

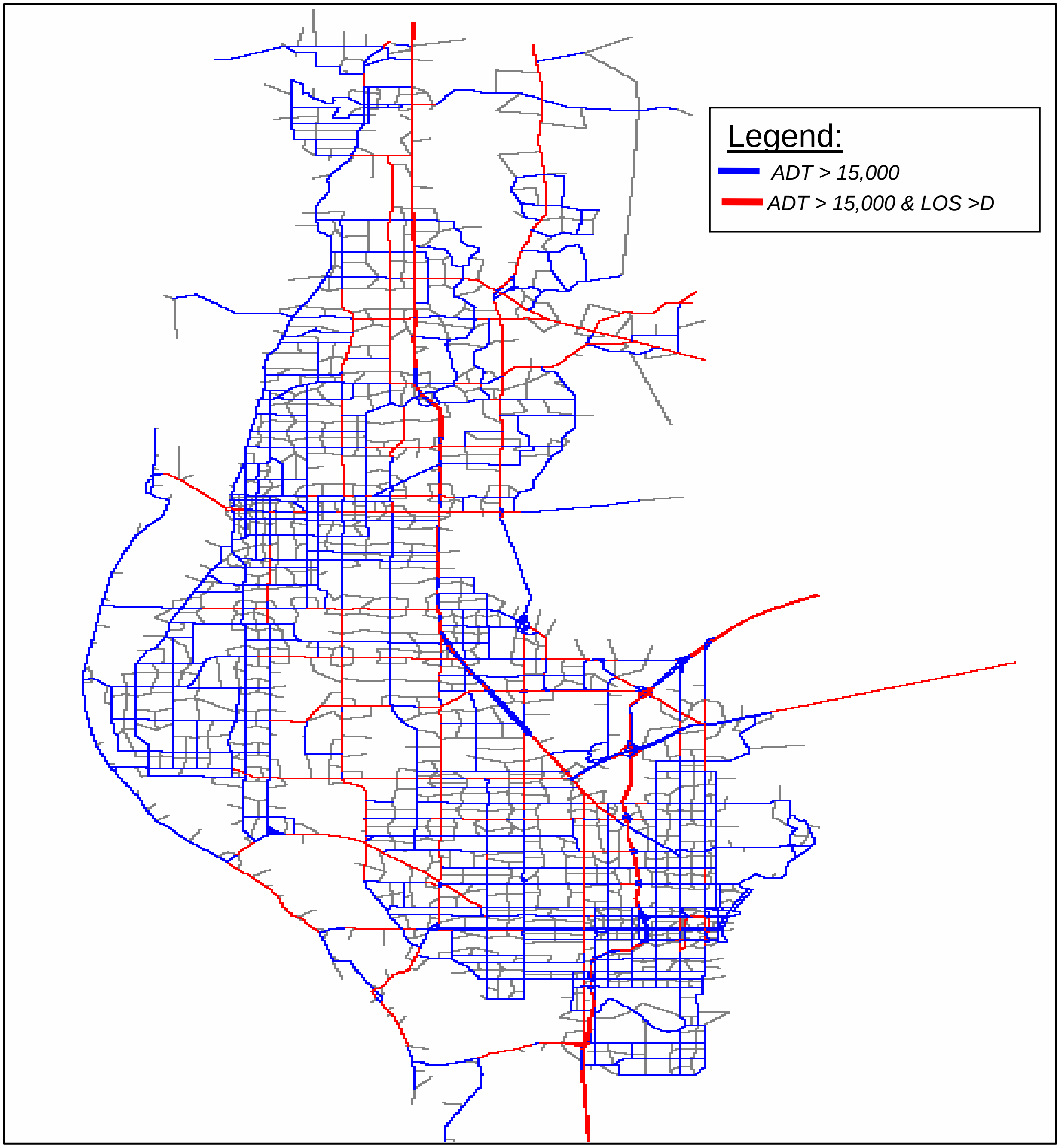
At the June 22, 2005, workshop, it was confirmed that the ITS improvements for the analysis were to be consistent with the recommendations from the studies previously summarized in section 2. While Pinellas County supports ITS improvements in the

areas of transit and multimodal services, they were excluded from the scope of this analysis. The services that were included are the following:

- ***Arterial Management System***
    - Traffic adaptive control at intersections
- ***Incident Management Systems***
    - Incident detection/verification – *This includes the deployment of CCTV and the use of detector data from the adaptive control signal system.*
    - Incident detection/verification combined with incident response management – *This assumes the co-location of the traffic management services and emergency management services in the planned central communications center.*
- ***Traveler Information Systems***
    - Dynamic Message Signs (DMS) – *The* Pinellas Countywide ATMS Feasibility Study[2] *identified an adequate deployment of DMS for the major arterials in Pinellas County. Other Traveler Information Systems discussed at the meeting included highway advisory radio and 511 Web/Internet/telephone services. However, the unrealistic results from these ITS improvements led to the detection of a software anomaly. The IDAS technical support service was contacted regarding these unrealistic results; they acknowledged that similar problems had occurred in other IDAS applications attempting to model these services. As a result, the 511 and highway advisory radio ITS improvements were eliminated from the analysis.*

The ITS corridor map depicts the adopted geographical deployment of ITS improvements, as previously shown in exhibit 1. As a preliminary analysis, the 2025 Tampa Bay Regional Planning Model (TBRPM) output data was reviewed to identify any additional ITS deployment needs beyond the adopted ITS corridor map. Exhibit 4 depicts links with a minimum average daily traffic volume of 15,000 and a level of service of “D” or greater. In comparison, the ITS corridor map closely reflects the corridors that are projected to be the most traveled and congested. While some planned ITS corridors are projected to function at less than level of service “D,” they were retained as part of the analysis because of other operational factors (e.g., evacuation). As a result, no new corridors were identified through this effort.

Exhibit 4 - 2025 Traffic Projections (Tampa Bay Regional Planning Model)



Once the ITS improvements and the geographical deployment of ITS improvements were determined, the following alternatives were defined under the IDAS structure:

- Project – Pinellas Countywide ATMS/ITS Master Plan
  - Alternative – 2025 TBRPM daily traffic projections and roadway improvements
    - Control Alternative – Baseline
    - ITS Option
      - #1 – Geographically covering Phase 1 funded projects with traffic adaptive control, incident detection/verification, and DMS.
      - #2 – Geographical coverage to include all of Phase 1 with traffic adaptive control, incident detection/verification, and DMS.
      - #3 - Geographically covering Phases 1 and 2 with traffic adaptive control, incident detection/verification, and DMS.
      - #4 - Geographically covering Phases 1, 2, and 3 with traffic adaptive control, incident detection/verification, and DMS.
      - #5 - Geographically covering Phases 1, 2, and 3 with traffic adaptive control, combined incident detection/verification response (co-locating at a central communications center), and DMS.

3.3. MODEL VALIDATION

IDAS utilizes the output from a transportation travel demand calculation and performs an internal trip assignment process to establish a control alternative or baseline condition. Information from the 2025 TBRPM was provided by the MPO and used to develop the IDAS control alternative. The output from the IDAS control alternative was then validated as being consistent with traditional transportation planning practices. This process included the comparison between the TBRPM travel demand model and the IDAS control alternative (which has no ITS improvements). The comparison was conducted on three levels: network-wide, and by facility type and link. The network-wide and facility type levels compared vehicle miles traveled (VMT) and vehicle hours of travel (VHT). At the link level, the average annual daily traffic volumes (AADT) were compared across a sample of links. The link validation process utilized the percent root mean square error (%RMSE) check, which is a standard tool used to compare two sets of output data, and widely used to validate planning model data. The %RMSE formula is defined as follows:

Where $Count_j$ is the observed TBRPM demand model output count by direction for link j, $Volume_j$

$$\%RMSE_i = \frac{\sqrt{\dfrac{\sum_j (Count_j - Volume_j)^2}{n_i - 1}}}{\overline{x}_i}$$

is the IDAS output directional volume for link j, n_i is the number of links in the volume group i such that j = 1, 2, 3,…n_i, and i is the average directional count for volume group i.

When comparing VMT and VHT, 20 percent or less represents an acceptable difference, and the acceptable %RMSE value is less than 30 percent for a sample of 20 links. The following shows the results of the validation process:

- ***Network wide Validation***
  - VMT difference = 2.0%
  - VHT difference = 10.7%
- ***Facility Type Validation***
  - VMT differential ranged from -4.5% to +5.2%
  - VHT differential ranged from -18.0% to -0.1%
- ***Link: Validation***
  - %RMSE = 12%

As a result, the IDAS control alternative is within acceptable ranges and is considered to be validated for use in the analysis of ITS alternatives.

3.4. USER INPUT CALIBRATION

The IDAS model allows users to define input parameters for estimating the benefits and costs associated with the proposed ITS improvements. The benefits were derived from various sources, as follows:

Adaptive Traffic Signal Control Improvements – Traffic adaptive improvements are defined in IDAS by increasing the link capacity. IDAS estimates a reduction in vehicle-hours of delay based on the magnitude of increased link capacity. As part of the *Pinellas Countywide ATMS Feasibility Study*[2] efforts, traffic adaptive control benefits were estimated with the Synchro™ traffic simulation model. These benefits were defined in terms of reduced vehicle-hours of delay. The increase in link capacity was adjusted in IDAS to yield the same level of reduced vehicle-hours of delay. The result was a 15 percent increase in link capacity.

Incident Management Improvements – Two types of incident management improvements were considered for the alternative analysis: (1) incident detection/verification, and (2) combined incident detection/verification and response.

- Incident detection/verification improvements are defined in IDAS by setting a parameter for a reduction in incident durations, in terms of a percent reduction. This parameter is used to estimate the benefits associated with travel time reliability or reduced unexpected delays. As part of the *Pinellas Countywide ATMS Feasibility Study*[2] efforts, a reduction in delay was estimated from accident data for areas to be covered by CCTV in terms of vehicle-hours. The IDAS parameter was adjusted to yield the same level of delay as estimated by the feasibility study. In this case, the IDAS parameter was set for a reduced incident duration amounting to 5 percent. This is consistent with the *ITS Investment Cost-Benefit Analysis Study Analysis of Tampa Bay Interstates* conducted by the Center of Urban Transportation Research (CUTR) in October 2005[4]. This is considered conservative, because the IDAS default value is 9 percent.

- Similar to incident detection/verification, the combined incident detection/verification and response improvements are defined in IDAS by setting a parameter for a reduction in incident durations (in terms of a specific percentage). The IDAS default value is a 51 percent reduction in incident durations, or 5.7 times more than would be achieved by incident detection/verification alone (9 percent). To be conservative, it was assumed that a 20 percent reduction would be realized in incident durations.

In addition to reduced incident durations, the IDAS model estimates benefits for a reduction in fatality accidents, emission rates, and fuel consumption. The IDAS default values for these benefits are greater for the combined incident detection/verification and response improvements than for incident detection/ verification alone. However, to be conservative, the default values for the incident detection/verification improvements were used for combined incident detection/verification and response improvements. Exhibit 5 lists the IDAS default values for incident management systems and the values used for the project. These adjustments and all other IDAS default values were assumed reasonable and acceptable for the analysis.

Exhibit 5 – Incident Management Systems Benefits Parameters

Improvement	Impact	IDAS Default Value	Project Value
Incident Detection/ Verification	Reduction in incident duration	9%	5%
	Reduction in fatal accidents	10%	10%
	Reduction in all emission rates	15%	15%
	Reduction in fuel consumption	15%	15%
Combined Incident Detection/ Verification and Management	Reduction in incident duration	51%	20%
	Reduction in fatal accidents	42%	10%
	Reduction in all emission rates	42%	15%
	Reduction in fuel consumption	21%	15%

Traveler Information System Improvements – Dynamic message signs (DMS) were the only ITS improvement used for traveler information systems. As mentioned earlier, there was an attempt to model highway advisory radio and 511 (Web/telephone) services, but there were software anomalies that limited the modeling of these services under this project. For DMS, IDAS requires the user to input three parameters:

- Percent of vehicles that pass the DMS and saved time
- Percent of time the DMS is turned on and disseminating information
- Average time savings per vehicle using the information (in minutes)

As per the *ITS Investment Cost-Benefit Analysis Study Analysis of Tampa Bay Interstates,*[4] the IDAS default value for the percent of time the DMS was turned on and disseminating information was too high; accordingly, the value was lowered from 10 percent to 2.5 percent. These adjustments and all other IDAS default values were assumed to be reasonable and acceptable for the analysis. Exhibit 6 lists the IDAS default values for incident management systems and those used for the project.

Exhibit 6 – Traveler Information Systems Benefits Parameters

Improvement	Impact	IDAS Default Value	Project Value[1]
Dynamic Message Sign	Percent of vehicles that pass the DMS and saved time	20%	20%
	Percent of time the DMS is turned on and disseminating information	10%	2.5%
	Average time savings per vehicle using the information (in minutes)	3	3

[1]Note: These values are from the *ITS Investment Cost-Benefit Analysis Study Analysis of Tampa Bay Interstates.*[4]

3.5. EQUIPMENT COST ESTIMATION

IDAS's capability for estimating cost was not utilized for this study due to the complex nature of the link/node structure in the TBRPM, and limitations on inputting ITS components into IDAS (i.e., IDAS doesn't have the option to input fiber optic communications). A more practical approach was applied, using available data from construction bid prices and Florida-specific resources. Project budget costs were used for deployment, as previously indicated in exhibit 3. Equipment costs for future projects were developed at a high level, using industry standard unit costs and available cost data. The following assumptions were considered for both capital costs and operation/maintenance costs:

- ***Fiber Optics Communications*** – It was assumed that all fiber optic communications would be installed underground, along with new conduit, for a unit cost of $140,000 per mile[5]. This also includes lateral drops, cabinets, and communications hardware, such as network switches. This is very conservative because the actual communication network design may identify segments that could be installed as aerial segments, or using existing conduit. Operations and maintenance costs for the fiber optic communications network were estimated a $1,000 per mile[5] per year. This supports adequate staffing (4–5 personnel) dedicated to managing and conducting utility locates for the full-build scenario, as well as funding for an emergency callout contract.
- ***Traffic Adaptive Control*** – Based on current bids for Phase 1, Stage 1, deployment, the furnished and installed costs for new traffic adaptive signals are approximately $45,000 per intersection. This includes new controllers, cabinets, detectors, and integration. For operations and maintenance costs, Pinellas County has a standard rate for operations and maintenance of $5,500 per traffic signal per year. This includes personnel, equipment, and utility costs. It is anticipated that the new traffic adaptive control system will require more diligent maintenance for the increase in vehicle detectors. Therefore, the estimated annual cost was raised to $6,000 per intersection.
- ***Incident Detection/Verification*** – Incident detection equipment costs were based on the industry standard deployment for CCTV, which is one CCTV per mile. Based on recent bids for Phase 1, Stage 1, deployment, CCTV costs are approximately $20,000 per location.[5] This includes the pressurized dome CCTV, pole (with lowering device), cabinet, and communications equipment. Operations and maintenance costs for CCTV have been estimated at $2,000 per CCTV per year.[5]
- ***Combined Incident Detection/Verification and Response*** – The estimated costs for the co-location of traffic and emergency services into a centralized communications center were based on the current programmed budget of $12,800,000, with an operations and maintenance cost of $1,280,000 per year. It is anticipated that the ITS portion of the operations and maintenance costs will be lower, as such this is a conservative estimate.
- ***Traveler Information Systems*** – DMS equipment costs were based on recent bids for the Phase 1, Stage 1, deployment. A cost estimate of $150,000 per sign was used for the analysis. This includes the structure, sign, cabinet, and controller. Annual operations and maintenance costs were estimated based on industry standards, and were assumed $5,000 per sign.

Exhibit 6 depicts the estimated capital costs and annualized costs in 2005 dollars for each alternative. The annualized costs are calculated by converting the capital costs to annual payments, based on the expected life cycle in years and an interest rate of 7 percent. Then the estimated operational and maintenance costs are added to yield a total annualized cost for each alternative.

Exhibit 6 – Estimated Costs (2005 Dollars) for ITS Improvements

Alternative[4]	Capital Costs[1]	Annualized Capital Costs[2]	Operations & Maintenance Costs[3]	Total Annual Costs
Phase 1 Funded	$50,387,498	$7,174,046	$1,164,000	$8,338,046
Phase 1	$74,621,498	$9,755,353	$2,108,000	$11,863,353
Phases 1 and 2	$98,549,178	$12,312,920	$3,1,68,830	$15,481,750
Phases 1, 2, and 3	$143,890,018	$17,229,391	$4,934,020	$22,163,411
Phases 1, 2, and 3 with Central Communications Center	$156,690,018	$18,437,620	$6,334,020	$24,771,640

[1]Note: Capital costs include 40% of construction costs for contingency, design, integration and CE&I.
[2]Note: Annualized costs assume an interest rate of 7%, design life of 20 years for fiber optics communication, design life of 10 years for traffic signal equipment, design life of 10 years for CCTV, design life of 20 years for the central communications center, and a design life of 10 years for DMS.
[3]Note: Operations and Maintenance Costs include the Pinellas County's existing budgeted annual Operations and Maintenance Costs.
[4]Note: Includes FDOT Freeway Management System along I-275 under Phase 1 Funded and along SR 60/Courtney Campbell and Gandy Boulevard under Phase 3.

3.6. RESULTS

IDAS provides outputs in terms of performance measures and benefit/costs.

Performance Measures – The performance measures are calculated by facility type (e.g., freeways, arterials), market sector (e.g., autos, trucks), and districts (user-defined grouping of links). The network-wide performance measures for each alternative are presented in exhibit 7. Travel time reliability (hours of unexpected delay) is the only performance measure estimated for incident management systems related to ITS improvements. This is evident when comparing Alternative #4 with Alternative #5. The change in ITS improvements between these two alternatives reflects improved travel time reliability as a function of reduced incident duration (i.e., the reduction of duration parameter increased from a 5 percent improvement to 20 percent, as previously shown in exhibit 6). Full deployment of incident management improvements (Alternative #5) is estimated to yield a 19.8 percent reduction in hours of unexpected delays or delays associated with incidents. As a result of deploying traffic adaptive control along the proposed corridors, Pinellas County can expect a 7.3 percent reduction in vehicle delay (note: IDAS doesn't estimate performance measure changes for DMS deployments, just a savings in travel time, which is then used to calculate a user mobility benefit).

IDAS results suggests the current and planned ITS deployments will improve operational efficiency of the transportation network. As ITS improvements are deployed throughout Pinellas County, the operational efficiency of the transportation network will improve.

Exhibit 7 – Performance Measures by Alternative

Performance Measure	Alternative #1 Phase 1 Funded	Alternative #2 Phase 1	Alternative #3 Phases 1 and 2	Alternative #4 Phases 1, 2 and 3	Alternative #5 Phases 1, 2 and 3 with new Comm. Center
Vehicle Miles of Travel	-14,313 (-0.1%)	-23,342 (-0.1%)	-30,252 (-0.1%)	-50,361 (-0.2%)	-50,361 (-0.2%)
Vehicle Hours of Travel	-29,046 (-3.0%)	-38,547 (-4.0%)	-57,968 (-6.0%)	-70,928 (-7.3%)	-70,928 (-7.3%)
Average Speed	1(3.0%)	1(3.5%)	1(4.4%)	1(5.2%)	1(5.2%)
Person Hours of Travel	-38,976 (-3.0%)	-51,693 (-4.0%)	-77,402 (-6.0%)	-94,932 (-7.4%)	-94,932 (-7.4%)
Number of Fatality Accidents	-7.276E-03 (-3.1%)	-1.013E-02 (-4.3%)	-1.293E-02 (-5.4%)	-1.669E-02 (-7.0%)	-1.669E-02 (-7.0%)
Number of Injury Accidents	-1.701E-01 (-0.7%)	-3.068E-01 (-1.3%)	-4.244E-01 (-1.8%)	-6.335E-01 (-2.7%)	-6.335E-01 (-2.7%)
Number of Property Damage Only Accidents	-2.638E-01 (-0.8%)	-4.598E-01 (-1.4%)	-6.411E-01 (-2.0%)	-9.382E-01 (-2.9%)	-9.382E-01 (-2.9%)
Travel Time Reliability (hours of unexpected delay)	-5,156 (-3.7%)	-11,302 (-8.1%)	-11,534 (-8.2%)	-16,542 (-11.8%)	-27,694 (-19.8%)
Fuel Consumption (gallons)	-87,427 (-5.7%)	-136,034 (-8.9%)	-186,719 (-12.2%)	-233,718 (-15.2%)	-233,947 (-15.2%)
Hydrocarbon and Reactive Organic Gases Emissions (tons)	-2.1505 (-5.9%)	-2.9944 (-8.3%)	-4.0729 (-11.3%)	-5.1658 (-14.3%)	-5.1658 (-14.3%)
Carbon Monoxide Emissions (tons)	-17.9247 (-6.5%)	-25.2924 (-9.2%)	-35.0974 (-12.8%)	-44.6365 (-16.3%)	-44.6365 (-16.3%)
Oxides of Nitrogen Emissions (tons)	-2.1795 (-4.8%)	-3.0118 (-6.6%)	-3.8807 (-8.5%)	-4.9256 (-10.8%)	-4.9256 (-10.8%)

Benefits – IDAS calculates benefits by applying user-defined dollar values (benefits parameters) to the performance measure outputs previously shown in exhibit 7. Exhibit 8 depicts the IDAS default values and the values used for the project. The values used for the project were based on the values used in the *ITS Investment Cost-Benefit Analysis Study Analysis of Tampa Bay Interstates*[4].

IDAS calculates travel time benefits using two different measures. "User mobility" is calculated using traffic analysis zone-to-traffic analysis zone (i.e., origin to destination) travel times and the number of trips between zones. A traffic analysis zone (TAZ) is the unit of geography most commonly used in conventional transportation planning models. The size of a zone varies, but for a typical metropolitan planning software, a zone of under 3000 people is common. A TAZ is a statistical entity delineated by state and/or local transportation officials for tabulating traffic-related census data; especially journey-to-work and place-of-work statistics. "User travel time" is calculated on a link-by-link basis using link speeds and volumes, and represents an in-vehicle travel time. User mobility is a more recently developed performance measure advocated by FHWA, while user travel time is the more familiar measure of travel-time benefits. They both are measures of the same impact. Therefore, the two measures were set to 25 percent each to share a 50 percent weighting and to avoid double-counting the benefit. It is important to include user mobility in the analysis because IDAS places all the benefits from DMS in the user mobility benefits measure.

IDAS allows the user to define the weighting of these benefits. As part of FDOT's evaluation[6] of the IDAS model, they recommended certain weighting factors that are consistent with the Florida ITS goals defined in *Florida's ITS Strategic Plan.* The recommended weighting was modified slightly to add up to 100 percent. The FDOT evaluation recommended only a 10 percent weighting for fuel and operating costs, leaving 10 percent for off-model factors when prioritizing ITS deployments. The fuel and operating costs were increased from 10 percent to 20 percent to compensate for off-model factors. The following benefits and weighting were used to derive the benefits shown in exhibit 10:

- User mobility (25%)
- User travel time (25%)
- Fuel and operating costs (20%)
- Accident costs (20%)
- Emissions (10%)

Exhibit 9 contains the estimated benefits from the proposed ITS improvements, the annualized costs, and the benefit/cost ratio for each alternative. As indicated by exhibit 9, the ITS improvements for Phase 1 (funded), Phase 1, and Phases 1 and 2 show a progressive improvement in benefit/cost ratio as the ITS projects are deployed. The benefit/cost ratio begins to level off for Phase 3 deployment, but then increases when the central communications center in considered in the analysis. The central communications center improves the overall incident management benefits through co-location of traffic and emergency management services. The additional costs for the facility are offset by the increase in benefits, ultimately increasing the overall benefit/cost ratio.

Exhibit 8 – IDAS Benefits Parameters

Benefits Parameter		IDAS Default Value	Project Value[1]
Value of Time			
	In vehicle auto cost ($/hr)	$8.50	$6.15
	In vehicle truck cost ($/hr)	$20.80	$60.00
	Auto travel-time reliability ($/hr)	$25.00	$18.45
	Truck travel-time reliability ($/hr)	$62.40	$180.00
Vehicle Costs			
	Fuel costs ($/gallon)	$1.21	$2.00
	Auto non-fuel costs ($/mile)	$0.034	$0.061
	Truck non-fuel costs ($/mile)	$0.1	$0.245
Safety Costs			
	Accidents with fatalities ($)	$2,317,398	$1,000,000
	Accidents with injuries ($)	$50,760	$25,000
	Accidents with property damage only ($)	$2,824	$2,500

[1]Note: These values are from *ITS Investment Cost-Benefit Analysis Study Analysis of Tampa Bay Interstates.*[4]

Exhibit 9 – Benefits/Costs Summary by Alternative

Performance Measure (Weight)	Alternative #1 Phase 1 Funded	Alternative #2 Phase 1	Alternative #3 Phases 1 and 2	Alternative #4 Phases 1, 2 and 3	Alternative #5 Phases 1, 2 and 3 with new Comm. Center
Annual Benefits					
User Mobility (25%)	$26,996,630	$36,655,405	$57,714,310	$85,261,613	$114,518,487
User Travel Time (25%)	$35,556,343	$56,402,514	$73,189,058	$95,627,296	$167,960,552
Fuel and Operating Costs (20%)	$9,106,209	$14,171,109	$19,448,742	$24,945,887	$24,969,786
Accident Costs (20%)	$874,606	$1,355,451	$1,796,572	$3,348,173	$3,348,173
Emissions (10%)	$2,123,060	$2,987,690	$4,113,154	$5,326,413	$5,326,413
Total Annual Benefit	$74,656,848	$111,572,169	$156,261,836	$214,509,383	$316,123,412
Annual Costs[1]	$8,338,046	$11,863,353	$15,481,750	$22,163,411	$24,771,640
Net Annual Benefits	$66,318,802	$99,708,816	$140,780,086	$192,345,972	$291,351,772
Benefit/Cost Ratio	7.95	8.40	9.09	8.68	11.76

[1]Note: Annual costs are in 2005 dollars and assume a 7 percent interest rate; a 20-year life cycle for fiber optics communications, and the central communications center; and a 10-year life cycle for signals, CCTV, and DMS.

4.0 IMPLEMENTATION PLAN

The results from the IDAS model showed that the proposed ITS deployments would yield significant benefits. They also showed that the progression from the current funded projects to the full-build scenario yields an increase of benefits. This section takes a closer look at the benefits by corridor to evaluate the current ITS phasing plan identified in the ITS corridors map (see exhibit 1). IDAS has the capability to code the links and group them by districts. Exhibits 10, 11, and 12 show a breakdown of the phases by district/roadway segment.

As part of the "McMullen Booth ATMS Project", traffic adaptive signals and fiber optic communications are currently being installed on Tampa Rd., Curlew Rd., Main St./SR 580, Sunset Rd., and Drew St. (Excluding US 19 and Drew) between McMullen Booth and US 19. In addition, CCTV cameras are being installed at Tampa Rd.& Lake St George, Curlew Rd.& Countryside Rd., and US 19 & Main St./SR 580.

The road segment SR 686 from SR 688/Ulmerton Rd. to Bryan Dairy is not built as of the date of this report. It was included in the IDAS model analysis because the IDAS model was built from the 2025 TBRPM based on the current LRTP. It is recommended to include ITS infrastructure into design of this segment.

The methodology for evaluating the current phasing of ITS deployments distributes the benefits based on use of each facility by the public. The benefits from Alternative #5 were used and distributed across each district based on the VMT on that district. The benefits by district were then divided by the annualized deployment costs for that specific district to yield a benefit/cost ratio. This methodology provides a direct relationship between the customers (represented by VMT) traveling along ITS corridors and the benefits on the links with ITS improvements. While IDAS produces other performance measures (e.g., speed), the benefits from the other performance measures are distributed across the network and are not limited to the district/links coded with the ITS improvements. This is because IDAS performs a trip assignment as part of the modeling procedure and will reassign vehicles to links with increased capacity from the ITS improvements. As a result, links with no ITS improvements also may show benefits. Therefore, these other performance measures were excluded from the analysis because they may skew the direct relationship between the customers (represented by VMT) traveling along ITS corridors and the benefits on the links with ITS improvements.

The benefit/cost ratios for each district/roadway segment are tabulated in exhibits 10, 11, and 12, and graphically shown in exhibit 13.

This is a high-level analysis and is not intended to reprioritize any operational needs considered during the development of the current phasing. It is understood that the current phasing was developed based on local knowledge of the operational needs of the transportation network, which would override any slight differences in benefit/cost ratio.

Exhibit 10 – Benefit/Cost Ratios by District (Phase 1)

Main Corridor		Terminus		B/C Ratio
		Begin	End	
Phase 1 Funded				
District	**N-S Corridors**			
1	US 19/SR 55	Beckett Way	54th Avenue N.	11.74
1	McMullen Booth/East Lake Rd.	Trinity	Gulf to Bay/SR 60	
1	I-275	Howard Frankland Bridge	Skyway Bridge	
	E-W Corridors			
1	Gulf to Bay/SR 60	Hillcrest Ave.	Damascus Drive	
Phase I Not Funded				
District	**N-S Corridors**			
2	Belcher Rd.	Klosterman Rd.	Druid Rd.	8.97
3	Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	5.92
4	66th St. N./SR 693	US 19/SR 55	46th Avenue N	9.03
5	66th St. N./SR 693	46th Avenue N	Gulf Blvd.	6.68
6	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	14.65
	E-W Corridors			
7	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd.	13.73
8	Tampa Rd.*	Belcher Rd.	McMullen Booth	16.39
9	Curlew Rd./SR 586*	Belcher Rd.	McMullen Booth	11.62
10	Main St./SR 580*	Belcher Rd.	McMullen Booth	11.58
11	Sunset Point Rd.	Belcher Rd.	McMullen Booth	9.70
12	Drew St.*	Belcher Rd.	McMullen Booth	8.93
13	East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	11.89
14	Walsingham Rd./Ulmerton Rd./SR 688	Gulf Blvd.	66th Street N	10.56
15	Walsingham Rd./Ulmerton Rd./SR 688	66th Street N	I-275	9.52
16	54th Avenue N.	66th St. N.	I-275	7.65

* As part of the "McMullen Booth ATMS Project", traffic adaptive signals and fiber are currently being installed on Tampa Rd., Curlew Rd., Main St./SR 580, Sunset Point Rd. and Drew St. (Excluding US 19 and Drew) between McMullen Booth and US 19. In addition, CCTV cameras are being installed at Tampa Rd.& Lake St George, Curlew Rd.& Countryside Rd., and US 19&Main St./SR 580.

Exhibit 11 – Benefit/Cost Ratios by District (Phase 2)

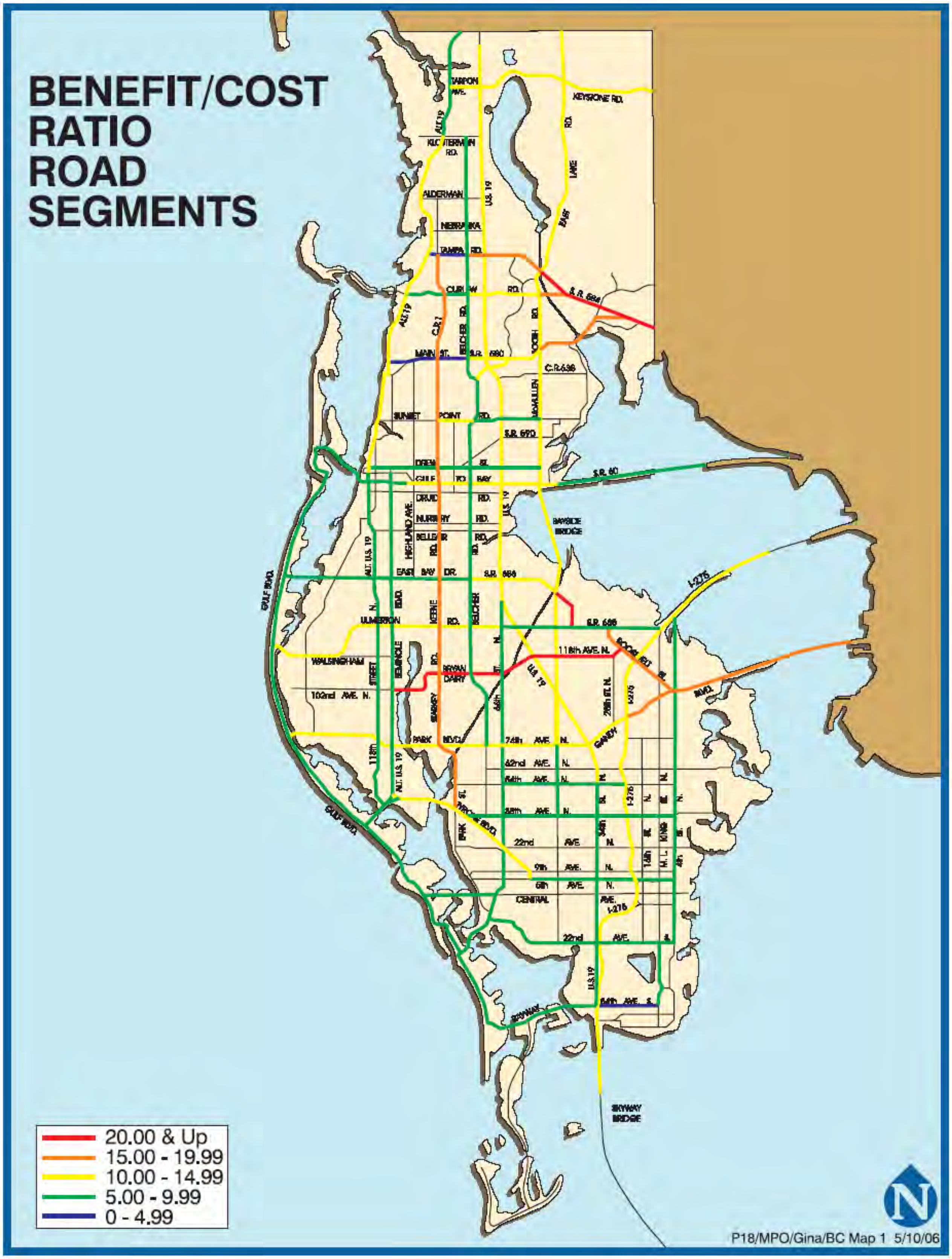
Main Corridor		Terminus		B/C Ratio
		Begin	End	
District	**N-S Corridors**			
17	Alt. US 19/SR 595/Pinellas Ave.	Klosterman Rd.	Pasco County Line	5.62
18	49th St.	Park Blvd. N.	US 19/SR 55	10.45
19	SR 686*	49th St.	Bryan Dairy	22.90
20	US 19/SR 55	54th Avenue S.	54th Avenue N.	8.73
	E-W Corridors			
21	Tampa Rd.	Alt. US 19/SR 595/ Palm Harbor Blvd.	Belcher Rd.	1.65
22	Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	23.02
23	Curlew Rd./SR 586	Alt. US 19/SR 595/ Bayshore Blvd.	Belcher Rd	7.29
24	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd.	16.18
25	Main St./SR 580	Alt. US 19 / SR 595 / Broadway	Belcher Rd	3.27
26	Main St./SR 580	McMullen Booth	SR 584/Tampa Rd.	19.37
27	Drew St./SR 590	Alt. US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	5.00
28	Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd.	Hillcrest	6.39
29	Belleair CSWY/(West/East) Bay Drive/SR 686	Gulf Blvd.	Belcher Rd.	9.21
30	Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt Blvd./SR 686	21.33
31	Park Blvd./Gandy Blvd./SR 694	Gulf Blvd.	I-275	10.52
32	Roosevelt Blvd./SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR 694	17.85
33	Trinity Blvd.	East Lake Rd.	County Line	11.99

* The road segment SR 686 from SR 688/Ulmerton Rd. to Bryan Dairy is not built as of the date of this report. It was included in the IDAS model analysis because the IDAS model was built from the 2025 TBRPM based on the current 2025 Long Range Transportation Plan[1].

