Pinellas County, Florida

Intelligent Transportation Systems/ Advanced Traffic Management Systems

IMPLEMENTATION PLAN

Task Work Order No. 19

C-7827; FPN: 406255-2-62-01

PREPARED FOR:

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TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

PREFACE

This report governs Pinellas County's 10-year investment plan in Intelligent Transportation Systems (ITS). ITS solutions do not replace the traditional capacity building investments such as new lanes or new roads. Nor are they substitutes for conventional traffic engineering and traffic operations strategies. ITS offer the transportation agencies a broad set of transportation related technologies that encompasses more than smart traffic signal systems.

This study supports a subset of elements associated with the ITS 'pinwheel' adopted by the Pinellas County MPO including adaptive control, bus rapid transit, pedestrian crosswalk signals, Fire trucks signal preemption, amber alert, highway advisory radio, weather alert, local radio/TV, etc. The focus is on the arterial street system within Pinellas County with consideration given to the freeway system as necessary to address regional traffic management needs during recurrent congestion, major incidents, evacuations, and other transportation related emergencies. ITS tools utilized by the county's transportation professionals to optimize management of traffic operations, travel demand, and roadway capacity include:

- Detection system
- Traffic control including traffic signal controllers and central control software
- Traffic monitoring and surveillance
- Data capture and archiving and information dissemination
- Signal priority for transit buses and signal preemption for Fire trucks
- Uninterrupted power supply
- Communications
- Sharing data, video, and operating plans in real-time with ITS program stakeholders
- Operational strategies, such as fully actuated traffic signals, optimized traffic operations, traffic responsive control, traffic adaptive control, incident management, travelers' information, and special event management.

In April 2007, under Work Order Contract Number 19, the Florida Department of Transportation (FDOT) commissioned Gord & Associates, Inc. to undertake this study, whose purpose is to define the Pinellas County ITS / Advanced Traffic Management System (ATMS) master plan to govern the development and deployment of technology-based solutions for the management of surface street system in Pinellas County.

TRAFFIC CONTROL AND MANAGEMENT NEEDS

Pinellas County cannot build its way out of congestion by solely investing in new capacity. Investments in ATMS solutions are necessary to address these challenges. Table PF-1 presents the county's ATMS program areas and associated needs.

Table PF-1: Pinellas County Transportation Needs

ITS Program Focus	Pinellas County Needs
Needs, Problems, Issues, Challenges, Barriers	❑ Improve traffic safety countywide ❑ Reduce traffic congestion ❑ Address reactive traffic management ❑ Provide timely, accurate, and comprehensive transportation data ❑ Create automated centralized cohesive transportation databases
Actions	❑ Upgrade obsolete and proprietary traffic control equipment ❑ Deploy a hybrid fiber-copper-wireless communications network using open communications standards ❑ Utilize existing twisted pair copper cabling ❑ Improve traffic operations along coordinated corridors ❑ Improve signal operations by updating signal timings and operational design ❑ Deploy ATMS devices and operational strategies along priority corridors ❑ Establish relational databases for transportation and travel data ❑ Identify funding sources and partners to support and sustain ATMS program ❑ Address limitations in staffing, training, and resources to proactively operate and maintain ATMS systems and associated components ❑ Establish regional institutional framework for ATMS

ATMS PROGRAM ELEMENTS

The recommended ATMS elements that address the county's needs within the next ten years are summarized in Table PF-2. They include technologies for surveillance, control, management, and operations of surface streets and for gathering, sharing, and archiving (data only) real-time travel and transportation related data and video. The program stakeholders, both public (including travelers) and private (news media, value added resellers) can make use of the data / video. The result will be better choices in planning, design, operations, management, maintenance, and assessment of the County's transportation needs. To minimize maintenance and operational costs, the county's ATMS master plan is built on proven technologies, operational strategies, and historical deployments within the county.

Table PF-2: Pinellas County ATMS Concept and associated Elements

Technology	Deployment Criteria
Central Control Platform	❑ MIST
Adaptive Control	❑ OPAC ❑ RHODES ❑ Other
Signal Priority	❑ Conditional Service for Buses
Signal Preemption	❑ Fire Trucks En-route to Emergencies
Shared Detection for Adaptive Control & Incident Management	❑ Sensys Wireless Detectors & Microwave Detectors
Traffic Signal Controller	❑ 2070L
Traffic Signal Controller Firmware	❑ NextPhase with ASC2 2070 (Non-adaptive) ❑ NextPhase with ASC2 2070 'OPAC' version (Adaptive)
Adaptive Control Hardware	❑ Single Board Computer (OPAC) ❑ Gecko Board (RHODES)
Device Cabinet	❑ Co-locating ATMS Devices at Traffic Signals (Share Power, Communications, UPS, Batteries, Slab, Grounding, and Cabinet) where R/W is Limited (TS-2 Type 1, Shelf-mount) ❑ Separate Device Cabinets and UPS Cabinets ❑ Type 334 Cabinets for ATMS Devices
Signal Priority & Preemption	❑ Opticom (216 Signals and 130 Fire Trucks are Equipped with Opticom IR Technology). Future System Expansion to Consider Replacement of Opticom IR with Opticom GPS)
Uninterrupted Power Supply (UPS)	❑ Meet FDOT Standard
Detection (IP based) Tactical Control (Signalized Intersections)	❑ Inductive Loops ❑ VIDS at Mastarm based Traffic Signals (MPEG-4) ❑ Sensys Wireless Detectors
Detection Strategic Control (Advanced Detection)	❑ Sensys Wireless and/or MVDSs Upstream of Traffic Signals ❑ Support Adaptive Control and Incident Management
Closed Circuit Television (CCTV) Cameras	❑ Located at Traffic Signals at Intersections of Two Priority Corridors (Primary), Traffic Signals at Intersections of Priority Corridors With Minor Arterials (Secondary), Following One Mile Spacing along Priority Corridors And Horizontal Curves (Tertiary), and for Special Events Needs
Dynamic Message Signs (DMSs) Dynamic Trailblazing Signs (DTBs) Highway Advisory Radios (HARs)	❑ Regionally Significant Corridors and Evacuation Routes (Augment Capacity Of Arterial and Freeway Corridors)
Communications	❑ Open Standards using MPEG-2 Encoders (CCTV Cameras), MPEG-4 Encoders (VIDS), Terminal Servers for CCTV Pan-Tilt-Zoom Control, 100 Mbps Ethernet Switches for Fiber based Local Loops, 1 GigE Ethernet Switches in Air-Conditioned Communications Hubs, 1 GigE Expandable to 10 GigE Core Switch in the Primary Control Center ❑ VDSL for Legacy Twisted Pair Copper Cabling ❑ 4.9 GHz Band for Use in Public Safety Designated by FCC
Primary Control Center	❑ Interconnected to Secondary Control Centers, Communications Hubs Housing Backbone Switches, Field ATMS Devices, and Other Centers

IMPLEMENTATION PLAN

An incremental implementation plan is recommended to ensure newly installed ATMS devices are supported by the necessary staff, resources, and training for effective operations and management. This should occur at the onset of program deployment and sustained over time. Given the complexity of ATMS solutions, the county should also consider outsourcing some of the design, operations, management, integration, and maintenance functions.

By installing ATMS devices incrementally, the risks associated with advanced technologies will be minimized. The strategy for migrating from the county's current system to standards-based, open-architecture system involves three deployment phases with several stages. The pace and distribution of recommended improvements and number of priority corridors will depend on the level of funding. Currently, it is anticipated that the ninth-cent fuel tax will generate an annual funding stream of about $3.8 million. This funding will be sufficient to support the deployment of phase I corridors partially within the 10-year focus of this master plan. Table PF-3 presents ranked operational corridors for deployment phase I. Additional funding, such as Federal grants and FDOT ATMS investments along state routes, will be needed to instrument all phase I corridors with ATMS solutions. Other deployment phases are included in the main body of the report.

Table PF-3: ATMS Deployment Phase I Corridors

Dist.	Rank	Main Corridor	Begin	End	B/C Ratio
1	1-1	US 19/SR 55	Beckett Way	54th Avenue N.	11.74
1	1-2	McMullen Booth/East Lake Rd	Trinity	Gulf to Bay/SR 60	11.74
1	1-3	I-275	Howard Frankland Bridge	Skyway Bridge	11.74
1	1-4	Gulf to Bay/SR 60	Hillcrest Ave	Damascus Drive	11.74
22	1-5	Tampa Rd/SR 584/SR 580	East Lake Rd	County Line	23.02
19	1-6	SR 686	49th St	Bryan Dairy	22.90
30	1-7	Bryan Dairy	Seminole Blvd/Alt US 19	Roosevelt/SR 686	21.33
26	1-8	Main St/ SR 580	McMullen Booth	SR 584/Tampa Rd	19.37
32	1-9	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St N/ SR 694	17.85
8	1-10	Tampa Rd	Belcher Rd	McMullen Booth	16.39
24	1-11	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd	16.18
6	1-12	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	14.65
7	1-13	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd	13.73
13	1-14	East Bay/Roosevelt/SR 686	Belcher Rd	49th St N/Bayside Bridge	11.89
9	1-15	Curlew Rd./SR 586	Belcher Rd	McMullen Booth	11.62
10	1-16	Main St./ SR 580	Belcher Rd	McMullen Booth	11.58
14	1-17	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St N	10.56
40	1-18	Countryside Blvd	Belcher Rd	Main St	10.36
15	1-19	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St N	I-275	9.52
4	1-20	66th St. N./SR 693	US 19/SR 55	54th Street	9.03
2	1-21	Belcher Rd	Klosterman Rd	Druid Rd	8.97
12	1-22	Drew St	Belcher Rd	McMullen Booth	8.93
3	1-23	Belcher Rd	Druid Rd	Ulmerton Rd/SR 688	5.92

In addition to the operational corridors, the county should actively invest in transportation and travelers information infrastructure. Data flow analysis highlights the need for interconnecting the county's Primary Control Center with Construction and Maintenance Unit, Emergency Management, 511, Media, Weather Service, PSTA, Fire Department, Law Enforcement, FDOT District Seven, Pasco County, and Event Promoter (for special events management). Sharing of traffic data, video, operating plans with these local stakeholders and regional stakeholders will be invaluable in management of recurrent congestion, incidents, emergencies (including regional evacuations), and special events within the county. The county should establish center-to-center connectivity with these users (other centers) within and without the county organization. Given the high value associated with integrated, holistic, and regional transportation management and sharing of data, video, and operating plans, this investment should be made as soon as possible to reap immediate benefits. The overall cost (in 2009 dollars) by implementation phase, for modernizing and expanding Pinellas County's ATMS program using advanced technologies and strategies are presented in Table PF-4. This cost is in addition to the county's historical investments (approximately $19 million) in ATMS.

