Pinellas Countywide ATMS Requirements Document

Prepared for:

Pinellas County
Metropolitan Planning Organization

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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.*

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

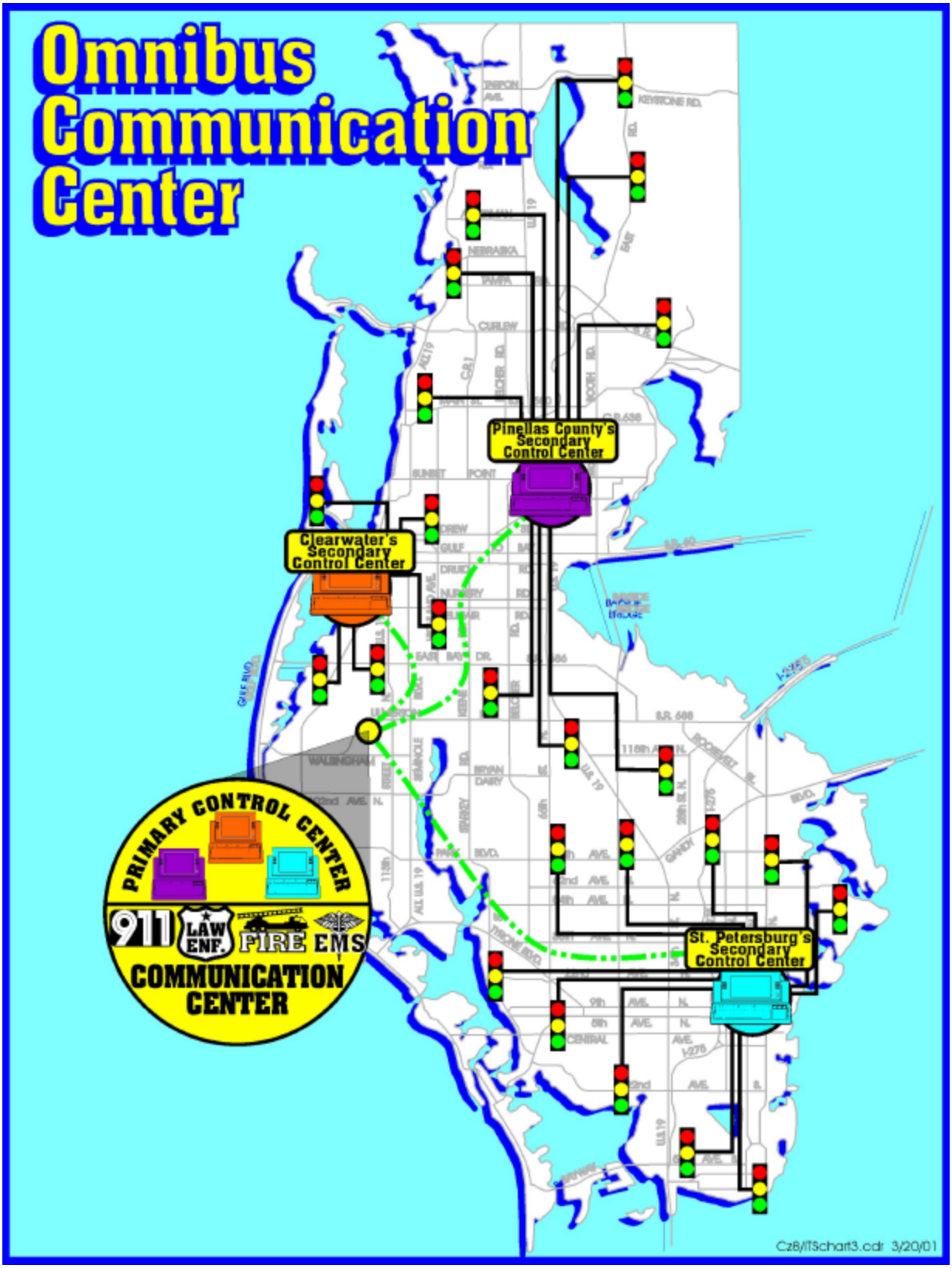

Figure 1: Omnibus Concept

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.