Exhibit 12 – Benefit/Cost Ratios by District (Phase 3)

Main Corridor		Terminus		B/C Ratio
		Begin	End	
District	**N-S Corridors**			
34	Gulf Blvd./Pinellas Bayway	Clearwater CSWY	I-275	8.01
35	Alt. US 19/SR 595/Palm Harbor Blvd./Bayshore Blvd./ Broadway/Edgewater Dr./Myrtle Avenue	Klosterman Rd.	Gulf to Bay/SR 60	10.22
36	Alt. US 19/SR 595/Ft. Harrison Ave./Clwr/Largo Rd./West Bay/113th St.	Gulf to Bay/SR 60	Tom Stuart CSWY / SR 666 /Welch CSWY/Madeira CSWY	5.17
37	Tom Stuart CSWY/SR 666/ Welch CSWY/Madeira CSWY	Gulf Blvd.	Seminole Blvd./Alt. US 19/ Bay Pine Blvd.	7.75
38	Missouri Ave./Seminole Blvd./SR 595/SR 651	Gulf to Bay/SR 60	Tom Stuart CSWY/SR 666/ Welch CSWY/Madeira CSWY	8.50
39	Starkey Rd./Keene Rd./Park St.	Tyrone Blvd./Alt. US 19/SR 595	Tampa Rd.	15.35
40	Countryside Blvd.	Belcher Rd.	Main St.	10.36
41	Belcher Rd.	Ulmerton Rd / SR 688	Park Blvd	8.29
42	49th St. N.	Park Blvd./SR 694	38th Avenue N.	8.93
43	9th St. S.	54th Avenue S.	22nd Avenue S.	5.63
44	4th St. N.	22nd Avenue S.	I-275	7.20
	E-W Corridors			
45	Tarpon Ave.	Alt. US 19/SR 595	US 19/SR 55	10.42
46	Keystone Rd.	East Lake Rd.	County Line	10.36
47	Sunset Point Rd.	Keene Rd.	Belcher Rd.	11.28
48	38th Avenue N.	Tyrone Blvd./SR 595	4th St. N.	8.06
49	5th Avenue N./SR 595/Bay Pines Blvd.	Tyrone Blvd./SR 595	4th St. N.	5.63
50	Tyrone Blvd./SR 595	Alt. US 19/SR 595/ Seminole Blvd.	5th Ave. N./SR 595	10.49
51	22nd Avenue S./Gulfport Blvd.	Pasadena Ave.	4th St. S.	6.15
52	Treasure Island Causeway	Gulf Blvd.	Alt 19/66th St	8.47
53	54th Ave. S.	I-275	9th St. S.	3.27
54	Gandy Blvd	I-275	Hillsborough County	15.47
55	Courtney Campbell	Damascus Rd.	Hillsborough County	7.40

Exhibit 13 – Benefit/Cost Ratios by District (All Phases)



Based on the results, it is recommended that some districts/roadway segments be reprioritized. Final investment priority should consider the cost of existing ITS infrastructure (i.e., existing conduit), which was not included in the analysis for determining the benefit/cost values. Exhibit 14 depicts the recommended changes to the current ITS phasing plan.

In general, the Tampa Road corridor west of McMullen Booth shows greater benefits then the 66th Street/SR 693 and 54th Avenue roadway segments. In addition, the east-west roadway segments west of Belcher Road and north of Gulf-to-Bay/SR 60 show less benefit than the roadway segments east of Belcher Road.

Starkey Rd./Keene Rd. yielded a high benefit / cost ratio (15.35). This provides justification for moving this segment up to Phase 1. However, roadway-widening projects are scheduled over the next five years; as such, it was moved to Phase 2. It is recommended to include ITS infrastructure into the design and construction of these projects. Basic infrastructure includes communications conduit and poles. Incorporating the ITS infrastructure into these projects could greater reduce the estimated ITS deployment costs.

The recommended changes include the following (exhibit 15 contains the estimated capital costs by phase for the recommended changes):

Phase 1 to Phase 2

- 66th St. N./SR 693 from Gulf Blvd. to 46th Avenue
- Sunset Point Rd. from Belcher Rd. to McMullen Booth
- 54th Avenue N. from 66th St. N. to I-275

Phase 2 to Phase 1

- Bryan Dairy from Seminole Blvd./Alt. US 19 to Roosevelt Blvd./SR 686
- Roosevelt Blvd./SR 686 from Ulmerton Rd./SR 688 to Gandy Blvd./ 4th St. N./ SR 694
- SR 686 from 49th Street to Ulmerton Rd./SR 688
- Tampa Rd./SR 584/SR 580 from East Lake Rd. to County Line
- Curlew Rd./SR 586 from McMullen Booth to SR 584/Tampa Rd.
- Main St./SR 580 from McMullen Booth to SR 584/Tampa Rd.

Phase 2 to Phase 3

- Alt. US 19/SR 595/Pinellas Ave. from Klosterman Rd. to Pasco County Line
- Tampa Rd. from Alt. US 19/SR 595/Palm Harbor Blvd. to Belcher Rd.
- Curlew Rd./SR 586 from Alt. US 19/SR 595/Bayshore Blvd. to Belcher Rd.
- Drew St./SR 590 from Alt. US 19/SR 595/ Ft. Harrison Ave. to Belcher Rd.
- Main St./SR 580 from Alt. US 19/SR 595/Broadway to Belcher Rd.

Phase 3 to Phase 2

- Starkey Rd./Keene Rd. from Tyrone Blvd./Alt. US 19/SR 595 to Tampa Rd.
- Belcher Rd. from Ulmerton Rd./SR 688 to Park Blvd.

Phase 3 to Phase 1

- Countryside Blvd. from Belcher Rd. to Main St.

Exhibit 14 – Recommended ITS Implementation Plan

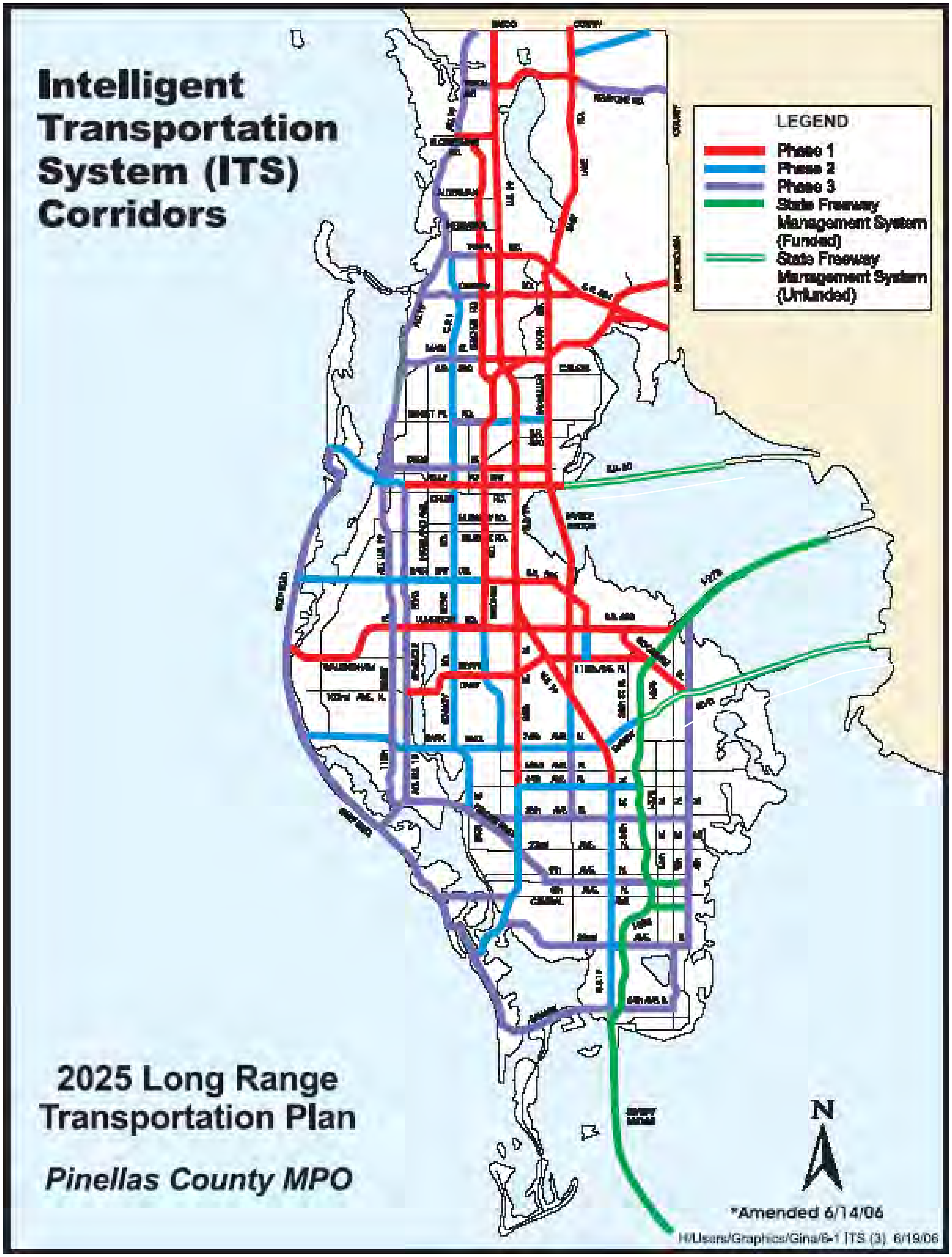


Exhibit 15 – Revised Capital Costs by Phase for Remaining Arterials

Deployment	Phase 1 (unfunded only)	Phase 2	Phase 3[1]	Total[1]
Communications Network	$10,656,800	$8,099,000	$18,223,800	$36,979,600
Traffic Adaptive Signals	$4,905,000	$4,905,000	$9,540,000	$19,350,000
CCTV	$1,520,000	$1,180,000	$2,600,000	$5,300,000
DMS	$1,350,000	$600,000	$600,000	$2,550,000
Design/Integration (17%)	$3,133,406	$2,513,280	$5,263,846	$10,910,532
CE&I (8%)	$1,474,544	$1,182,720	$2,477,104	$5,134,368
Contingency (15%)	$2,764,770	$2,217,600	$4,644,570	$9,626,940
Total	**$25,804,520**	**$20,697,600**	**$43,349,320**	**$89,851,440**

[1]Note: The FDOT Freeway Management System (Courtney Campbell and Gandy Blvd) and Centralized Communications Center are not included. Central communications center deployment may occur during any phase. It is currently programmed for $12,800,000 in 2008.

The estimated capital cost in exhibit 15 was developed at a high level and was conservative. It was developed for the benefit/cost analysis and to determine the feasibility of deploying ITS along the ITS Corridors identified by the ITS Advisory Committee. As indicate in exhibit 15, communications costs are significant relative to the overall costs and can influence the number of corridors funds. Pinellas County has successfully used exiting conduit for fiber optic communications in the McMullen Booth ATMS Project. A conceptual design will help reveal the availability of existing conduit, which would better refine these costs for programming funds. It is recommended to conduct a conceptual design for communications, as well as other field equipment, along the corridors to refine the estimated costs in exhibit 15.

Additional recommendations include the consideration of using the local county-owned radio for disseminating traffic information. This is a low-cost alternative to deploying more DMS along arterials. The signs used to alert the motorists are less intrusive than DMS, and the motorists can receive more information via radio than from DMS postings. Consideration of a service patrol program along the US 19 corridor and other major corridors is recommended. FDOT District Six (Miami-Dade County) has deployed such a pilot program along the US 1 corridor, and the initial results have been very positive.

5.0 OPERATIONS & MAINTENANCE RECOMMENDATIONS

The proposed ITS improvements will improve the operational efficiency of roadways in Pinellas County without increasing the physical capacity of the roadways. Therefore, how Pinellas County operates and maintains the ITS improvements is critical to realizing the benefits identified in section 3.0. This section will provide guidance for proper operations and maintenance (O&M) of the proposed ITS improvements in the areas of budget, staffing, policies, and procedures.

5.1. STAFFING STRUCTURE

The MPO has adopted the concept of a unified ATMS system that includes a primary control center. The primary control center will manage the ATMS/ITS corridors and potentially be located in the programmed central communications center identified earlier. The *Pinellas Countywide ATMS Requirements Document* defined a concept of operations for the primary control center. The concept of operations envisioned a proposed staffing structure that included the following:

- Management team
- Primary Control Center (PCC) manager
- PCC assistant manager
- Information systems engineer (network engineer)
- Public information specialist
- ATMS/ITS operators
- Administrative staff

The *Pinellas Countywide ATMS Requirements Document* focused on the primary control center and did not address ATMS/ITS-specific maintenance staff. It is assumed that Pinellas County, the City of Clearwater, and the City of St. Petersburg have adequate staff for maintaining the traffic signals. They are also assumed to have adequate resources for addressing signal timing adjustments as needed. However, additional staff will be required for maintaining the fiber optic communications, CCTV, and DMS.

Establishing adequate management support is critical to the success of the ATMS/ITS operations and maintenance. Therefore, it is recommended that key personnel be hired prior to the completion of Phase 1 (funded). The key personnel include the PCC manager, the network engineer, the public information specialist, and the maintenance supervisor. This covers all aspects of the ATMS/ITS program to ensure cohesiveness in the overall operations and maintenance activities. Their initial responsibilities will focus on the following:

- PCC Manager – Participate in initial operations to understand the capabilities and level of effort associated with daily operational tasks. The PCC Manager would use this experience to develop a comprehensive training program and detailed standard operating procedures (SOP). The detailed SOPs should expand the initial set of

operating procedures in the "Countywide ATMS/ITS Traffic Signal Interlocal Agreement." In addition, the PCC Manager should be responsible for developing performance measures and archived data structures. These activities should be closely coordinated with the management team on all initial activities.

- Network Engineer – He/she should participate in the initial installation of the PCC computer networks, system software, and video wall. This will provide valuable experience in understanding the capabilities of the ATMS/ITS systems. He/she will be responsible for installing and configuring all archived data equipment. This includes coordinating with other local agencies, media, and other regional partners to establish information-sharing functions, as identified in the Pinellas countywide ATMS requirements documents.
- Public Information Specialist – He/she should focus on developing a public outreach program to clearly communicate ATMS/ITS improvement expectations from the user's perspective. This will include developing newsletters, issuing press releases, and making presentations to various citizen groups. He/she will also play an active role in interagency coordination.
- Maintenance Supervisor – He/she should focus on developing a detailed maintenance plan to meet the requirements set forth in the "Countywide ATMS/ITS Traffic Signal Interlocal Agreement." In addition, he/she should help develop the protocols between the maintenance staff and ATMS/ITS operators, as well as with other local agencies. Finally, he/she should supervise and ensure the quality of maintenance, and actively participate in the development of any scope of work for potentially contracted maintenance services.

The additional recommended staffing requirements are presented in exhibit 16. This assumes the hours of operations will be from 6:00 AM to 7:00 PM, Monday through Friday. (*Once performance measures for the system have been developed, it is recommended that these performance measures be monitored to determine if an adjustment in operating hours is required.*) This level of operation can be covered with two shifts. Initially the operations will require one operator per shift, with part-time help during the peak periods. By the completion of Phase 2, it is assumed that two full-time operators will be required per shift, along with an additional two operators to cover for vacations, sick leave, and overtime/weekend coverage when needed. As part of this expansion of operational staff, it is recommended that a PCC assistant manager and an administrative assistant be added to the staff.

As indicated earlier, the maintenance requirements for the traffic signals would not require additional staffing or equipment. Therefore, the maintenance staffing proposed in exhibit 16 represents additional staffing requirements for the fiber optic communications, CCTV, and DMS. The staffing requirements presented in exhibit 16 assume the following:

- No additional maintenance technicians will be required because the initial maintenance of the new installations will be covered by the contractor as part of the initial construction (for one-year) of Phase 1 (funded). For Phase 1 unfunded, it is recommended that three maintenance technicians be hired. The skill sets for one of the staff should be strong in the area of electronics, while the skill sets of the other two should be particularly strong in electrical work. This will provide a team of two

maintenance technicians (one with an electronics background for the devices, and one with an electrical background for power needs). The third staff member should have an electrical background, with specific experience in performing utility locates. He/she will provide a backup to the initial maintenance team, as well as performing utility locates. This assumes that the operators will be able to help with processing tickets for the utility locates. This also encourages cross-training of personnel in order to have redundant resources.

- For Phase 2, it is recommended that a fourth maintenance technician with experience in electronics be hired, thus creating two teams for maintenance. One team can be dedicated to conducting routine maintenance activities, and the other to performing utility locates. The two teams should be trained in both routine maintenance and utility locate responsibilities; having the two teams would thus provide redundant resources. Also, it is assumed that the additional operational staff will be able to help with process tickets.
- For Phase 3, it is assumed that one of the existing four maintenance technicians can be reassigned to serve as an assistant to the maintenance supervisor. He/she would assist with troubleshooting, handling any overflow of maintenance activities and carrying out special projects. Then there would be a need to hire a fifth technician to maintain two maintenance teams.

Exhibit 16 – Additional Staffing Requirements by Phase

Position	Cumulative Total Personnel			
	Phase 1 (Funded)	Phase 1	Phase 1 & 2	Phase 1,2, & 3
PCC Manager	1 full-time	1 full-time	1 full-time	1 full-time
PCC Assistant Manager	0	0	1 full-time	1 full-time
Network Engineer	1 full-time	1 full-time	1 full-time	1 full-time
Public Information Specialist	1 full-time	1 full-time	1 full-time	1 full-time
ATMS/ITS Operators	2 full-time and 2 part-time	2 full-time and 2 part-time	6 full-time	6 full-time
Administrative Staff	0	0	1 full-time	1 full-time
Maintenance Supervisor	1 full-time	1 full-time	1 full-time	1 full-time
Maintenance Technicians	0[1]	3 full-time	4 full-time	5 full-time

[1]Note: Assumes the contractor, as part of the initial installation, will cover initial maintenance under warranty for one year.

5.2. BUDGET

Adequately funding the operations and maintenance costs is the first step to ensuring the success of the proposed ITS improvements. Pinellas County, the City of Clearwater, and the City of St. Petersburg currently have funding for traffic signal operations and maintenance. It is anticipated that cost per signal will increase from $5,500 to $6,000 due to the additional detection maintenance for traffic adaptive signals. It is assumed that most of the signal related training requirements will be met during construction of the ITS improvements as they are installed. However, it is recommended that a budget be established for developing a training curriculum for recurring training; it should include cross-training for operations and maintenance personnel. Additional budget and resources will be required for the operations and maintenance of fiber optic communications, CCTV, and DMS.

Based on the cost assumptions in section 3.0, Pinellas County will need an additional $2,005,250 per year for the full-build scenario, or completion of all three phases. This assumes that FDOT will be responsible for the operations and maintenance of the freeway segments (I-275, Gandy Blvd and Courtney Campbell Causeway), and the building maintenance for the PCC will be part of a separate county facilities budget. The additional estimated operations and maintenance budget requirements by phase are listed below. (Note: the budgets do not consider inflation or raises for employees.)

- Phase 1 (funded) – $763,670
- Phase 1 – $1,070,100
- Phases 1 and 2 – $1,549,860
- Phases 1,2, and 3 – $2,005,250

5.3. POLICIES AND PROCEDURES

ITS improvements are different from traditional transportation improvements, in that the operation and maintenance of the ITS improvements have to be closely coordinated and managed in a unified manner to maximize the benefits. The MPO's program statement defines high-level policies for potential resource sharing and the need for developing protocols to facilitate interagency coordination. More specifically, there is a need to develop protocols for signal system operational strategies, information sharing, and interagency coordination.

6.0 FUNDING OPPORTUNITIES

This section describes possibilities and options for funding the projects proposed in the *ATMS/ITS Long-Range Master Plan*. Funding opportunities are available through a myriad of federal, state, county, municipal, and possibly private-sector sources. The following information was drawn from available resources[7,8].

6.1. FEDERAL/STATE FUNDING

On August 10, 2005, the federal surface transportation act known as *Safe, Accountable, Flexible, Efficient Transportation Equity Act* (SAFETEA-LU) was signed into law. SAFETEA-LU authorizes $286.5 billion in spending in federal fiscal years 2004–2009 for numerous surface transportation programs, including ATMS and ITS projects. While previous federal transportation acts included specific earmarks for ITS projects, SAFETEA-LU mainstreams ATMS/ITS funding through the federal aid program (rather than using earmarks). From a national perspective, SAFETEA-LU amounts to an inflation-adjusted increase of about 5 percent for highways over TEA-21 (the previous six-year transportation act that expired two years ago).

System operations and maintenance costs are eligible for federal funds. Such costs should be estimated in a manner that allows agencies to take every opportunity to secure Surface Transportation Program and National Highway System funds. Pinellas County is eligible for such funding.

National Highway System (NHS) – The NHS focuses federal resources on projects that are most important to interstate travel and national defense, roads that connect with other modes of transportation, and roads essential for international commerce. These roads are collectively referred to as federal-aid roads, or the National Highway System. The FDOT is primarily responsible for prioritizing the projects that use these funds. Previously, this act limited the time period that funds could be used for start-up costs for traffic management and control to two years. ISTEA and TEA-21 both eliminated the two-year limitation on reimbursement of start-up and operating costs for traffic management and control. Further, "infrastructure-based intelligent system capital improvements" are added as eligible projects for NHS funding. Additionally, as now defined in 23 U.S.C 103(b)(6), the term “operating costs for traffic monitoring, management, and control” includes labor costs; administrative costs; cost of utilities and rent; and other costs associated with the continuous operation of traffic control, such as integrated traffic control centers.

Operating expenses can also include costs incurred for hardware and software system upgrades and system maintenance activities that are intended to ensure peak performance of installed systems. Replacement of defective or damaged computer components and other traffic management system hardware, including street-side hardware, is considered eligible for funding as well. However, these funds are still restricted from being used for maintenance activities.

Surface Transportation Program (STP) – The Surface Transportation Program (STP) is a block-grant type program that may be used by states and localities for any roads (including NHS) that are functionally classified as local or rural minor collectors or

above. The MPO's role is to guide the prioritization of STP funds. Once funds have been allocated by the states, each state must set aside 10 percent of the funds for safety construction activities and 10 percent of the funds for transportation enhancements. As under the NHS program, "infrastructure-based intelligent system capital improvements" are added as eligible projects in STP. STP funds can be used indefinitely for capital and operating costs for traffic monitoring, management, and control facilities. As with NHS funds, STP funds cannot be used for maintenance activities. Other funding sources may also augment STP funds.

In the past, Pinellas County was eligible for Congestion Management and Air Quality Mitigation (CMAQ) funds. However, these funds are no longer available because of the current "attainment" status for air quality.

Transportation Regional Incentive Program (TRIP) – The 2005 legislature created, within the FDOT, the Transportation Regional Incentive Program (TRIP) for providing funds to improve regionally significant transportation facilities in regional transportation areas. The purpose of the TRIP is to provide an incentive for regional planning; to leverage investments in regionally significant transportation facilities (roads and public transportation); and to link investments to growth management objectives. The intent of these funds is to generate additional capacity through growth in the transportation program. All proposed projects will be evaluated in light of this policy. The department will allocate funding available for TRIP to the districts by statutory formula (using equal parts of population and motor fuel tax collections). The percentage of state matching funds provided from the TRIP will be matched on a dollar-for-dollar basis by eligible funds or eligible in-kind sources. TRIP funds may be used to fund up to 50 percent of the nonfederal share of the eligible project costs.

Strategic Intermodal System (SIS) – SIS funds were recently assigned to fund the Regional Transportation Management Center project in Jacksonville as part of the Jacksonville Multimodal Center program. Similar efforts may be pursued in funding the Pinellas County Centralized Communication Center. SIS funding priority is assigned to projects that (a) support SIS goals; (b) are linked to growth management objectives (e.g., concurrency, backlog funding, urban infill, and redevelopment); (c) have a commitment of funds from partners; and (d) are production-ready.

6.2. COUNTY/MUNICIPAL FUNDING SOURCES

Local county and municipal funding sources include the Local Option Gas Tax, transportation impact fees, the "Penny for Pinellas" infrastructure surtax, grants, ad valorem taxes, and general funds. Local revenues are expected to increase considerably, particularly with the potential extension of the "Penny for Pinellas" tax for an additional 10 years.

Local Option Gas Tax (LOGT) – The current LOGT is in effect until August 31, 2007. Gas taxes were first imposed by the local governments of Pinellas County in September 1985. This was a 4-cent tax levied for a 10-year period that extended to September 1995. Funding was continued with the Board of County Commissioners' imposition of a 2-cent LOGT for the period beginning September 1987 and ending August 1995, and a 6-cent LOGT from September 1995 to August 1997. Pursuant to an inter-local agreement, 75 percent of the funding generated from this gas tax was

allocated to the county. The remaining 25 percent share was divided between the cities for local transportation projects within the municipalities, and the unincorporated county. The 6-cent tax was subsequently extended to August 2007 in June 1993. The County Commission recently voted to approve a penny increase to the LOGT, which is expected to generate $3.9-million annually.

In the past, Pinellas County has participated in the County Incentive Grant Program (CIGP) to fund the "McMullen Booth ATMS Project", where the FDOT matched 50% of the funded provided by Pinellas County. The percentage that the FDOT matches depends upon the jurisdiction and classification of the roadway.

Transportation Impact Fees – Pinellas County levies a transportation impact fee on all new development or redevelopment that will increase vehicular trips. This revenue is used primarily to fund road construction projects. Fifty percent of all impact fees collected are remitted to Pinellas County, and the remaining percentage is kept within the presiding jurisdiction where the development occurs. Annual collections from impact fees are expected to decline over time, primarily due to the lack of available land for development.

Penny for Pinellas Infrastructure Surtax (Sales Tax) – The county levies a 1-cent sales tax to generate funding for capital improvements. It provides the largest portion of capital improvement funding for the county and its municipalities. The county currently receives 53 percent of the Penny for Pinellas infrastructure sales tax revenue. A voter referendum is required to further extend the surtax for another 10 years (to 2020).

Sources for Operation and Maintenance – In addition to the LOGT, other revenues are expected to be derived from taxes, licensing and permitting fees, charges for services/public safety and transportation, interest earnings, rents, surplus/refunds, and reimbursements (which are included as a primary funding source for operation and maintenance projects). The municipal governments fund operation and maintenance programs using their share of the LOGT and general funds, including ad valorem taxes, proceeds from the sale of assets, interest earnings on investments, franchise fees, utility service taxes, license and permit fees, intergovernmental state sharing, grants, public service district charges, leisure service user fees, fines, and forfeits.

6.3. PUBLIC/PRIVATE PARTNERSHIPS

Public/private partnerships represent another potential funding mechanism to support the ATMS/ITS program. These mechanisms may include traveler information and shared resource strategies.

Traveler Information – Opportunities exist to arrange for private-sector information service providers (ISP) to provide traveler information services. The treatment of ISPs is therefore a key element in both the architecture design and implementation of the ATMS/ITS program. ISPs are considered to be the information bundlers for the various ITS information sources. While Mobility Technologies is currently providing this service for FDOT, similar strategies may be considered to provide traveler information along the major arterials within the ATMS.

Shared Resources – Innovative funding sources should also be explored (within statutory constraints) to supplement available federal and state funds. These potential

funding sources could include public/private partnerships, resource sharing with public agencies (both within and external to the county), and revenue opportunities. Examples of potential funding sources are revenue from leasing of fiber optic communications capacity.

APPENDIX A – ATMS/ITS DOCUMENT SUMMARIES

Introduction

The following report summarizes a system assessment made of the three traffic control systems on May 13 and 14, 1999. All three agencies were interviewed following a general questionnaire. The general observations and impressions are listed below. I have also included some suggestions and issues to be considered for future programs in the region.

A General Observations Of The Traffic Control Systems

The three systems are all of the same general age, hardware construct and support the same general functions. They utilize a *Concurrent Computer* 3212 mini-computer, with simple CRT terminals running the MTCS software package developed by *Computran*[1]; this software package was based upon the FHWA software, UTCS (Urban Traffic Control System), which was widely used and customized during the 80's. The specific implementation of the software on all three systems supports a more generalized communications protocol to the intersections which enables real-time monitoring and provides central management of the local controller's database. Thus, a central operator (traffic engineer) can access the local timing parameters without going to the street location.

All three systems communicate with the intersections on a once-per-second basis providing real time data for system displays, communications statistics, traffic status, and equipment status. The timing plans are run locally (at the controller); second-by-second control is not used with these systems, rather, they download and update the plans that run locally. This technique reduces the sensitivity to communications and central system failure.

All three systems utilize an area wall map with LED illumination to show controller status and detector status/traffic conditions. In addition, each system includes a large push-button control console to effect plan changes, change of display parameters, etc. although operators can access all of these functions through the terminals. This console was typical of the UTCS systems from the 1980's.

The communications systems use 1200 baud asynchronous, Bell 202 compatible, FSK (1200Hz/2200Hz) modems (analog) configured for multi-drop operation with up to 10 controllers on a single communications channel, although most channels run fewer than this number. The communications media is a mixture of leased lines and agency owned cable. The leased lines are used for St. Petersburg, most of Pinellas county, and a few remote circuits in Clearwater. Clearwater's communications network is good quality twisted pair cable installed with the system and extended over the years.

The systems have been <u>very</u> reliable. They have reported that the main computers virtually never fail, and the controllers, communications and CCU have been very reliable. Their weakest link is the communications facility, and in general that is repaired quickly. Even in the event of communications failures, the local controllers revert to backup timing plans which maintain coordination.

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[1] *Computran* Systems, Hackensack N.J.

Each agency has a hardware maintenance contract for the central computer (*Concurrent*), and has handled traffic application software support with a maintenance contract with *Computran*. Hardware maintenance for the traffic controllers and the remaining central hardware (e.g. central communications interface unit, map display, control console) is handled directly by the agency's own electronic technicians.

All three control centers are relatively small facilities, but adequately server the number of operators and the existing level of operation.

There is no interconnection between traffic control centers (other than telephone). None of the systems is configured to export data and even if they did, the other systems are not capable of accepting this type of data. There is a need to maintain clock synchronization between systems because some of the major arterials continue between jurisdictions; to date this is handled with telephone calls between operators.

All three agencies (agency wide – not just traffic) are at various levels of general office and management system integration. Clearwater is the most advanced with a central management and information system group and procedures for operation, maintenance, and configuration management. While the traffic control systems are not integrated into their networks, it is clear that they are ready with the LAN/WAN technology and support. St. Petersburg and Pinellas County are just about to bring their initial information systems on line. Eventually this will include 'groupware', web access, e-mail, and the possibility of integrating their traffic systems. This is an important consideration because it is likely that the next generation of systems will be PC and network based (e.g. Microsoft NT).

As a commentary, the older traffic control systems were treated as 'turn-key' systems, and were not candidates for broader integration into wide area networks or other agency systems. The agency did not have to deal with any of the issues of 'open systems' integration, hence, the *Concurrent* mini computers ran a proprietary operating system, unknown to the MIS department, and were treated as a standalone, real-time process (traffic) control systems, not computer systems. Such systems have typically not been upgraded, enhanced and expanded except to add intersections/detectors and traffic plans. The agency cannot use the systems for any other applications (e.g. word processing and spreadsheets).

With newer, 'open systems', everyone expects a computer on their desktop, and that computer is supposed to be integrated to handle routine office transactions (e.g. e-mail, word processing, spread-sheets) and client server applications, such as internet access, incident management, databases, variable message sign control, AND traffic control. Such broad integration brings new complexities and the need for 'experts' (typically system administrators) who can manage the agency's applications, networks, domains, database administration, machine configurations, drivers, hardware, applications, backups, reboots, et cetera. Therefore, it is important to look at the agency as a whole when selecting an approach and technology to ensure that there are sufficient resources with the expertise to maintain these 'open systems' or stability and reliability can be seriously jeopardized; upgrading to the newest 'open systems' technology could create more problems than it solves if the agency is not prepared.

B Traffic Plan Generation

Timing plans were generated for the region as part of the initial system implementation. A second round of new timing plans have recently been generated (for the entire region) and are about to be implemented. There is considerable skepticism in both Clearwater and St. Petersburg about

whether the new plans will be more effective than the plans they are currently running. The traffic engineers and signal maintenance groups in both of these cities feel that they have a better understanding of their respective networks and pointed to past experiences with 'consultant generated timing plans.' Some of these issues arise because the optimum timing plan for an arterial may not recognize the importance of a side street to influential members of the public.

It is interesting to note that all three systems have recently installed a PC based, off-line timing plan generation software from *Computran* called FORCAST. This software has not been used yet, although the agencies have been receiving training. This software will retrieve timing plan data from the MTCS systems, generate timing plans and re-install the timing plans back into the system – thereby simplifying the tedious process of establishing timing plans. This new software should provide the agencies with the means to more rapidly evaluate and modify their timing plans. This is a proprietary timing plan development program.

After the initial implementation (90-91), *before* and *after* studies were conducted (by the county) indicating modest improvements in speeds and travel times on critical arterials. These improvements can be attributed to the new timing plans and the timing accuracy of the local controllers; the new system maintains clock synchronization for all controllers thereby assuring proper progression depending upon the timing plan.

C Data collection

The MTCS system has the ability to generate many reports including traffic volumes. The agencies currently print these reports and make the information available to their planning department in the form of volumes of printed reports. It is clear that with the improvements in planning software, automated maintenance of log files for traffic volumes in a well known and easily readable format may be of benefit to the city planning departments. However, this implies that both groups are able to electronically process the data. At this point, most agencies manually re-enter the timing information into their planning models.

D Perceived Benefits from the Original Systems

During our discussions with the agencies one of our questions was: "What would [you] characterize as the primary benefits achieved with the deployment of the existing system?" Both cities indicated that one of the principle benefits was improved reliability of the street controllers and the more rapid detection of failures which allowed the agency to restore proper operation much faster. This has had the side benefit of improving the public safety, although it is unlikely this is visible to the public. Although there were benefits from the new timing plans, it was the reliability of the new systems and their ability to allow more careful monitoring of equipment status and the ease of implementing changes that were high on the list of benefits. This improvement came with the replacement of obsolete electromechanical technology with solid state traffic controllers.

Another significant issue/benefit that is often overlooked is the use of identical technology throughout a system – and in this case, the County. Because the central systems and field controllers were purchased from a single group of vendors (*Computran* [central], Winko-Matic [CCU], Transyt [controllers]) and are all of similar age, the maintenance shops are able to keep an adequate supply of spares, learn and perfect diagnostic and repair procedures, and understand the anomalies which are characteristic of the equipment. Too often, agencies 'inherit' (get stuck with) a diverse collection of different technologies (due to multiple low bid contracts), different manufacturers and varying quality which can dramatically increase the cost of maintenance. Any

new procurement needs to consider the benefits of like technology and a common manufacturer for all of the field equipment.

Another benefit expressed was the ability to synchronize the field clocks. Prior to the installation of the system, signal synchronization had to be maintained with time-based coordination which is notoriously unreliable due to clock drift. With the installation of the system, the field clocks are automatically synchronized with the central clock. Thus, when the field devices fall back to time-based coordination, the public cannot tell the difference during a typical outage.

E Issues/Concerns

E.1 Critical Points Of Failure

Each agency expressed major concern over the potential failure of the central communications unit (CCU). The CCU uses custom circuit cards to handle the information transfer, communications timing, and the protocol on the communications channels. These cards utilize custom firmware which is matched to the *Computran* protocol. This portion of the system also uses a Universal Logic Interface card (ULI) which was custom modified to interface with the *Concurrent* machine and the CCU itself. The original manufacturer (Winko-Matic) of this equipment is no longer in business and hence the purchase of additional cards or depot repair are not possible. While the CCU has been very reliable, this is the single most vulnerable point of the system – in fact, it is the only point of serious vulnerability; should a failure occur, the agency will have to repair the cards themselves and this could be a lengthy process since they do not stock spares, understand its operation, or have adequate diagnostic tools. [Note the design is from 1985.] The only mitigation was that the manufacturer utilized all socket mounted integrated circuits which means that wholesale component replacement on the circuit cards is not difficult.

All other elements of the system are either non critical (map display, terminals, control console), or under a maintenance contract (Concurrent Computer).

It will be important that the next generation CCU utilize electronic assemblies which are easily supported or replaced with ‘like devices,’ such as terminal servers or Com: ports.