Table PF-4: Pinellas Countywide ATMS Investment

Pinellas Countywide ATMS Investment				
Item	Phase I	Phase 2	Phase 3	ATMS Program Future Projects
	Total Cost	Total Cost	Total Cost	Total Cost
Corridor Subtotal	$20,208,172	$17,164,974	$23,529,376	$60,902,522
Mobilizations	$1,010,409	$858,249	$1,176,469	$3,045,126
MOT	$1,010,409	$858,249	$1,176,469	$3,045,126
Engineering Design and Survey	$3,334,348	$2,832,221	$3,882,347	$10,048,916
System Testing, Integration, and Configuration	$2,424,981	$2,059,797	$2,823,525	$7,308,303
Construction Engineering and Inspection	$1,333,739	$1,132,888	$1,552,939	$4,019,566
Contingency	$2,020,817	$1,716,497	$2,352,938	$6,090,252
Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency	$11,134,702	$9,457,901	$12,964,686	$33,557,289
Total Capital Costs	$31,342,874	$26,622,875	$36,494,062	**$94,459,811**
Annual Operations and Maintenance Cost	$3,134,287	$2,662,287	$3,649,406	**$9,445,981**

The county must invest in the needed staffing, resources, training, and operational improvements during incremental deployment stages. This is essential to support and sustain the critical functions such as system operations, maintenance, management, and training. The annual cost for these functions is about 10 percent of deployed ATMS cost. This translates into the need for approximately $3,134,287 of additional funding upon completion of all phase 1 corridors.

EXECUTIVE SUMMARY

BACKGROUND

Sustained growth in traffic demand has burdened Pinellas County's surface street system with high levels of traffic congestion and safety risks. Though the county's traditional investments in roadway construction and reconstruction projects have helped improve traffic operations, they are insufficient to keep pace with growing demand for travel. Growth in travel has elevated traffic safety risks, caused long delays during peak periods, and frustrated motorists. In addition, many operational corridors traverse across jurisdictional boundaries with disparate control systems that limit the opportunity for holistic regional transportation management control. Many of the east-west and north-south arterial streets within the county are currently congested during peak periods. The result has been long commute times, stop-and-go operations, and expanding peak periods.

Given the significant growth in traffic demand and increasing levels of traffic congestion and safety risks, Pinellas County clearly faces a transportation challenge to sustain its economic vitality, public health, and safety. The county cannot build its way out of traffic congestion due to a multitude of constraining factors such as increasing traffic demand, environmental impacts, right-of-way limitations, and costs of building new and/or expanded highways. The county has historically strived to improve traffic safety and congestion via traditional investments in roadway capacity, such as roadway construction and reconstruction projects. Though these investments have enhanced travel demand distribution and management, they have proven insufficient to meet fluctuating traffic demand. The county must augment traditional capacity building investments with Intelligent Transportation Systems (ITS) solutions to optimize use of existing infrastructure capacity through improved operations management, demand management, and staff productivity across jurisdictional boundaries, operational corridors, and transportation modes.

In April 2007, under Work Order Contract Number 19, the Florida Department of Transportation (FDOT) commissioned Gord & Associates, Inc. to undertake a study to define the Pinellas County Advanced Traffic Management System (ATMS) master plan to govern the development and deployment of surface streets related ATMS solutions in Pinellas County. This document presents the county's ATMS master plan report, which is organized into five sections and two appendices including:

- ❑ Introduction
- ❑ Legacy System
- ❑ Conceptual Plan
- ❑ Implementation Plan
- ❑ Appendix A – Graphs
- ❑ Appendix B – Tables
- ❑ Appendix C – Glossary.

STUDY PURPOSE AND APPROACH

The Pinellas County ATMS master plan aims to sustain the county's economic vitality, safety, and mobility by identifying and recommending technology-based solutions for implementation along priority corridors within the county during the next ten years. It provides guidance for phased deployment of ATMS countywide by prioritizing the county's operational corridors for instrumentation with ATMS technologies and strategies. It considers a build-out scenario of the countywide ATMS and subsequently provides programmatic information (i.e., costs, schedules, and funding sources) for adding component projects into the Transportation Improvement Program. The plan serves as the roadmap for developing a detailed work program for ATMS implementation, developing and maintaining a cost loaded schedule, and identifying associated project elements in support of the Pinellas County ATMS program. Table ES-1 provides the elements of the Pinellas County ATMS master plan.

Table ES- 1: ATMS Master Plan Elements

Plan Element	Element Description
Inventory of Legacy System	❑ Field Equipment ❑ Communications ❑ Traffic Operations Centers
Mission Statement of Pinellas County ATMS	❑ Goals and Objectives ❑ Performance Measures
Vision of ATMS Build-out	❑ ATMS Field Components ❑ Communications System ❑ Concept of Primary Control Center
Procurement Strategies	❑ Traditional 'Design-Bid-Build' ❑ Design - Build ❑ System Manager
Cost Estimates	❑ Mobilization and Maintenance of Traffic ❑ Design ❑ Construction and CEI ❑ Operations and Maintenance
Phased Deployment Plan	❑ Prioritization of Operational Corridors ❑ Prioritization of ATMS Devices ❑ Prioritization of Component Projects ❑ Packaging and Staging of Implementation Projects ❑ Schedule of Design and Construction Packages
Recommendations	❑ Ranked Operational Corridors ❑ Phased/Staged Implementation Plan ❑ Costs of Implementation Phases and Stages ❑ Funding Requirements for input to the TIP

Various data sources were used to define the ATMS concept. These sources included review of the county's legacy system, numerous face-to-face interviews and group discussions with county staff, presentation to Pinellas County Metropolitan Planning Organization's ITS Committee, extensive research and consultation with applicable product manufacturers, considerations of information available on traffic safety and operations along operational corridors, and review of studies previously performed by the county's consultants and staff. The stakeholders' input and contributions were invaluable in guiding this planning effort. The previous studies, interviews, presentations, and historical deployments have collectively set the foundation for building ATMS in Pinellas County. The Tampa Bay Regional ITS Architecture (TBRIA) was also used to identify applicable prioritized user services and market packages. Use of this regional ITS architecture provided a basis for ensuring consistency with the National ITS Architecture, and in identifying user services and market packages that reflect the county's needs. The specific tasks and subtasks of the study are presented in Table ES-2**.**

Table ES- 2: Study Tasks and Subtasks

Task	Subtasks
Identify goals, objectives, problems, needs, opportunities, and constraints	❑ Identify stakeholders ❑ Research regional ITS architecture ❑ Define study goals and objectives ❑ Review inventory of legacy system ❑ Identify existing opportunities and constraints ❑ Conduct interviews and literature research to identify needs ❑ Identify prioritized user services and market packages ❑ Review historical ATMS deployments and effectiveness
Develop system framework and conceptual plan	❑ Conduct interviews and literature review to define requirements ❑ Identify ATMS functional requirements ❑ Develop system framework ❑ Identify viable technology solutions ❑ Study basis for prioritized operational corridors ❑ Define corridor-based conceptual design
Develop implementation plan	❑ Develop criteria for prioritizing operational corridors ❑ Group/package ATMS devices and operational strategies ❑ Develop integration strategy ❑ Develop a 10-year investment program and associated projects, staging, schedule, and budget for instrumenting operational corridors with ATMS
Prepare GIS Drawings	❑ Develop various GIS based drawings that depict the county's legacy and future ATMS devices by type and location along prioritized operational corridors countywide
Develop ATMS master plan report	❑ Prepare ATMS master plan report
Study deliverables	❑ Presentations to MPO ITS Committee ❑ ATMS master plan report encompassing legacy ATMS system, conceptual plan, and implementation plan

It is important to highlight that the focus of this study is not to reinvent the wheel by questioning investment decisions and choices made historically by program stakeholders, some of which have been founded on other studies. The focus of this study is to leverage historical studies, choices, and ATMS deployments; as well as associated technologies, operational strategies, lessons learned, and priorities to assemble a comprehensive ATMS master plan for systematic and incremental implementation along operational corridors countywide within ten years. The study focuses on the arterial street system within Pinellas County and considers the freeway system to the extent necessary to address regional traffic management needs during major incidents, evacuations, and emergencies. Summaries of the high-level findings, conclusions and recommendations of this report are presented below.