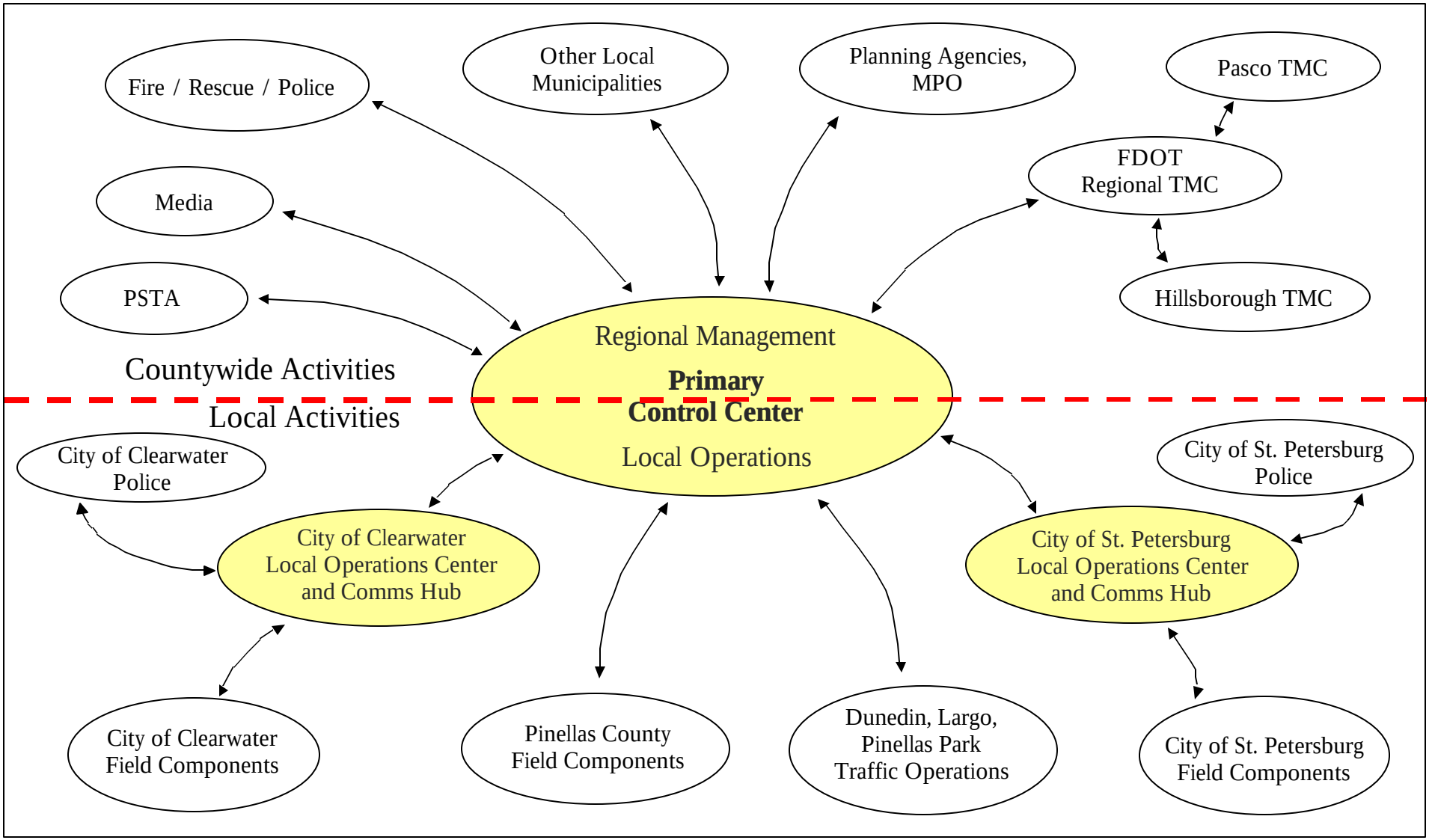

Figure 2: Pinellas County ATMS System Architecture

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.