E.2 Obsolescence

The central system is a ‘closed system’ operating on a mini computer and is not easily (or inexpensively) upgraded or changed. Although not yet critical, it is important that the three central systems be upgraded so that they can become ‘nodes’ on a regional architecture in preparation for integration into the National ITS architecture. These upgrades must be high-reliability configurations so that they meet or exceed the reliability of the old systems.

The field equipment is now nine years old, having been installed in 1990-1991. While all three agencies indicated good reliability, it is time to begin planning for the replacement and upgrade of this equipment. The controller designs are already obsolete and eventually, replacement parts for the field controllers will become scarce or impossible to obtain; hence, it is important that the agencies begin to plan now for the eventual replacement of the field hardware.

It must also be noted, that while the previous generation of controllers and field equipment have been [relatively] easily to repair, the next generation of equipment will employ high density, multi-layer, surface mount technologies which require a higher level of skill and more sophisticated equipment to properly effect repairs. Thus, the next system procurement needs to consider the issues of depot maintenance, modularity, and adequate spares. It is unlikely that the agencies will

be able to complete as many of the repairs at the board level as they do today. The alternative is to include a program of intensive maintenance training and new maintenance equipment for the shops – or possibly contracting with a third party for maintenance. These issues will need to be considered as part of the development of the next system.

E.3 Control Centers

The control centers, while small, are well structured for the tasks at hand (monitor equipment status, dispatch repair crews, adjust signal timing). They have a combination of terminals which meet most of the needs for operation and maintenance. While one might suggest that a traffic management center should include projection graphics, the map displays provide a good overall view of traffic conditions and equipment conditions hence meet most of their needs. Although fixed map displays are not easy to modify, this geographic area is relatively stable, the maps are in good shape (using LED technology) and relatively easy to repair.

The old style control consoles consume a large amount of desk space and are custom in design. It would be prudent to eliminate these consoles in favor of a more integrated PC workstation.

None of the agencies employ video in their operation, although Clearwater has some coverage for a few critical areas. Most expressed interest in acquiring video, but it appeared that the most useful (and cost effective video) would be related to special events or be portable in nature. This is consistent with their operations which would use video primarily for special event management or troubleshooting new timing plans. However, even with an increase in video surveillance, the physical space of the existing centers could easily handle the few monitors that would be needed; integration would occur on the workstation.

F Future ITS Integration

While the systems are currently focused on surface street traffic control, there are several areas of the region which could benefit from such technologies as changeable message signs, highway advisory radio and video surveillance. Such functionality is best managed when integrated into an overall regional system. This will require a system interconnect or leased facility to exchange this type of data. Except for video, most of the bandwidth requirements are modest and can be handled via simple WAN technologies.

As a result of the TEA-21 legislation, future improvements and enhancements will be required to show both conformance to national architecture, and a migration plan for use of the emerging ITS standards. Therefore, any new system should include these requirements. The existing system does not meet this test.

F.1 Incident Management

During the interviews, it was noted that none of the agencies actively participate in any type of incident management/mitigation program. While several of the agencies have developed timing plans for the management of specific events (storms, parking, concerts, games), there was no support for an overall incident management program [e.g. corridor management, freeway diversion]. Currently, the local police manage all incidents, including towing, clean-up, traffic direction/routing, et cetera. While it may be pre-mature to suggest that regional incident management is essential, it would be advisable to conduct a more thorough assessment of the emergency management services for the region and to determine what the costs/benefits might be for a more integrated approach to regional and local incident management. This type of integration can have far reaching

implications on the systems and infrastructure; therefore, it is important that these issues be investigated as soon as possible so that the requirements can be included in the next generation system designs.

F.2 Other Technologies

Portable variable message signs (VMS) are used in the region, but they are not integrated into any of the traffic systems. Some of them are dial-up while others require direct control at the sign. Additional investigation would be needed to determine a more integrated approach to the use of VMS in the region. Most modern integrated systems would make VMS available for multi-agency use with well defined protocols for their use for incidents, planned events, and driver notification of planned changes (e.g., construction).

F.3 Inter System Coordination

There is no intercommunication or LAN/WAN connection between these systems or even between the agencies. However, it is also clear that there will be integration between the management and office automation systems used by the agencies and it is likely that this ‘path’ could be used to handle inter-agency coordination and communications for most functions (except video). The initial phase is likely to be e-mail; shared system access will have to wait until the central systems are upgraded.

There is a need to establish a better clock synchronization between systems.

F.4 Integration With Their Office Networks

Integration with their office networks and systems will allow more convenient access to their systems and the data sharing for such functions as planning. However, it brings with it the potential for higher operating costs due to the complexity of network and ‘open systems’ management.

Another concern will be the accuracy of the data being accumulated. As the traffic data is shared, the ability of the agency to properly calibrate the field equipment and the level of maintenance for the agency becomes much more visible. While I would not anticipate a problem with these three agencies because they have an excellent loop maintenance program, it is important to keep in mind that wider accessibility of data means a higher level of operation and maintenance visibility.

G Future Directions

This section considers some of the recommendations for improvements to the existing systems. Some of these recommendations are made reluctantly because I have seen tried and true, stable systems replaced with more ‘open systems’, wide area networks, et cetera, at the expense of increased maintenance and reduced reliability. One must be very careful to consider all of the costs when recommending technology upgrades. The use of PC networks can greatly reduce the cost of maintenance while increasing the accessibility and establishing a robust integration platform, if done properly.

G.1 Conformance To National Standards

The agencies will be required to develop a transition plan for conformance with both the national architecture and evolving ITS standards. The existing systems will not meet these requirements

without a complex series of 'translators' and interface servers. Further, as the field controllers adopt the NTCIP standard, the existing system will not support such standard controllers.

G.2 Technology Refreshment

Just as the initial system upgrade from electromechanical controllers to NEMA, solid state controllers made a significant improvement in stability and reliability, it is important that the agencies begin to plan now for the next generation. The systems installed in 1990-1992 have allowed the agencies to support the growth in the region and the increase in traffic with little impact on the public. If the agencies wait until the existing equipment is obsolete and un-repairable, it is very likely that the public will see and feel the impact of reduced reliability.

G.3 Capability Of Handling New ITS Technologies

The existing systems cannot handle the integration of new and emerging ITS technologies. As it is, such devices as changeable message signs are being handled with fragmented systems.

It is not clear whether adaptive control would be of benefit to these agencies. They have yet to really test traffic responsive control.

It is clear that there may be some measurable benefits by adding some ATIS system elements to alert the public during special events and freeway incidents. This would take some more detailed studies.

G.4 LAN/WAN Support For The Traffic Control System

The national architecture and standards allow for the effective interconnection of systems and data sharing between systems. The existing systems cannot support this type of integration. In addition, upgrading the concurrent machines would be a very costly approach when suitable central systems are available with this type of integration already available.

H System Summaries

	St. Petersburg	Pinellas County	Clearwater
Number of intersections	290	280	140
Number of intersections connected to the central computer	250	250	126
Pre-timed	125	None	None
Actuated	125	All	All
Traffic Responsive operation	None	About to start	About to restart
Communications	Leased	Mostly Leased	Mostly owned– with a few leased circuits

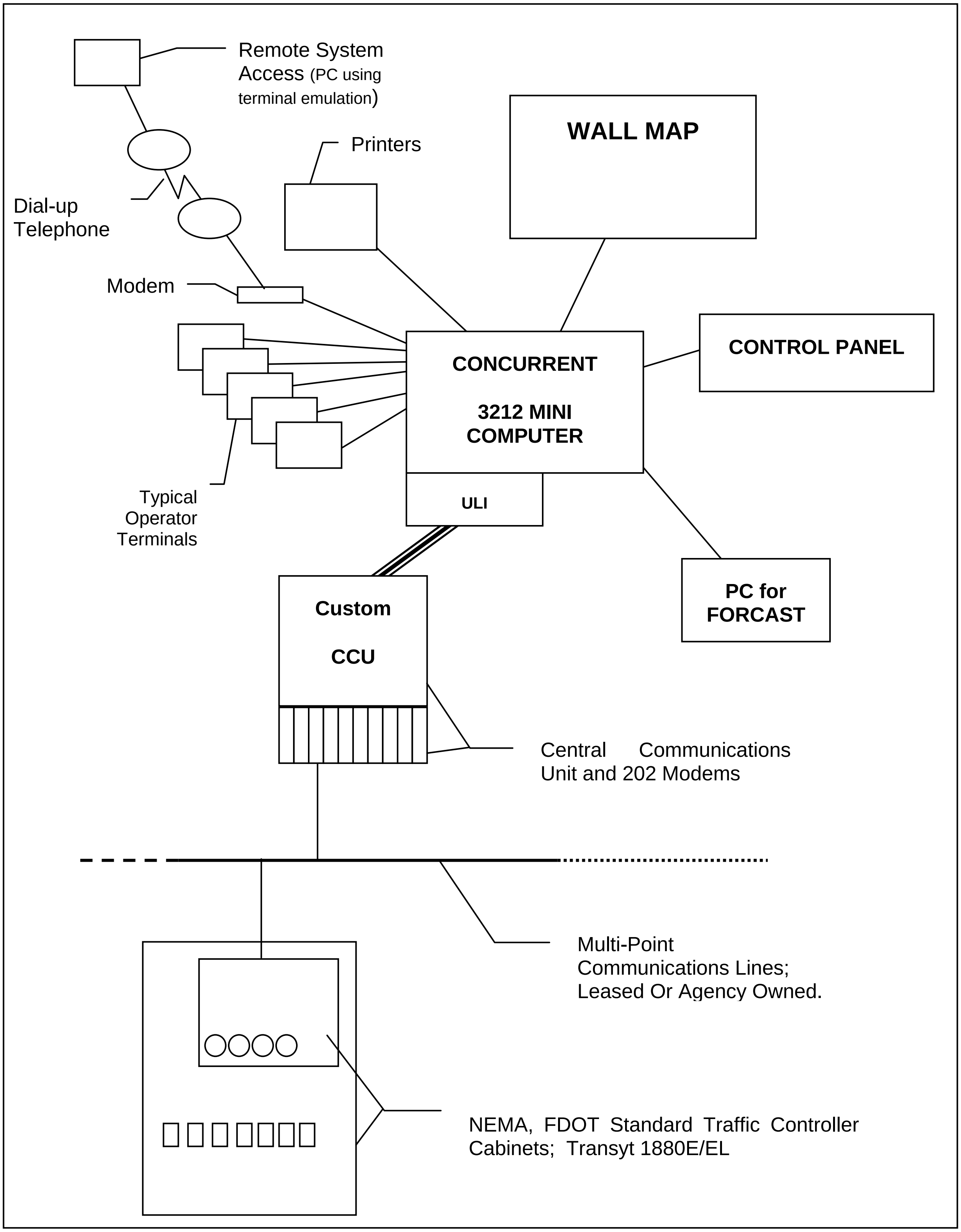

Figure 1 – Typical System Block Diagram

General Engineering Consultant Agreement
Contract#C-7499
Financial Project No.: 254547 2 32 01

Executive Summary

Prepared for:

FLORIDA DEPARTMENT OF TRANSPORTATION DISTRICT 7

Prepared by:

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EXECUTIVE SUMMARY

Since completion of the original Tampa Bay Regional ITS Architecture (TBRIA) in 1999, the Florida Statewide ITS architecture (SIA) was adopted in 2000, and several ITS projects have progressed to the design stage. The Tampa Bay stakeholders stressed the need for harmonization of these architectures so that they relate well to one another to insure that ITS development in the region proceeds in a consistent manner. Further, the federal rule on conformity with the National ITS Architecture (NIA) was promulgated in the same period as a new FTA policy, triggering a revisit to the Advanced Public Transportation Systems (APTS) components of the TBRIA.

As part of on-going changes to the NIA, new user services and market packages are being introduced and changes to the architecture components are being implemented. The original TBRIA was based on the NIA Version 2.0. Since then, the NIA has been updated to Version 3.0, and recently to Version 4.0. Note that the TBRIA update was largely completed prior to the publication of the NIA Version 4.0, and therefore, the Version 4.0 new market packages were not necessarily included in this update.

This update to the TBRIA also responds to the absence in the NIA Version 3.0 of user services and a market package for pedestrian safety and access. Thus, the update includes a functional analysis, and a course of action, to develop this as a new market package for eventual inclusion in the NIA and the SIA.

The original Tampa Bay Regional ITS Architecture development and update process have been integrated in a series of seven technical memoranda (TM) as listed below:

TM 1 (original TM 1): Baseline Architecture - ITS Inventory

TM 2 (original TM 2): Selection of Market Packages

TM 3 (update TM 1): ITS Architecture Reviews - Updated Market Package Selections

TM 4 (update TM 2): The FHWA Rule/FTA Policy on ITS Architecture Consistency

TM 5 (update TM 3): Logical and Physical Architecture Update

TM 6 (original TM 6): Conceptual ITS Communications Plan

TM 7 (update TM 4): Pedestrian Safety and Access Market Package Research

This is HOME

Note that each TM was recently renamed for the sake of integration of the TBRIA documents administered under two separate projects. Each TM documented a step in the TBRIA development or update process, from the baseline architecture/ITS Inventory through consideration of systems technologies to Pedestrian Safety and Access market package research. A synopsis of each technical memorandum is provided below.

TM 1 - Baseline ITS Architecture- ITS Inventory

TM1 identifies the "legacy" hardware, software, and institutional arrangements of each local government in the region. Its purpose was to lay a foundation, an architectural framework, for developing the baseline ITS architecture. This effort began with a comprehensive inventory of all existing ITS technologies, including the type of technology, control center, vehicle fleet controlled, and the type of communications media. Terminology used in the National ITS Architecture and mapping of the existing technologies to appropriate market packages are also included in TM 1. In addition, a description is provided for the necessary communication backbone capable of supporting the recommended architecture, as well as an assessment made of the existing and programmed communications infrastructure for each region.

The various elements of the "legacy" Regional ITS Architecture are described in detail and by jurisdiction, including ITS subsystems, terminators, communications, and market packages. TM 1 concludes with a description of the next steps to be undertaken for the Tampa Bay Regional ITS Architecture development.

Once the baseline architecture was understood and defined, future market packages for each jurisdiction were developed, which was the basis for TM 2. The baseline architecture is essentially unchanged since its issuance and, as a consequence, TM 1 was not revised in this update.

TM 2 - Selection of Market Packages for a Regional Architecture

TM 2 shows the selection of market packages under "legacy" systems identified in TM 1 and explains how these packages were developed through the outreach process. Future market packages were also identified and compared to the *District 7 Strategic Plan for ITS* to define a comprehensive set of market packages for further decomposition as part of the subsequent regional architecture development.

The *District 7 ITS Strategic Plan for ITS* recommended a prioritized list of user services and market packages based on an extensive analysis of existing transportation infrastructure, local priorities, cost concerns, and compatibility with local goals and objectives. The analysis and the outreach sessions conducted during the development of the Strategic Plan revealed the need for a new market package not currently shown in the NIA, to support pedestrian safety and mobility. Starting with the market package list prepared under the Strategic Plan, the prioritization process for the TBRIA involved all major stakeholders namely FDOT and local government staffs in Pinellas, Hillsborough, Pasco, Hernando, and Citrus counties. The major stakeholders then evaluated each market package as to whether it was needed in their jurisdiction. It was then decided, based on the decision by each jurisdiction, whether a particular market package was to be selected for the TBRIA.

In addition, TM 2 reflected feedback from the various jurisdictions and was key in compiling a list of appropriate technologies for future deployment of selected market packages. Based on the District 7 Strategic Plan for ITS, deployment time frames were defined as being either short- (1-4 years), medium- (5-10 years) or long- (11-20 years) term. Based on a priority assessment, each selected market package was recommended for implementation within one of these time frames.

TM 3 – ITS Architecture Reviews –Updated Selection of Market Packages

This memorandum reviewed the Florida Statewide ITS Architecture (SIA) issued in February 2000, the Tampa Bay Interstates Feasibility Study, the I-4 Corridor ITS Plan, the US 19/SR 60 project in Pinellas County, and the US 19 project in Pasco County in comparison to the TBRIA. Any differences observed were noted, and determinations of which, if any, of the two architectures should be changed were performed. Further, telephone interviews were conducted to reassess transit stakeholder needs upon the adoption of an ITS Policy by the FTA similar to Rule 940. These transit agency interviews provided an opportunity to better map the responses to transit related market packages available within the NIA, SIA and TBRIA. Finally, this TM provides a comprehensive summary table listing the recommended market packages to be retained, deleted, or added to the TBRIA based on the ITS architecture reviews and Tampa Bay stakeholders needs. This TM formed the basis for the *Logical and Physical Architecture Update* documented in TM 5.

TM 4: The FHWA Rule/FTA Policy on ITS Architecture Consistency

This technical memorandum provides an overview of the Federal Highway Administration's (FHWA) Rule/Federal Transit Administration (FTA) Policy on ITS Architecture Consistency. It describes the rule intent and requirements. Further, the Tampa Bay Regional ITS Architecture (TBRIA) was compared to the rule requirements. If, in the opinion of the consultant, the TBRIA is consistent with the requirements, it is noted. If further work is needed to be consistent, suggestions are made to help guide future efforts towards consistency.

The Rule 940/FTA Policy also requires that federally funded ITS projects use USDOT adopted ITS standards. TM 4 includes a brief discussion of ITS Standards.

TM 5-Logical and Physical Architecture Update

TM 5 was produced once market packages were selected and prioritized for each jurisdiction. The architecture defines the following:

- Identification of the Center subsystems within the TBRIA;
- Functions and functional requirements required for ITS (e.g., gather traffic information or request a route);
- Physical entities or subsystems where these functions reside (e.g., the roadside or the vehicle); and
- Information flows that functionally connect physical subsystems together into an integrated system.

A logical architecture defines the functions necessary to support selected ITS user services. It defines the processes that perform ITS functions and information or data flows to be shared between these processes. The term "logical architecture" is also referred to as an "Essential Model" because it is independent of technology, design, geography, jurisdiction, or implementation. This independence makes it accommodating to innovation, supportive of widely varied system designs, and scalable from small-scale implementations to large regional systems.

A physical architecture provides agencies with a physical representation of ITS interfaces and major system components, independent of technology and design. The architecture also provides a high-level structure around the processes and data flows defined in the logical architecture. Its principal elements are the 19 subsystems, related communications flows that connect these subsystems, and the terminators that demarcate the subsystems.

A greater level of detail with regard to the Center Subsystem guided the update of the Physical Architecture. In the Update, market packages were now included at the level of City Departments, Fire and Police, whereas previously market packages were presented at the level of counties. A second feature of the Update resulted from a more thorough outreach in the area of APTS.

The logical architecture based on functional decompositions, as outlined in the National ITS Architecture, is developed for the selected market packages under each designated "center" within the Tampa Bay region. The physical architecture includes recommended information flows and interface requirements between the equipment packages (i.e.: vehicle, remote traveler, personal information access) and other ITS subsystems, namely planning, transit, and emergency management. The Regional Center-to-Center architecture information flows are modeled on the related National ITS Architecture physical architecture flows.

TM 6 - Conceptual ITS Communications Plan for the Tampa Bay Regional ITS Architecture

TM 6 outlines regional communication needs to support Tampa Bay Regional ITS Architecture as earlier described in TM 5. The conceptual plan includes an assessment of communication capacity (i.e., order of magnitude bandwidth) that is needed to support inter-agency communications and priority market packages.

TM 6 focuses exclusively on inter-agency communications to support the priority market packages. The memorandum provides a high-level summary of technical options for delivering this communication capacity, which includes considerations of network topology and transport technology (e.g., SONET, ATM, wireless, satellite, etc.). Non-technical considerations, such as procurement options, are also presented.

A brief discussion on the prioritization of communication needs, which is an extension of the prioritization of market packages and supporting communication services, is included in TM 6, as well as a "strawman" network using a system block diagram approach. This diagram includes technical options for key geographical constraints, as well as the proposed Florida Fiber Network (FFN).

The data flows and interfaces in the regional physical architecture form the context within which all communications will take place. Each communication context has its own set of requirements, or controlling specifications.

TM 7 –Pedestrian Safety and Access Market Package Research

During outreach sessions for the Tampa Bay Regional ITS Architecture (TBRIA) development in 1999, Tampa Bay area stakeholders expressed concerns about pedestrian safety and mobility in the region.

The TBRIA recommended that a customized market package for *Pedestrian Safety and Access* be developed as a countermeasure to enhance pedestrian safety and operational problems. In TM 7, functional requirements and a market package are specifically proposed for national consideration and inclusion in the NIA.

For any questions or additional information on the TBRIA, please call Mr. Jerry Karp, Planning Programs Manager, Florida Department of Transportation, District 7, at (813) 975-6413 or E-Mail: Jerry.Karp@dot.state.fl.us

COMPUTERIZED SIGNAL SYSTEM

EVALUATION PROJECT

TECHNICAL MEMORANDUM NO. 1

PROTOCOL-90 COMMUNICATIONS ISSUES

PREPARED FOR:

PINELLAS COUNTY METROPOLITAN PLANNING ORGANIZATION

PROVIDED BY:

TEI ENGINEERS & PLANNERS

UNDER CONTRACT TO:

TRANSCORE

March 2000

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Introduction

The Pinellas County Metropolitan Planning Organization (MPO) is currently investigating opportunities for updating the technology utilized in the County's three computerized traffic signal control systems. A major consideration of any system modernization or enhancement project is the accommodation of the "legacy" systems' features in a staged implementation process. As funding of a complete and total replacement of the systems is not anticipated, plans must be made for maintaining existing traffic control and management levels while implementing the new technologies.

One specific area of interest relates to the communications between the central computer and the local intersection controllers. The existing system control software, implemented in Pinellas County, St. Petersburg, and Clearwater, utilizes a proprietary communications protocol developed by Computran Systems Corporation. The software for the local intersection controllers was specially modified for this communications protocol to allow internal communications capabilities. Any change in either the communications protocol or the local intersection controllers will have a significant impact on the continued operation of the three systems.

This Technical Memorandum has been developed to document communications issues relating to the existing communications protocol used by the Pinellas County systems, including ownership of the protocol and the implications of the ownership of the protocol on various system replacement scenarios.

Development of MTCS and the Protocol-90 Communications Protocol

The implementation of the three systems within Pinellas County advanced the then-current state-of-the-art in centralized traffic control systems. During the mid-1980's, most large central systems were based on the Urban Traffic Control System (UTCS) software package developed by the Federal Highway Administration (FHWA). UTCS installations utilized a communications format that provided command messages to, and received monitoring data from, each local controller assembly on a second-by-second basis. As most controllers of that timeframe (particularly of the NEMA family) did not have internal communications capabilities, external communications units in each controller cabinet were used to interface with the controller units.

As the Pinellas system project was initiated in late 1985, closed-loop type systems were becoming commonplace for smaller system installations. Closed-loop systems included internal controller communications capabilities, allowing both system control as well as access to the controller's full memory for uploading and downloading purposes. In planning the Pinellas systems, it was deemed desirable to have internal communications capabilities for the local controllers.

Because of the lack of a standard communications protocol for UTCS-type systems, NEMA controller manufacturers were not eager to invest a significant software development effort for the limited number of controllers related to most systems projects. However, the funding of the Pinellas County system included plans to replace a majority of the local intersections in the County, thus drawing the interest of a number of controller manufacturers.

Computran Systems Corporation was the system developer for the Pinellas systems, and had been working on a standardized communications protocol that could be utilized on a number of their systems. Their system software package, the Modern Traffic Control System (MTCS), represented a significant enhancement to the original UTCS software, and a standardized communications protocol, which would allow internal communications to controller units, would further their MTCS enhancements. The protocol would be open to any interested controller manufacturer, thus keeping Computran independent of any specific brand of controller. And, because of Computran's role in the systems marketplace, the volume of potential controller sales would be an enticement to the various manufacturers to develop compatible software. This new protocol was named Protocol-90, and its first implementation was on the three Pinellas systems.

The Transyt Corporation (now Peek Traffic) won the bid to provide controller equipment for the Pinellas systems, and developed internal Protocol-90 compliant communications software for both its Model 1880E and Model 1880EL controllers. These controllers represent the vast majority of controllers currently in the field in Pinellas County.

In addition to the Pinellas systems, the Protocol-90 communications format has been implemented on the Tampa computerized traffic control system, as well as on systems in Winston-Salem, North Carolina; Tempe, Arizona; and Birmingham, Alabama.

Technical Aspects of Protocol-90

The Protocol-90 communications format is a time division multiplexed (TDM) system that operates at 1200 baud on a four-wire, full duplex circuit. Each second is divided into ten intervals of 100 milliseconds each. In the first nine intervals, the Central Communications Unit (CCU) addresses and commands nine remote units with an eight byte (11 bits per byte) message; during the tenth interval, the CCU provides a time and date message to be used by all units on the circuit. Concurrently, each local intersection is responding to its command message with an eight byte (11 bits per byte) response message.

During normal control, the command messages include command bits for Hold-On-Line, Holds, Force Offs, Phase Calls, Special Function Calls, Flash, and Phase Omits. Response messages include Green Returns, Coded Status Bits, Special Function Feedback Bits, Flash Feedback, and Volume and Occupancy data for eight detectors.

During the downloading or uploading of controller data, the normal command and feedback messages are modified to provide only limited information, thus making time for the controller data messages within the framework of the TDM operation. In this manner, local intersections remain "on-line" during controller upload and download operations.

License Restrictions on MTCS and Protocol-90

A Software License and Non-Disclosure Agreement is in existence between Computran Systems Corporation and the Pinellas County Board of County Commissioners. Similar agreements are assumed to be in place between Computran and the Cities of St. Petersburg and Clearwater. The Pinellas County agreement is attached to this Technical Memorandum as Exhibit A.

Without providing a legal interpretation of the documents, it appears that Computran Systems Corporation maintains all rights to the use of Protocol-90. Specifically mentioned in the license is that the agreement includes the "...executable programs, algorithms, procedures, proprietary technologies, and related documentation, drawings, or diagrams furnished by Computran...". In addition, the license states that the licensed software "...is the sole and exclusive property of Computran and embodies proprietary, trade secret, and/or copyrighted materials". A written request to Computran to confirm this position, and the firm's response, are included in this document as Exhibit B.

The use of the Protocol-90 communications format would be key to the staged integration of the field components of the existing Pinellas systems into any new technology proposed in the current MPO review. Some systems are capable of operating with multiple communications protocols. This is the approach that Computran used in the replacement of the Tampa computerized traffic signal system. The original Tampa system used a non-proprietary communications protocol, which Computran duplicated and incorporated into its software. The system now operates two protocols – the original and Protocol-90 – selectable on a channel-by-channel basis. This approach allows the staged replacement of controller equipment. However, it appears that a systems software developer or integrator (other than Computran) would not be able to utilize the Protocol-90 communications format to communicate with the existing field controllers.

Implications of Protocol-90 Ownership

The primary implication of the recognition of Computran's sole rights to the Protocol-90 communications format is that the replacement of the central control software by anyone other than Computran will require the modification or replacement of the local controller equipment operating under that software.

The modification of the local controller units would involve a software development effort, on the part of Peek Traffic, to replace the Protocol-90 compliant communications firmware with comparable firmware for a different protocol. However, this approach is not feasible, as Peek's interest is in manufacturing and selling controllers, not developing software modifications. In addition, the majority of the Peek equipment in the field, replaced as part of the system installation, is now over ten years old and approaching obsolescence. Therefore, the modification of controller units would not be feasible.

An alternative to modifying the controller units is the utilization of external communications units that operate with the new protocol. However, as access to the controller unit's memory would not be possible, the current capability for uploading and downloading controller data would be lost – a step backward for the capabilities of the Pinellas systems. Again, this does not appear to be a feasible approach.

That leaves the replacement of the controller units as the primary option; however, the anticipated funding for the project may not be adequate for the mass replacement of controllers. This would lead into the need for various staged implementation scenarios.

Other Communications Protocol Implications

The discussion thus far in this memorandum has been geared toward the impacts on local controller equipment caused by changing communications protocols. A second concern of significant importance is the capability of the existing communications infrastructure to accommodate other (and particularly more advanced) protocols.

Federal funding guidelines are leading systems implementers toward the use of NTCIP compliant protocols. In general, an NTCIP compliant protocol, when used in a second-by-second environment, transfers significantly more data than the existing UTCS-type protocols, including Protocol-90. A preliminary investigation performed as part of the Tampa system replacement indicated that, where eight intersections could operate on a channel on the original Tampa system, only three or four intersections could be accommodated on an NTCIP compliant channel.

Almost all system communications (with the exception of a majority of the Clearwater system intersections) are accommodated through leased telephone lines. Clearwater has an extensive twisted-pair telecommunications network. All would need extensive reconfiguration, or alternative media, to accommodate a protocol that incorporated greater data requirements or higher data speeds.

Conclusions

The replacement of the existing system communications protocol (Computran's Protocol-90) with a different protocol (whether it be NTCIP-compliant or not) will have a

significant impact on the existing intersection controllers and communications infrastructure. At a minimum, controller units would need to be replaced to accommodate the new protocol; a protocol with higher data transfer requirements would also require a significant investment in the communications infrastructure.

Computran, through its license agreements with Pinellas County and the cities of St. Petersburg and Clearwater, retains the rights to Protocol-90 and the other software aspects of the three systems.

If the system control software is to be replaced, Protocol-90 could be retained as a means for maintaining the components of the legacy system under two primary scenarios:

- Computran is contractually involved in the software development process for the new system. If Computran were system developer for the new system, it could incorporate Protocol-90 as an available protocol in the new, multiple protocol system. Alternatively, Computran could potentially authorize (license) the use of Protocol-90 by others to incorporate into a new multiple protocol system.

- Computran is not contractually involved in the new system efforts. In this case, the existing system operation could be retained as long as Protocol-90 compliant controllers remained in the field (and as long as the existing system remained functional). Controllers would be replaced in logical groups as funding became available, and transferred to the new, non-Protocol-90 system. However, a funding mechanism should be in place to ensure system components and controllers are replaced prior to failure or obsolescence.

An alternative, as suggested within Computran's response to our inquiry, is a strategy they have called a "head replacement". In this scenario, the existing central computer equipment (including computer, central communications unit, and operator interface devices) would be replaced with current technology devices. Computran would then implement their MTCS.pc software, which utilizes Protocol-90 and would be able to interface with the existing field controllers over the existing communications network.

The head replacement would not necessarily provide any system control features beyond the current systems' capabilities. However, it would serve to postpone the need for the replacement of field controllers or the reconfiguration of the communications plant until appropriate funding sources are identified for a major system replacement project.

Composite* TS&MCC

Utility Measure Matrix

#	Criteria	Discussion Notes			Weight
1	Cost	Central system	controller purchase price		8.6
2		Software maintenance, spare parts, maintenance history			7.8
3	Experience & Reputation of the Vendor	With Pinellas County? Florida DOT?			5.6
4	Bandwidth requirements				3.8
5	Real-time Monitoring	How important is second-by-second monitoring / control			4.7
6	Financial and corporate stability	If this is important – suggest measurements			4.7
7	Support for ITS functions	Ramp Metering	Incident management	VIDS	9.0
		CCTV	DMS	ATIS	
8	Support for Transit Preemption				1.9
9	Computer Platform	PC, NT, UNIX, High Reliability configurations,			6.6
10	Integrated Adaptive control module	As opposed to simple Traffic Responsive, CIC, TOD, Local actuated control, etc.			7.2
11	Standards Supported	TMDD	NTCIP	ETMC2	6.8
		ATC/2070	NEMA	C2C/CORBA	
12	Maintenance support	E.g. In-state maintenance depot? Consistent with existing agency shop support.			6.1
13	Cabinet Type	ATC, FDOT, 170, TS2/1, TS2/2, other			3.0
14	Operational Features	Capability for TOD, TRSP, Manual, Special Events			4.3
15	Signal Preemption	Emergency/ Transit			3.0
16	Multiple, Concurrent Users				3.9
17	On-Line Timing Plans	Dynamic plan generation (Transyt/Passer); Modify plan while on-line with central; Temporary timing plan change			5.3
18	Upload/Download Timing Plans				3.9
19	Compatibility with Legacy System				2.9
20	Other				.3

Based on the average of the scores (sample size of 8) provided by members of the TS&MCC March 2000.

EXECUTIVE SUMMARY

Purpose

The purpose of the *Assessment of Technology* document is to provide an objective summary of commercial-off-the-shelf (COTS) systems. The assessment will serve to assist the stakeholders in the decision-making process to update the countywide signal system. The *Assessment of Technology*, along with the *Evaluation Methodology* (provided separately) will give the Traffic Signal & Median Control Committee (TS&MCC) a framework for selecting an ITS compatible signal system which meets the needs of the community.

Objective

First, the identified stakeholders must individually assess needs and compile evaluation criteria. Next, the evaluation criteria shall be collectively analyzed and weighted to achieve a final output or decision. Note, however, the final system selection rests with the members of the TS&MCC which includes the City of Pinellas Park, the City of Dunedin, the City of Largo, the Florida Department of Transportation, Pinellas County, the City of Clearwater, the City of St. Petersburg, a representative of the Technical Coordinating Committee of the Pinellas County Metropolitan Planning Organization (TCC) and MPO staff.

The global factors to consider during this process are as follows:

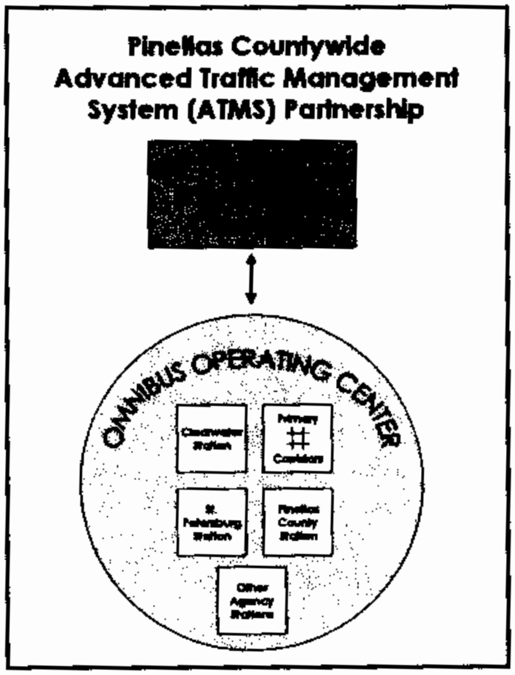
- ITS Compatibility
- Technological Refreshment
- Funding Sources
  - Federal
  - State
  - Local
- Costs
- Control Center Strategies
- Adaptive Control Strategies
- Procurement Methods
- Implementation Schedule
- Feasibility Study Requirements

While this and other supplied documents associated with this task are intended for creating an evaluation framework, there are other pertinent documents which shall be considered as supplemental information and are as follows:

- The National ITS Architecture
- Florida's ITS Strategic Plan
- The Regional ITS Master Plan
- Related Communications Issues Documents
  - NTCIP
  - Draft Technical Memorandum: Protocol-90 Communications Issues
- District Seven ATMS Feasibility Study for US-19/SR 55 in Pasco County
- Recommended Evaluation Methodology
- System Assessment for Clearwater, Pinellas County and St. Petersburg
- Vendor Supplied Information

<u>Summary</u>

The members of the committee should not view the selection as a replacement of three separate signal systems, but rather as an opportunity to create a single system with multiple components. Each agency should be capable of maintaining existing levels of control, at the same time providing a cost-effective approach to regional management of the system. **The *Omnibus Operating Center Concept* is offered as a potential organizational structure which would facilitate the regional management of the countywide ITS system,** specifically as it relates to the maintenance and operation of an Advanced Traffic Management System (ATMS).



The *Omnibus Operating Center Concept* is technically feasible based on the assessment of existing traffic management systems provided herein. An analysis of the various alternatives is provided in this document. Although the inter-jurisdictional issues associated with implementing such an organizational structure are not addressed, they should be considered before making a final selection.

An innovative hybrid approach is recommended to achieve ITS compatibility with an appropriate organization to support an ATMS while accomplishing technological refreshment of the existing legacy systems. The hybrid approach will include maintaining the capabilities of the existing three traffic management centers. With the addition of center-to-center communications and a universal interface, an integrated ATMS is possible which allows each operating agency to maintain any desired level of jurisdictional autonomy. The technically feasible concept is presented as an *Omnibus* / Virtual Control Center. Each agency can have segmented or global control dependent upon mutually agreed security tiering.