LEGACY ATMS SYSTEM

The county's Primary Control Center is currently located on the second floor of Building 10 at 22211 US 19 in Clearwater. It houses servers, software and hardware, end communications equipment, workstations, operators' consoles, video wall, uninterrupted power supply, etc. The county's central control systems are MIST (Management Information System for Transportation) and i2TMS. The county has elected to enhance MIST functionality to become the county's standard common central control platform with capacity to interface with OPAC and RHODES using Econolite ASC2/OPAC and NextPhase/RHODES, respectively. MIST integration with RHODES will enable system operators to monitor and adjust RHODES operations including upload/download functionality. MIST/OPAC and i2TMS/RHODES were originally deployed, as part of Pinellas Countywide ATMS Stage I project, to function independently of each other. MIST/OPAC system resides within the Primary Control Center whereas i2TMS/RHODES system is housed within the City of Clearwater Traffic Operations Center though each control center can operate both i2TMS and MIST since they are part of a local area network.

Pinellas County has 801 traffic signals dispersed within the county (371, 46%), Clearwater (130, 16%), and St. Petersburg (300, 38%). There is an existing deployed base of 226 traffic signals (within the county and Clearwater) and 130 fire trucks that are equipped with Opticom Infrared (IR) technology used exclusively for preempting equipped traffic signals by fire trucks enroute to emergency situations. The legacy traffic signals are comprised of adaptive traffic control (23) using 2070L controllers housed in Type 332 cabinets or TS-2 shelf-mount Type IV cabinets and non-adaptive traffic control (778) using TS-1 technology in Type IV cabinets. The county perceives that TS-2 shelf-mount Type IV cabinets provide more space for signal technicians to perform maintenance functions. The county has also elected to use separate cabinets (no co-location) for Closed Circuit Television (CCTV) cameras located at signalized intersection. This decision reflects the county's wish to demarcate in-house and outsourced maintenance work applicable to traffic signals and CCTV cameras, respectively.

The legacy communications infrastructure is comprised of empty underground conduit (2 miles), aerial twisted pair copper cabling (20 miles), underground twisted pair copper cabling (77 miles), and underground fiber optic cabling (58 miles). Twisted pair copper has been used to interconnect the traffic operations center with traffic signals primarily within Clearwater. St. Petersburg has used leased telephone drops at controller cabinets and experienced significant recurrent cost. The existing twisted pair copper cabling could be used as local communications loops or access to remote devices instead of installing fiber optic cabling; thus reducing deployment costs for new fiber optic cabling. Other ATMS elements deployed include CCTV cameras (51), Dynamic Message Signs (DMS, 12), MPEG-2 encoders, and end communications equipment that are interconnected to the Primary Control Center via a fiber optic based communications network. Four CCTV cameras that are interconnected to St. Petersburg traffic operations center via wireless communications network. Figure ES-1 presents the county's legacy ATMS elements.

TRAFFIC CONTROL AND MANAGEMENT NEEDS

Pinellas County faces several interrelated transportation issues, including traffic safety, traffic congestion, constrained mobility, and disconnected transportation modes, all of which are exasperated by limitations in financial and budgetary resources. These challenges are typical for large metropolitan areas like Pinellas County. Pinellas County must pay immediate attention to these challenges given the gravity of impacts on the welfare and economic vitality of the county. Traffic safety and congestion are typically the most fundamental transportation needs of major metropolitan areas. Since Pinellas County cannot build its way out of congestion by solely investing in new capacity, investments in ATMS solutions are necessary to address these challenges. The county's ATMS program areas and associated needs are presented in Table ES-3.

METROPOLITAN PLANNING ORGANIZATION
Pinellas County, Florida

Pinellas County ATMS Master Plan

Figure ES-1
Legacy ATMS Elements

Legend

Traffic Signals
- Existing Adaptive Phase 1 / Stage 1
- Adaptive Phase 1 / Stage 2
- Adaptive Phase 1 / Stage 3

CCTV Cameras
- Existing CCTV Phase 1 / Stage 1
- Existing CCTV Phase 1 / (Wireless)
- CCTV Phase 1 / Stage 2
- CCTV Phase 1 / Stage 3

Dynamic Message Signs
- Existing DMS Phase 1 / Stage 1
- DMS Phase 1 / Stage 2
- DMS Phase 1 / Stage 3
- Existing Underground Twisted Pair
- Existing Aerial Twisted Pair
- Existing Conduit Only

Roads
- Major Roads
- Minor Roads
- Local Roads

Prepared By
Gord & Associates, Inc.

November 2008

Table ES-3: Pinellas County Transportation Needs

ITS Program Focus	Pinellas County Needs
Needs, Problems, Issues, Challenges, Barriers	❑ Improve traffic safety countywide ❑ Reduce traffic congestion ❑ Address reactive traffic management ❑ Provide timely, accurate, and comprehensive transportation data ❑ Create automated centralized cohesive transportation databases
Actions	❑ Upgrade obsolete and proprietary traffic control equipment ❑ Deploy a hybrid fiber-copper-wireless communications network using open communications standards ❑ Utilize existing twisted pair copper cabling ❑ Improve traffic operations along coordinated corridors ❑ Improve signal operations by updating signal timings and operational design ❑ Deploy ATMS devices and operational strategies along priority corridors ❑ Establish relational databases for transportation and travel data ❑ Identify funding sources and partners to support and sustain ATMS program ❑ Address limitations in staffing, training, and resources to proactively operate and maintain ATMS systems and associated components ❑ Establish regional institutional framework for ATMS
Vision	❑ Improving transportation for a strong and prosperous Pinellas County
Mission	❑ Enhancing traffic safety, operational efficiency, mobility, and staff productivity through technology, innovation, leadership, and public service
Vital Few Priorities	❑ Safety improvement ❑ Congestion mitigation ❑ Environmental stewardship ❑ Proactive traffic management and customer service ❑ Timely, accurate, and comprehensive transportation data for better decisions ❑ ATMS technologies, strategies, and automated tools
Goals	❑ Improve traffic safety ❑ Increase surface street efficiency ❑ Improve mobility ❑ Reduce fuel congestion and environmental cost ❑ Improve productivity (do more with less)
Requirements	❑ User services ❑ Market packages ❑ Devices, end communications equipment, communications infrastructure ❑ Strategies ❑ Funding ❑ Staffing/resources ❑ Training ❑ Phased instrumentation of prioritized operational corridors

ATMS Conceptual Plan

ATMS solutions are founded on advanced technologies that offer the opportunity to address surface transportation needs such as traffic safety, congestion, mobility, and quality of life. These technologies are represented by 64 market packages that support 32 user services and augment conventional solutions to transportation management in addressing traffic congestion and safety. The scarcity of financial resources requires Pinellas County to prioritize its investment needs in traffic control and management technologies for phased implementation. These needs are represented by priority user services, which are customer-oriented strategies for meeting the county's envisioned requirements for traffic control, operations, and management. The delivery of each user service requires investment in a myriad of interrelated intelligent technologies or market packages, which are deployment-oriented strategies that enable delivery of user services. The county's highest priority user services include traffic control, incident management, demand management and operations, and pedestrian safety and access. The highest priority market packages or technologies encompass network surveillance, surface street control, traffic information and dissemination, regional traffic control, incident management system, ITS planning, multi-modal coordination, and pedestrian safety. Table ES-4 maps the county's priority market packages to the respective priority user services.

Table ES-4: Priority User Services and Market Packages

Market Packages (How?)	User Services (What?)			
	Traffic Control	Incident Management	Demand Management and Operations	Pedestrian Safety and Access
Network Surveillance	X	X	X	X
Surface Street Control	X		X	
Traffic Information Dissemination	X	X		
Regional Traffic Control	X		X	
Incident Management System	X		X	
ITS Planning	X	X	X	X
Multi-modal Coordination	X			
Pedestrian Safety	X			X

The priority user services and market packages define the framework for traffic control and management investments in the county designed to address short-term transportation needs. The market packages deliver the envisioned user services through a multitude of empowering technologies and functionalities. They will help the county's transportation professionals optimize management of traffic operations, travel demand, and roadway capacity. These functions include:

- ❑ Detection system
- ❑ Traffic control including local controller and central system software
- ❑ Traffic monitoring
- ❑ Information dissemination
- ❑ Signal priority and signal preemption
- ❑ Uninterrupted power supply
- ❑ Communications

- ❑ Collecting, applying, archiving, and sharing real-time data, video, and operating plans
- ❑ Operational strategies, including fully actuated mode of operation for isolated traffic signals, optimized operational designs, traffic responsive control, traffic adaptive control, incident management, and special event management.

The proposed ATMS elements are summarized in Table ES-5. They encompass technologies for surveillance, control, management, and operations of surface transportation as listed below.

- ❑ Advanced detection (e.g., video image detection, microwave vehicle detection, wireless vehicle detection, etc.)
- ❑ CCTV cameras
- ❑ DMS, DTB signs, blankout signs, and highway advisory radios (HARs)
- ❑ Advanced traffic controllers and cabinets
- ❑ Central control software and local control firmware
- ❑ Adaptive traffic control
- ❑ Signal priority and signal preemption
- ❑ Uninterrupted power supply.

These technologies are to be leveraged by the county for managing recurrent congestion, incidents, special events, and emergency conditions including regional evacuations. Many have previously been deployed along several operational corridors within the county for which the county has gained in-depth understanding and experience applicable to their functionally and requirements for sustained operations and management. The county's ATMS master plan is built on proven technologies, operational strategies, and historical deployments within the county so as to assure a uniform base of deployment. This uniformity minimizes maintenance and operations costs while providing the system operators the needed functionality to optimize traffic operations and safety countywide. This approach is reflected in the stakeholders' election not to reinvent the wheel, during ATMS program definition phase, given the county's historical investments in ATMS.