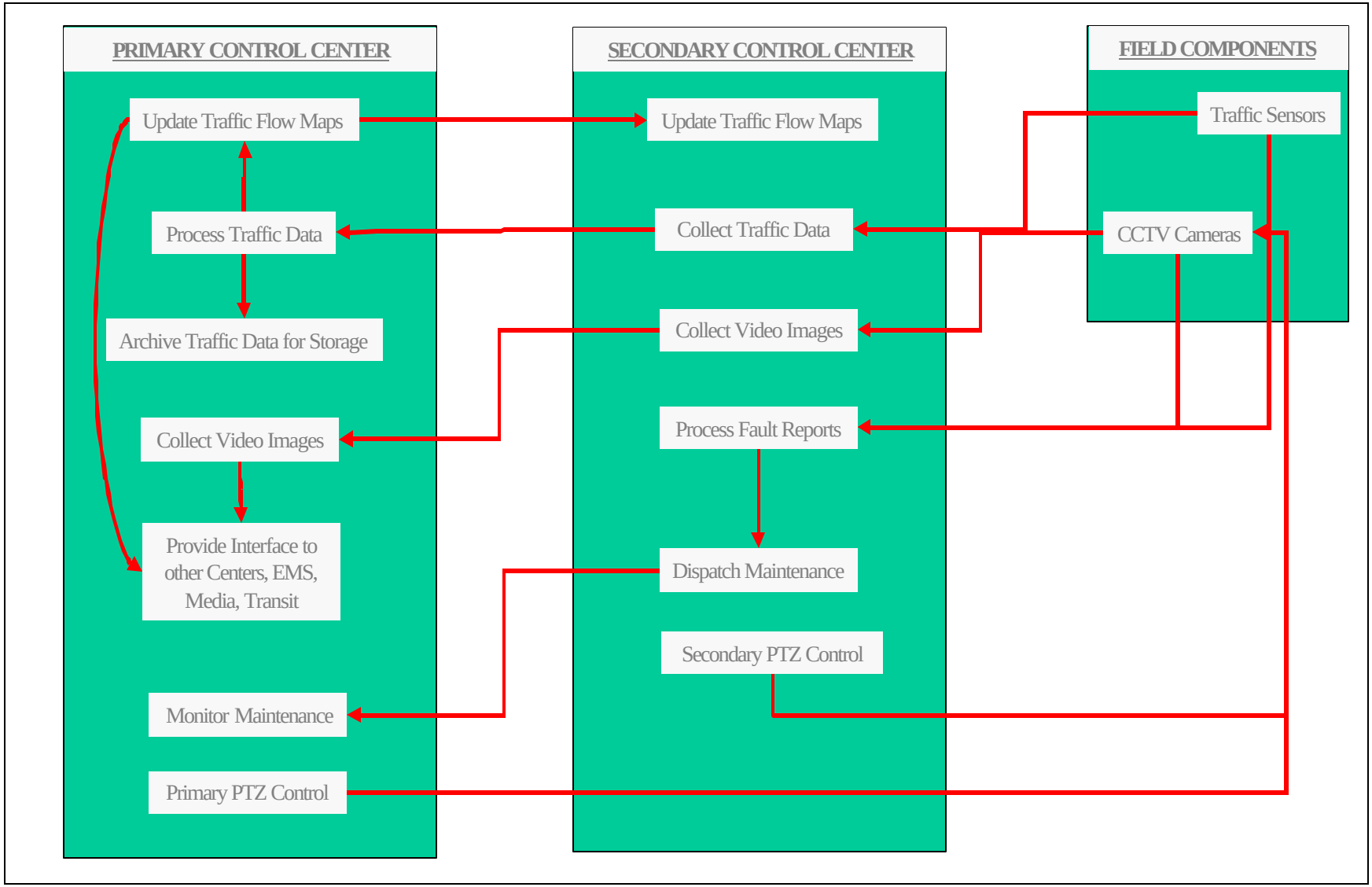

Figure 3: Network Monitoring

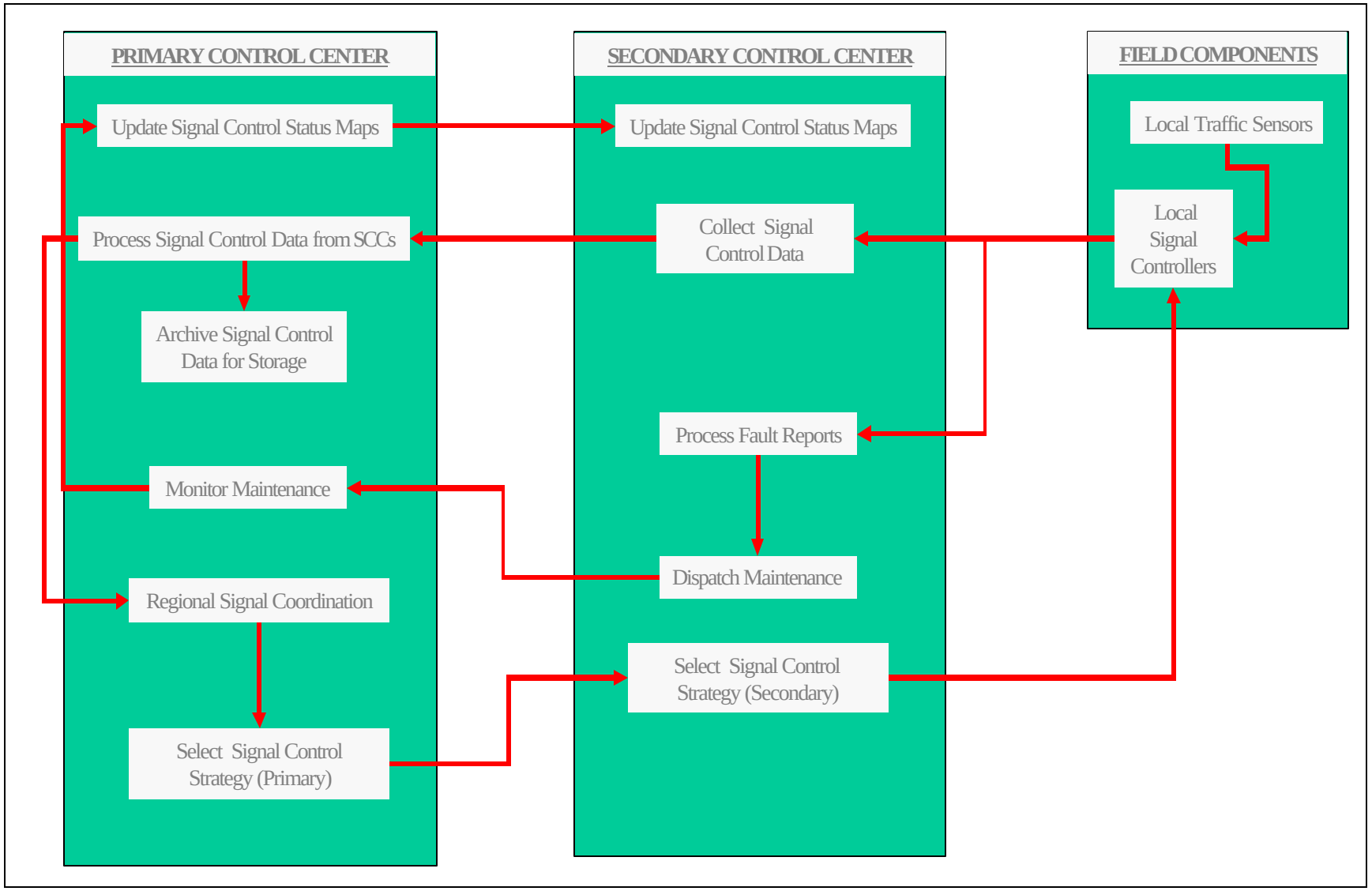