Alternatively, minimal technological refreshment of the existing central system can be achieved by updating the central system hardware and software without changing the field devices. This technological refreshment could be an interim step. The new central system hardware and some of the software might be re-used by a future system that would be consistent with the overall objectives of the committee and the requirements of the funding application(s).

Ultimately, the identification and implementation of a countywide ATMS is a complex policy and procurement matter rather than a simple identification of the "best available technology." **A feasibility study should be authorized as the next step.** This study would provide valid comparative costs and address the other relevant technical issues to allow the advancement of this important project. Following the completion of the feasibility study, the committee may either recommend a general approach for creating a countywide ATMS or direct the preparations of specifications for the procurement of preferred components.

PROGRAM STATEMENT ON THE
COUNTYWIDE SIGNAL SYSTEM
(July 3, 2001)
modified April 9, 2003 (p.m.)

The Metropolitan Planning Organization (MPO) Intelligent Transportation Systems (ITS) Advisory Committee reviewed the ATMS Requirements Document for the Countywide Signal System. It was concluded there were six subject areas that are in need of clarification to minimize misunderstanding and to better define the program for all participants.

With that intent in mind, the following six areas are listed and a statement is provided.

A. <u>THE MANAGEMENT TEAM POLICY DIRECTION</u>

The Requirements Document defines that a Management Team consisting of the Director of Public Works for Pinellas County, the City of Clearwater, and the City of St. Petersburg would be providing technical advice to the County government Primary Control Center. While this would provide good technical input and representation, an agency authorized and accountable for the ITS corridors must be clear. This is agreed upon to be the Board of County Commissioners.

B. <u>PROGRAM STAFFING</u>

The Requirements Document calls for a staffing of the Primary Control Center, which is at the heart of the Countywide Signal System. It is assumed there are two scenarios to implement this and the balance of the full system. The first scenario is that each of the three participating agencies would provide staff to the program, with the assignment that they would perform the necessary tasks to operate the countywide system. The expense of this effort would then be incurred by the respective jurisdictions with the understanding that all participants will benefit from this united effort. The staffing would thereby be accomplished through an appointment procedure, with a full or part-time appointment to countywide functions. The second scenario would be that those selected to be associated with the countywide ITS system would then be separately funded for this purpose by a revenue source set up for this function. The agreed upon staff approach is as follows:

a. An integrated staffing program where the primary jurisdictions provide all of the staff necessary to support systems not otherwise on the ITS system but coordinated with the countywide system. Each jurisdiction would be responsible for funding their staff.

b. A countywide ITS staffing program where all of the staff who are performing the countywide ITS functions would be working under the County government which would have sole funding responsibility.

C. <u>SYSTEM EQUIPMENT RESPONSIBILITIES</u>

The Requirements Document defines the equipment and resources that will be needed for the system. The two scenarios as noted in Paragraph B on staffing would apply to this aspect of the program as well. The first scenario would be for each of the participating jurisdictions to be responsible for operating and maintaining a portion of the equipment utilizing federal, state, and local funding. The second scenario would be that all of the equipment associated with the Countywide ITS Signal system would be acquired, operated, and maintained by one jurisdiction utilizing federal, state, and local funding. It is understood that all of the

equipment would operate as one system and be fully coordinated. The system equipment responsibilities are:

a. An integrated program as used in Paragraph B for staffing where the participating jurisdiction provides the equipment operation and maintenance in direct association with the staffing effort that jurisdiction is assigned responsibility for.

b. The ITS where the system equipment, operation, and maintenance would be the responsibility of one jurisdiction, the Board of County Commissioners.

D. TIED-IN (NON SIGNAL) FUNCTIONS

The Countywide Signal System is concerned with a fully-coordinated signal system that is responsive as an integral part of the Intelligent Transportation Systems (ITS). Those ITS functions that are relevant and identified to be part of the system will be coordinated through the ITS framework. These functions are identified to be: a) fire response services, b) law enforcement, c) emergency medical services (EMS), d) emergency communications, e) transit services, and f) traveler information services. These will be considered the core non-signal functions with additional ancillary services that would be involved on an as-needed basis.

E. PROTOCOL FOR FUNCTIONS (CORRIDORS EVENTS)

The traffic signals within the County must respond to different functional responsibilities that range from traffic control on a local street that has very little surrounding impact to traffic signals on major arterials where their function could dramatically effect the flow of countywide traffic. There is, therefore, the need to establish protocols for the functioning of these signals and their different levels of influence. As a minimum, there is the need to establish a protocol to ensure that the arterials function at their most optimum level at all times of the day irrespective of events or incidents. This would be of primary concern to the countywide system. At the other end of the spectrum is the need to establish a protocol for special local events that are of interest to a community. The protocols are important because they define which signals are involved on which roadways and then how that system functioning is to be carried out through both normal operations and in response to incidents that may occur. The protocols presumed to be included within the system would be: a) primary countywide corridors protocol, b) secondary countywide corridors protocol, c) special event protocol, d) local street protocol, e) controlled access ramp system protocol, and f) a regional protocol that would be concerned with disaster responses and other such across-the-board situations.

F. DOCUMENTATION – TIME TABLE PLANS

Concerning the Advanced Traffic Management System (ATMS) for the signal system, the Requirements Document defined the ATMS functions to be:

a) traffic adaptive signal control;
b) video monitoring;
c) dynamic message signs;
d) vehicle detection; and
e) archive database management.

The key function is that of adaptive control where the system can register the traffic on a corridor and then adjust the signals to make that traffic flow more efficiently. This is a change from the current use of predetermined timing plans for each signal along a corridor. Concerning the adaptive control program, consideration may need to be given to a counter

adaptive program for the ancillary or crossing roads in that corridor to ensure that the efficiency of those roads is somewhat preserved. Such a counter program will not be needed once the full road system is on adaptive control.

The Requirements Document calls for the need for agreements among participants as to how the system would function. It will be important that these agreements be defined as early as possible so that there will be a clear understanding of relationships and responsibilities. As part of this additional business, there is also the need to identify what activities in the program development would occur over the next several years to ensure not only the correct sequencing of events based upon a rational approach but also based upon the priorities that have been approved. This exercise would permit the MPO and participating policy groups to confirm the specific system functions they agree to along with the phasing of those functions in terms of staffing, equipment, tied-in functions, protocols, and corridor applications. In addition, the cooperative decision making by the various participating agencies as this system is developed is critical.

Concerning the above functions, the following approaches are recommended:

a) Traffic adaptive signal control should be implemented on a selected corridor basis beginning with U.S. 19 and Gulf-to-Bay Boulevard, followed by Ulmerton Road, McMullen-Booth/East Lake Road, and the Interstate system. However, it would be important to have other corridors (such as S.R. 580, Bay Drive, and C.R. 296) in this system as soon as possible to derive the full benefit of adaptive control, diversion procedures, and other ITS functions. It is the MPO intent to establish a full corridor network to be part of the MPO ITS Plan.
b) Video monitoring should be explored for as much area of the County as possible and in a joint venture with the private sector.
c) Dynamic message signs could either be applied within the original ATMS corridors or could be approached on a countywide basis.
d) A vehicle detection system should be initiated in conjunction with the adaptive signal control within those same corridors.
e) The archiving of the database should be as comprehensive as possible, including not just the initial corridors but the full system.

Pinellas Countywide ATMS Requirements Document

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COMMONLY USED TERMS

Advanced Traffic Management System (ATMS) – ATMS is the application of technology to manage traffic more efficiently and safely. ATMS provides services that improve traffic flow through signal coordination, improved maintenance of the traffic signals, and improved incident management. ATMS is a subset of ITS.

Centralized Communications Center (CCC) **–** The new communication facility to be constructed on Seminole & Ulmerton Roads. It is planned to house: Emergency Management, Emergency Communications, Communication Center (911), radio systems division, countywide radio, communication support division, Pinellas County Sheriff's Office Dispatch, and Ambulance Control Center.

Intelligent Transportation System (ITS) – ITS is the application of technology to manage transportation facilities across all modes of travel.

Omnibus Operating Center – An approved concept for unified traffic management.

Primary Control Center (PCC) – Traffic control center that will be responsible for traffic management along the major corridors in Pinellas County.

Secondary Control Center (SCC) – Existing City of Clearwater, Pinellas County, and City of St. Petersburg traffic control centers.

1. INTRODUCTION

1.1. Background

In December 1998, Pinellas County Public Works submitted a Congestion Mitigation and Air Quality grant application for a $7.5 million signal system project that included Advanced Traffic Management System (ATMS) technologies. Overall, approximately $11.3 million has been allocated from USDOT, CMAQ, FDOT, and local funding for a countywide signal system. The scope of the project is to implement ATMS along major corridors and upgrade the signal system centers at Pinellas County, City of Clearwater, and City of St. Petersburg. Since the project is intended to provide countywide benefits, the Pinellas County Metropolitan Planning Organization (MPO) has determined that these efforts be conducted through the Traffic Signal & Median Control Committee (TS&MCC) to provide diverse municipal representation in the development of a countywide ATMS project. The TS&MCC is made up of traffic engineering representatives from the County, Cities, and Florida Department of Transportation (FDOT); and representatives from the MPO staff and Technical Coordination Committee.

In 1999, the Pinellas County Metropolitan Organization (MPO), with the assistance of TransCore, Inc., an MPO General Planning Consultant, initiated a Signal System Evaluation Project. This effort resulted in a series of conclusions that were approved by the MPO at the October 11, 2000 meeting. The conclusions are provided in their entirety below[1]:

A. One System Recommendations (See Figure 1)

1. It is recommended that the Countywide Signal System operate as one system with primary and secondary control centers. This could be organized in various configurations, but the system would operate with no disruptions at the municipal boundaries and the major arterials would be coordinated. The system will be structured as a team approach through a Primary Control Center. The **Primary Control Center** *will consist of multiple agency representation and will provide both countywide and local direction in signal operation, as well as include full coordination for the signal system as a whole. All primary corridors will operate on Multi-jurisdictional Timing Plans controlled by the Primary Control Center, which will provide set criteria for the traffic signal operations. The Multi-jurisdictional Timing Plans will provide better corridor signal coordination. Other traffic signals, not on the primary corridors, will operate on coordinated timing plans controlled by the Secondary Control Centers; however, they could be controlled by the Primary Control Center if desired by the responsible agency. The* **Secondary Control Centers** *will be located at the local level and provide the local perspective of signal control to the Primary Control Center and manage maintenance of the signal system. This will provide for enhanced signal operation by the responsible jurisdiction and allow for countywide signal timing changes due to traffic incidents or special events. By operating the countywide system as one system, countywide coordination will be greatly enhanced. This will allow the local agency's experts to control the local system while providing full coordination with the surrounding road system. This will also provide the network to implement countywide Intelligent Transportation Systems.*

2. It is also recommended that the best alternative for the organizational structure is the "Countywide Multipurpose Signal Center" or the **Omnibus Center**. *The Pinellas County Emergency Communications Department is in the process of developing a communications building on Ulmerton Road and in establishing a fiber optic loop to serve the area. This building will house several agencies involved in emergency operations including the Sheriff's Office dispatch, the EMS Ambulance dispatch, 911 dispatch, Emergency Management, fire services, the Emergency Operations Center, and others. The construction of the facility is expected to begin in 2002, with the facility to be complete by 2004. The recommendation includes housing the Primary Control Center at this location. The concept of co-locating this function with the other functions at this facility has a number of benefits including communication, coordination, and efficiency.*

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[1] Pinellas County Metropolitan Planning Organization, "Signal System Evaluation Project -Strategy Report", October 11, 2000.

Figure 1: Omnibus Concept

Currently, none of the existing three signal control centers are staffed 24 hours a day, 7 days a week. Providing the video and traffic monitoring capabilities to the other communication building agencies, which are staffed 24 hours a day, 7 days a week, will be beneficial to all users of the system. Staff located at the communications building will be from several agencies and will work closely together to provide countywide service. This has been characterized as a "technology hotel" since the information created and gathered by the different agencies will be staffed at the one location. By locating the Primary Control Center at this site, the signal operation will be closely coordinated and the monitoring capabilities will greatly benefit the other agency tenants by providing the collected operational data to the users. Each of the three agencies, which have existing signal control centers, the Cities of Clearwater and St. Petersburg as well as Pinellas County, will provide a staff member as a representative in the Primary Control Center. This may require additional staffing by the local agency. The participation by the local agencies will provide the desired attention to the local facilities and special events, as well as provide countywide signal coordination and data sharing to the other participating agencies. Additional state, municipal, or other governmental agencies may also house a staff member in the Primary Control Center. It was noted that additional participation requests should be made as quickly as possible in order for the space requirements to be incorporated into the design of the building facility. Access to the Primary Control Center will be available at the three Secondary Control Centers via a remote computer, since this connection is needed, in some form, due to the configuration of the existing "intersection to control center" communication lines. While the Primary Control Center will house the countywide database, each of the Secondary Control Centers will also have a database in order to provide redundancy.

B. Initial Corridors for the ITS System

The corridors identified for initial implementation of the ITS program in Pinellas County are: Gulf-to-Bay Boulevard and Ulmerton Road; McMullen-Booth Road/East Lake Road; U.S. 19; and I-275. These corridors would be included for their entire length along with provisions of connectivity to facilitate the ITS purpose. This is with the further understanding that the balance of the appropriate ITS corridors will be implemented as soon as possible.

C. Computer Head Upgrade

The three existing signal centers utilize outdated computer hardware that is in serious need of upgrading. It is concluded that these centers should be upgraded with the appropriate PC systems, with the assumption that a like improvement would be made in the communications system linking these three centers so that some ITS data can be exchanged.

D. Requirements Document/Management Study

To further the ITS/signal system improvements that have been identified, a more detailed effort is needed to define the structure of the system. It is, therefore, concluded that a Requirements Document/Management Study should be authorized to accomplish that work.

E. ITS Committee

In addition to the Committee membership for the ITS function that was earlier acted upon by the MPO, three MPO members are also identified for participation on that Committee. The four three members identified at the workshop are Dunedin City Commissioner John Doglione, Largo City Commissioner Martin Shelby, County Commissioner Karen Seel, and St. Petersburg City Council member Kathleen Ford.

1.2. Purpose of This Report

The overall objective of this report is to determine the requirements for a Pinellas Countywide ATMS on three levels: operational (Section 2: Concept of Operations), technical (Section 3: Functional Requirements), and institutional (Section 4: Institutional Relationships). The Pinellas Countywide Requirements Document serves as a mechanism for the Traffic Signal and Median Closure Committee to communicate to FDOT their vision for the Pinellas Countywide ATMS. This report provides the basis for the conceptual design that will be prepared as part of FDOT's Pinellas Countywide Feasibility Study by the System Manager selected by FDOT.

2. Concept of Operations

This Concept of Operations serves as the starting point of the systems engineering process that will guide the MPO to realize the "***Omnibus Center***" concept. The "***Omnibus Center***" concept unifies the existing traffic control centers (City of Clearwater, City of St. Petersburg, and Pinellas County) through a common center referred to as the Primary Control Center. The Concept of Operations provides a "long-term vision" for the relationships between the Primary Control Center (PCC) partners regarding monitoring and control functions as well as exchange of real-time travel information through a ***System Architecture***. Based on the system architecture, a proposed ***Organizational Concept*** was developed for the PCC ATMS. This section provides the required input in preparing the institutional relationships and functional requirements for the physical design of the ATMS system components.

The FDOT developed a high level Concept of Operations to provide guidance to local agencies and future deployment of ITS. The "Omnibus Center" concept parallels FDOT's guidance, which highlights three main areas: Coordinated Operations, Active Travel Management, and Central Data Warehousing. The ITS Architecture for FDOT District 7, Guidelines for ITS Planning and Project Development in Florida DOT District 7 states "Although each jurisdiction and MPO have unique requirements and criteria with respect to project planning and/or project development activities, the integration process must be flexible enough to accommodate both local and regional needs."

The Concept of Operations was prepared in the spirit of providing integrated operations that would optimize synergies between the ATMS partners. The goal is to establish a unified ATMS operation across jurisdictional boundaries while maintaining the ability to address local traffic operations needs through the existing infrastructure and staff. The Concept of Operations guides the development of functional requirements and serves as a basis for developing institutional arrangements.

2.1. Pinellas Countywide ATMS System Architecture

The system architecture is presented in **Figure 2**. It establishes a high level view of the connectivity between the agencies that stand to benefit from the Pinellas Countywide ATMS. The proposed system architecture represents information sharing and dissemination via center-to-center communication linkages forming a coordinated central system (at the PCC) supported, to the extent that is cost-effective, by existing infrastructure. It maximizes the use of the existing communications infrastructure that exists between the Pinellas County, City of Clearwater and City of St. Petersburg Traffic Operations Centers and their respective field equipment, resulting in the most economical way to achieve coordinated traffic management throughout Pinellas County.

As shown in **Figure 2**, the Pinellas County, City of Clearwater, and City of St. Petersburg Traffic Operations Centers are referred to as Secondary Control Centers (SCC). Each SCC will be responsible for local ATMS activities, while the PCC will focus on countywide activities. The PCC's operation of the regional roadway network will allow the local SCC to focus on their respective local transportation needs and contribute to the overall goal of countywide coordination through the PCC. The local SCCs will be responsible for maintenance of the ATMS field components within their respective jurisdictions, coordination with local fire / rescue agencies, and coordination with other local agencies for which they provide transportation related support. The PCC will coordinate with agencies that have countywide interests, such as Emergency Management, 911 Dispatch, Pinellas Suncoast Transit Authority (PSTA), etc.

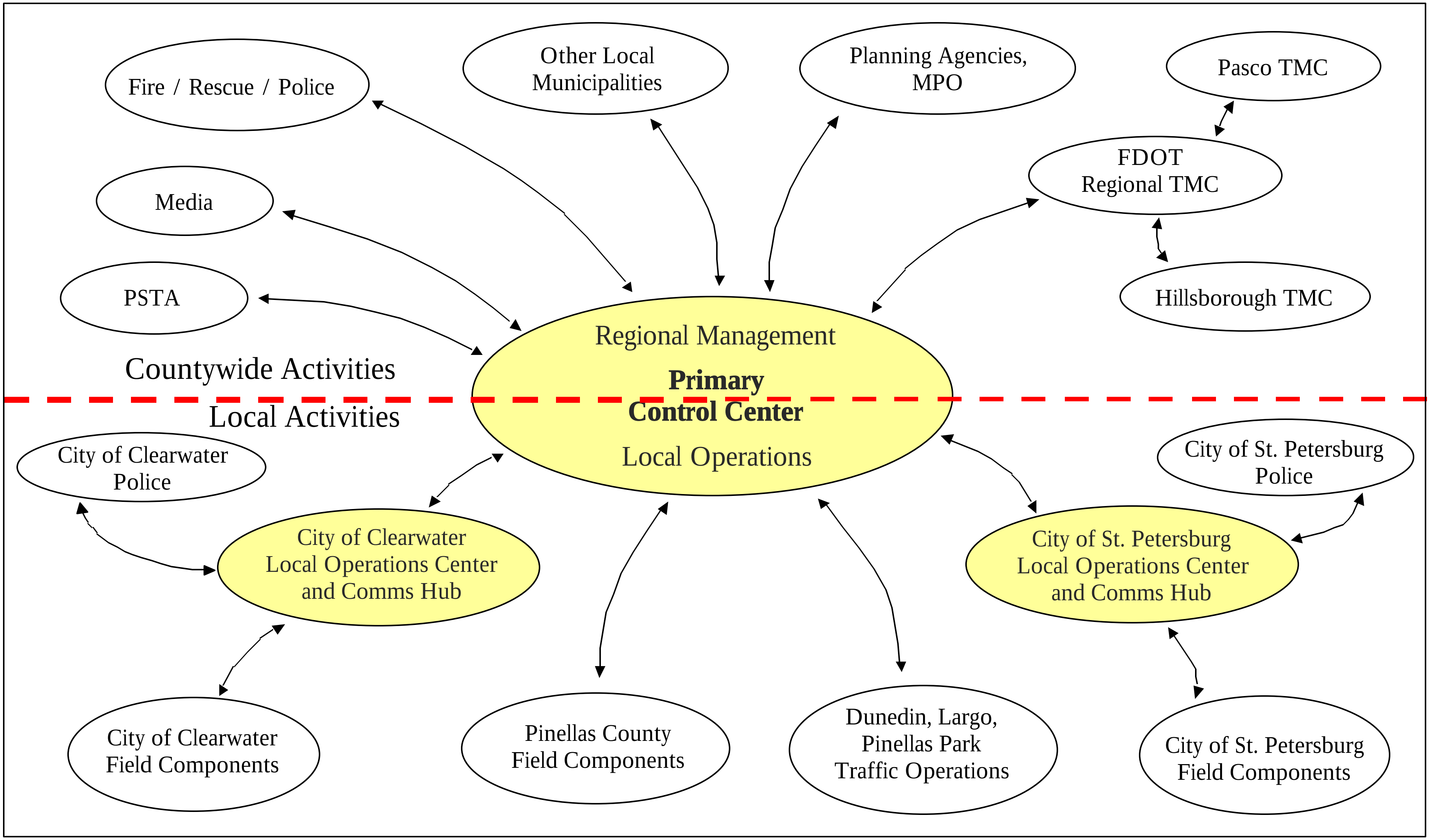


Figure 2: Pinellas County ATMS System Architecture

The Pinellas Countywide ATMS was developed based on the proposed ATMS services:

- **Network Monitoring**: The PCC will be responsible for processing real-time traffic data, such as traffic volumes, speeds, and video images. Information will be collected by the local SCCs and sent to the PCC to create real-time countywide traffic information display maps. This routing utilizes existing communications networks from the traffic signals to the SCCs. The PCC will make these maps available to both local and regional agencies, and will be viewable on a variety of display devices (PC monitor, video monitor, video wall).
- **Countywide Traffic Management Coordination**: The PCC will be responsible for implementing traffic control strategies along major corridors, such that the Pinellas Countywide ATMS operates seamlessly across jurisdictional boundaries.
- **Countywide Incident Coordination** (for both incidents and planned events): The PCC will be responsible for coordination with transit and emergency dispatch to ensure they have information to facilitate incident responses. The PCC will monitor incident response activities and provide coordination for planned events that impact regional travel.
- **Traveler Information Dissemination**: The PCC will be responsible for collecting and disseminating traveler information to the public through Dynamic Message Signs, web sites, etc. In addition, the PCC will serve as a central point of contact for the media, information service providers, and other regional traffic management centers.
- **Archived Data Management**: The PCC will be responsible for storing and providing information that is needed for transportation planning and other related activities.

Figures 3 through 7 depict a high-level view of the functions that will be required to achieve these services. They show what functions are to be carried out in each of the major subsystems: Primary Control Center, the Secondary Control Centers, and the Field Components. It is important to note that the data flows from the field components through the secondary control centers to the PCC to maximize the use of the existing communications infrastructure and build in redundancy in the operations of the ATMS.