Table ES-5: Pinellas County ATMS Concept and associated Elements

Technology	Deployment Criteria
Central Control Platform	❑ MIST
Adaptive Control	❑ OPAC ❑ RHODES ❑ Other
Signal Priority	❑ Conditional Service for Buses
Signal Preemption	❑ Fire Trucks En-route to Emergencies
Shared Detection for Adaptive Control & Incident Management	❑ Sensys Wireless Detectors & Microwave Detectors
Traffic Signal Controller	❑ 2070L
Traffic Signal Controller Firmware	❑ NextPhase with ASC2 2070 (Non-adaptive) ❑ NextPhase with ASC2 2070 'OPAC' version (Adaptive)
Adaptive Control Hardware	❑ Single Board Computer (OPAC) ❑ Gecko Board (RHODES)
Device Cabinet	❑ Co-locating ATMS Devices at Traffic Signals (Share Power, Communications, UPS, Batteries, Slab, Grounding, and Cabinet) where R/W is Limited (TS-2 Type 1, Shelf-mount) ❑ Separate Device Cabinets and UPS Cabinets ❑ Type 334 Cabinets for ATMS Devices
Signal Priority & Preemption	❑ Opticom (216 Signals and 130 Fire Trucks are Equipped with Opticom IR Technology). Future System Expansion to Consider Replacement of Opticom IR with Opticom GPS)
Uninterrupted Power Supply (UPS)	❑ Meet FDOT Standard
Detection (IP based) Tactical Control (Signalized Intersections)	❑ Inductive Loops ❑ VIDS at Mastarm based Traffic Signals (MPEG-4) ❑ Sensys Wireless Detectors
Detection Strategic Control (Advanced Detection)	❑ Sensys Wireless and/or MVDSs Upstream of Traffic Signals ❑ Support Adaptive Control and Incident Management
Closed Circuit Television (CCTV) Cameras	❑ Located at Traffic Signals at Intersections of Two Priority Corridors (Primary), Traffic Signals at Intersections of Priority Corridors With Minor Arterials (Secondary), Following One Mile Spacing along Priority Corridors And Horizontal Curves (Tertiary), and for Special Events Needs
Dynamic Message Signs (DMSs) Dynamic Trailblazing Signs (DTBs) Highway Advisory Radios (HARs)	❑ Regionally Significant Corridors and Evacuation Routes (Augment Capacity Of Arterial and Freeway Corridors)
Communications	❑ Open Standards using MPEG-2 Encoders (CCTV Cameras), MPEG-4 Encoders (VIDS), Terminal Servers for CCTV Pan-Tilt-Zoom Control, 100 Mbps Ethernet Switches for Fiber based Local Loops, 1 GigE Ethernet Switches in Air-Conditioned Communications Hubs, 1 GigE Expandable to 10 GigE Core Switch in the Primary Control Center ❑ VDSL for Legacy Twisted Pair Copper Cabling ❑ 4.9 GHz Band for Use in Public Safety Designated by FCC
Primary Control Center	❑ Interconnected to Secondary Control Centers, Communications Hubs Housing Backbone Switches, Field ATMS Devices, and Other Centers

Central Control Platform

Central Control System – Pinellas County has leveraged lessons learned from deployment of ATMS elements along US 19 and SR 60 corridors and selected MIST as its standard common central control platform. The county plans to enhance MIST functionality and features, including interface with RHODES adaptive traffic control system for reporting and monitoring purposes.

Adaptive Control

Today's prominent adaptive traffic control systems can be divided into proven and emerging technologies. The proven adaptive traffic control systems (SCOOT and SCATS) were developed outside the United States and leverage traffic control terminology that is unfamiliar to U.S. signal technicians. The emerging adaptive traffic control systems (RHODES and OPAC) were developed within the United States and continue to evolve. Both groups of adaptive systems are proprietary and not standards-based, since the associated algorithm and data element standards are currently nonexistent. ITS standards strive to bring forth plug-and-play solutions (hardware and software) that facilitate universal interoperability across open architecture and standards-based systems. Though this vision will not be fully realized for many years to come, progress has been made in a multitude of areas, such as fully actuated traffic control, DMS signs, National Transportation Communications for ITS Protocol (NTCIP) standard for center-to-field device communications, etc. No standards, however, have thus far been developed for adaptive traffic control systems and associated strategies.

Instrumentation of operational corridors within Pinellas County with adaptive control systems may use OPAC, RHODES, or other adaptive control systems whose operations will be demarcated across independent corridors or by time-of-day within the same corridor. To this end, the county has taken the initiative to enhance MIST functionality and features, including its interface with RHODES adaptive control system, in addition to OPAC. RHODES leverages peer-to-peer interface with adjacent traffic signals and does not require central supervision and intervention.

The program stakeholders support deployment of ATMS elements along operational corridors countywide including adaptive traffic control, devices, end communications equipment, etc. for traffic monitoring, surveillance, incident management, and traveler information purposes. St. Petersburg, however, wishes to postpone deployment of adaptive control technologies along priority corridors within the city until national standards for adaptive traffic control have been established that address operational needs of grid transportation networks. The city's current time-of-day plans for north-south and east-west corridors provide green-band coordination across the intersecting operational corridors, thus maintaining progressive systems along both corridors. This is currently not feasible under adaptive traffic control. The stakeholders' prioritization of operational corridors and deployment schedule reflect the city's wish not to be a participant in adaptive traffic control systems at this time.

Signal Priority and Signal Preemption

Emergency preemption is achieved via the same equipment used for signal priority. Opticom GPS is a great choice for both transit signal priority and signal preemption in Pinellas County because of its flexibility, versatility, scalability, cost, robustness, ease of maintenance, and enhanced features and functionality compared with Opticom IR (current deployed base). It is the recommended technology. It is also recommended that program stakeholders consider safety and operational benefits of Opticom GPS as the basis for deciding its countywide deployment along operational corridors for fire preemption. Signal preemption is an emergency management strategy for preferential treatment of fire and law enforcement vehicles responding to incidents and emergency conditions. Emergency signal preemption results in timely termination of active phases and provision of green indication to emergency vehicle. There will be significant operational and safety impacts with and without equipping traffic signals along operational corridors with signal preemption. Drivers, perplexed by sudden nature of approaching fire trucks and active siren, behave erratically especially when they are blocked by traffic queues from downstream traffic signals, which would be prevalent if signal preemption is not deployed. This erratic behavior adversely compromises not only the safety of the fire truck and other roadway vehicles but also the corridor's traffic operations. The Opticom GPS and adaptive traffic control system will provide traffic managers robust tools to proactively manage operational impacts of signal preemption while optimizing traffic safety along the route and citizen safety countywide by minimizing the response time to life-critical incidents.

For transit signal priority, various operational considerations influence the viability of transit signal priority. These considerations include level of corridor congestion, coordinated versus isolated traffic operations, number of buses equipped with signal priority technology, and operating strategy for preferential treatment of buses. Signal priority can be supported on a conditional basis. A bus equipped with automated vehicle location and GPS can maintain a real-time status of its location, speed, direction, and schedule, and can request priority treatment only when it is behind schedule by more than a predefined time period established by policy. Alternatively, the signal priority request can be made conditional to presence of on-board passengers exceeding a preset quantity (established by policy) as determined by the automated passenger count system on the bus, and/or intersection excess capacity at the time the signal priority is requested. These conditions can be combined, if necessary, for a more restrictive strategy. For example, if the intersection is still recovering from the impacts of a previous signal priority or signal preemption request, it may not be prudent operationally to accommodate a request for signal priority. Two candidate corridors (US 19 and SR 60) have been identified to serve as test beds for determining operational impacts of transit signal priority prior to considering large-scale deployment within the county.

LOCAL CONTROLLER AND FIRMWARE

The county has selected Type 2070L as its preferred local controller. A variety of local controller firmware packages are available in the marketplace for Type 2070L controller. Some are similar to the existing NEMA traffic control software packages. The local controller software must integrate effectively with the central control system software while accommodating local (e.g., intersection) and strategic (time-of-day plans, traffic responsive, traffic adaptive, etc.) control needs. The NEMA TS2-2003 standard for *Traffic Controller Assemblies with NTCIP Requirements*, Version 02.06, has standardized the essential functions and features needed to provide basic intersection traffic control. Most modern traffic control firmware for local controllers uses the NEMA standard to derive their core functionality and feature set. Manufacturers, who provide local controller software for Type 2070 controller, support basic traffic control functions and features prescribed by the NEMA TS2-2003 standard. As such, the choice of local controller firmware for the Pinellas County ATMS program is largely dependent on which package is most easily supported by the central system software and adaptive traffic control software selections. The county has completed its consideration of these requirements and selected NextPhase and ASC2 2070 for non-adaptive traffic signals and NextPhase with ASC2 2070 'OPAC' version for adaptive traffic signals. In addition, single board computers and Gecko boards are used as adaptive control hardware for OPAC and RHODES, respectively.