Figure 4: Countywide Traffic Management Coordination

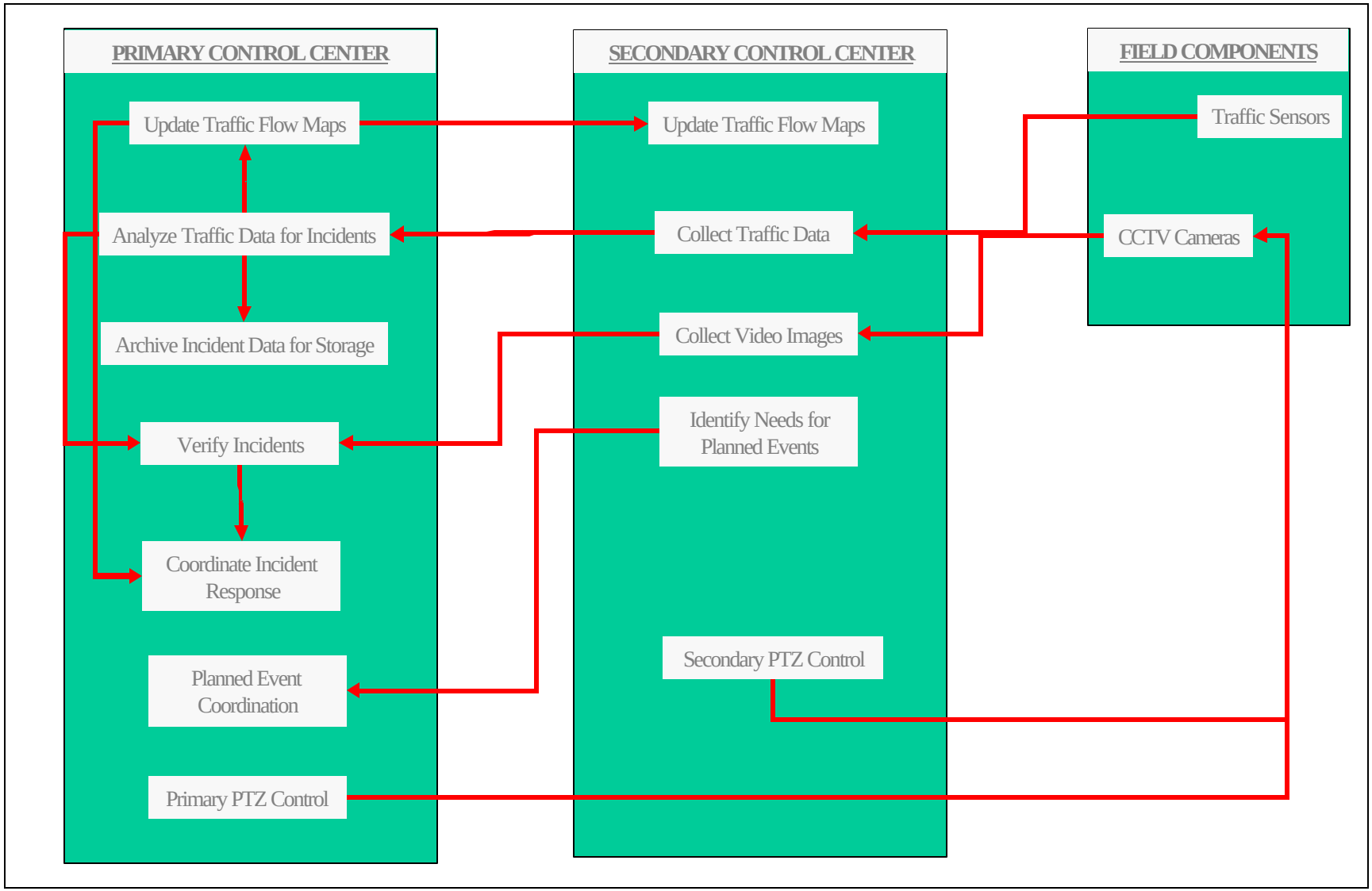

Figure 5: Countywide Incident Coordination