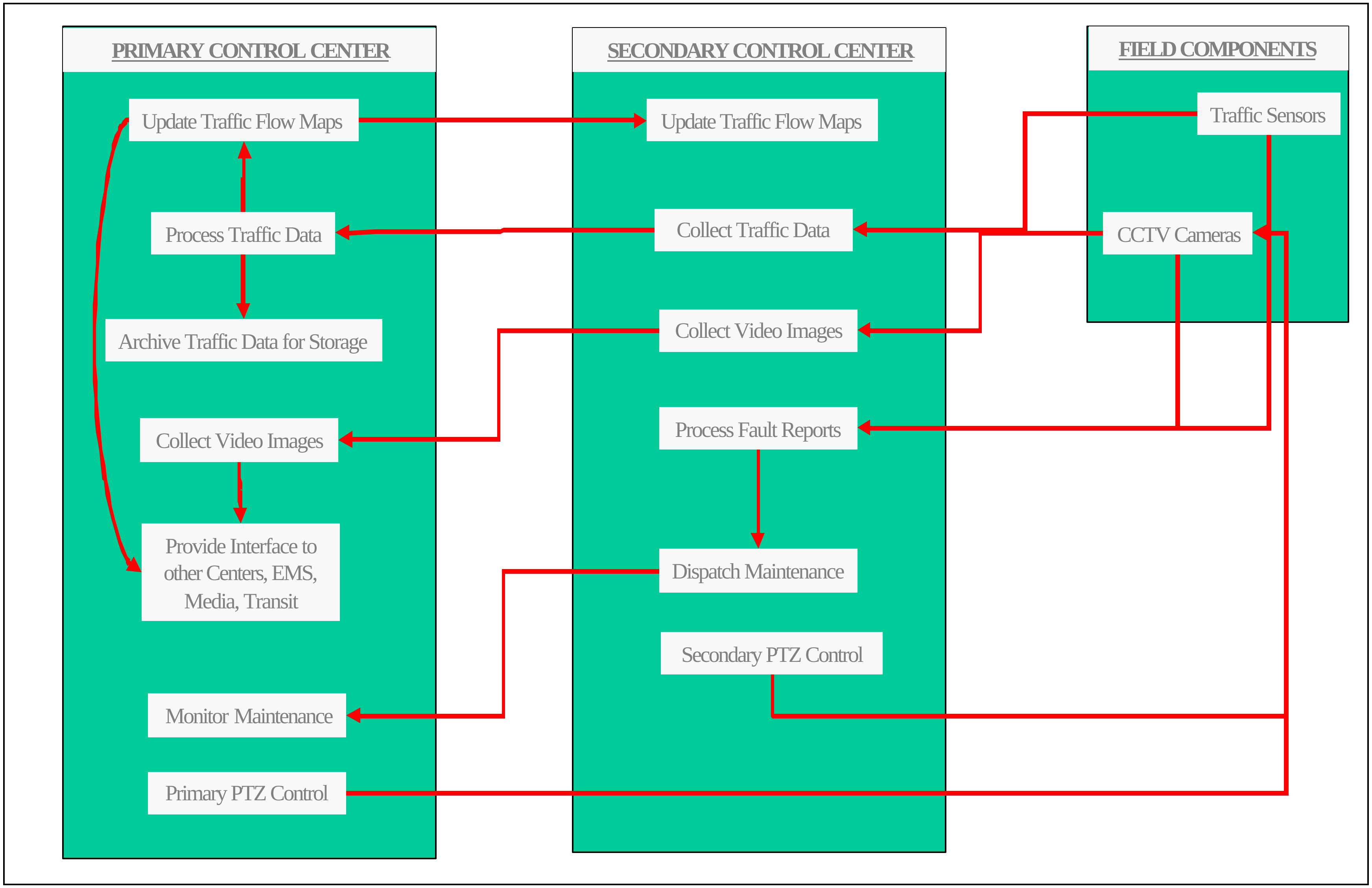


Figure 3: Network Monitoring

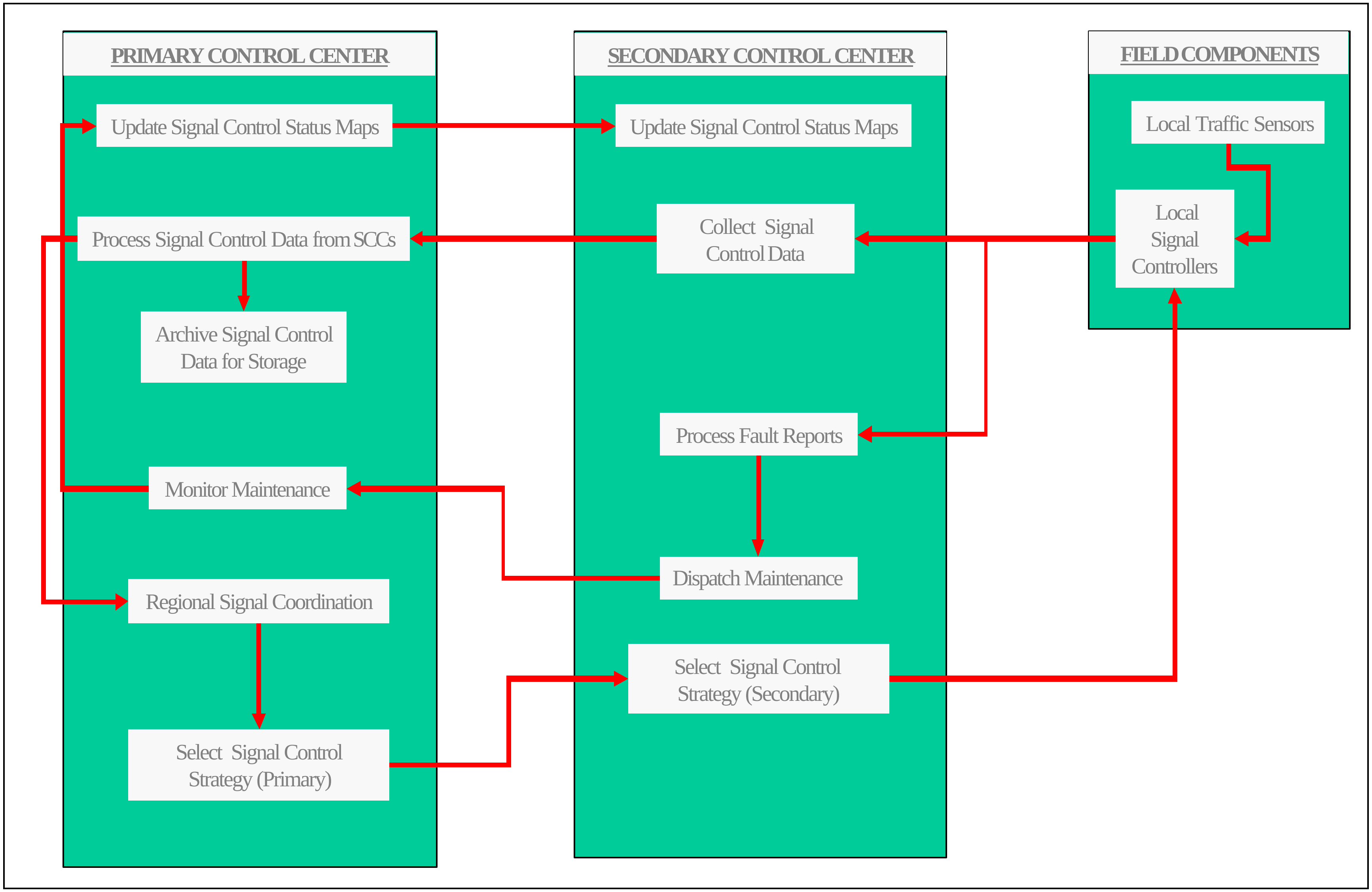


Figure 4: Countywide Traffic Management Coordination

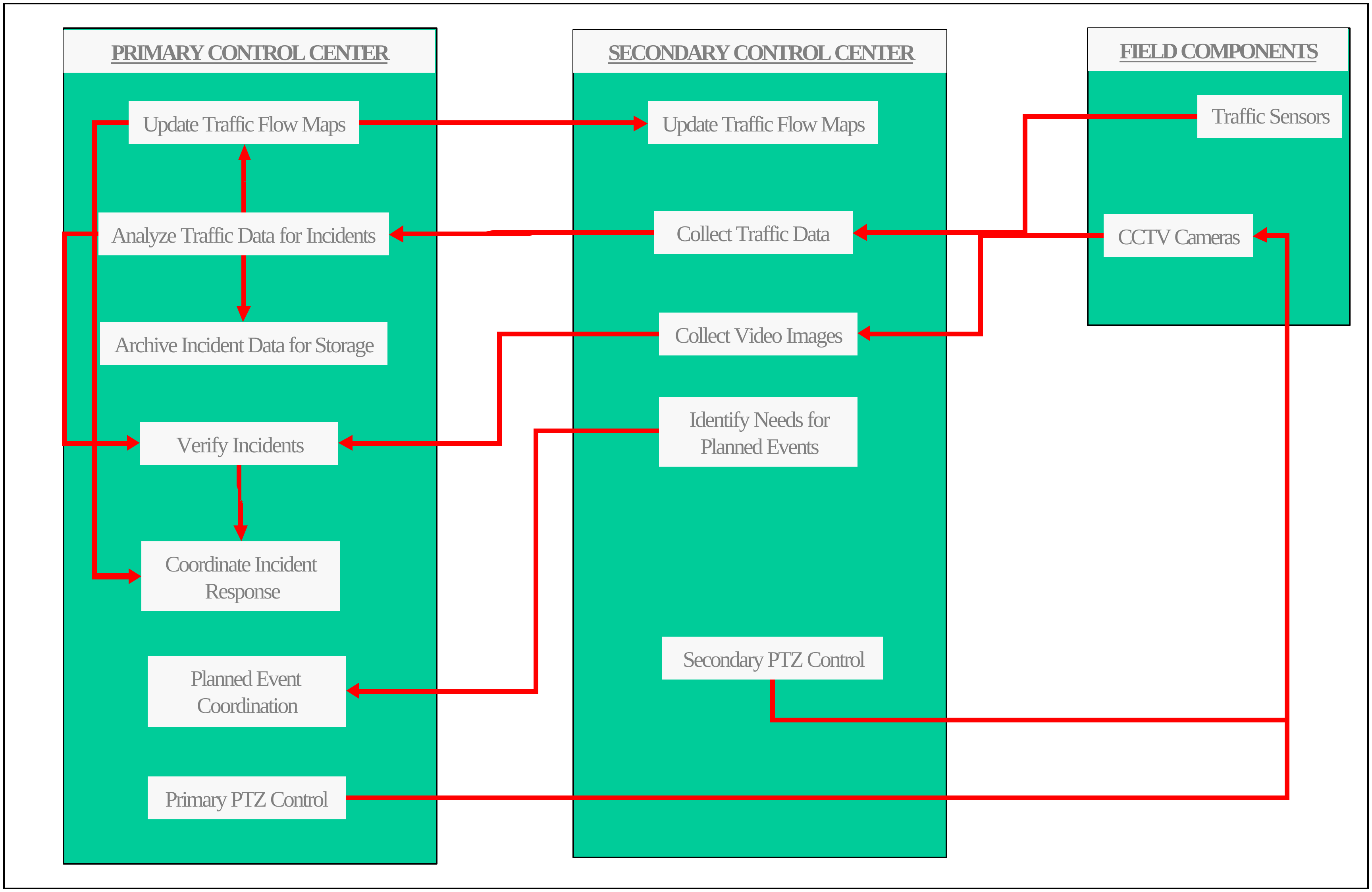


Figure 5: Countywide Incident Coordination

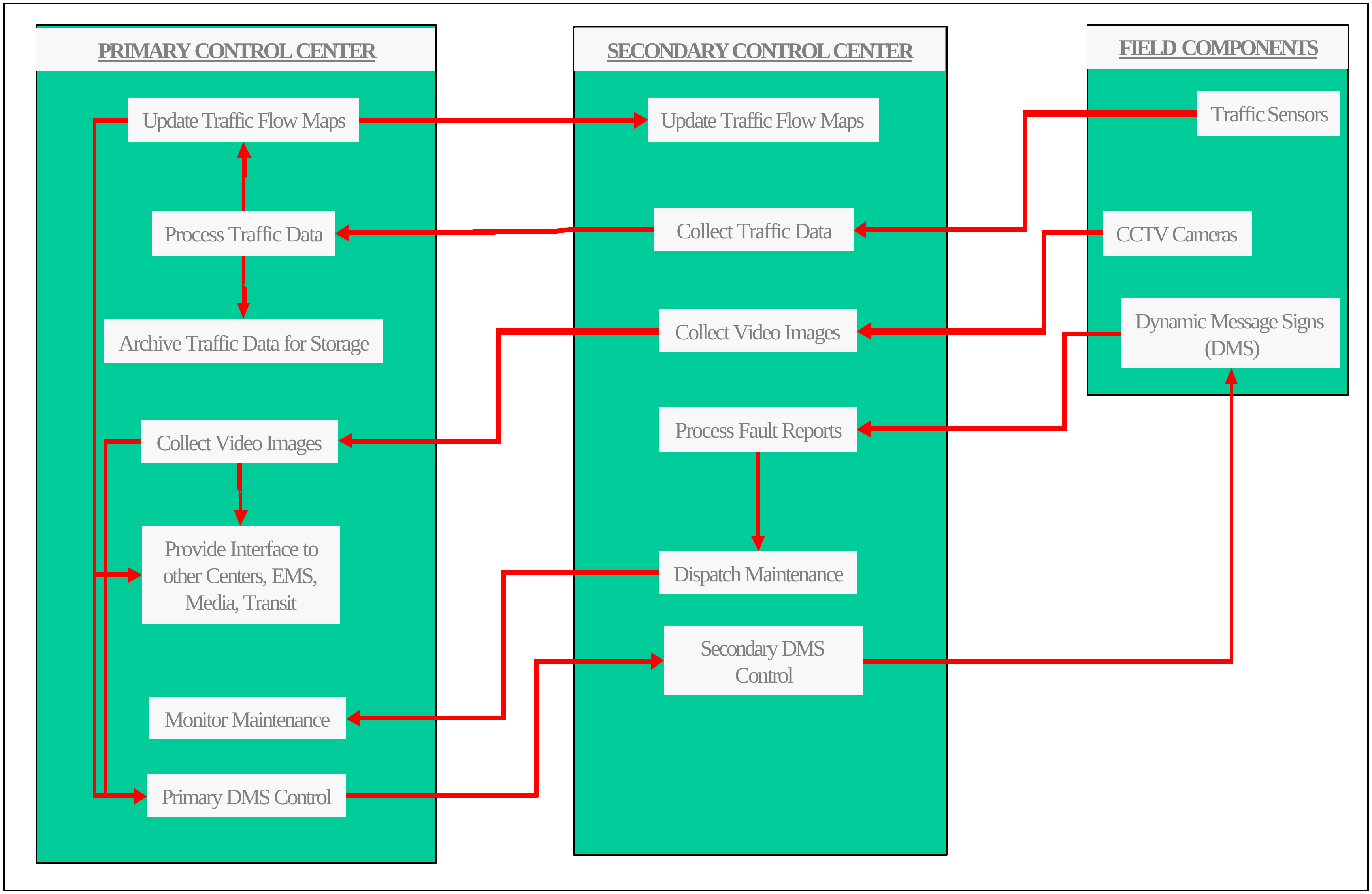


Figure 6: Traveler Information Dissemination

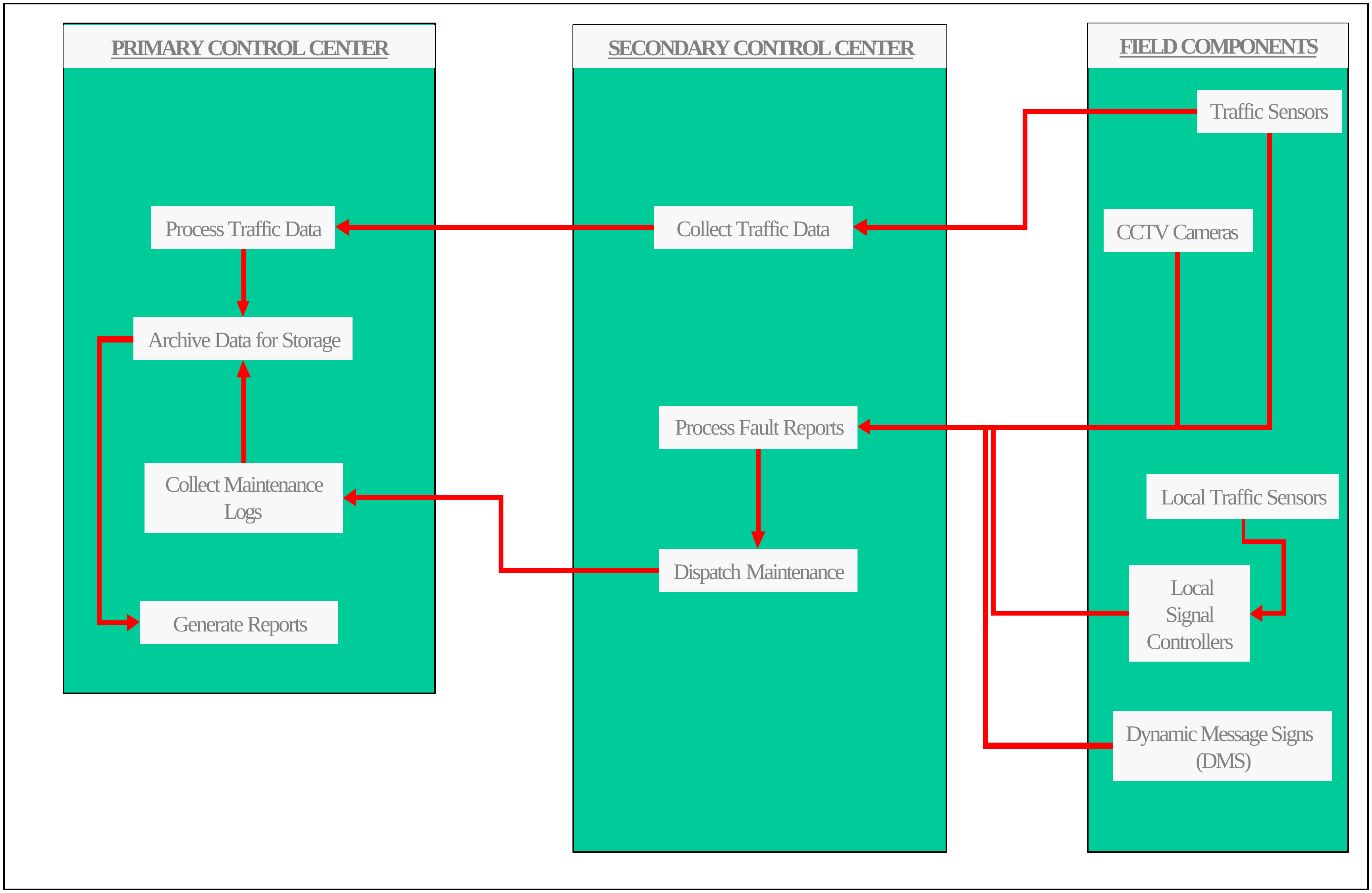


Figure 7: Archived Data Management

2.2. Organizational Concept

The organizational concept provides a framework illustrating how the PCC will manage and operate on a day-to-day basis to provide the services identified in the previous section. The PCC ATMS organizational structure is based on a "joint" jurisdiction team concept. It would be an administrative entity created by an interlocal agreement / joint participation agreement (JPA), where each member remains an employee of his or her respective agency.

The method or formula for equitably providing for financing the capital and operating costs would be determined by the parties and be incorporated into the JPAs. Typical methods include population, land area, and number of traffic signals on a weighted-average basis to determine equitable financial support from the members. One example would utilize percent of population relative to the total. For instance, total county population is approximately 879,000. If Clearwater City has 100,000 people, St. Petersburg has 235,000 people, and the remaining population in the County is 544,000, each would contribute their percentage of the total or 11%, 26% and 62% respectively.

An organizational chart was developed for the ATMS staff at the proposed PCC and is provided in **Figure 8**. The positions identified in the organizational chart were developed based on the roles and responsibilities required to carryout the functions identified in the PCC (see **Figures 3 through 7**). Initially, these positions may be made up of existing secondary control center staff. General job descriptions are provided for each area of the PCC organizational chart.

2.2.1. PCC Management Team

The JPA would establish a PCC Management Team made up of Public Works Directors (or designees) from Pinellas County, City of Clearwater, City of St. Petersburg, and a FDOT representative. Other agencies may be added to the PCC Management Team through agreements. These agencies will be required to participate in the funding and staffing of the operations and maintenance of the Pinellas Countywide ATMS. The PCC Management Team will be a review / policy team with members that represent the agencies who are funding the operation of the PCC, to make sure the operation adheres to the policies of the member agency. The PCC Management Team responsibilities may include, but are not limited to:

- Defining the responsibilities and objectives of the PCC Manager position.
- Appointing the PCC Manager.
- Reviewing and approving standard operating guidelines (SOGs) for the PCC staff responsible for the Pinellas Countywide ATMS.
- Liaisons for their respective agencies.
- Securing funding from their respective agencies.
- Coordination with the ITS Committee to ensure integration of the ATMS with other ITS initiatives.
- Approve changes to the SOGs, define policies and other administrative issues.

It is envisioned that the PCC Management Team would meet on a monthly basis to monitor the progress of the PCC ATMS to ensure the fulfillment of the PCC ATMS goals and objectives.

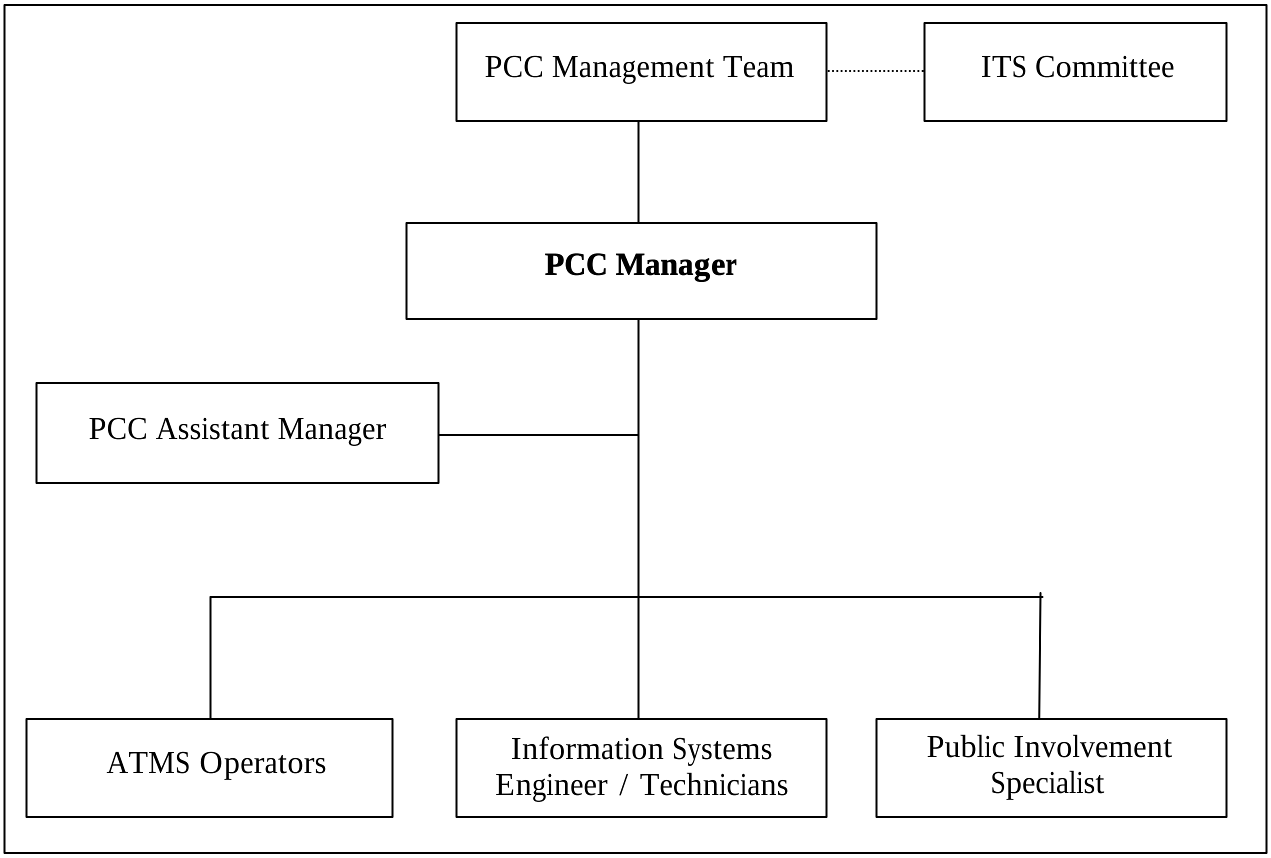


Figure 8: PCC Organizational Structure

2.2.2. PCC Manager

The PCC Manager would report directly to and implement policies established by the PCC Management Team. The PCC Manager will be accountable for all PCC ATMS functions and ensuring the SOGs are followed by all PCC ATMS staff. The PCC Manager should not directly report to an agency, although he or she will be on one agency's payroll to be eligible for an official employee benefits package. The PCC Manager's responsibilities may include, but are not limited to:

- Appointing PCC ATMS staff.
- Developing standard operating guidelines (SOGs) for the PCC staff responsible for the Pinellas Countywide ATMS, including, but not limited to:
    - Hours of operation,
    - Countywide coordination protocols for traffic management and incident management,
    - Protocols for changing control strategies, and
    - Regular maintenance activities for the ATMS.
- Managing daily operations and maintenance of PCC ATMS functions.
- Developing budgets for the PCC ATMS Operations and Maintenance and future ATMS capital improvements.
- Coordinating with representatives from County and local fire/rescue agencies, Pinellas Suncoast Transit Authority (PSTA), Florida Department of Transportation (FDOT), Pinellas County MPO, media, and other local agencies.
- Assigning tasks to PCC ATMS staff.
- Developing monthly status reports of PCC ATMS activities.

2.2.3. PCC Assistant Manager

The PCC Assistant Manager would provide administrative support to the PCC Manager.

2.2.4. ATMS Operators

The ATMS Operators complete daily activities such as monitoring and implementing control strategies. It is envisioned that this group will be made up of existing staff from the agencies and will remain on their respective agency's payroll to remain eligible for official employee benefits packages. The ATMS Operator will report directly to the PCC Manager for countywide coordination issues. It is envisioned that three operators will be necessary at full system build-out. Typical functions would include monitoring congestion alarms, incident detection, verification and response via notifying emergency responders, activating appropriate dynamic message signs and notifying media of incidents providing the public opportunity to avoid the area and/or advance knowledge of the traffic delays.

2.2.5. Information Systems Engineer and Technicians

The Information Systems Engineers and Technicians will be responsible for maintaining the ATMS computer network. They will manage the data archive functions, such as maintaining databases and produce reports upon requests. The Information Systems Engineer and Technicians will report

directly to the PCC Manager. Initially, the ATMS Operators may cover these responsibilities. However, as the ATMS expands, there will be a need for additional staff to ensure these functions are operated and maintained at levels to provide the perceived benefits. At full build-out of the system, one engineer and two technicians would be needed. These personnel would keep all computers, file servers, and communication devices operational. They would also assist trouble shooting of central-to-field device control failures.

2.2.6. Public Involvement Specialist

The Public Involvement Specialist will report directly to the PCC Manager. He or she will be responsible for developing public outreach programs and addressing the media as needed. Initially, the PCC Manager may perform these functions. In the future, the PCC Manager will need assistance in public outreach and coordination.

2.2.7. ITS Committee

The ITS Committee, which is currently being established, would coordinate with the PCC Management Team as it relates to other countywide ITS initiatives.

2.3. Primary Control Center Space Requirements

Space requirements for the Primary Control Center were estimated based on the organizational structure presented above. The requirements assume, based on the MPO recommendations, it will be housed in the proposed Centralized Communications Center (CCC). Therefore, the spacing requirements do not include common areas, such as restrooms and break rooms.

Table 1 contains the estimated square footage for the Primary Control Center. The space requirements are derived from typical control center and office requirements from similar types of facilities. They include:

- PCC Control Room – This room will contain the Operator Consoles, Video Wall and other computer peripherals, such as printers, fax machines, etc. Space requirements assume six consoles, one for each agency (i.e., City of Clearwater), plus expandability to accommodate future agencies (i.e., Pinellas Park, Largo, etc.).
- Offices – Each supervisory position will have a separate office and the supporting staff will have cubicles.
- Conference Room – The conference room will serve as the meeting room for the PCC Management Team, training room, and other Countywide Coordination meetings. It may be a common space shared with other tenants of the Central Communication Center.
- Computer Room – This room will house the computers and communications equipment.

The final selection of interior finishes will be determined during the design of the CCC. Typical flooring for an ATMS control center includes anti-static carpet tiles integrated with a raised flooring system, which is necessary for cable management. The height of facility will vary depending on the height of the video wall selected. To accommodate a 2x2 video cubed wall (each cube with 84" diagonal) would require a 15' ceiling height.

Table 1: Primary Control Center Facility Requirements

Facility	Number Required	Square Feet per Unit	Total Square Feet	Comments
PCC Control Room	1	1,225	1,225	This room is the focal point of activities and includes the six console workstations, peripherals, and a video display wall.
Computer and Communications Room	1	600	600	Contains the computers, file servers, communication servers, and interface equipment. IT also provides for ample growth
Conference Room	1	276	276	For staff meetings, situation assessments and staff training. May be shared with other users of Centralized Communications Center.
Manager's Office	1	244	244	
Assistant Manager's Office	1	162	162	
Information Systems Engineer's Office	1	162	162	
Public Information Specialist's Office	1	162	162	
Support Staff Cubicles	6	75	450	Includes cubicles for Information Systems Technicians and for Operators to perform off-line activities
Storage Room	1	64	64	Store records and office supplies for daily operations and functions.
Reception Area	1	96	96	

Total Required Floor Area:	**3,441 Sq. Ft.**

2.4. General Transition Schedule

The Concept of Operations paints a "future" picture for the proposed Pinellas Countywide ATMS. This section describes a general transition schedule that will take the existing systems from where they are today to realizing the concept of operations or a "full build" scenario.

The PCC organizational structure identifies a number of positions that were based on desired functionality at the PCC. It is recognized that the number of staff will vary as the Pinellas Countywide ATMS grows and the demands for these functions increase over time. The TS&MCC has approved the idea that the PCC Management Team will identify staffing needs as they arise during the implementation of the Pinellas Countywide ATMS.

Figure 9 illustrates a schedule of events that will occur over the next few years. The dates / duration depicted in **Figure 9** are estimates and do not reflect contractual obligations at this time. These events include:

- TS&MCC Signal System Selection
- Design / Construction of Central Communication Center
- PC Upgrade
- Milestones for Pinellas Countywide ATMS, including the Feasibility Study

This conceptual schedule was created to identify important decision points along the way to realizing the Concept of Operations. As shown in **Figure 9**, getting the approval for the Institutional Arrangements, establishing the PCC Management Team, and identifying Interim Staffing Needs occur prior to the 60% submittal for the ATMS Design. The 60% submittal for the ATMS Design is a critical date because any significant changes must be identified prior to the 60% submittal to maintain schedule for the project. Institutional arrangements must be in place to confirm communication needs for sharing information and to address any protocol issues for center-to-center communications. The PCC Management Team needs to be in place so they can provide input into the programming (establishing facility requirements) for the new Centralized Communications Center (CCC). The CCC programming is expected to begin in July 2001 and continue for nine months.

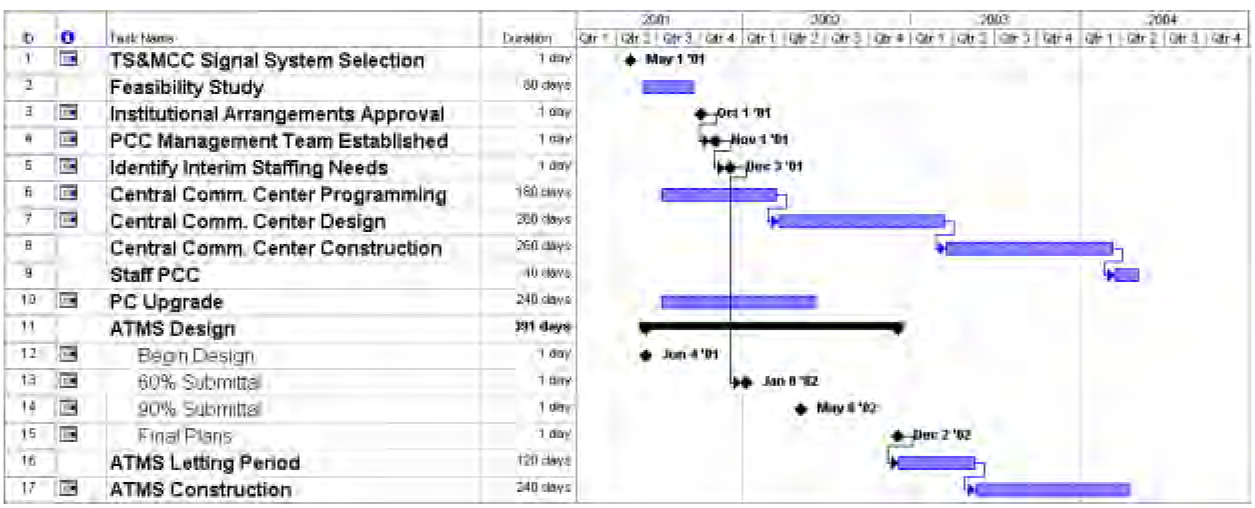


Figure 9: General Transition Schedule

3. ATMS Functional Requirements

This section describes the functions desired for the Pinellas Countywide Advanced Traffic Management System (ATMS) and is intended to provide a starting point for the selection of the detailed functions of the system. The System Manager will develop and provide a more detailed software description and specification to the Florida Department of Transportation for approval prior to the final development of software for the Countywide ATMS project.

The existing City of Clearwater, Pinellas County, and St. Petersburg Traffic Signal Systems were installed at the same time. The current systems are Modern Traffic Control System (MTCS) packages, which were installed and supplied by Computran Systems Inc., in 1989. The current system had a design life of ten years when it was installed. Some of the computing hardware has reached obsolescence. The MTCS software package was based on the Urban Traffic Control System (UTCS) Software that was developed by the FHWA in the 1970's. The existing system is also considered obsolete in regard to its ability to support Intelligent Transportation Systems (ITS) functions.

The existing Modern Traffic Control System (MTCS) central computers for each agency will be upgraded to a PC-based system. As part of the upgrade, the three centers will be linked together through Pinellas County's existing leased fiber optic backbone, providing a base communications infrastructure for the Pinellas Countywide ATMS.

The Concept of Operations in Section 2 laid the groundwork for developing the functional requirements for the Pinellas Countywide ATMS by identifying the services to be provided. The predominant functional requirement of the Pinellas Countywide Advanced Traffic Management System (ATMS) is the efficient control and management of roadway corridors through an integrated system, extending across multi-jurisdictional boundaries.

3.1. System Level Functional Requirements

To facilitate and promote regional mobility through cooperation of agencies, the Pinellas Countywide ATMS will require the complete integration of Systems. The ATMS shall be a system that operates in a Local Area Network (LAN) and a Wide Area Network (WAN) configuration. It will have the capability to share information and control among the Primary Control Center, the existing Secondary Control Centers, and remote workstations. All center-to-center communications shall be compliant with National and State ITS Standards.

Figure 10 depicts the system configuration for the Pinellas Countywide ATMS system. These include Graphical User Interface (GUI), Adaptive Traffic Signal System, Video Monitoring System, Vehicle Detection System, Dynamic Message Signs (DMS), and Archive Database Management. The proposed configuration is based on a modular design concept that will provide for system expansion. The system configuration shall be replicated in each of the centers to the extent necessary for each center to have control and access of each system component. The intent is to build redundancy into the system. The following subsections describe functional requirements for each component. The functional requirements can also be described in terms of the functional diagrams presented in **Figures 3 through 7**. These are referenced to provide consistency with the Concept of Operations.

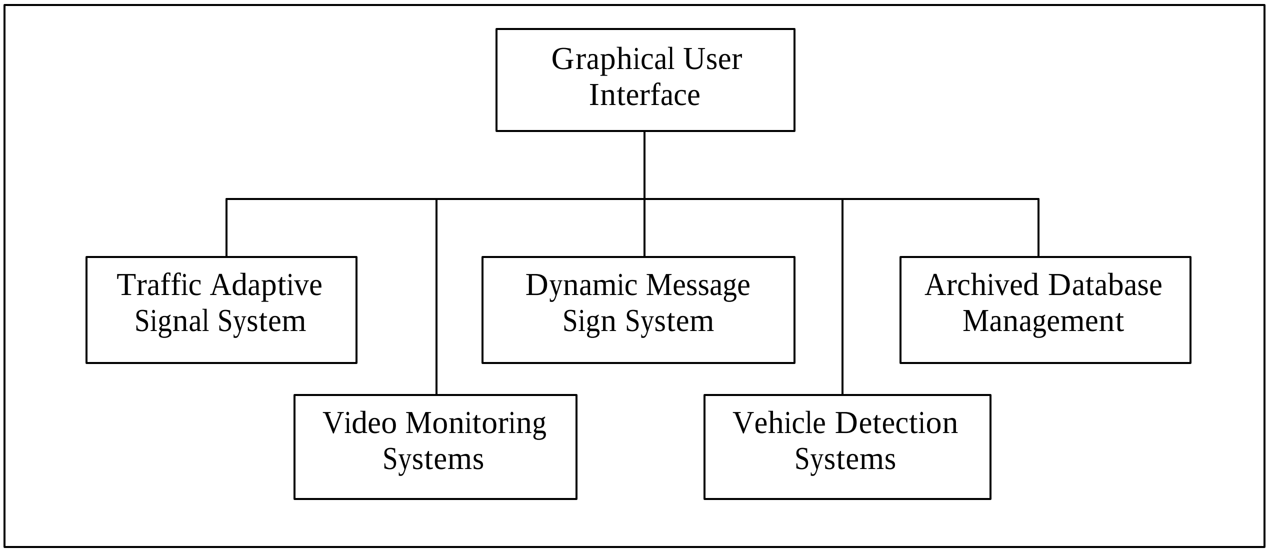


Figure 10: Pinellas Countywide ATMS System Components

3.2. Graphical User Interface Functional Requirements

The Graphic User Interface (GUI) ties the system components together, since it is the interface that allows users to input data and view system status. It includes the maps referenced in **Figures 3 through 7**. The GUI shall provide access to each of the system components. It is anticipated that the system components will be primarily commercial-off-the-shelf (COTS) products and the GUI shall integrate these components.

The GUI shall include all control, display, and alarm functions for the countywide integrated ATMS. The system shall provide for security functions to prevent unauthorized access to the system; operator access levels shall be definable and related to each assigned operator. Operators shall be required to enter a login code and password prior to gaining access to the system; the GUI shall clearly display the functions authorized for and available to the respective operator. All other functions shall either be grayed out or not visible the operator whom does not have access to that level of data/control. The system shall also provide for remote user access for sharing information with other agencies.

3.2.1. Graphic Display System

The system shall provide a graphic display system for displaying real-time traffic conditions and control strategies on workstations, monitors, and video walls. The graphic display system shall include a "Traffic Flow Map" and a "Signal Control Status Map."

- The Traffic Flow Map will display the real-time traffic conditions received from the vehicle detection system. Data will be compiled on a link-by-link configuration and display the data through a user-defined color-coded legend. The user-defined legend shall have a minimum of three different statuses; heavy congestion (red), light congestion (yellow), and no

congestion (green). The display map shall be able to display operator-defined incidents through icons/symbols. These incidents may be accidents, special events, or construction activity. The operator shall be able to select various views by zooming in and out of an area.

- Signal Control Status Map will display the operational status of the traffic signals on a real-time basis, communications failures, and other available features from the selected Traffic Adaptive Signal System.

Either the Traffic Flow Map or Signal Control Status Map may display the location and status of the other field devices, such as CCTV and DMS.

3.3. Traffic Adaptive Signal System Functional Requirements

A Traffic Adaptive Signal System (TASS) provides dynamic adjustment of the four basic control parameters used to control the individual and groups of traffic signals in the arterial network. The parameters are:

- Signal timing cycle length (cycle);
- Traffic movement phase percentage of the cycle (splits);
- Time difference between the beginning of artery green for an intersection and the beginning of artery green of an adjacent intersection (offset); and
- Selective traffic movement servicing (phase skipping).

A TASS manipulates these four parameters dynamically based on traffic volume, speed, and congestion levels predefined during the system configuration work performed during installation of the system equipment. The TASS is part of the Countywide Traffic Control function (**Figure 4**), although the same software may be useful as part of the Countywide Incident Coordination function (**Figure 5**).

The following are the minimum features required of the TASS to perform traffic adaptive signal control:

- The TASS will incorporate system control algorithms that select the optimal traffic signal control timing parameters in response to traffic demand detected in real time. The system will dynamically adjust the individual signalized intersection cycle lengths, phase splits, and offsets. In adaptive mode the system shall not depend on the existence of any pre-calculated signal timing other than minimum pedestrian, yellow clearance, and all red clearance times.

- System intersections may be grouped into subsystems consisting of master intersection(s) and multiple subordinate intersections. At each critical intersection, phase splits shall be selected and implemented in real time to maintain the monitored approaches at equal degrees of saturation in undersaturated traffic conditions. The TASS shall automatically provide a bias or preferential treatment to user-defined intersection approaches during saturated and oversaturated traffic conditions as detected through the intersection's vehicle detectors that may be installed at various distances from the approach to the intersection.

- Early termination and skipping of user-defined signal phases shall be provided in response to local controller vehicle actuation timers and detection devices associated with the intersection. Unused time within the signal cycle shall be reallocated automatically by the system in response to measured traffic demand within user-defined limits.

- Subsystem signal cycle lengths shall be calculated by the system within user-defined limits to maintain a maximum level of service in the subsystem.

- The system and intersection control software shall provide simultaneous use of adaptive control, time base coordination, and isolated vehicle actuated control strategies at different intersections within the same system and subsystem at the same time. The system and intersection control software shall allow for the transfer of any intersection to any mode immediately by operator command.

- In the event of central control computer failure, loss of intersection communication with central, or the loss of a critical number (to be determined) of subsystem detectors, the system will cause all of the intersections within the affected subsystem to fall back to a user-defined mode of operation of either time base coordination or isolated intersection control.

- If a master intersection is operating in time base backup, or offline mode, all intersections within the same subsystem shall operate in offline mode.

- If a subordinate intersection is operating in offline mode, any of the other intersections in that subsystem may operate in adaptive control mode or, if selected by the user, may operate in offline mode.

- All decision data for offline mode operation will be contained within the local intersection controller. The local intersection controllers shall contain at least 10 unique signal plans, and at least 20 unique time-of-day plan schedules for use in offline mode operation under time base coordination.

- The system will monitor the operation of each local traffic signal controller on a second-by-second basis.

- The system will be able to individually control and time each phase of multiple-phase, multiple ring controllers, with a minimum of eight phases.

- The system software will have the capacity to serve a minimum of 1500 intersections.

- The system will provide for on-street intelligence to allow the local controllers to automatically go to time base coordination backup in case of the loss of communications.

- The system will monitor each intersection to ensure that it is operating within the parameters of the timing plan in effect. If it is determined that an intersection is not operating within these constraints, an error message shall be generated. Failed controllers shall be provided one or multiple attempts to reestablish control automatically.

- The system will provide automated managing of the field and the central system database. The system shall also allow for the selective comparison of local controller database parameters.

- The interface and control of the adaptive signals shall take place through personal computers configured in a network with at least a graphics-based system user interface (referenced in Section 3.2) and a traffic adaptive signal (TAS) server. The computers shall operate using the Windows NT operating system and 100 percent compatible support software (database, utility software, etc).

- All operator commands are to be available from any TAS terminal subject to system administrator and user security access as defined in the system database. Access will also be provided through direct connection or dial-up telephone connection to the central system.

- Any system user that is connected to the central system (up to the authorized limits of the system) shall be able to monitor the operation of any TAS intersection or subsystem. The monitored data provided by the system is required at a minimum to be:
  - Intersection phase on/off/flashing, current phase demands, detectors occupied, cycle length, mode of operation, alarms, phase running, and time in phase.
  - Subsystem current directional split, offset plan, cycle length, detector data, approach congestion, and detector count data for each instrumented lane.

- The system, by operator command or time of day selection, shall immediately begin the change to the commanded signal timings (including an appropriate transition). The system shall allow the users to temporarily implement a timing-plan lock that holds the current plan or predetermined cycle length, split, and offset in operation.

- The system will display and allow the user to change all TAS control parameters without taking the TAS central computer network offline or remove any TAS intersection controllers from adaptive control.

- The system must provide a comprehensive set of alarm conditions to warn the user of unusual or fault conditions. The alarms are required to provide the warning of the following at a minimum:
  - Communication failure;
  - Conflict monitor trip;
  - Cycle lock;
  - Plan lock;
  - Pedestrian detector failure;
  - Vehicle detector failure;
  - Intersection in fallback operation;
  - High traffic volume density;
  - Intersection power failure; and
  - Intersection controller watchdog trip.

- The system will permit the preemption of the local intersection by railroad, emergency vehicle, or other local inputs, and report such preemption to the system. A report shall be generated. The report shall include, for emergency vehicles, the date, time, location, direction (if applicable), and emergency vehicle identification, as a minimum, and be automatically archived in the system historical database. The system will be able to provide emergency vehicle priority during all modes of operations. At the completion of the priority sequence, normal timing plan transition routines will be utilized to return to current mode coordination.

3.4. Video Monitoring Subsystem

The Video Monitoring Subsystem is an important component of the Network Monitoring, Countywide Incident Coordination, and Traveler Information Dissemination functions (**Figures 3, 5, and 6**, respectively). The images are used solely for operators to verify conditions (including incidents) and to provide information to the public. As such, cameras shall be placed at an appropriate height to observe conditions on a roadway for reasonable distance.

Cameras shall be positioned near signalized intersections on tangent sections if possible. The cameras shall be fitted with zoom lenses that will allow close-up (16mm) and zoom-out (160mm) viewing of the intersection and the approaches under day and night conditions.

In order to view the desired areas without limitations, the cameras shall be attached to pan and tilt units that offer a 360-degree horizontal view and near 180-degree vertical view.

As the initial installation will likely be integrated into a leased communication system, the video and camera pan/tilt/zoom control is required to be remotely accessed over multiple media including:

- Leased / dial-up telephone;
- Dedicated phone lines;
- Fiber optic cable;
- Spread spectrum radio;
- Cellular radio; and
- ISDN.

This capability is required as a means of supporting the field equipment during any staged migration from one form of communication system to any of the others noted. The field equipment is required to support the respective handshaking associated with each communication medium through the communication interface hardware.

The camera systems deployed at each center shall be capable of receiving video from and controlling any camera within the system. A switching system will allow the directing of video, to any authorized requestor on the LAN/WAN, to any workstation making such request.

Cameras will be color motion pan-tilt-zoom (PTZ) capability. A high quality weather-tight dome enclosure is required. Due to the salt air environment in Pinellas County, pressurized domes may

reduce corrosion rates of the mechanical parts and should be used. The cameras will have automatic iris control and be combination color and black & white with automatic changeover at low lighting levels.

3.5. Dynamic Message Signs

Dynamic Message Signs (DMSs) are required to provide dynamic messages to the public concerning the traffic flow conditions and alternate route information, usually in response to traffic incidents that may be present within the travel corridor. The DMS is part of the Traveler Information Dissemination function (**Figure 6**). These signs shall be designed for urban signing for facilities with speed limits (85th percentile speeds) of less than 55 mile per hour. The display visibility shall be at least 600 feet under day or night lighting conditions. 12-inch high characters within a line matrix configuration are required. The display shall provide 3-line messages with 15 characters on a line, consistent with the likely message library.

The DMS will be mounted on a sign support that either will span the roadway in a truss configuration or will be mounted on a butterfly sign support structure located on the side of the road, depending on field conditions. The DMS system shall provide:

- A separate ground-mounted DMS controller. This controller will be located at a distance from the DMS sign assembly such that a person may view the message presented on the sign face while exercising the controls for the sign within the control cabinet. Ground mounted DMS control cabinets shall provide space for vehicle detector, closed circuit television equipment, and termination facilities. Each DMS controller shall have two concurrent communication ports; one for local attachment to a laptop computer; and the other for remote connection via modem to a central location. Each sign controller shall have the capability to store at least 32 two-phase messages;

- Immediate message display;

- Download / upload of DMS controller stored messages;

- Download / upload of DMS controller / display configuration;

- DMS status response from DMS status requests;

- DMS extended status response from extended status requests;

- Error message response within status requests;

- At least 3 modes of display intensity control: (1) local automatic, (2) remote automatic, and (3) local manual display intensity control;

- At least three loss of communication display modes: (1) blank the message, (2) default message, and (3) last message displayed;

- Support future implementation of the NTCIP communication protocol by allowing a change from the initial non-NTCIP protocol to NTCIP. It is required that the other hardware required to support both the initial comms protocol and NTCIP be installed with the initial hardware installation;

- The complete DMS (ground and overhead equipment) are environmentally hardened and meet the environmental requirements of NEMA as relates to voltage, vibration, heat, cold, and humidity variation to the same extent as electronic traffic signal equipment; and

- The DMS sign enclosure and DMS sign housing shall provide necessary environmental control to maintain functionality and longevity of the internal components.