CABINET

Locating ATMS equipment for various devices within controller cabinet will enable respective devices to access the cabinet's electrical power, communications infrastructure, and surge protection equipment, resulting in an integrated ATMS system managed at the device level. This approach will minimize system deployment costs, as well as ongoing operations and maintenance costs. This strategy requires traffic cabinet to have sufficient spare space available to accommodate equipment for a myriad of devices, including traffic signals, VIDS, CCTV cameras, blankout signs, encoders, terminal servers, edge switches, surge protectors, and uninterrupted power supply. The county has decided to separate cabinets for CCTV cameras and traffic signals to demarcate separation of maintenance responsibilities between in-house and outsourced staff for traffic signals and CCTV cameras, respectively. The county has also elected to use the TS-2 Type-1 single-door shelf-mount Type IV cabinets as its standard. This election reflects the county's perception that a shelf-mount cabinet provides more space and flexibility to the signal technicians for performing maintenance functions. A two-door cabinet (Naztec Type 6 or Type 333 SD) may be considered for intersections where right-of-way is limited allowing deployment of one cabinet for traffic signals, CCTV cameras, VIDS, end communications equipment, and UPS. Type 334 cabinets will be used for ATMS devices such as CCTV cameras, DMS signs, etc.

UNINTERRUPTED POWER SUPPLY

Power outages are a source of concern when trying to effectively manage the movement of traffic in urbanized areas. It is often impossible to adequately respond to power outages with portable generators due to a lack of resources, or an inability to access an impacted location resulting from congestion and traffic queues. Historically, battery backup systems have been cumbersome in size and did not provide enough hold-up time to outweigh the perceived liability concerns associated with providing delayed response to power outages. Modern battery backup systems are now more capable of meeting the uninterruptible power needs of LED based signalized intersections, and other ATMS elements, such as DMS signs, CCTV cameras, and end communications equipment. Reduced power consumption needs, along with technology enhancement in battery backup systems, have now made it feasible to equip ATMS device cabinets with UPS solutions so that they maintain full or partial functionality for a period of time after power loss. It is recommended that all traffic signals and ATMS devices be equipped with uninterrupted power supply.

SURGE PROTECTION AND EQUIPMENT GROUNDING

The diversity of recommended equipment for traffic control and communications in Pinellas County brings forth the need for a properly designed and applied system of surge protection and equipment grounding. Weather conditions and high-moisture soil characteristics in Pinellas County, especially during rainy summers and hurricane season, further underscore this need. Surge protection equipment for ATMS applications is available from several reputable manufacturers. Device cabinets should have basic AC power protection for all equipment housed within the cabinet. The communications hubs, especially those equipped with HVAC components, also require such protection. The plug-in control equipment in device cabinets needs to be protected as well. The copper-based conductors used for power, video, and data at the device and cabinet levels need to be protected by surge protection units. Protection should also be provided on DMS signs and adjacent to CCTV cameras using properly located Franklin rods. Fiber links will require no protection except that the trace wires included in the fiber optic conduit system need to be properly grounded at each pull box.

DETECTION

A variety of detection strategies and technologies are required to support the envisioned traffic control and management functions in the county: Tactical control detection for traffic control and dilemma zone protection, strategic control detection for system surveillance (traffic responsive, traffic adaptive, and incident management), and collection of measures of effectiveness (speed, travel time, occupancy, etc.). There are many technology options for traffic detection, including inductive loops, video image detection systems, radar, sonic, microwave, wireless, etc. Application of video image and microwave detection systems has been widespread though the wireless vehicle detection system is gaining increased base of deployment and acceptance in the marketplace. Similar to the communications network, detectors are the backbone of ATMS systems. Wireless vehicle detection is recommended upstream of signalized intersections for strategic control, incident detection, and collection of operational measures of effectiveness. Wireless vehicle detection and video image detection are recommended for tactical control at span-wire and mastarm based traffic signals, respectively.

Wireless detection technology uses battery-operated in-pavement sensors to detect the presence and passage of vehicles, transmit detection information to downstream local controller and/or Primary Control Center via an access point located at traffic signals. The access point is interconnected to controller cabinet and uses power-over-Ethernet via Category 5 cabling. Battery-operated repeaters are located upstream (up to 2,000 feet) of the intersection for advanced sensors that could be used for adaptive traffic control and/or incident detection. Ease of installation, 10-year battery life for sensor and repeater, power-over-Ethernet for access point, wireless connectivity between repeater and access point and accuracy better than inductive loops make wireless detection an ideal technology in support of the Pinellas County ATMS program. Use of wireless detection technology will eliminate the need for device cabinets, power source, and wireline connectivity (via underground conduits or aerially) to downstream signalized intersections while providing the opportunity to place strategic detectors up to 2,000 feet upstream of traffic signals.

CCTV CAMERAS

CCTV cameras provide system operators with a visual tool to verify operational conditions caused by recurrent congestion, incidents, special events, and emergencies and to formulate, launch, and assess tailored response plans as appropriate. CCTV cameras should be located at key traffic signals countywide (on minimum 56-foot steel poles) along priority corridors following one-mile spacing. This will provide system operators with full coverage of all four intersection approaches by using cameras with half-mile visibility reach. Co-locating CCTV camera encoders in controller cabinets provides access to cabinet power, communications, and surge protection, resulting in minimizing deployment costs. CCTV cameras should also be located where changes in horizontal roadway alignment may detract from full coverage. They should also augment DMS signs for incident management and verification of DMS signs' messages. It is recommended that CCTV cameras be deployed at signalized intersections of two priority corridors, signalized intersections of priority corridors with minor arterial streets, following a one-mile spacing along priority corridors, and at horizontal curves that limit viewing coverage.

TRAVELER INFORMATION SYSTEM

Information dissemination to travelers can leverage a myriad of devices including DMS, Dynamic Trailblazing (DTB) signs, blankout signs, Highway Advisory Radios (HARs), the Pinellas County ATMS web page, and value added resellers such as news media and 511.

DMSs, DTBs, and blankout signs as well as HARs are used to share traffic information to roadway users at critical and strategic decision making points. These devices can be used along arterial streets for incident management, special events, and regional emergencies, especially along highway segments that serve as alternate routes to freeway corridors or vice versa. The value of these devices depends greatly on whether or not a regional approach to traffic management is utilized. This approach is one that is founded on an institutional framework for cooperation, coordination, and holistic management strategies, founded on tailored response plans for incidents, special events, and emergencies. The incident management plans need to identify criteria for traffic diversion, diversion scenarios, response plans, message sets, and roles and responsibilities of applicable stakeholders within the context of priority corridors, diversion routes, and ATMS instrumentations recommended by this study. Response scenarios need to be developed and agreed upon by the regional stakeholders for a variety of situations and operational conditions requiring regional intervention. Deployment of these devices along the designated routes is contingent upon establishing the required institutional framework, as well as stakeholders' willingness and ability to contribute funding for implementation, operations, and maintenance.

It is recommended that regionally significant corridors and evacuation routes be equipped with DMS, DTB signs, blankout signs, and HARs to augment capacity of arterial and freeway corridors. DMS signs should be placed about a half-mile upstream of critical decision-making signalized intersections. DTB signs should be placed in between DMS signs and critical decision-making points (signalized intersections) to positively guide approaching traffic. Blankout signs should be placed at critical decision-making points (signalized intersections) to positively control appropriate turning movement in effect during incident conditions or special events. HAR static signs and flashers could also be placed along regionally significant corridors and evacuation routes. Interfaces to the Pinellas County web page, news media, 511, and value added resellers make the opportunity to share data and video in real-time feasible, and further the reach and value of collected travel and transportation data and video.

TRANSPORTATION INFORMATION SYSTEM

Availability of timely, accurate, and comprehensive transportation, traffic, and travel information is critical to the mission of Pinellas County and its ability to realize the vision of a safe and efficient surface transportation network within the county. A core infrastructure element required for collecting, processing, sharing, and disseminating related data will be the county's Transportation Information System. ATMS solutions have typically been founded on such redundant infrastructure components as servers, uninterrupted power supplies, air conditioning, and hybrid communications plants, while neglecting the central server system and associated databases. Pinellas County has envisioned the need for leveraging redundant central server system architecture that is capable of ensuring system availability 24 hours a day, 365 days a year. The county has already made significant investments in establishing such a redundant system, which is founded on redundant equipment located at the county's Primary Control Center and the City of Clearwater Traffic Operations Center. The county has realized that server utilization will be small at the onset of the ATMS program deployment; but that data needs and central system resource requirements will grow exponentially as field devices and associated end communications equipment are deployed for center-to-field devices and center-to-center connectivity. The county's server environment has addressed this initial requirement while allowing the opportunity for incremental sizing of central system resources for deployment of future ATMS devices. This approach provides for the needed robustness, flexibility, scalability, and reliability in mission-critical functions associated with the ATMS program. This includes large-scale deployment of adaptive traffic control systems and associated detectors that can also support incident management. The redundant servers will need to operate in a synchronized fashion, using an external time source (i.e. Colorado Time Clock, GPS or Internet) to ensure drift-free server timing, which is essential for maintaining progressive signal systems. This time synchronization is critical for ATMS elements, especially for traffic signal control systems.

PRIMARY CONTROL CENTER

The county is constructing a new facility for day-to-day operations and management of ATMS elements. The Primary Control Center will need to be equipped with a myriad of tools, procedures, and policies to support the county's ATMS program including:

- ❑ Advanced systems, electronics, servers, databases, monitors, communications equipment, etc.
- ❑ Productivity improvement automated tools
- ❑ Performance measures and measures of effectiveness
- ❑ Business process reengineering
- ❑ Institutional strengthening, agreements, procedures, and coordination
- ❑ Customer management system
- ❑ Work-order management system
- ❑ Asset management system
- ❑ Defined and articulated roles and responsibilities for all program stakeholders within and outside the center
- ❑ Integrated video and data sharing, and management across organizational units, agencies, jurisdictional boundaries, systems, modes, and routes
- ❑ Unified and integrated approach to transportation management in response to recurrent congestion, incidents, special events, inclement weather, evacuation, and local/regional emergencies.