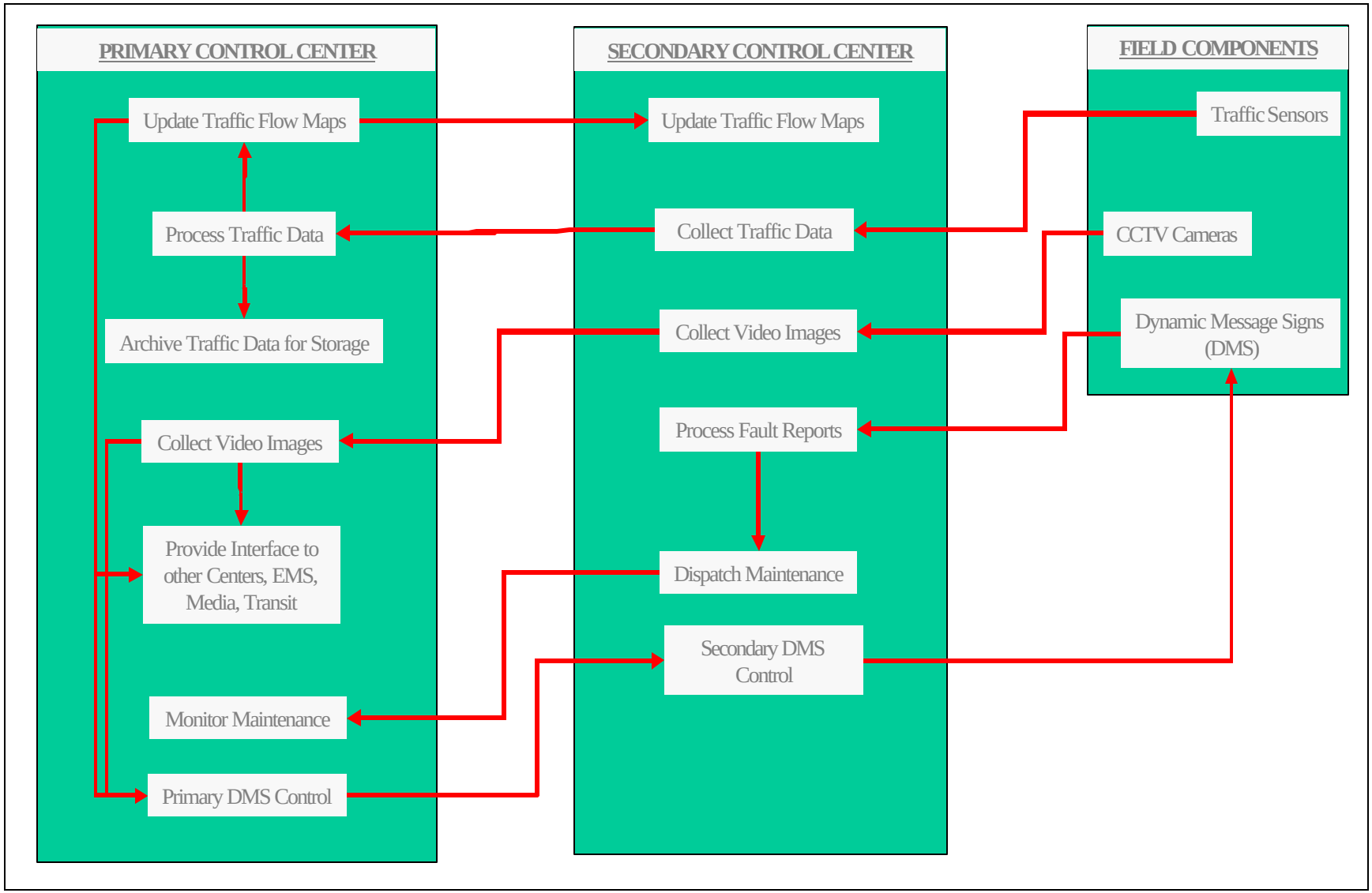

Figure 6: Traveler Information Dissemination

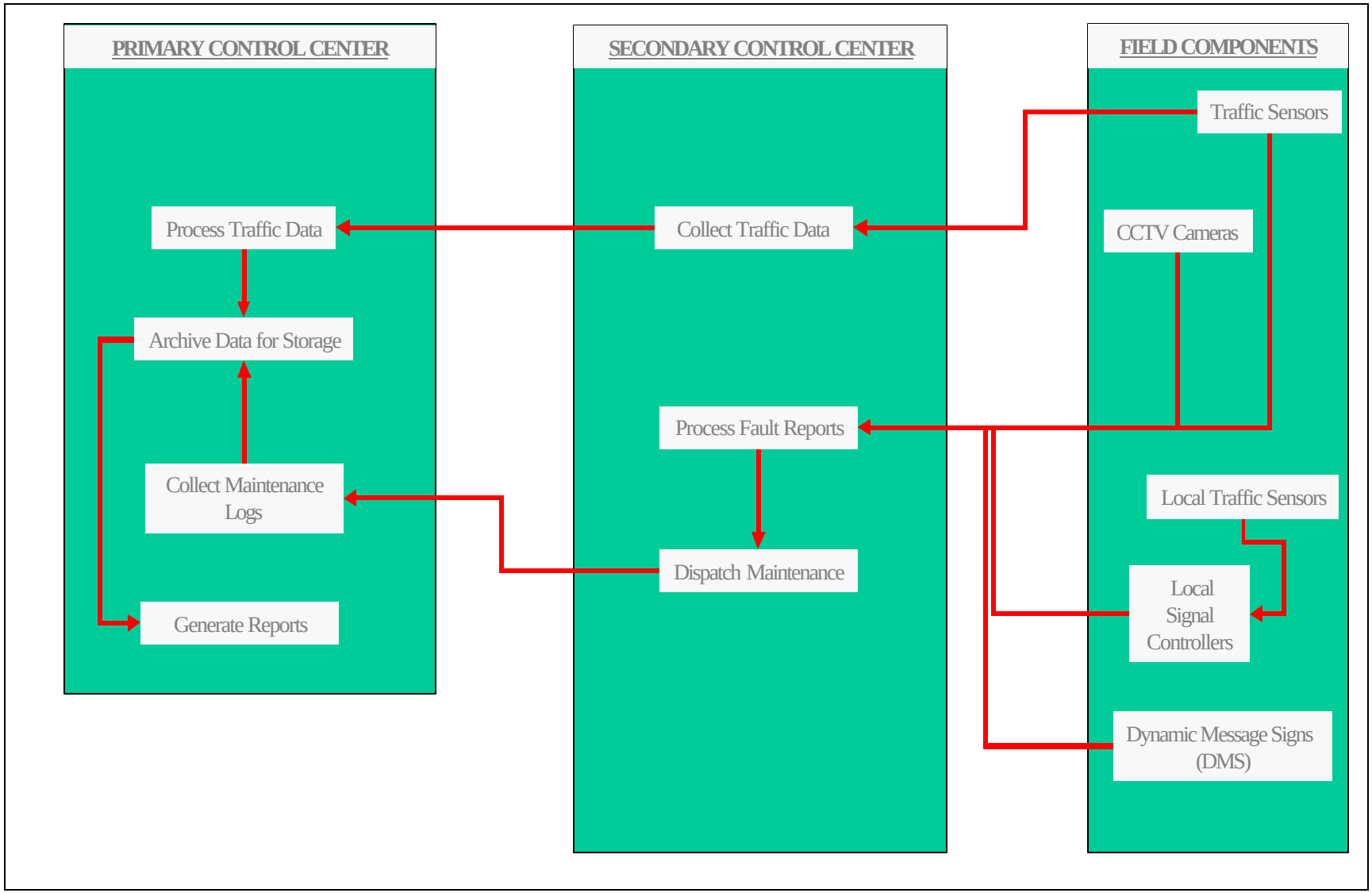