3.6. Vehicle Detection System

The vehicle detection system (VDS) is an integral part of all functions (**Figures 3 through 7**). The traffic count data that is generated at the detectors is used for Network Monitoring, Countywide Traffic Management Coordination, Countywide Incident Coordination, Traveler Information Dissemination, and Archived Database Management functions.

The VDS will collect real time traffic volume, speed, and occupancy data in each lane of traffic. This data shall be interfaced and provide support to the traffic flow map and the archived data management system. The technology shall be the most economical for the location.

The vehicle detection software shall detect incidents along the arterial network that the system controls using real time traffic data. The incident detection shall be based on user-defined thresholds that when met send an alarm to the operators. The alarm shall include a data set that includes, at a minimum, the location of the detector, the current traffic flow information, and a time/date stamp.

3.7. Archived Database Management

The Archived Database Management function (**Figure 7**) uses this subsystem. The database is a storage location for traffic information that may be used for planning purposes. Other uses include data supporting reports prepared for federal agencies, documentation required for risk management, etc.

The central database shall be fully integrated, automatic, and self-supporting. The relational database management system shall provide the necessary storage, retrieval and automated archiving functionality necessary for ATMS system operation, including automated system and data back-up procedures.

The database shall be interfaced with the other components to automatically retrieve user-defined data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional metadata management features that are necessary so that the data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features to facilitate discovery of information, patterns, and correlations in large data sets.

Agency coordination will assure that automated report generation satisfies the needs of all known data users. Multidimensional analysis, selective summarization and expansion of data details, and many other advanced analysis services may be offered by various software enhancements. This component shall perform quality checks on the incoming data, error notification, and archive-to-archive coordination.

4. INSTITUTIONAL ARRANGEMENTS

4.1. Introduction

In order to provide cooperative regional traffic management in Pinellas County, a clear direction on what form and type of entity the Primary Control Center (PCC) should become is necessary. Some possible organizational structures have been investigated relative to the joint establishment, operation, and management of the PCC.

As a result of research into the existing state statutes, three types of intergovernmental relationship possibilities have been found that may fulfill the objectives of a PCC. Each type will be discussed briefly along with its suitability for the PCC. A summary and recommendations section is provided. The full text of each state statute identified below is provided in **Appendix A**.

- Section 163.567 – Regional Transportation Authorities
- Section 163.02 – Councils of Local Public Officials
- Section 163.01 – Florida Interlocal Cooperation Act of 1969

4.2. Regional Transportation Authorities

A brief excerpt from Section 163.567 follows:

> *"The authority created and established by this part is granted the authority to purchase, own, or operate, or provide for the operation of, transportation facilities; to contract for transit services; to exercise power of eminent domain limited to right-of-way and contiguous transportation facility acquisition and subject to any further limitations set forth in the authority charter; to conduct studies; and to contract with other governmental agencies, private companies and individuals. However, no public transportation system shall be purchased, owned, or operated that would be in the continued business of competing with existing private charter transportation companies for charter business, nor shall a new system be implemented where an existing transportation system of the same mode is operating a comparable service without first purchasing said existing system through negotiation."*

The Regional Transportation Authority approach requires a charter committee with each governing body appointing one representative for the first 100,000 population or fraction thereof over 50,000 plus one additional representative for each additional 100,000 population to the committee. The committee creates a charter; it is executed by all parties then filed with the Department of State.

The Governor appoints two members to the Authority. The Board of Directors must have a director representing each member government and have at least five members, including the two appointed by the Governor. The Authority may employ an executive administrator who serves at the pleasure of the Board. The administrator may employ persons in positions approved by the Board.

4.2.1. Suitability for PCC

Using this statute, a separate and distinct entity would be created apart from the member agencies that created it. There is a potentially long lead-time to implement. Also, employees would become Authority employees.

The Charter contains the manner in which the Authority members will provide from their treasuries the financial support for the Authority. The Authority may independently contract for services. Directors of the Board receive no salaries or other compensation.

No county or municipality may be a member in more than one Regional Transportation Authority. This may be difficult to achieve given the existing Authority in the county (Pinellas Suncoast Transit Authority).

The system may also become more complicated. The statute appears to be written primarily for public transit system owners, not necessarily for traffic management and operations. Thus, use of the Regional Transportation Authority method could be more than what is needed.

4.3. Councils of Local Public Officials

A brief excerpt from Section 163.2 follows:

> *"The governing bodies of any two or more counties, municipalities, special districts, or other governmental subdivisions of this state, or any of them, herein referred to as member local governments, may, by resolution, enter into an agreement with each other for the establishment of a council of local public officials. Any council established under the authority of this section shall be a corporation not for profit…*
> *The local government council shall have the power to:*
> *(a) Study such area governmental problems, as it deems appropriate, including but not limited to matters affecting health, safety, welfare, education, economic conditions, and area development;*
> *(b) Promote cooperative arrangements and coordinate action among its members; and*
> *(c) Make recommendations for review and action to the members and other public agencies that perform local functions and services within the area.*
> *(4) The council shall adopt bylaws designating the officers of the council and providing for the conduct of its business. The council may employ a staff, consult and retain experts, and purchase or lease or otherwise provide for such supplies, materials, equipment and facilities, as it deems desirable and necessary.*
> *(5)(a) The governing bodies of the member governments may appropriate funds to meet the necessary expenses of the council. Services of personnel, use of equipment and office space, and other necessary services may be accepted from members as part of their financial support. …"*

The Council of Local Public Officials approach is merely an advisory group. They are to make recommendations for review and action by other public agencies. The council may employ a staff and purchase materials and supplies.

4.3.1. Suitability for PCC

The Council of Local Public Officials is not an operations and management body. The representative from each member local government must be the elected chief of said local government, most of whom have many other activities in their schedule and may have limited knowledge of regional traffic management techniques, challenges and methodologies. Use of this method may not fulfill the needs of regional traffic management.

4.4. Florida Interlocal Cooperation Act of 1969

A brief excerpt from Section 163.1 follows:

> *"It is the purpose of this section to permit local governmental units to make the most efficient use of their powers by enabling them to cooperate with other localities on a basis of mutual advantage and thereby to provide services and facilities in a manner and pursuant to forms of governmental organization that will accord best with geographic, economic, population, and other factors influencing the needs and development of local communities."*

The Florida Interlocal Cooperation statute provides for local governments to enter into agreements of mutual interest and provide for within the Interlocal Agreement addressing issues, such as:

- Stating the purpose and method by which the purpose will be accomplished;
- The organization, composition and nature of the administrative entity created, along with the powers designated to them;
- How the parties to the Agreement will provide financial support for the purpose set forth in the Agreement;
- How funds may be disbursed;
- The manner of employing the staff;
- The manner any purchases will be made or contracts entered into;
- Dispute resolution;
- Duration;
- Severance;
- Common power;
- The exercise of power;
- Entering into contracts;
- Acquisition, rent, lease of property;
- All matters relating to participation;
- Etc.

4.4.1. Suitability for PCC

The PCC Management Team can possess the common power specified in the Agreement and may exercise it in the manner according to the method provided in the Agreement. The Team would exist as an administrative entity, and could provide the needed arrangement to create and operate a Primary Control Center.

4.5. Conclusions & Recommendations

Based on the available information on possible intergovernmental relationships, the ***Interlocal Agreement*** appears to be the best match for the objectives to be met. All required language addressing the pertinent issues could be included in the body of the Agreement. **Appendix B** provides a draft of an interlocal agreement that could be used or revised for use in initiating the PCC Management Team.

The PCC group would be an administrative entity created by the interlocal agreement. Each member agency's representative would remain an employee of their respective agency.

To maintain the "joint" jurisdiction team concept, an Interlocal Agreement combining representatives from each agency is conducive to achieving a regional traffic management partnership.

4.5.1. Institutional Structure

The Agreement could establish a PCC Management Team, made up of a manager from each respective agency from which the PCC Manager receives guidance and direction on fulfillment of the goals, objectives, and responsibilities of the PCC. It is envisioned committee members would be the Public Works Directors (or designee) of the member agencies and the FDOT District Traffic Operations Engineer. In addition, the committee serves as the clearinghouse for operations changes and establishment and approval of overall operating procedures.

The appointment of the PCC Manager would be by the PCC Management Team. The PCC Manager would report to the committee and be responsible and accountable to the PCC Management Team. The staff in the PCC would report to and be accountable to the PCC Manager. It is anticipated that the PCC Manager would be on the one of the member agency's payroll, for the purpose of official employee benefits package reasons. This employer is only the "host" employer. The PCC Manager reports to and takes assignments from the joint committee.

4.5.2. Financial Support

The method or formula for equitably providing for and allocating and financing the capital and operating costs would be determined by the parties and be incorporated into the Agreement. It is anticipated that "host" employers would pay the salaries directly to their member representatives. Capital funding and future additions to operating costs could utilize the percent population ratio for determining pro-rata share contributions or other methods. Expanded formulas could incorporate population, land area, and/or the number of traffic signals on a weighted average basis to determine equitable financial support from the members. The exact method for funding formulas will be described in the interlocal agreement. The PCC Manager would be responsible for submitting proposed budgets for each agency's use in preparing their respective annual budget request packages.

4.6. Institutional Arrangements

Table 2 contains a comprehensive matrix of all the institutional arrangements required for the Pinellas Countywide ATMS. The table lists the agencies, type of agreement, information to be exchanged, the purpose of the agreement and any comments regarding the agreement.

Table 2: Inter-Agency Coordination and Agreements Matrix

Parties to the Agreement	Type of Agreement	Information Shared	Purpose	Comments
Clearwater, St. Petersburg, Pinellas County	Interlocal Agreement	Major Arterial Traffic Control / Traffic Management	Regional Coordinated Corridor Management	Establishes the Primary Control Center (PCC) and details the support arrangement.
Clearwater Public Works, Clearwater Police	Memorandum of Understanding	Video Monitoring & Incident Detection	Monitor Intersections with Frequent Incidents / Improved Response	Police dispatch able to monitor traffic conditions on critical arteries and improve dispatch of incident removal teams.
St. Petersburg Public Works, St. Petersburg Police	Memorandum of Understanding	Video Monitoring & Incident Detection	Monitor Intersections with Frequent Incidents / Improved Response	Police dispatch able to monitor traffic conditions on critical arteries and improve dispatch of incident removal teams.
PCC Management Team, Pinellas Suncoast Transit Authority	Memorandum of Understanding	Video Monitoring & System Detector Data	Monitor major stops and network performance	Transit operators able to monitor system performance and enable incident awareness. MOU would also cover use and privacy of video feeds.
PCC Management Team, Media	Memorandum of Understanding	Video Monitoring	Monitor major arterials and traffic disruptions for traffic information dissemination	MOU would condition use and broadcasting of video.
PCC Management Team, FDOT Regional TMC	Memorandum of Understanding	Video Monitoring & System Data	Share real-time video, system sensor and incident management information	Promote coordination and management of incidents on a regional scale. MOU would also cover use and privacy of video.
PCC Management Team, Pinellas County 911 Dispatch	Memorandum of Understanding	Video Monitoring & System Data	Monitor Intersections with Frequent Incidents / Improved Response	Promote coordination and management of incidents on a regional scale. Knowledge of incidents given to responders. Also provides information to facilitate re-routing around congestion/incidents for EMS/Fire & other emergency responses.
Pinellas County with: Dunedin, Largo, Pinellas Park	Interlocal Agreement	N/A	Maintenance of Cameras, Dynamic Message Signs i.e., ITS Devices	Covers maintenance of ITS devices by County for respective municipalities.
Pinellas County with: Dunedin, Largo, Pinellas Park	Memorandum of Understanding	Video Monitoring & DMS Operation	Regional Traffic Management	Covers use and operation of ITS devices by the county within the municipal boundaries.
PCC Management Team, Pinellas County Sheriff's Office	Memorandum of Understanding	Video Monitoring & Incident Detection	Monitor Intersections with Frequent Incidents / Improved Response	Police dispatch able to monitor traffic conditions on critical arteries and improve dispatch of incident removal teams.

EXECUTIVE SUMMARY

The Pinellas Countywide ATMS Feasibility Study builds on previous studies. This effort extends the S.R. 60 / U.S. 19 ATMS framework to include a broader stakeholder group and maintains the system functionality established in the Pinellas Countywide ATMS Requirements Document. This document covers the U.S. 19, S.R. 688, and C.R. 611 corridors, which travel through multi-jurisdictional boundaries. They are three of the four Phase 1 ITS Corridors set forth by Pinellas County. The fourth Phase 1 road (S.R. 60) was covered in the previous study entitle S.R. 60 / U.S. 19 ATMS Feasibility Study. The following presents an overview of each major component of the study.

- Needs Assessment
- Pinellas Countywide ATMS Project Architecture
- Conceptual Design
- Implementation Plan
- Stage 1 Benefits/Costs Analysis
- Evaluation Plan

Needs Assessment

This section summarizes the needs, issues and challenges to be addressed by the Pinellas Countywide ATMS. This includes an assessment of existing conditions (legacy systems, traffic/accident data, and the roadway network), the Pinellas Countywide ATMS Requirements Study, and efforts of the Pinellas County ITS Advisory Committee. A stakeholder workshop was held to identify / confirm the needs of the users and map them to the functional requirements already selected by the Pinellas Countywide ATMS Requirements Document. Based on the results of the workshop, the following services are to be addressed by the Pinellas Countywide ATMS.

- Network Monitoring: This includes processing real-time traffic data, such as traffic volumes, speeds, and video images. Information will be collected by the Clearwater and St. Petersburg Control Centers and sent to the Pinellas County Control Center to create real-time countywide traffic information display maps. These maps will be available to both local and regional agencies, and will be viewable on a variety of display devices (PC monitor, video monitor, video wall).

- Countywide Traffic Management Coordination: This includes traffic control strategies along major corridors, such that the Pinellas Countywide ATMS operates seamlessly across jurisdictional boundaries.

- Countywide Incident Coordination (for both incidents and planned events): This includes coordination with police, transit and emergency dispatch to ensure they have information to facilitate incident responses. The Pinellas Countywide ATMS Operators will monitor incident response activities and provide coordination for planned events that impact regional travel.

- Traveler Information Dissemination: The Pinellas Countywide ATMS will be responsible for collecting and disseminating traveler information to the public through Dynamic Message Signs, web sites, etc. In addition, the Pinellas County Traffic Control Center will serve as a central point of contact for the media, information service providers, and other regional traffic management centers.

- Archived Data Management: The Pinellas Countywide ATMS will store/archive information that is needed for transportation planning and other related activities.

Pinellas Countywide ATMS Project Architecture

An ITS Project Architecture was developed for the Pinellas Countywide ATMS to provide compatibility with the National ITS Architecture, Statewide ITS Architecture and the Tampa Bay Regional ITS Architecture. The Pinellas Countywide ATMS Project Architecture was developed using the Turbo Architecture Tool. The Turbo Architecture Tool provides a mechanism for documenting, managing, and merging the project architecture into the regional architecture. The primary focus of this effort was to establish interface requirements between the subsystems and identify applicable standards.

Conceptual Design

This section presents the conceptual layout of a full-build scenario for the Pinellas Countywide ATMS. It provides an overview of the design criteria used to determine field components, their approximate locations, and the communications infrastructure for the Pinellas Countywide ATMS. In addition, this section provides an overview of the field components, communications infrastructure and traffic control center components.

Subsequent to this report, a set of conceptual plans, using existing aerials, was developed that depict the approximate location of field components and communications. The following field components were recommended:

- Traffic Adaptive Controllers – Upgrade the existing traffic controllers at ninety-seven (97) intersections to perform adaptive control. This includes system detectors at all intersection approaches for monitoring traffic flows and support coordinated adaptive control.
- Detector Stations – Install twelve (12) additional system detectors along roadway segments that are not covered by the adaptive traffic control system detectors, such as segments between overpasses.
- Closed-Circuit Television Cameras (CCTV) – Install seventy-two (72) CCTV cameras for video monitoring and incident verification.
- Dynamic Message Signs (DMS) – Install twenty-two (22) DMS in advance of decision points for route diversion. The DMS locations were selected based on possible diversion routes.

The communication system is divided between the physical cable plant and the network electronics. These two separate subsystems combine to form the complete communication system. The conceptual design of the physical cable plant will contain the following elements:

- Approximately 90 miles of 96 strand fiber optic trunk cable.
- Approximately 202 - 12 strand fiber optic lateral drop cables.

The proposed communication architecture is based on the self-healing ring architecture. The self-healing ring configuration should be configured to automatically restore service outages caused by equipment card failures. In addition, the cable plant was designed with loop diversity to overcome cable cuts.

The following improvements are recommended for the Pinellas County existing Traffic Control Center:

- Traffic Control System Software/Hardware Installation: It is assumed that the central software will be deployed under the S.R. 60 / U.S. 19 ATMS Stage 1 project. The selected system will provide continuous monitoring of field devices, can support ATMS devices like CCTV and DMS, has the ability to provide coordinated adaptive traffic control, has extensive data management capabilities, can share video and data with other centers and has incident management capabilities. Some integration will be required to bring the new field devices online. Stage 1 will establish the Local Area Network (LAN) configuration, which includes servers, work stations, etc.
- Video Wall for Pinellas County TOC – This includes 4-67" video cubes, video controller and video switch.

In addition, additional back-up servers and workstations will be deployed at the St. Petersburg Traffic Control Center.

Implementation Plan

The implementation plan is a series of deployment stages that were developed according to various project requirements. Since the available funding will not cover the costs for the deployment of the full build scenario, criteria was used to geographically spread the deployment of the field components and communications over three stages. The following tables summarize the field components and communications for each deployment stage.

Staged Deployment of Field Components

		Field Components			
		Traffic Adaptive Signals	**Detectors**	**Cameras**	**DMS**
Stage 1	**Roadway**				
	U.S. 19	10		17	3
	S.R. 688				
	C.R. 611			16	2
	Subtotal	**10**	**0**	**33**	**5**
Stage 2	**Roadway**				
	U.S. 19	8	12	16	6
	S.R. 688	14		11	
	C.R. 611	20			1
	Subtotal	**42**	**12**	**27**	**7**
Stage 3	**Roadway**				
	U.S. 19	30		3	1
	S.R. 688	8		4	6
	C.R. 611	7		5	3
	Subtotal	**45**	**0**	**12**	**10**
	Total	**97**	**12**	**72**	**22**

Staged Deployment of Communications

	Fiber Optics (Existing Conduit in miles)	Fiber Optics (New Conduit in miles)
Stage 1 Fiber Optics	24.77	1.34
Stage 2 Fiber Optics	0.97	32.60
Stage 3 Fiber Optics	6.91	22.97
Total Fiber Optic Communication Plant = 89.56 miles		

A project cost for each deployment stage was developed. The project costs include a 15% contingency, 20% design fee and 20% construction, engineering & Inspection (CEI) fee. The estimated operations and maintenance costs are based on industry standard of 10% of capital costs. However, the annual operations and maintenance costs may be reduced because the new equipment will be replacing older equipment. In addition, the existing leased line communications cost will be reduced. The following table summarizes the project costs for each deployment stage.

Project Costs for Staged Deployment

Stage 1 Deployment Costs	Traffic Control Center Improvements	$349,000
	Field Components	$1,500,500
	Communications	$2,154,349
	Incident Management Tools	$39,000
	Total Capital Costs	$4,042,849
	15% Contingency	$606,427
	Design Cost 20%	$929,855
	CE&I Cost 20%	$929,855
	Total Project Cost	$6,508,987
	Annual O & M Costs	$404,285
Stage 2 Deployment Costs	Traffic Control Center Improvements	$300,000
	Field Components	$3,325,500
	Communications	$6,590,095
	Incident Management Tools	$0
	Total Capital Costs	$10,215,595
	15% Contingency	$1,532,339
	Design Cost 20%	$2,349,587
	CE&I Cost 20%	$2,349,587
	Total Project Cost	$16,447,108
	Annual O & M Costs	$1,021,560
Stage 3 Deployment Costs	Traffic Control Center Improvements	$200,000
	Field Components	$3,252,000
	Communications	$4,968,350
	Incident Management Tools	$0
	Total Capital Costs	$8,420,350
	15% Contingency	$1,263,053
	Design Cost 20%	$1,936,681
	CE&I Cost 20%	$1,936,681
	Total Project Cost	$13,556,764
	Annual O & M Costs	$842,035

Stage 1 Benefits/Costs Analysis

A benefit / cost analysis was performed for the Pinellas Countywide ATMS Stage 1 deployment. While Stage 1 will provide qualitative benefits, this section focuses on quantitative benefits specific to the Pinellas Countywide ATMS Stage 1 deployment. The benefit / cost analysis calculates the benefit / cost ratio. The benefit / cost ratio is a measure to determine the feasibility of deploying improvements. If the benefit / cost ratio is greater than 1.0, then the proposed improvements are feasible.

The analysis study area was determined based on available data and does not include all field components recommended for Stage 1. Therefore, the results are conservative. This and other conservative assumptions were made throughout the analysis.

The benefits / cost analysis tested the feasibility of Stage 1 by testing the following hypotheses:

- Hypothesis 1: The traffic adaptive signal system will improve signal operations, therefore reducing the delay to motorist.
- Hypothesis 2: The CCTV, DMS and service patrols will improve incident management, therefore reducing incident durations and ultimately delays to the motorists.

The analysis measured two congestion cost components: the personal delay cost and wasted fuel cost. In addition, both the benefits and costs were projected and analyzed based on a 10-year life cycle. The benefits / cost for Stage 1 is 6.577, thus indicating that Stage 1 deployment is a very cost-effective alternative.

Evaluation Plan

The general approach to developing the evaluation plan is to assess the Pinellas Countywide ATMS's performance, impacts, benefits and costs, and to identify deployment issues. This should be accomplished by using a variety of information sources, including traffic data, surveys, logs, interviews, and cost data. Four goals were developed for the evaluation plan. The goals consist of a series of specific objectives, measures of effectiveness, and hypotheses. The hypotheses provide a means of evaluating the objectives. The four goals are:

- Goal 1: Assess the performance characteristics of the Pinellas Countywide ATMS.
- Goal 2: Assess the transportation system impacts of the Pinellas Countywide ATMS.
- Goal 3: Document the cost impacts of the Pinellas Countywide ATMS.
- Goal 4: Identify deployment issues associated with the Pinellas Countywide ATMS.

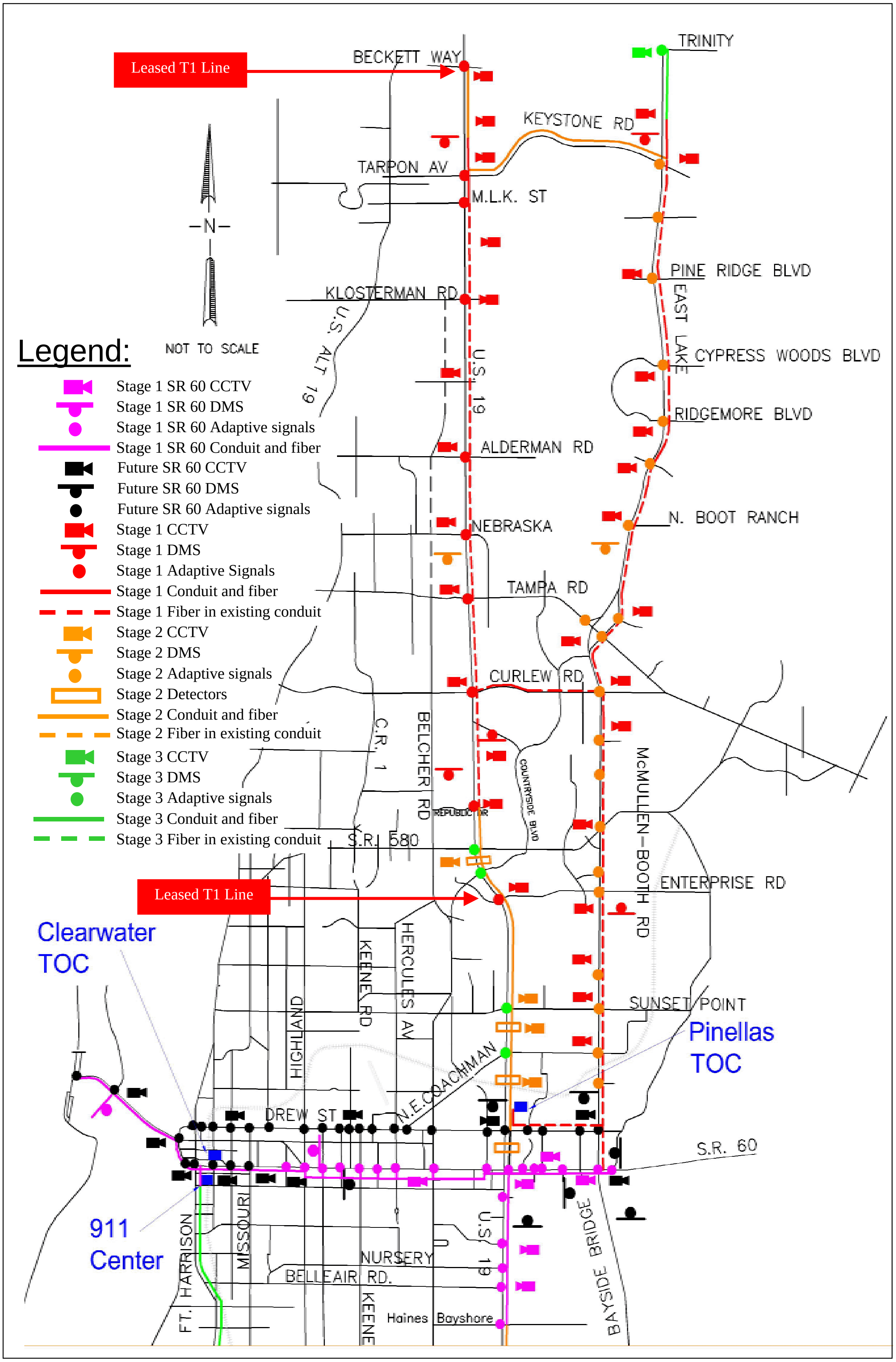


Figure 5-1: Pinellas Countywide ATMS Proposed Implementation Plan – North Section

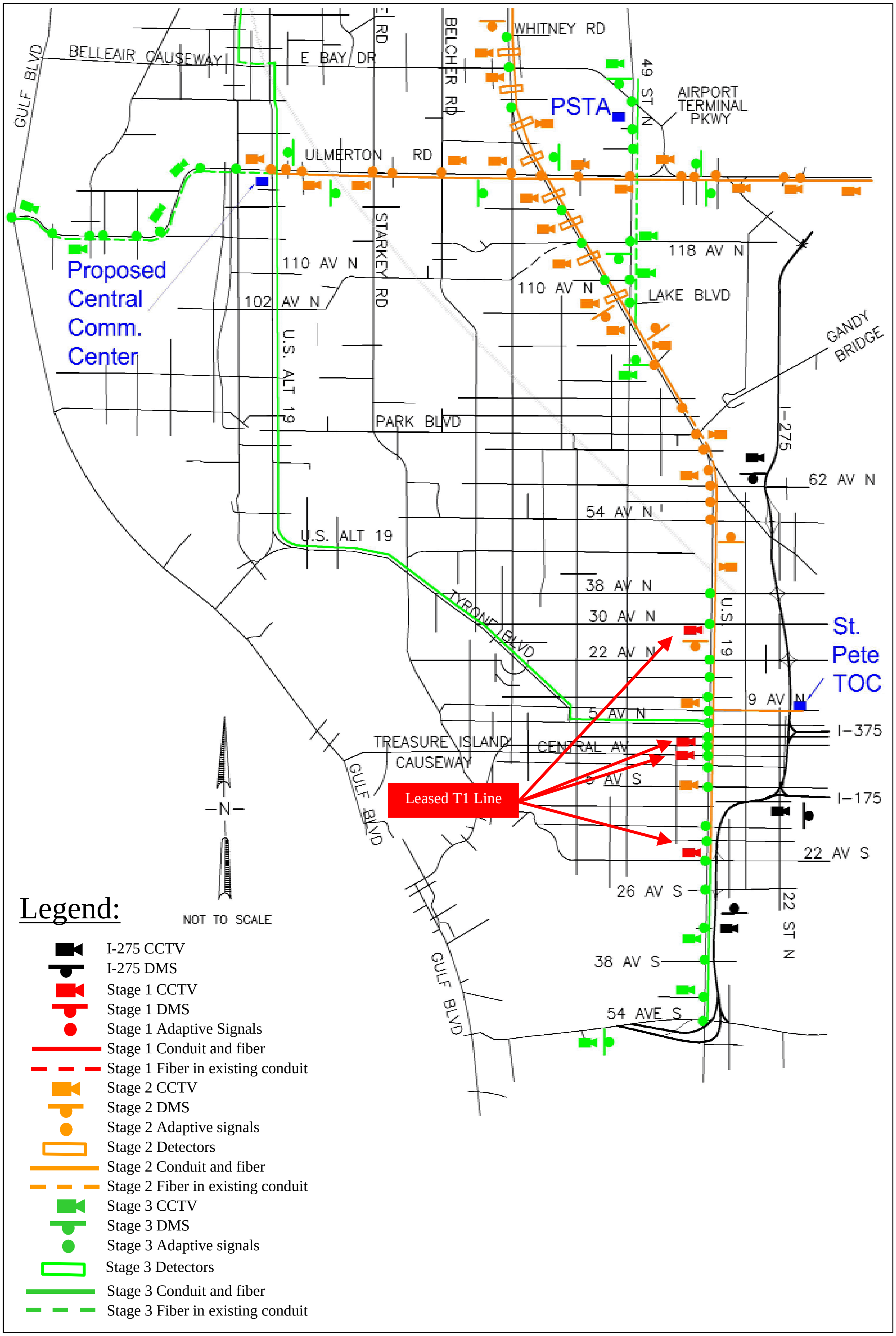


Figure 5-2: Pinellas Countywide ATMS Proposed Implementation Plan – South Section

Evaluation of Deployment Strategies
Pinellas Countywide ATMS / Adaptive Control Implementation Project

Executive Summary

The Pinellas County Metropolitan Planning Organization (MPO), through its General Planning Consultant contract, requested TEI Engineers & Planners to perform a high level evaluation of the current deployment strategy for the implementation of the Countywide ATMS / Adaptive Control project. As the first phase of the project is nearing the procurement stage, the MPO wishes to assess the feasibility and relevance of the approach being undertaken.

The specific scope of services for this task assignment required the review of the strategy developed for the deployment of the ATMS / ITS project, with emphasis on the following issues:

- The compatibility and interoperability of the suite of U.S.-developed traffic adaptive control algorithms called Adaptive Control Systems (ACS), formerly known as RT-TRACS, and including RHODES and OPAC, which are being recommended for deployment as part of this project.
- The feasibility of developing a network-wide supervisory (umbrella) software to coordinate the operation of OPAC and RHODES and other sub-systems, such as CCTV, VID, and DMS, which supervise the other elements of the ATMS/ITS deployment.
- An assessment as to the probable cost of developing such umbrella software.
- The impact on side street coordination resulting from the use of adaptive timing on U.S. 19 and Gulf-to-Bay and legacy timing control systems on side streets, particularly on major side streets, such as Belcher Road and Keene Road, where signal coordination is critical.
- The need for umbrella software and the effect on project cost if OPAC and RHODES are not both used.
- Any other significant issues that may surface during the review process.

Based on the documents reviewed and the conversations with the participating agencies, it is evident that there has been an extensive and exhaustive level of planning and coordination, and the MPO and all participating agencies are to be commended for their efforts and contributions. The system will be a better system due to their efforts.

In general, the course of the project is both appropriate and technically sound. The decisions made to date are logical in their reasoning and will result in a system that achieves the goals and objectives of the Technical Committee.

The following conclusions and recommendations are made:

1. ***The procurement plan for the first phase deployment of the system, which deploys two separate systems – MIST coupled with OPAC, and RHODES coupled with ICONS – is a sound and conservative approach.*** As both are fully integrated packages, there will be no software development in the first phase deployment. And, the deployment of both systems will allow operating staff to become familiar with both and therefore better

informed for making decisions concerning future integration of the system components into a single, fully-integrated Countywide system. A more conservative and equally sound approach would be to deploy both OPAC and RHODES under MIST, which will require minimal effort to fully integrate.

2. ***The development of a network-wide supervisory system is not recommended at this time.*** It is likely that either MIST or ICONS will be selected in the future as the ATMS application program that will run both adaptive control algorithms and also eventually phase out the existing MTCS.pc signal system. The extensive effort needed to develop a full-featured "umbrella" software package to supervise both MIST and ICONS would not be an effective use of project funds.

3. ***There will be some boundary effects where signalized intersections on the existing signal system are close to those on the adaptive control system.*** These should be evaluated on a case-by-case basis to determine the critical nature of the operations, and if necessary either the nearby signal should be incorporated into the adaptive control system, or some other type of interconnection strategy (i.e., slave relationship) considered.

4. ***The selection of both OPAC and RHODES (as part of the ACS adaptive control system packages) appears to have been a wise choice.*** FHWA has stated a commitment to supporting these algorithms, and they appear to have a promising and effective deployment on the selected corridors. In addition, the future deployment of the RTACL algorithm is also promising for grid networks. While alternative systems such as SCOOT and SCATS have extensive deployment histories, most are not domestic. The FHWA and the system vendors providing OPAC and RHODES both feel that these programs are mature and no longer experimental or developmental in nature.

5. ***Any significant control or monitoring integration with the MTCS.pc software is not recommended.*** The system should be considered a legacy system to be transitioned away from, as project funding permits, toward the Countywide ATMS.

6. ***A strategy for local intersection controller replacement should be developed. As the new ATMS will utilize Type 2070 controllers, these should be the target hardware.*** Software modifications to allow Type 2070 controllers to interface with the existing MTCS.pc system should be undertaken. These controllers would then be converted to the ATMS operation when funding permits.

7. ***It is critical that the expectations for the performance of the ATMS are appropriate and reasonable.*** The system will provide for a significant improvement in traffic flow and operations on an overall basis, but with only small improvements on a per-vehicle basis. If the expectations of the proposed system are excessive, then the system will never be successful.

8. ***It is also very important that a commitment to the proper operations and maintenance staffing of the system be made and followed for the life of the system.*** The system is only a tool for traffic management, and it must be supervised and controlled by skilled engineering staff.

TRAFFIC SIGNAL PREEMPTION BY EMERGENCY FIRE SERVICE VEHICLES POLICY

(January 21, 2004)

100.1 PURPOSE: To ensure a consistent policy for the use of traffic signal preemption devices, including emergency lights at fire station exits and to provide a safer response for emergency fire service vehicles and the public with a reduction in response times, while limiting the disruption to the traveling public.

100.2 DISCUSSION: This traffic signal preemption policy is designed to provide an emergency fire service vehicle, while responding to an incident, the ability to preempt a traffic signal in order to have the "green" light in the direction of the responding vehicle. The signal will preempt to green, to include applicable turning lanes, and to red in all other directions. Not all emergency vehicles will be provided with preemption emitter devices. It is the intent of this policy that, due to the concern regarding unwarranted disruption of traffic, only emergency fire service vehicles be permitted to activate the preemptive devices.

100.3 PROCEDURE FOR USE:

A. Traffic preemption devices are to be used by emergency fire service vehicles only when responding to documented emergency incidents. Each emergency incident is assigned an identification number by the 9-1-1 Center and is defined as a dispatch of an emergency vehicle to a valid emergency. Incident identification numbers, with corresponding data, are maintained in 9-1-1 files and will be used for monitoring of preemptive equipment use.

B. In the event of multiple fire service vehicles responding to an emergency incident, preemption activation should be limited to the initial vehicles responding. In the event of call downgrade, all vehicles will cease preemption.