Improvements to the Primary Control Center information technology infrastructure can increase the value and use of the existing investment. The current information technology infrastructure is fragmented, as summarized below.

- ❑ Servers located within the county's Primary Control Center and Clearwater's operations center run in independent environments with limited correlation (localized architecture)
- ❑ Database storage/ backup/ recovery is conducted separately for different ATMS sub-systems (central control, adaptive, video)
- ❑ Data repositories are distributed (not stored centrally)
- ❑ User access is application-dependent, requiring user activities to be logged separately for each application and without any centralized monitoring and supervision, which could pose a potential security risk
- ❑ System failover and recovery is manual, rather than automated, resulting in higher response times to system failures, need for continuous support, and elevated vulnerability to human errors and omissions
- ❑ System updates, maintenance, replacement, and troubleshooting are dispersed.

To address these deficiencies, there is a need to establish a seamlessly integrated, automated, and redundant information technology infrastructure across the primary and secondary control centers. This can be achieved by embracing an "enterprise-wide" systems approach. All applicable servers should be treated, regardless of their locations, as part of a common hardware platform distributed across centers. Such an integrated infrastructure will improve system maintenance, operations, and management by leveraging:

- Centralized data repository at the Primary Control Center, augmented by mirrored back-up databases at secondary center(s)
- Automated data backup/storage procedures
- Centralized system access, monitoring, and security across the network, with such features as access logs, virus protection, and password protection
- High-availability architecture, leveraging full redundancy in hardware, software, power source, and centers, for immediate recovery from hardware/application crashes, power failures, or emergency evacuations/shutdowns
- Ease of maintenance, updates, replacement, and troubleshooting.

COMMUNICATIONS

The communications network interconnecting center-to-center and center-to-field devices in Pinellas County will be scalable and based on a hybrid wireline (single-mode fiber optic and legacy twisted pair copper cabling) and wireless media (4.9 GHz band for use in public safety designated by Federal Communications Commission). The network must address ATMS program needs, requirements, and provide sufficient bandwidth capacity to support system modernization countywide. The envisioned communications network will fully leverage legacy aerial and underground twisted pair copper cabling and underground fiber optic cabling. Leveraging the county's legacy communications infrastructure will help optimize return on investment by minimizing deployment costs. The communications infrastructure for supporting the field devices is a critical component of the ATMS program and must be based on national and international standards as applicable.

The communications backbone must be scalable to support an integrated communications solution for transporting video, data, and voice via Ethernet/IP-based technology, and migrate to a fully redundant self-healing mesh topology in the long-run. The Ethernet/IP-based communications backbone will be capable of simultaneously monitoring many video output channels and field devices selected at the Primary Control Center. It must be designed and implemented based on open-architecture, standards-based technologies offering end-to-end solutions that allow for integration of video, data, and voice at controller cabinets or device cabinets. This strategy minimizes implementation costs by co-locating device equipment within the controller cabinets if/when embraced by the county. Ethernet/IP based communications network is recommended involving core, backbone, and edge switches and single-mode fiber plant to provide for center-to-field devices communications. The communications configuration is envisioned to ultimately migrate to a fully redundant mesh topology.

COMMUNICATIONS TOPOLOGY

Network survivability is a critical design criterion in ATMS applications. The network must be capable of sustaining fiber damage caused by contractors, utility companies, public and private construction projects, and inclement weather. The Primary Control Center, being a mission-critical entity, cannot afford to lose communications to other centers and field devices. The communications topology must provide for the needed levels of redundancy to ensure survivability. Mesh topology is the optimum solution, in the long run, in supporting and sustaining the ATMS system's capacity for traffic monitoring, control, and data dissemination. Mesh topology will enable the county to reap significant benefits from redundant communications paths as its investments in communications infrastructure will materialize and converge over time. Mesh topology is comprised of a scattered network of backbone switches, housed in communications hubs or nodes, each interconnected to the core switch in the Primary Control Center and field-based backbone switches through a multitude of communications paths. There should be redundancy, not only in network topology, but also physically. For example, the entry points of redundant fiber cables into the Primary Control Center should be dispersed around the building as opposed to being constrained to one point of entry.

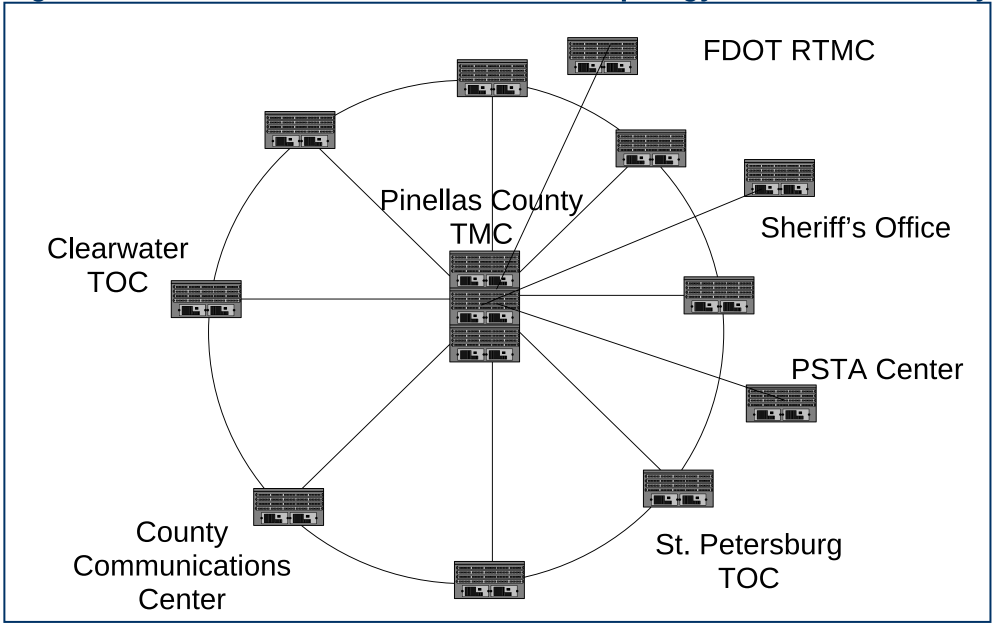
Communications networks are typically designed and implemented in incremental stages leveraging a three-layer communications architecture founded on switching at the Primary Control Center (core level), communications hubs (backbones/aggregate level), and field devices (device level). As deployment progresses, the communications topology typically migrates from star to ring and ring to mesh. A critically important aspect of the county's ATMS communications network is that all ATMS field devices are interconnected to the core switch located within the Primary Control Center via edge and backbone switches, some of which may be located within other centers. This mesh communications topology is distinctly different from a center-to-center communications topology, which is governed by three independent control centers whose core switches are interconnected to one another, with each core switch interconnected with its own exclusive set of ATMS devices deployed along respective priority corridors. Consolidation of system operations within the Primary Control Center requires a communications topology where all ATMS field devices directly report to the Primary Control Center as shown in Figure ES-2.

END COMMUNICATIONS EQUIPMENT

Edge switches coupled with encoders and decoders (hardware and software based) are designed specifically for the ATMS market. The field-based products are hardened at the component level and housed in device cabinets (or device level) for integrating video, data, and audio, as well as managing system components. Since hardware or software decoders are typically housed in an environmentally controlled facility (center), they do not need to be field hardened. This integrated approach supports deployment of ATMS devices along priority corridors without requiring air-conditioned device cabinets. The end communications equipment used at device cabinet will depend on the application. For example:

- ❑ MPEG-2 encoder is used for compressing CCTV camera video at six Mbps/camera for DVD quality image
- ❑ MPEG-4 encoder is used for compressing VIDS camera videos at 1Mbps/camera
- ❑ Terminal server is used to interface PTZ data, DMS signs, and/or legacy controllers using serial protocols (i.e., RS-232, RS-422, and RS-485).

Figure ES-2: Full-Mesh Communications Topology for Pinellas County



An edge switch is used to interface with MPEG-2 and/or MPEG-4 encoders, terminal servers, and Ethernet-based Type 2070 controller (via a 10/100Base-T port). Repeating this connectivity concept at each device level, a series of device level edge switches are daisy-chained together using 100BASE-LX Fast Ethernet single-mode dual fiber local loops for redundancy and fault tolerance. The local loops are interconnected to 100Base-T ports of 1000Base-T backbone switches that are located within air-conditioned communications hubs strategically deployed within the county. Each backbone switch is interconnected to other adjacent backbone switches, and a core switch is housed within the Primary Control Center. This connectivity concept creates a fully redundant mesh topology. Each local loop can interconnect many ATMS devices. The actual number of devices per local loop will primarily depend upon number and video resolution of CCTV/VIDS cameras within the local loop and link management protocol used for providing path redundancy (e.g., spanning tree, rapid spanning tree, etc.). Generally, it is not recommended to exceed more than 60% of total capacity of each local loop (or 600 Mbps).