Figure 7: Archived Data Management

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.

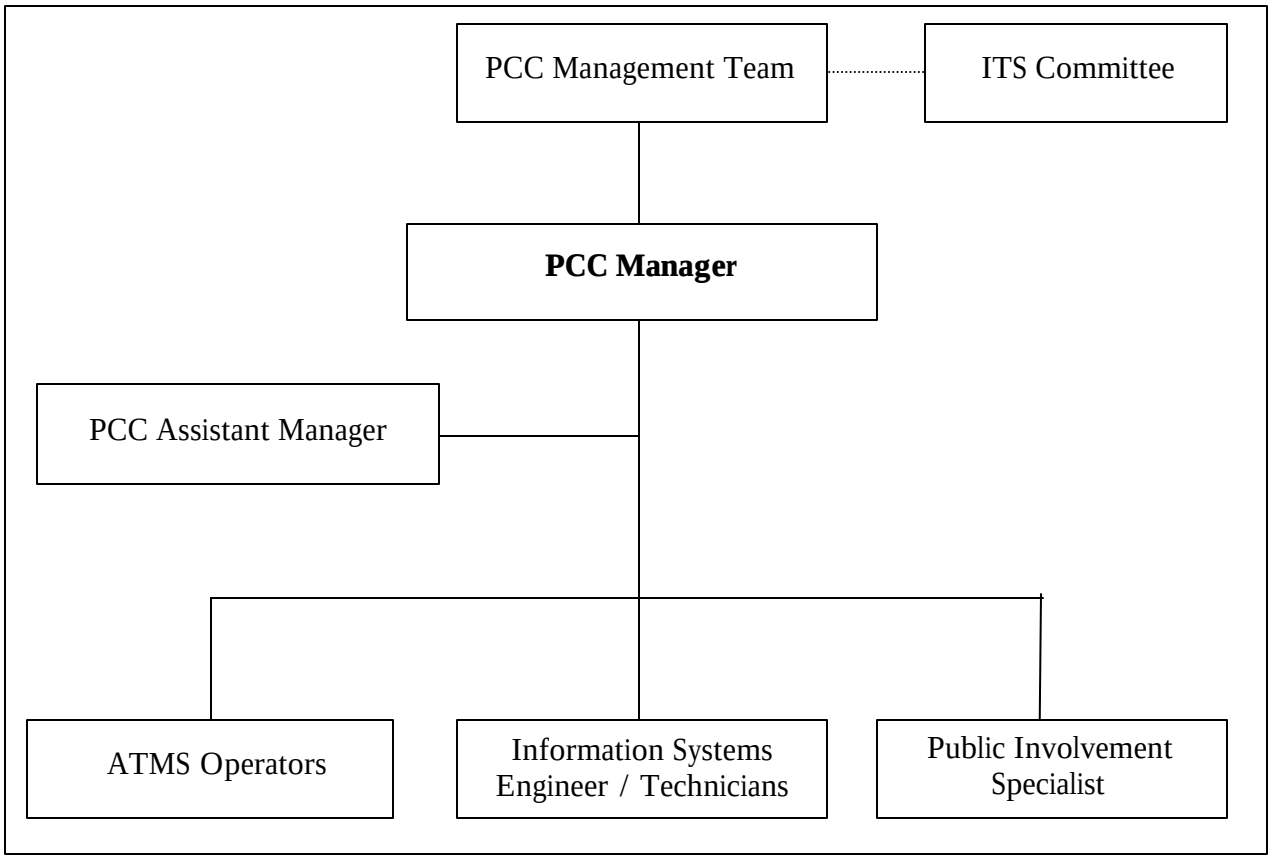

Figure 8: PCC Organizational Structure

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.