100.4 PROHIBITION OF USE:

A. Preemption will **not** be used any time when the emergency fire service vehicle is **not** assigned to an incident.

B. Preemption will not be used for station move-ups unless dispatched as an emergency move-up.

100.5 SYSTEM REPAIRS:

A. Any problems with a signal or preemption process will be reported to the 9-1-1 Communications Center and the responsible signal control agency: the Pinellas County Signal Shop at (727) 464-8909, the City of Clearwater Signal Shop at (727) 562-7255/7256, or the City of St. Petersburg Signal Shop at (727) 893-7761.

B. If the signal preemption device is reported to be out-of-service, the 9-1-1 Communications Center will electronically memo all fire stations via the Emergency Communications Wide Area Network A.S.A.P.

C. The local agency, along with the responsible traffic control agency, will monitor system use and abuse and make recommendations for improvements. In addition, routine reports of usage and other issues will be reported to the Preemption Subcommittee, as defined in Section 100.6.

D. Problems with vehicle emitters will be reported, by electronic memo or media, to the local agency's vehicle maintenance service.

100.6 SYSTEM MANAGEMENT:

A. A Preemption Subcommittee of the Countywide ITS group will be established with full participating agency representation, including the Florida Department of Transportation.

B. The Preemption Subcommittee will evaluate usage, enhancements needed, violations, and other aspects of the preemption system. This Subcommittee will determine the equipment needs to assure consistent installation countywide. The Subcommittee will assist in providing efficient emergency fire service vehicle usage while limiting interruption to the traveling public. The responsibilities of this Subcommittee include:

- Evaluation of intersection and corridor criteria;
- Assessment of intersections for equipment installation;
- Assist in prioritizing intersections and corridors for equipment installation;
- Assist in determining equipment compatibility for consistent countywide usage;
- Review activation records of the devices; and
- Develop additional policies and procedures as needed.

C. In order to provide uniform equipment throughout the County, each jurisdiction shall install preemption equipment that is compatible with the computerized signal systems and adjacent jurisdictions that have mutual aide agreements.

100.7 ADOPTION: This Policy Statement must be approved by each jurisdiction prior to the installation of preemption equipment. The inter-operational aspect of this policy is to assure the potential for fire service agencies to utilize the system regardless of jurisdiction.

f:\users\cendocs\mpo\ traffic signal preemption.ck.

COUNTYWIDE ATMS / ITS TRAFFIC SIGNAL

INTERLOCAL AGREEMENT

Agreement Between Pinellas County and
The City of Clearwater

Date March 2, 2006

COUNTYWIDE ATMS / ITS TRAFFIC SIGNAL
INTERLOCAL AGREEMENT

THIS AGREEMENT, made and entered into on the ____ day of _____________, 2006, by and between Pinellas County, a political subdivision of the State of Florida, hereinafter referred to as the COUNTY, and the City of Clearwater, a municipal corporation, hereinafter referred to as the CITY,

WITNESSTH, That:

WHEREAS, this Agreement is made and entered between parties pursuant to Section 163.01, Florida Statutes, the “Florida Interlocal Cooperation Act of 1969”, and

WHEREAS, the COUNTY and CITY desire to foster an atmosphere of cooperation, which will afford advantages to the citizens and businesses within the municipal boundaries and in the unincorporated area, and

WHEREAS, it is beneficial to all citizens throughout the County that the governments cooperate to address community needs in matters affecting health, safety, welfare, economic conditions and countywide mobility, and

WHEREAS, the COUNTY and CITY have determined that it is of mutual benefit to centralize traffic signal operations on specified arterial roads and other major thoroughfares, across municipal boundaries, establishing an Advanced Traffic Management System (ATMS), for the most efficient operations of those facilities on a countywide basis, and

WHEREAS, the COUNTY and CITY have determined that it is of mutual benefit to centralize Intelligent Transportation Systems (ITS) on specified arterial roads and other major thoroughfares across municipal boundaries, for the safest and most efficient operation of those facilities on a countywide basis, and

WHEREAS, the CITY presently has traffic control authority to carry out the matters authorized by Section 316.006(2), Florida Statutes on ATMS / ITS corridors within the city limits; and

WHEREAS, Section 125.01(p), Florida Statutes, authorizes counties to enter into agreements with other governmental agencies within or outside the boundaries of the county for joint performance, or performance by one unit in behalf of the other, of any of either agencies authorized functions.

WHEREAS, the Pinellas County Charter, Section 2.04(q), provides that County government has all powers necessary to transfer the functions and powers of any other

governmental agency upon approval by the governing body of that agency and the Board of County Commissioners, and

WHEREAS, Section 335.0415, Florida Statutes, authorizes that public roads may be transferred between jurisdictions only by mutual agreement of the affected governmental agencies.

WHEREAS, the COUNTY and CITY have determined that it is beneficial to transfer the responsibility for operation and maintenance all traffic control devices on any roadway to the COUNTY once ATMS / ITS equipment is installed, as per the implementation plan, and

WHEREAS, the COUNTY has agreed to assume the current funding obligation for the operations transferred hereunder, pursuant to the terms of this Agreement, and

WHEREAS, the COUNTY and CITY have determined that it is of mutual benefit to contract or transfer traffic signal maintenance between the CITY and the COUNTY for certain ATMS and non-ATMS traffic signals, and

WHEREAS, the COUNTY will establish, administer, manage, operate and maintain the Pinellas Countywide Primary Control Center**,** also known as the Pinellas County Regional Transportation Management Center, hereinafter referred to as the PCC, to provide for the ATMS and ITS.

NOW THEREFORE, the parties, in consideration of mutual promises herein contained, and for other goods and valuable consideration, receipt of which is hereby acknowledged by all parties, hereby agree as follows:

SECTION 1
GENERAL

It is mutually agreed that in exchange for relinquishing and transferring traffic control jurisdiction and related devices described herein on the ATMS / ITS corridors, to the COUNTY, the CITY shall be relieved of the expense associated with such traffic control, and in turn the COUNTY shall, after receiving such traffic control responsibilities, assume the costs and expenses of same. From this basic agreement the following sections are developed.

SECTION 2
ATMS / ITS NETWORK

2.1. For purposes of this Agreement the ATMS / ITS system network and implementation phasing is identified as Exhibit "A2". Exhibit "A2" is incorporated in the Metropolitan Planning Organization (MPO) Long Range Transportation Plan (LRTP). Any modifications to the map adopted by the MPO will automatically supersede the attached plan without need to amend this Agreement.

2.2. The CITY agrees to transfer to the COUNTY traffic control responsibilities on ATMS / ITS corridors at the beginning of the construction phase for ATMS corridor implementation projects within the CITY limits. This transfer will be effective upon "notice to proceed" for the construction contract. The COUNTY will perform all project coordination, construction inspection; system related activities and traffic control determinations. The COUNTY and CITY will develop a mutually agreed upon partnering plan for construction related activities.

2.3. For purposes of this agreement transfer of traffic control responsibilities on ATMS / ITS corridors shall be limited to those enumerated below. State roads remain the jurisdiction of the FDOT, however coordination of traffic control determinations with the FDOT will be by the COUNTY, with input from the CITY.

2.3.1. Conduct required traffic engineering studies to determine appropriate traffic control devices.

2.3.2. Install and maintain traffic signals where warranted.

2.3.3. Establish traffic signal timing for all traffic signals.

2.3.4. Establish timing plan settings for all traffic signals.

2.3.5. Modification to signal timing and phasing.

2.3.6. Establish speed limits.

2.3.7. Prohibit or restrict left, right and U-turns.

2.3.8. Designate crosswalks; establish school zones and safety zones for safe pedestrian movement.

2.3.9. Establish and mark traffic lanes, bike lanes and other striping required to regulate, guide or warn traffic.

2.4. It is specifically understood and agreed that all rights and powers as may be vested in the CITY pursuant to Chapter 316 of the Florida Statutes or any other law or ordinance or charter provision of CITY and not specifically transferred to COUNTY herein shall be retained by CITY. It is further understood and agreed that CITY is not transferring any of its traffic enforcement functions, right or duties by the execution of this Agreement, and CITY shall fully retain such traffic enforcement functions, rights and duties together with all rights of enforcement of CITY traffic ordinances or state traffic statutes.

SECTION 3
FUNDING

3.1. The COUNTY will fund, administer, staff, operate and maintain the PCC to accomplish the directives set forth in this Agreement.

3.2. The COUNTY will be responsible for all funding, as becomes available, for implementation, operation and maintenance of the ATMS / ITS features on the ATMS / ITS corridors.

3.3. Following transfer of ATMS / ITS corridors, the COUNTY will assume all capital cost for signal upgrades or new signal construction. If the signal is included as part of a separate road improvement, land development or other transportation project, funding will be from the project source of funds.

3.4. Following transfer of ATMS / ITS corridors to the COUNTY, the COUNTY will assume all operation and maintenance costs related to all traffic control devices and ATMS / ITS devices.

3.5. Following transfer of ATMS / ITS corridors the COUNTY agrees to be responsible for and pay utility bills for traffic control devices and ITS devices only. Utility bills for streetlights or other features are excluded from COUNTY responsibility.

3.6. Following transfer of ATMS / ITS corridors the COUNTY shall contract with the CITY for city forces to maintain all the traffic signals on the ATMS / ITS corridors, within the city limits of Clearwater. Some ATMS / ITS and non-ATMS / ITS signals may also be contracted to the CITY or transferred to the COUNTY, as mutually agreed upon, for purposes of economy, location or staffing availability. The contract rate will be directly tied to the standard flat rate maintenance charges utilized by the COUNTY for their signal maintenance contracts. All maintenance contracts shall utilize standardized Level of Service criteria. See Exhibit “A1”

3.7. The CITY shall continue to maintain all traffic signals, vehicle detection systems and communications network on all roadways that have not been transferred to the COUNTY. All costs associated with these responsibilities will be the CITY’S expense.

3.8. The CITY will continue to fund, administer, operate and maintain the CITY’S Traffic Operations Center (TOC) and existing MTCS-PC signal system. All costs associated with these maintenance responsibilities will be the CITY’S expense.

3.9. Upon execution of this Agreement the COUNTY will fund future modifications required to utilize the TOC as the secondary control center and backup location to the PCC. Any design, building modifications, equipment, software or communications infrastructure funds budgeted prior to execution of this Agreement will continue to be funded through existing sources.

3.10. The COUNTY will continue to fund, administer operate and maintain the existing MTCS-PC signal system in all areas of the County except the City’s of Clearwater and St.

Petersburg. All costs associated with these responsibilities will be the COUNTY'S expense.

3.11. There shall be no reimbursement or replacement for funds expended or budgeted for the ATMS / ITS implementation prior to execution of this agreement.

SECTION 4
PINELLAS COUNTY RESPONSIBILITIES

4.1. The COUNTY will exercise the necessary power, privilege and authority to accomplish countywide regional transportation management by operation of traffic signals and related intelligent transportation systems on the ATMS / ITS system.

4.2. The COUNTY will manage, operate and maintain the PCC through the County Public Works Department under the County Administrator. The functional management structure is defined in Exhibit "A1".

4.3. The COUNTY will provide all engineering and operational studies, signal system timing and make all traffic control determinations for ATMS / ITS corridors once they are transferred to the COUNTY.

4.4. The COUNTY will be the sole local government to negotiate public / private partnership agreements as related to the ATMS / ITS system. This includes companies that may provide infrastructure systems, components, or emerging technology in return for proprietary data that can be utilized for pay or premium services. This does not include agreements made by the CITY relative to equipment and services owned by the CITY.

4.5. The COUNTY Public Works Director will participate as an active member of the PCC Advisory Committee as outlined in Exhibit "A1". The COUNTY Public Works Director will chair the PCC Advisory Committee.

4.6. The COUNTY shall adhere to all standards set forth in the "Standard Operating Guidelines and Functional Management Structure for ATMS / ITS System", Exhibit "A1". The COUNTY agrees that the PCC Advisory Committee shall review, comment and approve all modifications to this document.

4.7. The COUNTY shall provide a CITY REPRESENTATIVE to be a liaison to the CITY for coordination of local issues. Should an existing CITY employee initially fill the position, the COUNTY would provide funding to the CITY for reimbursement of employee salary burdens through a separate inter-local agreement. Job duties are described in Exhibit "A1".

4.8. The COUNTY shall be the Primary Project Manager for design of all ATMS / ITS corridor projects and in prioritizing implementation of these systems. All projects will be built to specifications established by the COUNTY or FDOT.

4.9. Following transfer of an ATMS / ITS corridor any new traffic signals installed on transferred roadway within the city limits of Clearwater shall be paid for by the COUNTY, excluding state roads. Mast arm type signals will be utilized, including the CITY'S choice of color, unless circumstance or design limitations would preclude this type of installation. Other esthetic or decorative items will be handled through a separate Joint Project Agreement (JPA). Upon completion the maintenance will be contracted to the CITY as per section 3.6 and 5.3.

4.10. The COUNTY will provide and own the fiber-optic communication lines that constitute the countywide ATMS / ITS communication network trunk line. This excludes any CITY owned fiber-optic lines.

4.11. The COUNTY will involve the CITY in design, project meetings and plan reviews for all ATMS construction projects within the CITY limits.

4.12. The COUNTY will maintain close coordination with CITY fire and police agencies relative to operation and maintenance of traffic signals and preemption devices within the city limits. The CITY REPRESENTATIVE will be the primary contact for these agencies.

SECTION 5
CITY OF CLEARWATER RESPONSIBILITIES

5.1. The CITY Public Works Administrator will participate as an active member of the PCC Advisory Committee as outlined in Exhibit "A1".

5.2. The CITY shall adhere to all standards set forth in the "Standard Operating Guidelines and Functional Management Structure for ATMS / ITS System", Exhibit "A1". The CITY agrees that the PCC Advisory Committee shall review, comment and approve all modifications to this document.

5.3. The CITY may, at their own expense, house CITY staff members at the PCC. Operation and Maintenance Costs will be established through a separate agreement. In lieu of annual payment, the local contributions already made to the overall ATMS / ITS implementation will be deemed satisfactory compensation to offset annual payment until such costs exceed the CITY'S initial $3.8 million contribution.

5.4. The CITY agrees to provide maintenance for mutually agreed upon ATMS and non-ATMS traffic signals, as outlined in Section 3.6 of this agreement.

5.5. The CITY agrees to utilize the CITY'S TOC, located in the Municipal Services Building, as a secondary control center and the backup location for the ATMS / ITS computer network, unless or until other mutually agreed upon provisions for back up are established.

5.6. The CITY may participate in ATMS / ITS corridor projects within or near the city limits including plans review, project meetings and construction coordination.

5.7. The CITY shall continue to operate and maintain the existing MTCS-PC signal system. This includes hardware and software maintenance, staffing at appropriate locations and signal timing plan development.

5.8. Following transfer of a ATMS / ITS corridor the CITY grants to the COUNTY permission and permit to use any CITY public rights-of-way or easement needed for maintenance of traffic signals, ATMS, ITS or communications facilities on those corridors.

5.9. Nothing in this agreement affects existing CITY duties or responsibilities for funding, traffic control or other CITY jurisdiction on any and all non-ATMS / ITS corridors.

SECTION 6
SPECIAL PROVISIONS

6.1. Upon execution of this Agreement, the existing Pinellas County Traffic Control Center, located on US 19, will operate as the PCC and be so designated.

6.2. The PCC staff and the CITY will coordinate efforts for all CITY special events. Each event will be studied to determine whether the impact of the event is better handled by the local TOC, PCC, or a combination of both. To the extent possible, events where there will be PCC involvement the CITY REPRESENTATIVE will coordinate and operate event related activities at the PCC.

6.3. The PCC will provide control access to the CITY for local ITS activities including parking information, special event management and other situations where utilizing ATMS / ITS devices provide benefit to the citizens of the CITY and the COUNTY. The PCC may, if circumstances dictate a higher level of need, supercede CITY control to utilize ATMS / ITS equipment for appropriate response. Such instances would include detection of an incident, emergency response, or other emergency level situation.

SECTION 7
MISCELLANEOUS PROVISIONS

7.1. Any amendment to or modifications of this Agreement or any alteration, extension, supplement or change of the time or scope of the work shall be in writing and signed by both parties.

7.2. This Agreement shall be governed and construed in accordance with the laws of the State of Florida.

7.3. Nothing herein shall be construed to create any third party beneficiary rights in any person not a party to this Agreement, nor to increase the liability of the COUNTY to third parties under any theory.

7.4. If any word, clause, sentence or paragraph of the Agreement is held invalid, the invalidity shall not affect other provisions of the Agreement which can be given effect without the invalid provision, and therefore the separate provisions of this Agreement are severable.

7.5. This document embodies the whole Agreement of the parties. There are no promises, terms, conditions or allegations other than those contained herein and this document shall supersede all previous communications, representations and/or agreements, whether written or verbal, between the parties hereto.

7.6. This Agreement shall be binding upon the parties, their successors, assigns and legal representatives.

7.7. The parties will offer each other full cooperation in the transition phase as well as throughout the term of this Agreement.

SECTION 8
FISCAL FUNDING CLAUSE

In the event that sufficient budgeted funds are not available for a new fiscal period, the COUNTY shall notify the CITY by January 1st of the fiscal year prior to such an occurrence and the Agreement shall terminate on the last day of the then fiscal year period without penalty or expense to the COUNTY.

SECTION 9
EFFECTIVE DATE AND TERMINATION

This Agreement shall take effect upon the County identifying funds for purposes of this agreement followed by execution by the parties and filing with the Clerk of the Circuit Court for Pinellas County, Florida. This Agreement shall be effective for a period of ten (10) years from the date of execution. This agreement may be renewed subject to execution of a written renewal agreement between the COUNTY and CITY. Each renewal period may not exceed (10) years. There is no limit to the number of renewals unless so specified in a subsequent renewal agreement. This Agreement shall be terminated upon mutual consent of the parties or by either party, upon formal written notice received prior to January 1st of any calendar year with termination becoming effective October 1st of the same calendar year.

IN WITNESS WHEREOF, the parties hereto have caused these present to be executed by their duly authorized officers, and their official seals hereto affixed, the day and year first above written.

ATTEST:
Ken Burke:

By:______________________________
Deputy Clerk

PINELLAS COUNTY, FLORIDA,
by and through its
Board of County Commissioners

By:______________________________
Chairman

Countersigned:

By:______________________________
Mayor-Commissioner

CITY OF CLEARWATER, FLORIDA,

By:______________________________
City Manager

ATTEST:

By:______________________________
City Clerk

APPROVED AS TO FORM

____
OFFICE OF THE COUNTY ATTORNEY

APPROVED AS TO FORM

____
OFFICE OF CITY ATTORNEY

Pinellas County Regional Transportation Management Center

Standard Operating Procedure Manual and Functional Management Structure for ATMS / ITS System

Exhibit “A1”

Table of Contents

Figure and Tables

I. Introduction:

The Pinellas Countywide Primary Control Center (PCC), also known as the Pinellas County Regional Transportation Management Center was created to manage and operate the Countywide Advanced Traffic Management System (ATMS) and the related Intelligent Transportation Systems (ITS). The system is comprised of major arterials and thoroughfares within Pinellas County that cross jurisdiction boundaries impacting countywide regional travel.

The goals and objectives of the PCC are to utilize the ATMS / ITS systems to provide the most efficient use of the countywide roadway network through corridor management and related ITS services. The PCC is responsible for implementing traffic control strategies along major corridors so they operate seamlessly across jurisdictional boundaries. This includes utilizing ITS devices to provide comprehensive data necessary for incident detection and traveler information.

II. Functional Management Structure:

Pinellas County will manage, operate and maintain the PCC through the County Public Works Department under the County Administrator. The following describes the functional management structure of the system (See Figure 2). Although not specifically discussed the Metropolitan Planning Organization's ITS Committee will play an interactive role with the PCC in development of the Pinellas County Regional ITS Plan.

The management structure for the PCC staff is shown for initial completion of ATMS Phase 1. Additional positions will be required as the system size and tasks increase. Under the full build scenario approximately 8 total positions will be required. Pinellas County will employ all personnel.

The following defines the different positions involved in operation and management of the PCC.

A. PCC Advisory Committee:

The initial representation on the committee will be the Director of Public Works for Pinellas County, the Public Works Administrator for the City of Clearwater and a representative of the FDOT. The COUNTY Director of Public Works will be the chairman of the committee. Additional representatives may be added as determined by the committee members. The Advisory Committee will be a review / policy Committee to the PCC. The functions of the Advisory Committee are as follows:

1. Appoints the PCC Manager.
2. Reviews and recommends approval of operating guidelines, protocols and overall countywide traffic management strategies.
3. Responsible for review, comment and adoption of changes to the PCC – Standard Operating Procedures Manual.

4. Reviews work program submittals and project funding requests. Verifies consistency with overall priorities of the ATMS / ITS implementation.
5. Shall be responsible for resolving any disputes or disagreements concerning standard operating guidelines and administrative issues.
6. The committee will determine the make up, level and representation of the PCC Advisory Committee.
7. Recommends which traffic signals the COUNTY will contract or transfer for maintenance responsibilities.

The Advisory Committee will meet on a regular basis, as determined by the Advisory Committee, to conduct its business.

The following positions are required for staffing the PCC for the initial completion of ATMS Phase 1.

PCC Manager: (1)
PCC Traffic Management Operators (2)
City Representative (1)
Clerical Assistant (1)

A brief job description for these staff positions is as follows:

B. PCC Manager: (1)

1. Responsible for attaining the goals and objectives of the PCC including corridor management and ITS services.
2. Responsible for overseeing the day-to-day operations of the PCC.
3. Supervision of all PCC staff.
4. Shall perform hiring and evaluations of PCC staff members.
5. Responsible for developing Standard Operating Guidelines for the PCC.
6. Develops and oversees PCC yearly budget.
7. Develops and manages ATMS / ITS implementation work program.
8. Responsible for proper management of contracts for expansion and enhancement of the system.
9. Provides coordination between government agencies, emergency services, media, information service providers and other transportation management centers on ATMS and ITS services.
10. Coordinate with the ITS Committee to ensure consistency of the ATMS and ITS services with the Pinellas County ITS Plan.

C. ATMS / ITS Transportation Specialist (2) – City Representative will occupy an equivalent position.

1. Operate the ATMS / ITS system on a daily basis.
2. Receive and handle complaints.
3. Coordinate with municipalities on signal operations concerns.
4. Coordinate with municipalities on special events.
5. Make adjustment to system for optimum efficiency and performance.

6. Determine appropriate actions when incidents are detected.
7. Coordinate and participate in incident management with emergency services dispatch.
8. Contact and dispatch maintenance personnel to equipment failures.

D. City Representative:

1. The primary duty of a City representative is to be a City's liaison to the PCC. This would include, but not limited to, primary contact point for City questions, comments and concerns related to traffic signals and ITS devices within the municipal boundaries, local representation to a City for coordination meetings on special events, traffic signal operations, ITS operations, and interaction between the City Traffic Operations Center and the PCC.
2. The City representative will be a staff member of the PCC and work under the supervision of the PCC Manager to obtain the overall goals of the ATMS / ITS System. This includes working on any part of the ATMS / ITS system as needed to accomplish countywide operation of traffic signals and intelligent transportation system devices, disregarding municipal boundaries.
3. Other duties as described under the ATMS / ITS Transportation Specialist.

E. Clerical Assistant (1)

1. Perform clerical duties for PCC staff.
2. Perform purchasing and time keeping for PCC.

III. Operation and Management Guidelines:

The PCC is defined as the location where management and operation of the Countywide Regional ATMS / ITS system will occur. The objective of the PCC is to provide countywide corridor management and related ITS services for consistency and accountability. This location will provide for these objectives based on the following guidelines. From time to time this document will be updated to reflect new guidelines, operational strategies and ITS services. The PCC will be responsible for:

1. Network monitoring for processing and disseminating real-time traffic data, such as traffic volumes, speeds, and video images.
2. Implementing traffic control strategies along major corridors operating seamlessly across jurisdictional boundaries and providing the most efficient operation.
3. Implementing incident management strategies to facilitate quicker incident response and minimize impact on transportation network due to road and lane closures.
4. Provide coordination with other agencies that may also be implementing ITS strategies and devices that may impact the operation of the regional transportation

FUNCTIONAL MANAGEMENT STRUCTURE For PINELLAS COUNTY REGIONAL TRANSPORTATION MANAGEMENT CENTER (PCC)

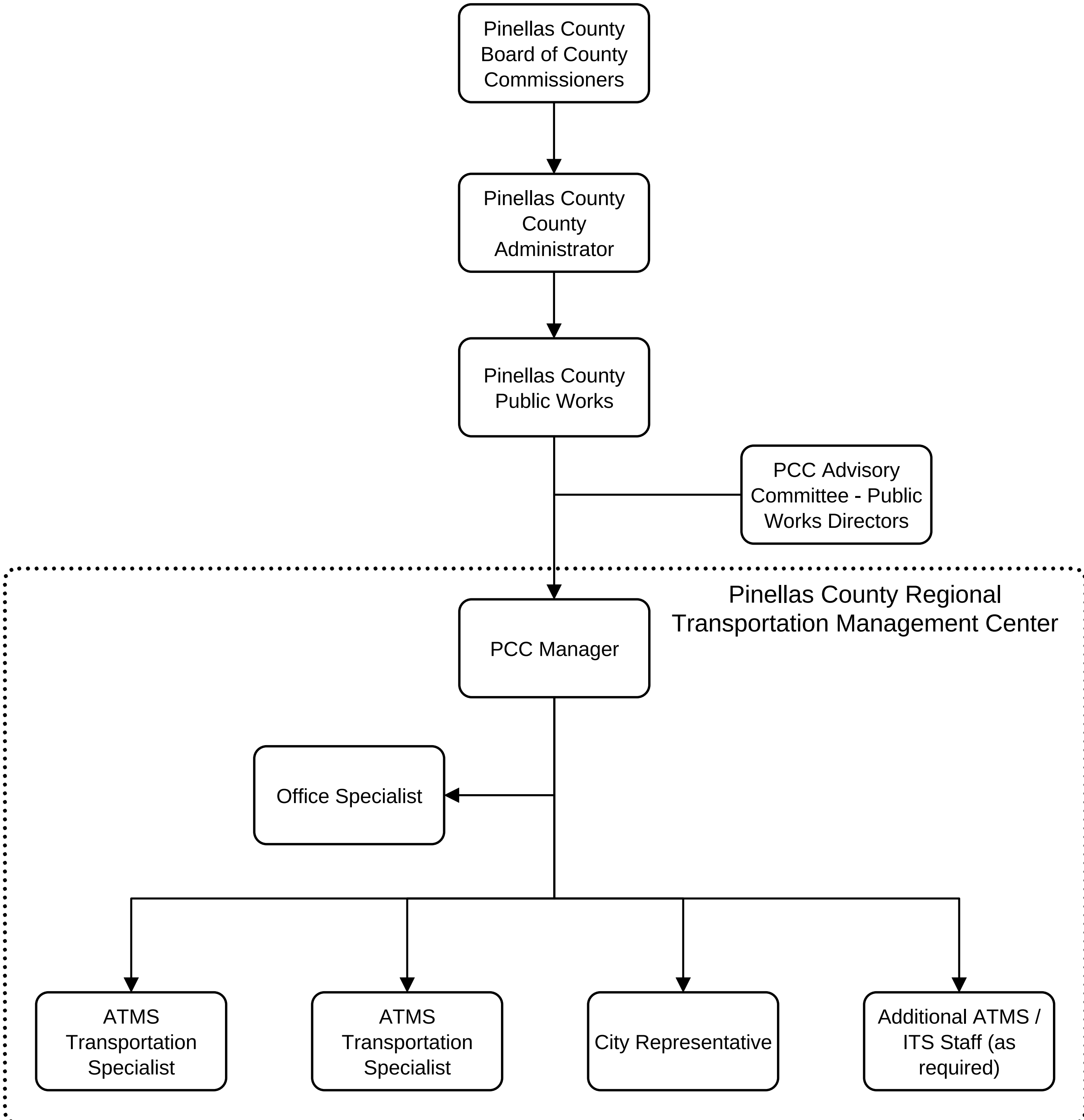


Figure 1

network. These agencies may include transit, emergency service dispatch and the FDOT.

5. The PCC will monitor response activities and provide coordination for planned events that impact countywide regional travel.
6. Collecting and disseminating traveler information through Dynamic Message Signs, web sites, etc. In addition, the PCC will serve as a central point of contact for the media, information service providers, and other regional traffic management centers.
7. Archiving and storing traffic information.
8. The PCC will work with other local jurisdictions on questions, comments and concerns related to traffic signals and ITS devices within their jurisdiction. The PCC staff will provide representation to the local jurisdictions for coordination meetings on special events, traffic signal operation and design, Intelligent Transportation System operations, and interaction between locally controlled intersections and the ATMS.
9. The PCC will be responsible for ATMS / ITS services as may be developed and added to the system.
10. The PCC will be the lead agency to prioritize and manage a work program to expand and enhance the ATMS and related ITS system. Staff will coordinate local municipalities, the Florida Department of Transportation and the Pinellas County Metropolitan Planning Organization to evaluate other work programs where ATMS or ITS related components may be incorporated to aid in expansion of the ATMS.
11. The PCC Staff will be the primary project manager for all current and future design, construction or implementation projects for the ATMS / ITS system, disregarding where funding is obtained.
12. The PCC will be the lead agency in developing public / private partnerships for the beneficial expansion, utilization or enhancement of services provided to the public. This may include, but not limited to, companies that may provide infrastructure systems, components, or emerging technology in return for proprietary data that can be utilized for pay or premium services.

IV. Maintenance Standards and Guidelines:

The PCC will be responsible for maintaining all aspects of the ATMS / ITS network. The maintenance function will be divided into several areas to best accommodate the overall network. The following is a basic outline of those functions and what entity will perform the maintenance functions. Where specific standards are available they are listed herein.

A. ITS Devices:

Pinellas County will be responsible for maintaining all ITS devices once they have been installed. ITS devices include all devices attached to the ATMS / ITS system, excluding traffic signals. They may include CCTV cameras, Dynamic Message Signs (DMS), trail blazer signs and system communications cable.

B. Traffic Signal Maintenance:

Following transfer of ATMS / ITS corridors Pinellas County will be responsible for maintaining all traffic signals on those roads. The County will execute this function is several possible ways. They include:

1. The County may contract traffic signal maintenance to any city that has an existing traffic signal shop and desires to provide these services. They shall be maintained by the same service and maintenance standards as defined in this exhibit. The contract rate will be established and authorized through a separate contract. The PCC Advisory Committee will determine which signals should be contracted to the City for maintenance.
2. The County will maintain traffic signals on transferred ATMS / ITS corridors in municipalities that have no established traffic signal shop and will eliminate the flat rate maintenance cost currently being paid by those cities.
3. Contracts maybe let by the County for certain aspects of traffic signal maintenance that may be beneficial to the operation of the ATMS / ITS network. (i.e. a loop maintenance contract). The maintaining entity may opt out of these contracts if they can perform the function at the same level as defined within the contract scope and requirements.

C. Traffic Signal Maintenance – Levels of Service Standards:

The following is a list of existing levels of service standards for maintenance of traffic signals that are part of the ATMS / ITS network.

1. All signals must be maintained as per FDOT maintenance guidelines.
2. All signals will have preventative ground maintenance performed at a minimum of twice a year. This includes checks of all signal equipment including loops, controller settings, cabinet wiring and grounding.
3. All signals will have preventative aerial maintenance performed, at a minimum, of once a year. This includes checks on all overhead wiring, signal head and pole and mast arm connection inspections.
4. All signal malfunctions received during regular work hours will be dispatched immediately after receiving call.
5. All signal malfunctions will have a one- hour response time after hours by the standby personnel.
6. All inductance loop repairs will be done within 48 hours of notification.
7. In the event of a reported power outage a technician will be dispatched immediately during normal working hours and one-hour response time after hours by standby personal to confirm the outage.

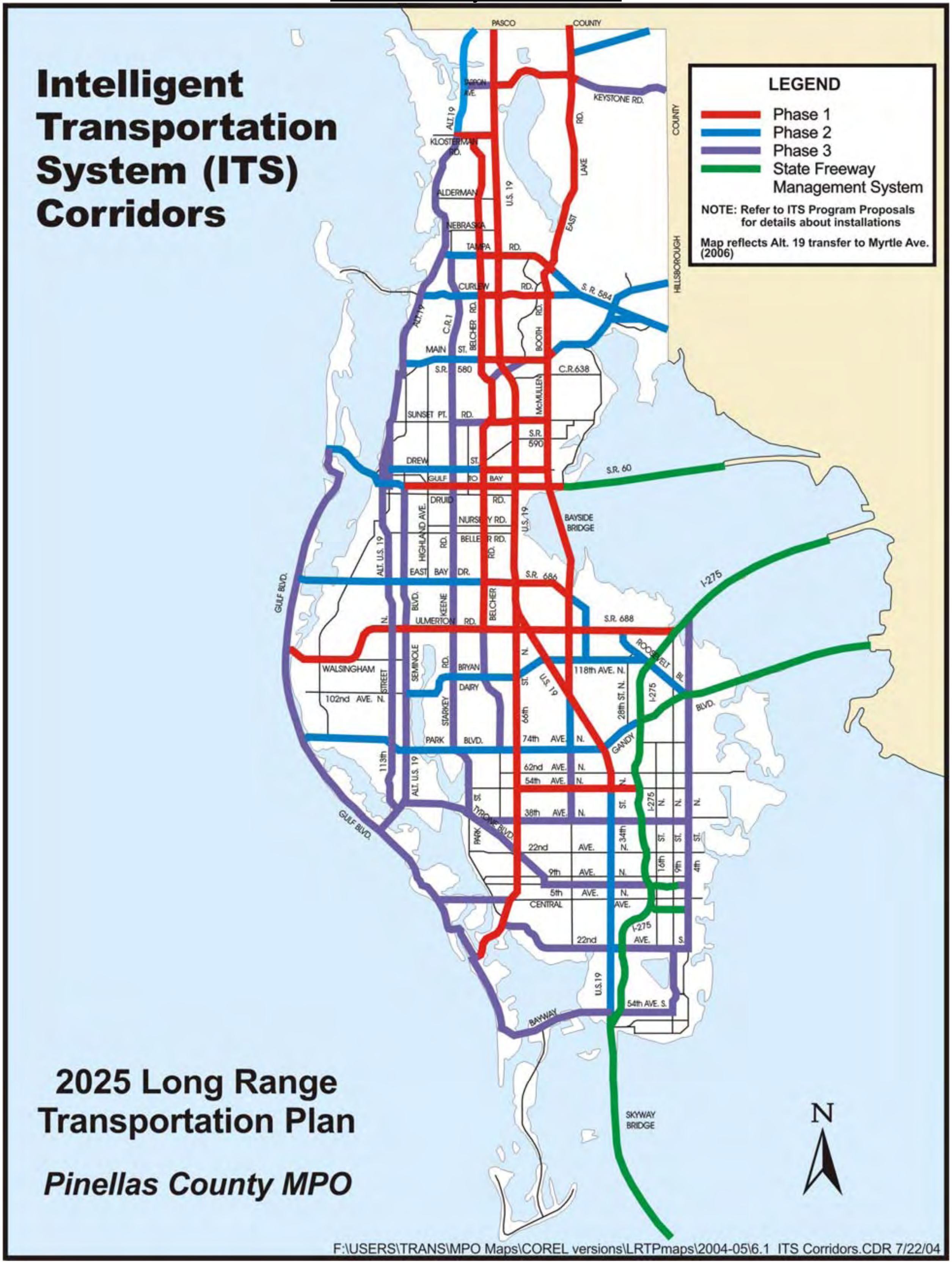
8. All conflict monitors will be checked on the bench and certified semi-annually with a documented maintenance form.