The county's communications architecture leverages field communications hubs, strategically located within the county, that house the 1000Base-T backbone switches. The backbone switches interface with a multitude of 100Base-T local loops, each containing a myriad of ATMS field devices located along priority corridors. The 1000Base-T backbone switches will be interconnected to a high capacity core switch (1GigE expandable to 10 GigE) located within the county's Primary Control Center and adjacent backbone switches to create a redundant mesh topology. The number of field communications hubs and associated switches is a function of potential physical constraints and/or barriers, as well as distribution and allocation of respective 100Base-T local loops interconnecting to ATMS field devices. From a technical point of view, traffic signals can be daisy-chained into one 100Base-T Ethernet local loop with each loop supporting ten ATC Type 2070s, ten VIDS system, four CCTV cameras, and as many DMS signs as needed. This device configuration will use approximately 60% to 70% of the 100 Mbps capacity of each local loop, assuming 6Mbps for each CCTV camera and 1Mbps for each VIDS camera. The required communications bandwidth is not significant for ATC Type 2070, PTZ data, legacy controllers, and DMS signs, compared to streaming videos generated from CCTV and/or VIDS cameras, to govern communication design.

For center-to-field devices communications, the county has already invested in a core switch housed in the Primary Control Center. This switch can be equipped with both 100BASE-TX electrical interfaces and 1000BASE-LX optical interfaces for interconnection with decoders and the communications backbone, respectively. This approach will require only one core switch at the Primary Control Center and potentially a second one at the Clearwater Traffic Operations Center for redundancy purposes. The core switches will also accommodate center-to-center communications and must be capable of supporting full layer 3 functionality, including IP routing, multicast support (DVMRP, PIM-DM, PIM-SM), and OSPF. The county's core switch is a high density gigabit switch with upgrade path to 10 gigabit capacity.

COMMUNICATIONS STANDARDS

There are two categories of ITS communications standards – those that deal with exchange of information from center-to-field devices, and those that deal with communications between centers. The applicable center-to-field communications standards supporting the Pinellas County's ATMS program include:

- ❑ *NTCIP 1201 (Global Object Definitions)*
- ❑ *NTCIP 1202 (Actuated Signal Control)*
- ❑ *NTCIP 1203 (Dynamic Message Signs)*
- ❑ *NTCIP 1204 (Environmental Sensor Systems)*
- ❑ *NTCIP 1205 (Closed Circuit Television Camera Control)*
- ❑ *NTCIP 1206 (Data Collection & Monitoring)*
- ❑ *NTCIP 1207 (Ramp Meter Control)*
- ❑ *NTCIP 1208 (CCTV Switching)*
- ❑ *NTCIP 1209 (Transportation Sensor Systems)*
- ❑ *.NTCIP 1210 (Signal System Masters)*
- ❑ *NTCIP 1211 (Signal Control & Prioritization)*
- ❑ *NTCIP 1212 (CCTV Network Cameras)*
- ❑ *NTCIP 1213 (Electrical & Lighting Management Systems).*

The applicable center-to-center communications standards include:

- ❑ *DATEX (DATa Exchange)*
- ❑ *CORBA (Common Object Request Broker Architecture)*
- ❑ *XML (eXtensible Markup Language).*

XML is an approach to support robust command and control by leveraging the existing standards of the World Wide Web Consortium (W3C) that include Simple Object Access Protocol (SOAP) and Web Services Description Language (WSDL), a file-based sharing approach with a focus on information sharing and aggregation (referred to as XML Direct). The existing ASN.1 message sets are expected to be translated for reuse with XML. A grassroots effort has begun to implement XML-based center to center communications in many locations, including the Florida Department of Transportation. The county's MIST central control system uses DATEX and CORBA whereas Cameleon (universal software decoder) uses XML.
FDOT SunGuide uses XML for center-to-center communications. Selection of a protocol for

center-to-center communications is a regional decision. FDOT has considered developing SunGuide software for arterial management system, which can be provided to local agencies for center-to-center communications. Another option that is being explored to provide center-to-center connectivity between the FDOT Regional Traffic Management Center and traffic management centers of Hillsborough County and Plant City has been to provide FDOT a client license for central control system for viewing traffic signal operations and Cameleon for viewing and control of CCTV cameras. Pinellas County should engage in discussions with partner agencies throughout the region and advance the dialog toward a center-to-center protocol decision. The implementation of disparate central control software (MIST for Pinellas County, SunGuide for FDOT, Naztec for Hillsborough County and Plant City, SCATS for Pasco County, etc.) will add complexity for a common standards-based center-to-center communications. The data elements used in message exchange between centers is defined in the *Traffic Management Data Dictionary (TMDD).* In addition to the protocol selection, TMDD is an essential standard for use in center-to-center communications and is therefore recommended for use in the Pinellas County system.

IMPLEMENTATION PLAN

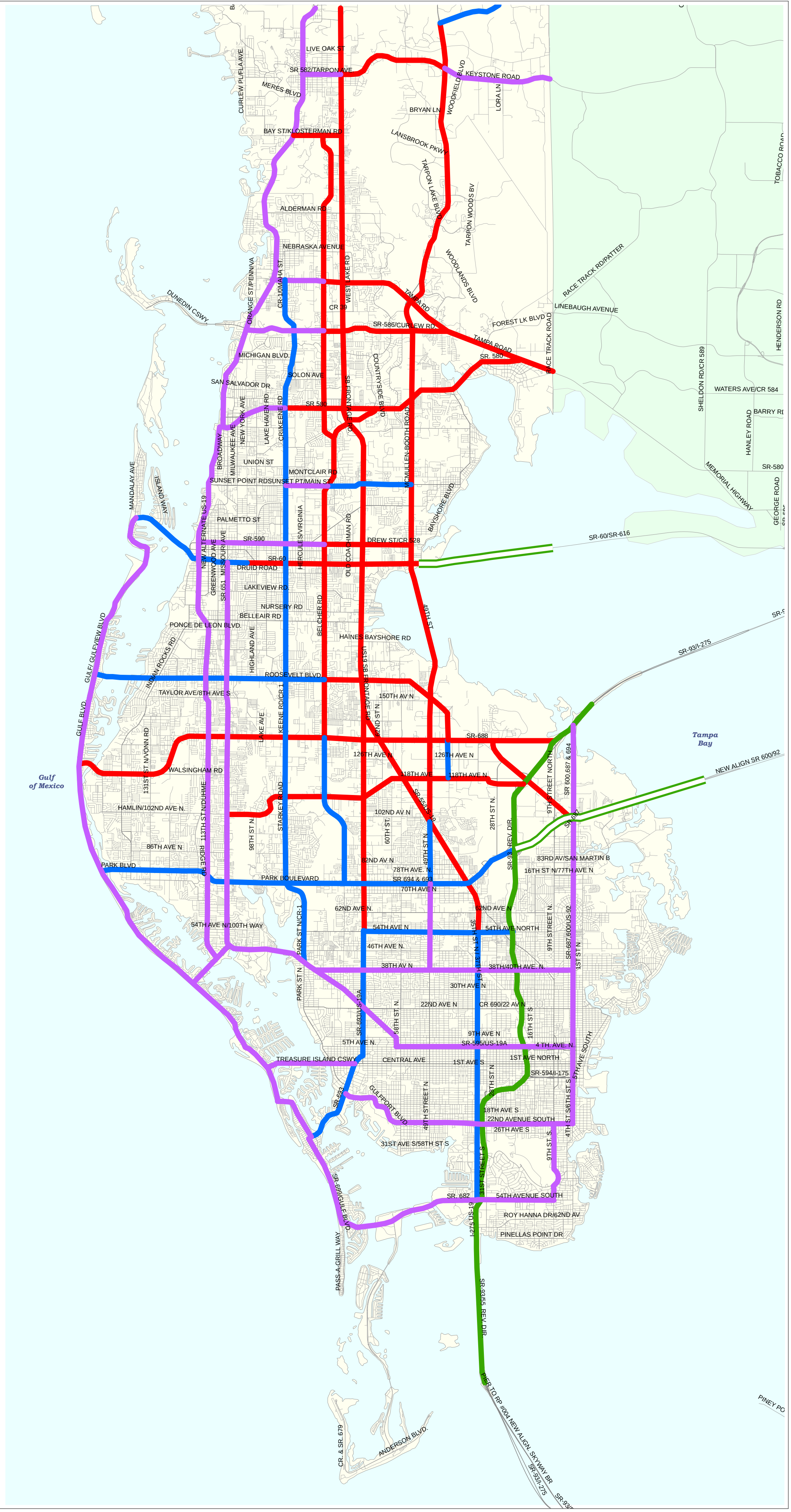
Figure ES-2 and Tables ES-6 through ES-8 present the county's final deployment phases and associated operational corridors. An incremental implementation plan must be followed, not only because of limited funding, but also to ensure newly installed ATMS devices are augmented by additional staff, resources, and training for effective operations and management. This requirement must be supported not only at the onset of program deployment but also sustained over time as the size and complexity of deployed solutions increase to encompass a multitude of priority corridors and technologies. Given the complexity of ATMS solutions and ongoing challenge for hiring and retaining experienced technicians and engineers to sustain system operations and management, the county should also explore outsourcing some of the operations, management, and maintenance functions, particularly those related to electronic devices in the Primary Control Center, ATMS field devices, and fiber-based communications network.

The new ATMS devices and intelligent strategies should be introduced logically and incrementally, having incorporated lessons learned from previous deployments. This approach will help minimize deployment risks associated with advanced technologies and avoid overwhelming the county's maintenance and management staff. The strategy for migrating from the county's legacy system to the envisioned intelligent standards-based, open-architecture system would involve three deployment phases each encompassing many deployment stages. The pace and geographic distribution of recommended improvements as well as number of priority corridors for instrumentation with ATMS, on an annual basis, will depend on the level of funding stream over time. Currently, it is anticipated that the ninth-cent fuel tax will generate an annual funding stream of about $3.8 million. This funding will be sufficient to support the deployment of phase I corridors partially within the 10-year focus of this master plan. Additional funding, such as Federal grants and FDOT ATMS investments along state routes, will be needed to instrument all phase I corridors with ATMS solutions. A series of overlapping deployment stages are needed for design, procurement, construction, and integration of these operational corridors.