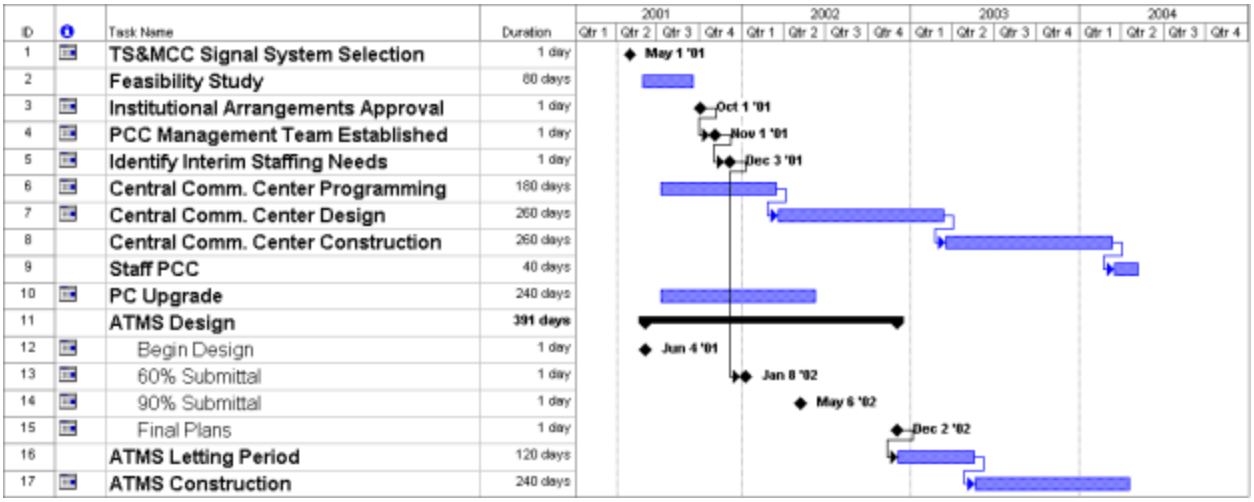

Figure 9: General Transition Schedule

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.

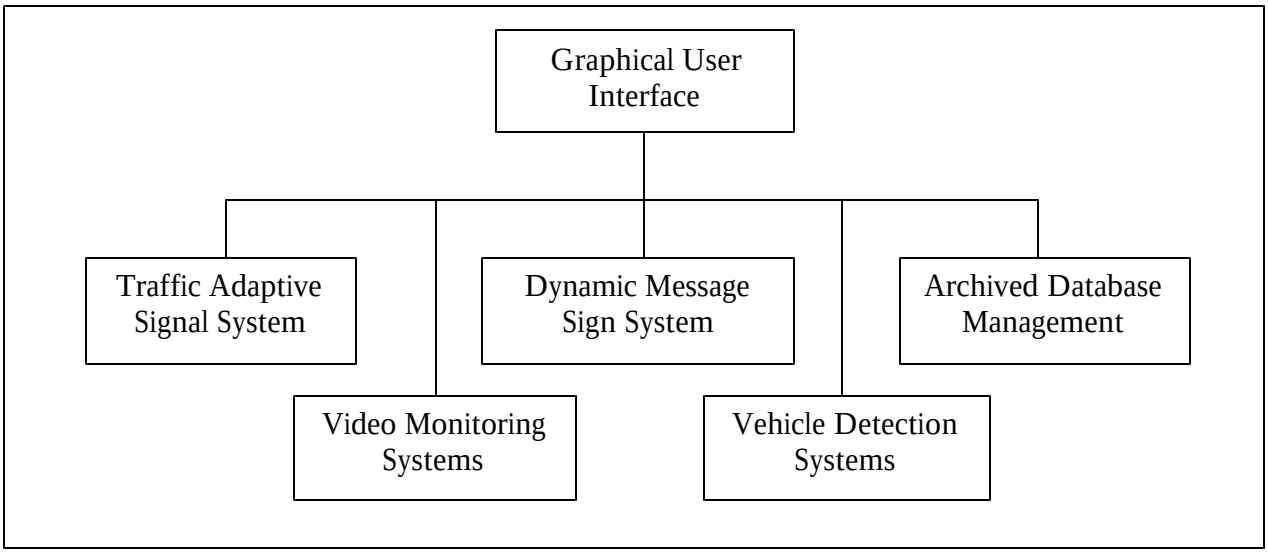

Figure 10: Pinellas Countywide ATMS System Components

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.