ATMS / ITS System Network

Exhibit “A2”

Exhibit "A2"

ATMS / ITS System Network



STEPS TOWARD ENHANCING PEDESTRIAN SAFETY: THE PEDESTRIAN SAFETY AND ACCESS MARKET PACKAGE

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ABSTRACT

As part of the Tampa Bay Regional ITS Architecture (TBRIA) Update project currently being administered by the Florida Department of Transportation (FDOT), PB Farradyne, a Division of Parsons Brinckerhoff Quade & Douglas Inc., developed a customized market package named *Pedestrian Safety and Access* to enhance pedestrian safety in the Tampa Bay region. The project Team is currently interacting with the National ITS Architecture (NITSA) committee members and the ITS community at large for addition of this market package to the NITSA so that other regions could benefit from this research. The *Pedestrian Safety and Access* market package development process included the following tasks:

1. An outreach process to assess pedestrian safety problems in the region.
2. A literature review and interviews with various public agencies with experience in pedestrian ITS technologies to define pros and cons of each technology and classify technologies under broad functional areas.
3. Develop pedestrian safety functional areas and associated requirements.
4. Review the Version 3.0 of the NITSA to examine "what's out there" in terms of pedestrian related data flows.
5. Develop an equipment package to deliver the identified advanced pedestrian functions and a top-level market package based on dataflows to and from various ITS subsystems and terminators.
6. Interact/coordinate with the NITSA committee and the other members of the ITS community for addition of this market package under the NITSA.

In essence, this paper provides conceptual details of a customized *Pedestrian Safety and Access* market package, developed for the Tampa Bay region with a potential for broader applications in many other regions with pedestrian safety problems. Further research work is needed to add and/or refine functional areas, specify requirements, and develop on the pedestrian safety market package concepts outlined in this paper.

BACKGROUND

The Tampa Bay Regional ITS Architecture (TBRIA) was developed in the year 1999 through extensive stakeholder outreach sessions participated by the Florida Department of Transportation (FDOT) District 7, Pinellas County, Hillsborough County, Hernando County, Pasco County, and Citrus County representatives (1, 2). During outreach sessions, several of the Tampa Bay's major stakeholders expressed concerns regarding high pedestrian accidents in the region, and as a result, a customized market package named "*Pedestrian Safety and Access*" was conceived. As part of the TBRIA Update project initiated by the Florida Department of Transportation (FDOT) in 2001, PB Farradyne, a Division of Parsons Brinckerhoff Quade & Douglas Inc., developed a market package called the "*Pedestrian Safety and Access*," as a safety countermeasure.

The Tampa Bay primary stakeholders have shown a keen interest in deploying ITS technologies to enhance pedestrian safety and improve operational efficiency along intersection crossings, crosswalks, and pedestrian malls. To gauge the seriousness of the pedestrian safety problems, stakeholders considered the following pedestrian safety statistics reported by the *Insurance Institute for Highway Safety*, *Highway Loss Data Institute*, and *National Highway Traffic Safety Administration (NHTSA)*:

- Nationwide, there were 5220, 4906, and 4739 pedestrian fatalities in 1998, 1999, and 2000, respectively. In 2000, there were 78,000 pedestrians injured in traffic accidents.
- In the year 2000, 492 pedestrian fatalities occurred in Florida.
- Sixty-eight percent of the pedestrian fatalities in 1999 and 2000 occurred in urban areas. However, the ratio of deaths to injuries is higher in rural areas because of higher impact speeds on rural roads.
- In 2000, on an average a pedestrian was killed in a traffic crash every 101 minutes, more than two-thirds of those killed were males, and a pedestrian was injured every 7 minutes.
- Almost one fourth of the children between five and nine year old killed in traffic crashes in 2000 were pedestrians. Forty-two percent of all young pedestrian fatalities (under 16) occurred between 4 PM and 8 PM.
- Older pedestrians (ages 70+) accounted for 17 percent of all pedestrian fatalities and 6 percent of all pedestrians injured.

Although pedestrian fatalities have been declining since 1975, the above statistics were alarming enough to warrant the development of a "*Pedestrian Safety and Access*" market package for the Tampa Bay region. Since this market package is not a part of the National ITS Architecture (NITSA), there were no functional areas or requirements identified, neither were dataflows, or any traceability to the NITSA (3) for logical architecture or physical architecture entities. This paper documents the development of a top-level architecture for the proposed *Pedestrian Safety and Access* market package focusing on the following three basic functional areas developed through a review of the current literatures and stakeholder needs namely: (i) ensure safe crossings of <u>all types</u> of pedestrians through advanced pedestrian crossing technologies, (ii) avoid/reduce severity of pedestrian-vehicle collisions, and (iii) prioritize pedestrian movements to reduce waiting times. The technology review identified the types of pedestrian safety enhancing ITS technologies currently deployed and mapped them into the three major functional areas. Detailed functional requirements were developed under each of the three functional areas

followed by the development of a top-level physical architecture with major dataflows linking terminators to ITS subsystems. A conceptual equipment package called "Advanced Pedestrian Crossing" was recommended to deliver various identified functions.

TECHNOLOGY REVIEW

A review of the various technologies available to enhance pedestrian safety and provide a higher level of service to pedestrians was conducted as a precursor to the development of the proposed *Pedestrian Safety and Access* market package. An assessment of these technologies were undertaken to group them under various functional areas and determine the need for a new equipment package to develop the proposed *Pedestrian Safety and Access* market package. Although deployment of pedestrian ITS technologies are limited nationwide, several types of ITS technologies were identified.

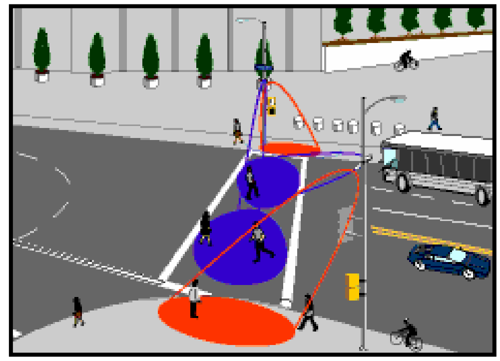
PEDESTRIAN SAFETY ITS TECHNOLOGIES

The most common type of pedestrian signal technology deployed throughout the United States consists of pedestrian signal heads indicating "Walk/Don't Walk," activated by pedestrian push buttons generally placed at each street corner with each pushbutton wired to display a particular pedestrian phase. While this generic pedestrian technology may suffice at locations where pedestrian activity is low, it may not offer adequate safety and operational efficiency under the following conditions:

- Presence of a high number of pedestrians prevalent in metropolitan cities or generated during special events.
- Presence of physically or visually challenged pedestrians.
- Reduced visibility of crosswalks at night or during low light conditions.
- Inadequate roadway geometric conditions with a limited sight distance, unusual grade etc.
- Adverse environmental conditions such as heavy precipitation, fog, snow/ice, storm, and hurricane.

To ensure safety of all types (typical, visually/physically challenged) of pedestrians during the above conditions and enhance safety and operational efficiency at all crosswalk locations, several types of new technologies have been developed as discussed below.

The presence of a pedestrian at a crossing could be detected by manually pushing a call button or by automated advanced detection devices. These advanced devices can continually monitor a crosswalk providing information to the controller as to when pedestrians are waiting to cross and times when the crosswalk is clear of pedestrians so that normal vehicular phases could be restored. The pedestrian detection information could also be used to extend the time of a pedestrian signal to ensure accommodation of slower moving or visually/physically challenged pedestrians to ensure crossing safety. The signal controller can provide a number of other functions using ITS technologies such as illuminated pushbuttons to provide an immediate feedback to the pedestrian that the crossing call has been registered, animated eyes display to remind the pedestrian to look both ways prior to crossing, and countdown signals to let the pedestrian know how much time is remaining to safely cross the road (4,5,6).



Microwave Pedestrian Detectors

In- Pavement Lighting Systems

The pedestrian ITS technologies mentioned above are all designed for the sighted pedestrians and a different set of technologies are needed to accommodate visually challenged pedestrians. A feedback to the visually challenged pedestrians that the pedestrian signal is in the "Walk/Don't Walk" phase or the time remaining for a safe crossing could be provided with various types of auditory signals. Finally, when a pedestrian is either in or about to step into a crosswalk, an in-pavement lighting system could be automatically activated to alert approaching vehicles as to the presence of the pedestrian (7,8). All of these above technologies could be integrated under the proposed *Pedestrian Safety and Access* market package.

A summary of various types of pedestrian ITS technologies along with brief deployment information is provided in Table 1.

Table 1: Summary of Deployment of Pedestrian ITS Technologies

Type of Pedestrian Technology	***Place/State***	***Brief Description /Contact***	***Other Locations***
Animated Eyes Display	Clearwater, FL	The City of Clearwater has installed animated eyes display technology at two locations: Cleveland Street/Garden Avenue, and Cleveland/Ft. Harrison Avenue.	
In-Pavement Lighting	Orlando, FL	The City of Orlando in 1997 installed a prototype of LightGuard™ technology on Livingston Street just west of the downtown Orlando. The crosswalk connects a major hotel to the Bob Carr Performing Arts Center and the Orlando Arena	Pemberton, NJ

Type of Pedestrian Technology	***Place/State***	***Brief Description /Contact***	***Other Locations***
		Contact: Harry Campbell, City of Orlando; Phone: (407) 246-3255	
In-Pavement Lighting/ Illuminated Crosswalks	Kirkland, WA	The City of Kirkland has installed LightGuard System™ of in-pavement lighting at two locations –Central Way and 4th Street and NE 124 Street at the North Kirkland Community Center. Contact: Mr. David Godfrey – dgodfrey@ci.kirkland.wa.us	Santa Rosa, Fort Bragg, Lafayette, West Hollywood, Willits, Orinda, Petamula, CA Reno/Tahoe, NA Seattle, Lynwood, University Place, WA
Infrared/Microwave Pedestrian Detection	Portland, OR	The City of Portland uses a number of pedestrian ITS technologies including infrared and microwave detectors. The infrared detectors are installed at two locations for curbside pedestrian detection. Flashing beacons are used to warn motorists during pedestrian crossings. Microwave sensors, Smartwalk™ detectors, are currently installed at the NE Sandy Boulevard and 18th Avenue and are being used to extend pedestrian clearance intervals for pedestrians requiring additional crossing times. Contact: Mr. Bill Kloos kloos@trans.ci.portaland.or.us	Los Angeles, CA
Video Pedestrian Detection	Los Angeles, CA	As part of a video pedestrian detection field test, the City of Los Angeles installed one (1) camera at the corner of a signalized intersection. Using video recordings of pedestrian activities, results of the video detection were evaluated and declared as acceptable. This was the first application of its kind for both customer (Los Angeles Department of Transportation) and the video	

Type of Pedestrian Technology	Place/State	Brief Description /Contact	Other Locations
		manufacturer (Traficon, Belgium) Contact: Raul Deanda, City of Los Angeles; Phone: (213) 847-2943	

Sources:
1. United States Department of Transportation – FHWA Turner-Fairbank Highway Research Center
2. Traficon, Video Systems Manufacturer - Belgium

FUNCTIONAL AREAS AND REQUIREMENTS

The proposed *Pedestrian Safety and Access* market package was conceptually developed around the following three major functional areas, as identified in the previous section. The hierarchical functional requirements under each of the three functional area were identified for a top-level pedestrian safety ITS architecture development.

(i) ENSURE SAFE CROSSINGS OF ALL TYPES OF PEDESTRIANS

This functional area was envisioned to ensure that all types of pedestrians would be able to safely cross the street including those visually challenged, physically challenged, and the elderly. Therefore, to deliver this function, identification of appropriate advanced pedestrian detection technologies to detect and ensure crossing safety of all types of pedestrians by means of pre-crossing and enroute-crossing pedestrian information, and extension of the “Walk” clearance phase to assist the slower moving pedestrians would be pertinent.

A number of pedestrian ITS technologies currently exist but there is a need for more, and even more significant is the integration of these technologies to deliver this function. For example, technologies exist that can automatically detect the presence of a pedestrian(s) and relay this information to the traffic signal controller and/or to a Traffic Management Center (TMC). Along with various automated pedestrian detection devices, this functional area also covers the technologies used to relay safety information to pedestrians such as animated eyes display, countdown signals, and illuminated pushbuttons but new technologies are needed to provide automated “Walk” clearance phase extensions and other specific pedestrian/driver safety advisories. To summarize, ITS technologies to support this functional area include:

- Pedestrian detection: push buttons and automated pedestrian detection devices including infrared, microwave, and video detectors.
- Pre-crossing safety information: illuminated pushbuttons, accessible (audible) signals for the visually challenged, and safety advisories to pedestrians and drivers.
- Enroute-crossing pedestrian safety information: countdown signals and automated “Walk” clearance phase extension for accommodation of slower pedestrians.
- Pre-crossing/enrooted-crossing safety advisory information: animated eyes to remind pedestrians to look for turning vehicles and safety advisories to pedestrians and drivers.

Based on the above discussion, the following functional requirements were derived:

Functional Area: 1.0 Ensure safe crossings of all types of pedestrians through advanced pedestrian crossing technologies
Functional Requirements:
1.1 Detect/count pedestrians
1.1.1 Detect/count normal paced pedestrians
1.1.2 Detect/count slower paced pedestrians
1.2 Implement safe pedestrian crossing phase
1.1.3 Relay detection/count data to controller and/or Traffic Management Center (TMC)
1.1.4 Request appropriate pedestrian crossing phase
1.1.5 Provide safety advisories to pedestrians
1.1.6 Implement special "Walk" clearance phase or extend existing pedestrian phases
1.1.7 Display reminder to look for approaching turning vehicles
1.1.8 Display time remaining for safe crossing
1.1.9 Provide pedestrian safety advisories to drivers

(ii) AVOID/REDUCE SEVERITY OF PEDESTRIAN-VEHICLE COLLISIONS

The accident avoidance technologies could be either vehicle based, or roadway based, or a combination of both. A number of technologies currently exist but there is a need for new roadside based technologies for providing pedestrian safety advisories to motorists, and most importantly, integration of vehicle/roadside based technologies. The roadway-based technologies are implemented to draw attention to a pedestrian in a crosswalk (e.g., in-pavement lighting) or through roadside specific (not generalized) safety alerts to passing vehicles. The vehicle-based technologies provide for a better visibility with an on-board night vision system or an obstacle detecting infrared system for collision avoidance, to name a few. This functional area would integrate roadside based safety/collision avoidance technologies with the Advanced Vehicle Safety Systems (AVSS) technologies.

The ITS technologies needed to support this functional area include:

- Roadway based collision avoidance: in-pavement lighting systems designed to warn vehicles of crossing pedestrians and automated roadside pedestrian/driver safety advisories.
- Vehicle based collision avoidance: on-board pedestrian collision avoidance systems such as night vision, obstacle detection, etc.
- Vehicle based severity reduction: technologies deployed during a pedestrian-vehicle collision such as an impact based vehicle hood release system to reduce pedestrian severity.

Based on the above discussion, the following functional requirements were derived:
Functional Area 2.0: Avoid pedestrian/motorist collisions and reduce severity to enhance overall pedestrian safety.
*2.1 Avoid/protect (reduce severity) pedestrians in case of collision - **Roadway***
2.1.1 Monitor pedestrian crossings and improve pedestrian visibility
2.1.2 Provide roadside specific safety alerts near pedestrian crossings
2.1.3 Detect pedestrians-vehicle collisions
2.1.4 Update pedestrian safety alerts

2.1.5 Relay collision information to Traffic Management Center

2.2 Avoid/protect (reduce severity) pedestrians in case of collision and reduce severity - ***Vehicle***
2.2.1 Deploy sensors for pedestrian/obstacle detection
2.2.2 Deploy night vision systems for visibility enhancement
2.2.4 Deploy advanced braking and steering for collision avoidance and/or severity reduction
2.2.3 Deploy in-vehicle sensors to release vehicle hood to reduce pedestrian injury (severity)

(iii) PRIORITIZE PEDESTRIAN PHASES TO REDUCE PEDESTRIAN WAITING TIMES

The prioritization of pedestrian movements for reduction of pedestrian waiting times at intersections and crossings is an important functional area but may not be applicable in all jurisdictions since prioritization of pedestrian movements affects the operational efficiency of the traffic signal system. The pedestrian phase prioritization could be provided through force-off or skipping of vehicular phases. Therefore, this functional area was considered separately and <u>not combined with the functional area (i),</u> as this function would be applicable to pedestrian friendly neighborhoods or as discretionary, case-by-case, deployments.

This functional area is based on the concept of prioritization of pedestrian phases through a real time comparison of average pedestrian count/waiting times being greater than a user selectable delay or pedestrian count threshold to warrant a particular level of prioritization. The following <u>preliminary</u> prioritization levels were identified:

- Level 1: If pedestrian count of less than five and average waiting time less than five minutes, then implement regular pedestrian phases but initiate monitoring of pedestrian signal operation for at least three cycles.
- Level 2: If pedestrian count greater than five and average waiting time greater than five minutes, then implement minor street phase force-offs to serve pedestrian phases.
- Level 3: If pedestrian count greater than 10 for the three successive signal cycles and average waiting time greater than five minutes, then implement minor/major street phase force-offs, pedestrian phase extensions, and initiate a Call-to-Non-Actuated (CNA) command to display "Walk" signal in every signal cycle phases. Extend the priority call to other signals in the corridor or in an area for possible coordination of pedestrian movements.

The technologies such as the following apply to this functional area:

- Pedestrian detection: pushbuttons and automated pedestrian detection devices including infrared, microwave, and video detectors.
- Pedestrian phase priority: new technologies are needed for pedestrian platoon image processing for the selection of a prioritization level and various pedestrian priority algorithms.

Based on the above, the following functional requirements were derived:
Functional area 3.0: Prioritize pedestrian phases to reduce pedestrian waiting times
Functional Requirements:
3.1Estimate pedestrian delay/waiting times

3.1.1 Detect/count pedestrians
3.1.2 Send detection time stamps and count information to controller and/or TMC
3.1.3 Estimate pedestrian waiting times

3.2 Reduce pedestrian delay through prioritization
3.2.1 Compare pedestrian waiting times and counts with pedestrian delay/count threshold
3.2.2 Select pedestrian priority level
3.2.3 Transmit pedestrian priority instructions from the TMC to local signal controller(s)
3.2.4 Implement and monitor prioritized pedestrian treatment

PEDESTRIAN SAFETY AND ACCESS MARKET PACKAGE

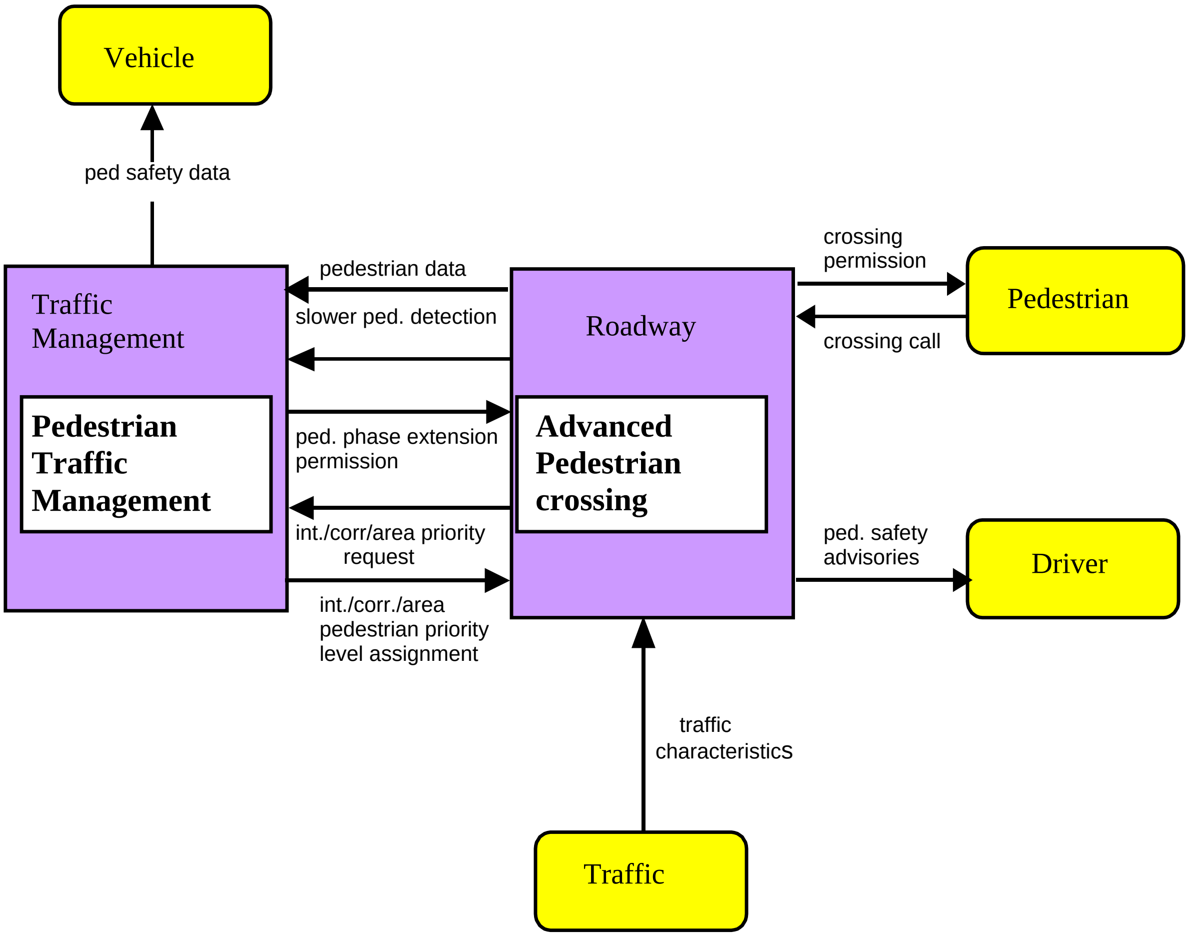
Based on the three major pedestrian related functions and associated functional areas discussed above, the proposed *Pedestrian Safety and Access* market package was developed using the key interrelationships among the various ITS architecture subsystems and terminators. The following major architectural entities were considered:

- Pedestrian –typical, visually/physically challenged (terminator)
- Vehicle (vehicle subsystem)
- Driver (terminator)
- Roadway –new advanced pedestrian crossing equipment package (roadway subsystem)
- Traffic (terminator)
- Traffic Management Center (traffic management subsystem)

A review of the NITSA, Version 3.0, conducted to assess how pedestrians are currently represented, found that only two types of pedestrian related dataflows are included as part of the roadway subsystem and *Surface Street Control* market package. The two basic dataflows represented were "crossing request call" and "crossing permission." This finding led to the conclusion that a new Advanced Pedestrian Crossing Equipment Package would be needed to accommodate the advanced pedestrian functions, including but not limited to, pedestrian detection and communications to ensure safe crossings of all types of pedestrians, pedestrian safety through integration of roadside/vehicle safety systems, and isolated, corridor, or areawide priority to pedestrians desired in high pedestrian locations.

This market package was envisioned to manage pedestrian traffic at intersections, crosswalks, and pedestrian malls where operational requirements dictate advanced pedestrian features. The advanced pedestrian information systems may be integrated with other Advanced Traffic Management Systems (ATMS) and Advanced Vehicle Control Systems (AVSS) market packages such as the Surface Street Control, Standard/Advanced Railroad Grade Crossing, Intersection Safety Warning, and Pre-crash Restraint Deployment. Figure 1 shows the conceptual *Pedestrian Safety and Access* market package diagram.

Figure 1: Conceptual Pedestrian Safety and Access Market Package



CONCLUSION

The conceptual *Pedestrian Safety and Access* market package presented in this paper is likely to undergo periodic changes in future as new functions/functional requirements are added and new pedestrian ITS technologies emerge and mature. This market package will be beneficial to not only the Tampa Bay region but also other regions experiencing pedestrian related safety problems or as a proactive measure to reduce pedestrian accidents. Efforts are underway to have this market package included under the National ITS Architecture. The final decision will be based on the NITSA committee recommendations. In case this market package is accepted, the NITSA committee is likely to conduct additional research and nationwide stakeholder outreach for input to the development of logical and physical architectures with detailed mappings to other referenced market packages. Additional functions and functional requirements may also emerge from such stakeholder interactions.

ACKNOWLEDGEMENT

This paper is based on the opinions and views of the author and not necessarily that of the agency administering the project (FDOT District 7). The author would like to acknowledge Jerry Karp of FDOT District 7 and Dan Baxter of PB Farradyne, a Division of Parsons Brinckerhoff Quade & Douglas, Inc., for their help during various phases of the Tampa Regional ITS Architecture Update project.

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APPENDIX B – PINELLAS COUNTY METROPOLITAN PLANNING ORGANIZATION TIMELINE OF ACTIONS FOR ATMS / ITS

Pinellas County Metropolitan Planning Organization
Timeline of actions for ATMS / ITS

September 10, 1997

- The MPO received a presentation from a FDOT consultant, Parson Brinckerhoff, concerning current initiatives and possibilities of ITS

May 13, 1998

- The MPO approved the use of ITS concepts as part of considered solutions for the Ulmerton Road corridor

January 13, 1999

- The MPO approved an initiative to be taken up by the Signal Committee for evaluating and upgrading the computerized traffic signal program

March 10, 1999

- The MPO requested additional information on the computerized traffic signal system to include a time line indicating money already spent on the system and a review of the system's potential
- The MPO agreed to establish a task force pursuing the its responsibilities for the ITS
- The MPO indicated that a general planning consultant be used to develop the concept plan for the countywide computerized signal system; the Signal Committee was authorized to direct the project, not to exceed $75,000

April 21, 1999

- The MPO reviewed the consultant selection schedule for the general planning consultant to be used in part for the signal project
- The MPO approved the use of PL funds

June 9, 1999

- The MPO accepted the consultant's Task 1 report describing and assessing the current countywide computerized traffic signal system
- MPO authorized the Scope for Tasks 2 and 3, an evaluation of available new systems and applications to Pinellas County
- The MPO stipulated that the MPO's Signal Committee will act as the steering committee for the project

December 8, 1999

- The MPO concluded that the present three separate traffic signal systems should be consolidated into one countywide system and that this objective be incorporated in the signal system evaluation project

February 9, 2000

- The MPO approved MPO Resolution #00-2,defining the MPO's willingness to ensure consistency with Federal ITS standards

April 12, 2000

- MPO approved TSMCC recommendations for priority corridors with Feasibility Study
- MPO approved Clearwater's request for $1.6 million CMAQ with $1.1 local match

June 14, 2000

- MPO approved concept of $1.5 million for head upgrade and connecting communications system as well the concept of the development of the Requirements Document for a Countywide system

July 12, 2000

- MPO recommended a joint workshop with the MPO, TSMCC members and other participants as appropriate

September 13, 2000

- MPO approved workshop recommendations including the initial corridors, computer head upgrade with connecting communications system, Requirements Document and ITS Committee membership.

October 11, 2000

- MPO approved the updated Section A of the Strategy Report and as per that report recommended that the BCC design the proposed Communications Center to accommodate the signal system as identified

November 8, 2000

- MPO approved Work Program change for the Requirements Document

May 9, 2001

- MPO approved the head upgrade with the connecting communications system

July 11, 2001

- MPO endorsed the recommendation of the RT-TRACS system for presentation to Clearwater and St. Petersburg

September 12, 2001

- MPO received for review draft Program Statement dated July 3, 2001.
- MPO approved the Requirements Document with the exclusion of the management section 2 which is being further deliberated with the cities
- MPO announced Adaptive Control Software workshop to be held on September 19, 2001 at Largo City Hall from 4:00 to 6:00 pm.

December 12, 2001

- MPO approved map of ITS corridor phasing as recommended at the November 28, 2001, ITS Committee meeting

July 10, 2002

- MPO approved the Fire Preemption procedure as recommended by the ITS Committee

September 11, 2002

- MPO approved the addition of 22nd Avenue South as a Phase 3 corridor

May 14, 2003

- MPO approved a 100 hour GPC authorization to conduct a system evaluation
- MPO approves Program Statement on the Countywide Signal System

June 11, 2003

- MPO approved the GPC report on the signal system with the understanding that it would provide guidelines for implementation

October 13, 2004

- MPO approved amendments adding County CMAQ ITS project ("overarching software," operations and other ITS projects) to TIP

February 16, 2005

- ITS Committee approved the MOU for submission to the MPO and to the cities for their approval.

March 9, 2005

- MPO approved Regional Architecture for ITS in compliance with Federal rules
- MPO approved prioritization of ITS corridors, Walsingham/Ulmerton, US 19, SR 60, 66th Street and the designation of the County Control Center as the interim Countywide Primary Control Center.
- MPO approved MOU as recommended by the ITS Committee

APPENDIX C – IDAS ITS IMPROVEMENTS

Arterial Traffic Management Systems

Isolated Traffic Actuated Signals

Traffic signal at single intersection using loop detectors to sense traffic and adjust timing.

Preset Corridor Signal Coordination

Series of traffic signals operated by a single controller using preset timing scenarios.

Actuated Corridor Signal Coordination

Series of traffic signals tied to common controller using traffic data from sensors to adjust timing.

Central Control Signal Coordination

All signals in region centrally controlled at TMC (does not include surveillance).

Emergency Vehicle Signal Priority

Signal priority (extended green phase or shortened red phase on a signal) for emergency vehicles.

Transit Vehicle Signal Priority

Signal priority (extended green phase or shortened red phase on a signal) for transit vehicles.

Freeway Management Systems

Preset Ramp Metering

New ramp meters with preset timing.

Traffic-Actuated Ramp Metering

New ramp meters with traffic-actuated control using loop detectors.

Centrally Controlled Ramp Metering

New ramp meters where timing is coordinated from TMC.

Advanced Public Transit Systems

Fixed Route Transit – Automated Scheduling System

Planning, scheduling, run cutting, and dispatching for fixed-route transit services.

Fixed-Route Transit – Automatic Vehicle Location

Real-time vehicle location monitoring for fixed-route transit services.

Fixed-Route Transit – Combination Automated Scheduling System and Automatic Vehicle Location

Combination of automated scheduling system and automatic vehicle location for fixed-route transit.

Fixed-Route Transit – Security Systems

Security (CCTV, hot button) on board the transit vehicle as well as in parking areas, stations, stops, and other transit-related areas (includes emergency response).

Paratransit – Automated Scheduling System

Planning, scheduling, run cutting, and dispatching for paratransit services.

Paratransit – Automatic Vehicle Location

Real-time vehicle location monitoring for paratransit services.

Paratransit – Automated Scheduling System and Automatic Vehicle Location

Combination of automated scheduling system and automatic vehicle location for paratransit.

Incident Management Systems

Incident Detection/Verification

Roadside surveillance equipment sending data to TMC for incident detection and verification.

Incident Response/Management

TMC monitors and coordinates with EMC on incident response and management.

Incident Detection/Verification/Response/Management (Combined)

Combination of incident detection/verification and incident response/management.

Electronic Payment Systems

Electronic Transit Fare Payment

Automated, electronic collection of transit fares on board and at vending machines (connected to transit center).

Basic Electronic Toll Collection

Automated, electronic collection of road user tolls with a set cost structure.

Railroad Grade Crossing Monitors

Emergency Vehicle Control Service

Four quadrant gates plus coordination at nearby traffic signals, pedestrian warning signal and gates, and detection of vehicles trapped in crossing.

Emergency Management Services

Emergency Vehicle Control Service

Centralized dispatching and routing of vehicles to emergencies with real-time traffic information (does not include AVL or signal preemption).

Emergency Vehicle AVL

Real-time vehicle location monitoring for emergency vehicles.

In-Vehicle Mayday System

Notification of the proper authorities when drivers are involved in incident or accident. Travelers can mutually or automatically notify appropriate personnel about an accident or potentially hazardous situations.

Regional Multimodal Traveler Information Systems

Highway Advisory Radio

Dissemination of locality-specific traffic information via highway advisory radio.

Freeway Dynamic Message Sign

Dissemination of locality-specific or upcoming traffic information via variable message signs on the freeway.

Transit Dynamic Message Sign

Dissemination of locality-specific or transit facility information via variable message signs at a transit station or stop.

Telephone-Based Traveler Information System

Up-to-date multimodal travel information via telephone.

Web/Internet-Based Traveler Information System

Up-to-date multimodal travel information via Web/Internet.

Kiosk with Multimodal Traveler Information

Up-to-date multimodal travel information via kiosk.

Kiosk with Transit-Only Traveler Information

Up-to-date transit information only via kiosk.

Handheld Personal Device – Traveler Information Only

Up-to-date multimodal travel information only via handheld personal device.

Handheld Personal Device – Traveler Information with Route Guidance

Centrally processed route guidance and interactive travel information, plus up-to-date traffic and transit information via handheld device.

In-Vehicle – Traveler Information Only

Up-to-date multimodal travel information only via in-vehicle device.

In-Vehicle – Traveler Information with Route Guidance

Centrally processed route guidance and interactive travel information, plus up-to-date traffic and transit information via in-vehicle device.

Commercial Vehicle Operations

Electronic Screening

Electronic identification of commercial vehicles.

Weigh-in-Motion

Mainline weighing of commercial vehicles.

Electronic Clearance – Credentials

Electronically checking commercial vehicle credential status to determine bypass status.

Electronic Clearance – Safety Inspection

Use of safety data in algorithm to determine bypass status of commercial vehicles (includes documenting and forwarding violations).

Electronic Screening/Clearance (Combined)

Combination of electronic screening and electronic clearance – safety inspection.

Safety Information Exchange

One-stop roadside electronic access to all safety information for vehicles, including documenting and forwarding violations.

On-board Safety Monitoring

Track commercial vehicle system, report to driver and roadside facilities, no AVL, no tracking of passengers or cargo.

Electronic Roadside Safety Inspection

Automate roadside commercial vehicle and driver inspection using handheld devices (includes documenting and forwarding violations).

Hazardous Materials Incident Response

Hazardous materials are continuously monitored on board the commercial vehicle, and any changes in condition are reported to the driver, fleet manager center, emergency management center, and traffic management center.

Advanced Vehicle Control and Safety Systems

Motorist Warning – Ramp Rollover

Infrastructure-based system (roadway/roadside) to warn vehicles about potential rollover on freeway ramps.

Motorist Warning – Downhill Speed

Infrastructure-based system (roadway/roadside) to warn vehicles about downhill speed.

Longitudinal Collision Avoidance

Onboard sensors detect potential hazards around the vehicle (includes advanced cruise control to

automatically maintain safe speeds and following distance).

Lateral Collision Avoidance

Onboard sensors detect potential hazards around the vehicle (includes advanced steering control to automatically maintain lane position).

Intersection Collision Avoidance

Infrastructure-based system (roadway/roadside) to warn, prevent vehicles from colliding at intersections (includes advanced steering control, advanced cruise control, and an in-vehicle signing system).

Vision Enhancement for Crashes

Onboard system to enhance driver visibility in inclement weather, at night, etc.

Safety Readiness

Provides continuous vehicle diagnostic capability and monitors physical fitness of the driver, who may be warned of potential hazards.

Supporting Deployments

Traffic Management Center

Center to compile and disseminate traffic information.

Transit Management Center

Center to coordinate and schedule transit operations.

Emergency Management Center

Center to receive and respond to emergency information.

Traffic Surveillance – CCTV

CCTV system that communicates with centralized facility.

Traffic Surveillance – Loop Detector System

Loop detectors that communicate with centralized facility.

Traffic Surveillance – Probe System

Probe vehicles collect data on road conditions.

Basic Vehicle Communication

Two-way radio communication.

Roadway Loop Detector

Loop detector with no link to centralized facility.

Information Service Provider Center

Center to compile, analyze, and disseminate travel information.

REFERENCES

[1] 2025 Long-Range Transportation Plan, Metropolitan Planning Organization, Pinellas County, Florida, December 2004.

[2] *Pinellas Countywide ATMS Feasibility Study*, May 2002.

[3] *IDAS Modeling Software Manual*, version 2.3, Cambridge Systematics, Inc.

[4] *ITS Investment Cost-Benefit Analysis Study Analysis of Tampa Bay Interstates*, CUTR, October 2005.

[5] Technical Memorandum No. 6 – *IDAS Customization Integration and Testing of Customized Florida Costs and Benefits.*

[6] Technical Memorandum No. 8 – *Project Evaluation and Ranking Processes Based on Intelligent Transportation Systems Deployment Analysis System*, October 5, 2005.

[7] FDOT, *2005 Growth Management Legislation*, 2005.

[8] FDOT, *Program Guidance for Transportation Regional Incentive Program*, 2005.