METROPOLITAN PLANNING ORGANIZATION
Pinellas County, Florida

Intelligent Transportation System (ITS) Corridors

Figure ES-3
Deployment Phases and Operational Corridors



Legend

Rank 1

Per Stakeholders

- Phase 1
- Phase 2
- Phase 3
- State Freeway (Funded)
- State Freeway (Unfunded)

Roads

- Major Roads
- Minor Roads
- Local Roads

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Prepared By

Gord & Associates, Inc.

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Miles

Table ES-6: ATMS Deployment Phase I Corridors

Dist.	Rank	Main Corridor	Begin	End	B/C Ratio
1	1-1	US 19/SR 55	Beckett Way	54th Avenue N.	11.74
1	1-2	McMullen Booth/East Lake Rd	Trinity	Gulf to Bay/SR 60	11.74
1	1-3	I-275	Howard Frankland Bridge	Skyway Bridge	11.74
1	1-4	Gulf to Bay/SR 60	Hillcrest Ave	Damascus Drive	11.74
22	1-5	Tampa Rd/SR 584/SR 580	East Lake Rd	County Line	23.02
19	1-6	SR 686	49th St	Bryan Dairy	22.90
30	1-7	Bryan Dairy	Seminole Blvd/Alt US 19	Roosevelt/SR 686	21.33
26	1-8	Main St/ SR 580	McMullen Booth	SR 584/Tampa Rd	19.37
32	1-9	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St N/ SR 694	17.85
8	1-10	Tampa Rd	Belcher Rd	McMullen Booth	16.39
24	1-11	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd	16.18
6	1-12	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	14.65
7	1-13	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd	13.73
13	1-14	East Bay/Roosevelt/SR 686	Belcher Rd	49th St N/Bayside Bridge	11.89
9	1-15	Curlew Rd./SR 586	Belcher Rd	McMullen Booth	11.62
10	1-16	Main St./ SR 580	Belcher Rd	McMullen Booth	11.58
14	1-17	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St N	10.56
40	1-18	Countryside Blvd	Belcher Rd	Main St	10.36
15	1-19	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St N	I-275	9.52
4	1-20	66th St. N./SR 693	US 19/SR 55	54th Street	9.03
2	1-21	Belcher Rd	Klosterman Rd	Druid Rd	8.97
12	1-22	Drew St	Belcher Rd	McMullen Booth	8.93
3	1-23	Belcher Rd	Druid Rd	Ulmerton Rd/SR 688	5.92

Table ES-7: ATMS Deployment Phase II Corridors

Dist.	Rank	Main Corridor	Begin	End	B/C Ratio
39	2-1	Starkey Rd/Keene Rd Park St	Tyrone Blvd/ Alt US 19/SR 595	Tampa Rd	15.35
33	2-2	Trinity	East Lake Rd	County Line	11.99
31	2-3	Park Blvd/Gandy Blvd/SR 694	Gulf Blvd	I-275	10.52
18	2-4	49th St	Park Blvd N	US 19/SR 55	10.45
11	2-5	Sunset Point Rd	Belcher Rd	McMullen Booth	9.70
29	2-6	Belleair CSWY/ (West/East) Bay Dr/ SR 686	Gulf Blvd	Belcher Rd	9.21
20	2-7	US 19/SR 55	54th Avenue S	54th Ave N	8.73
41	2-8	Belcher Rd	Ulmerton Rd/SR 688	Park Blvd	8.29
16	2-9	54th Ave N	66th St N	I-275	7.65
5	2-10	66th St N/SR 693	54th Street	Gulf Blvd	6.68
28	2-11	Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	6.39

Table ES-8: ATMS Deployment Phase III Corridors

Dist.	Rank	Main Corridor	Begin	End	B/C Ratio
54	3-1	Gandy Blvd	I-275	Hillsborough County	15.47
47	3-2	Sunset Point Rd	Keene Rd	Belcher Rd	11.28
50	3-3	Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd	5th Ave N/ SR 595	10.49
45	3-4	Tarpon Ave	Alt. US 19/ SR 595	US 19	10.42
46	3-5	Keystone Rd.	East Lake Rd	County Line	10.36
35	3-6	Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore Blvd./Broadway /Edgewater Dr./ Myrtle Avenue	Klosterman Rd	Gulf to Bay/SR 60	10.22
42	3-7	49th St. N.	Park Blvd/ SR 694	38th Ave N	8.93
38	3-8	Missouri Ave/ Séminole Blvd/SR 595/SR 651	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	8.50
52	3-9	Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.	8.47
48	3-10	38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	8.06
34	3-11	Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	8.01
37	3-12	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	Gulf Blvd	Seminole Blvd/Alt. US 19/ Bay Pine Blvd.	7.75
55	3-13	Courtney Campbell	Damascus Rd	Hillsborough County	7.4
23	3-14	Curlew Rd./SR 586	Alt US 19/SR 595/ Bayshore Blvd	Belcher Rd.	7.29
44	3-15	4th St. N.	22nd Ave S	I-275	7.20
51	3-16	22nd Ave S/Gulfport Blvd	Pasadena Ave	4th St N	6.15
17	2-13	Alt US 19/SR 595/ Pinellas Ave	Klosterman Rd	Pasco County Line	5.62
43	3-17	9th St S	54th Ave S	22nd Ave S	5.63
49	3-18	5th Ave N/ SR 595/Bay Pines Blvd	Tyrone Blvd/ SR 595	4th St N	5.63
36	3-19	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
27	3-20	Drew St/ SR 590	Alt US 19/SR 595/ Ft Harrison Ave	Belcher Rd	5.00
25	3-21	Main St/ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd	3.27
53	3-22	54th Ave S	I-275	9th St S	3.27
21	3-23	Tampa Rd	Alt US 19/SR 595/ Palm Harbor	Belcher Rd	1.65

For example, each deployment stage could leverage one year for design and two years for procurement, construction, and integration with $3.8 million annual funding. The design years could encompass the first, fourth, and seventh years of a 10-year implementation plan each following a 2-year period for procurement, construction, and integration. This approach will help streamline design and deployment activities by bundling several corridors within each deployment stage as feasible as supported by annual revenue stream. In addition, this approach will allow the county to leverage enhancements in advanced technologies and operational strategies as well as handle contract management and administration. The staged deployment approach would be repeated for subsequent set of operational corridors until all priority corridors have been instrumented. This strategy will enable the county to instrument most priority corridors of deployment phase I within a 10-year period. Care must be exercised to ensure each deployment stage is constructible and manageable from the work programming, construction management, and execution standpoint.

Table ES-9 presents the overlapping three-year deployment stages and associated priority corridors to be instrumented with ATMS devices, support infrastructure, communications infrastructure, and operational strategies consistent with the ATMS master plan. The projects included in the first deployment stage reflect corridors previously funded for ATMS improvements under various funding mechanisms, corridors' ranking score, and corridors that facilitate center-to-center connectivity to enable sharing of traffic video and data and automated collaborations across centers.

Table ES-9: Deployment Stages and Priority Corridors (Phase I Corridors)

Stage	Rank	Priority Corridors			
		Roadway	From	To	Length (Miles)
1	1-1 F	US 19/SR 55	Beckett Way	54th Avenue N.	25.25
	1-2 F	McMullen Booth/East Lake Rd	Trinity	Gulf to Bay/SR 60	15.17
	1-3 F	I-275	Howard Frankland Bridge	Skyway Bridge	11.43
	1-4 F	Gulf to Bay/SR 60	Hillcrest Ave.	Damascus Drive	4.54
	1-5 F	Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	7.42
	1-10 F	Tampa Rd	Belcher Rd.	McMullen Booth	2.34
	1-23 F	Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	4.31
2	1-6	SR 686	49th St.	Bryan Dairy	1.25
	1-7	Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	8.32
	1-8	Main St./ SR 580	McMullen Booth	SR 584/Tampa	3.28
	1-9	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR 694	3.10
3	1-11	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa	0.93
	1-12	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	6.78
	1-13	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd.	2.99
	1-14	East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	2.83
4	1-15	Curlew Rd./SR 586	Belcher Rd.	McMullen Booth	2.34
	1-16	Main St./ SR 580	Belcher Rd.	McMullen Booth	2.41
	1-17	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	8.10
	1-18	Countryside Blvd	Belcher Rd.	Main St.	1.13
5	1-19	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	5.01
	1-20	66th St. N./SR 693	US 19/SR 55	46th Avenue N.	6.00
	1-21	Belcher Rd.	Klosterman Rd.	Druid Rd	8.89
	1-22	Drew St.	Belcher Rd.	McMullen Booth	2.28

The overall cost for modernizing and expanding the Pinellas County's ATMS program based on advanced technologies and strategies for each deployment phase are presented in Tables ES-10 through ES-12.

Table ES-10: ATMS Program Cost Summary – Deployment Phase I

Item	Total Cost
ATMS Field Devices	$13,520,528
Field Communications	$6,687,644
Mobilizations	$1,010,409
Maintenance of Traffic	$1,010,409
Engineering Design	$3,334,348
System Testing, Integration, and Configuration	$2,424,981
Construction Engineering and Inspection	$1,333,739
Contingency	$2,020,817
Total Cost	$31,342,874
Annual Operations and Maintenance Cost	$3,134,287

Table ES-11: ATMS Program Cost Summary – Deployment Phase II

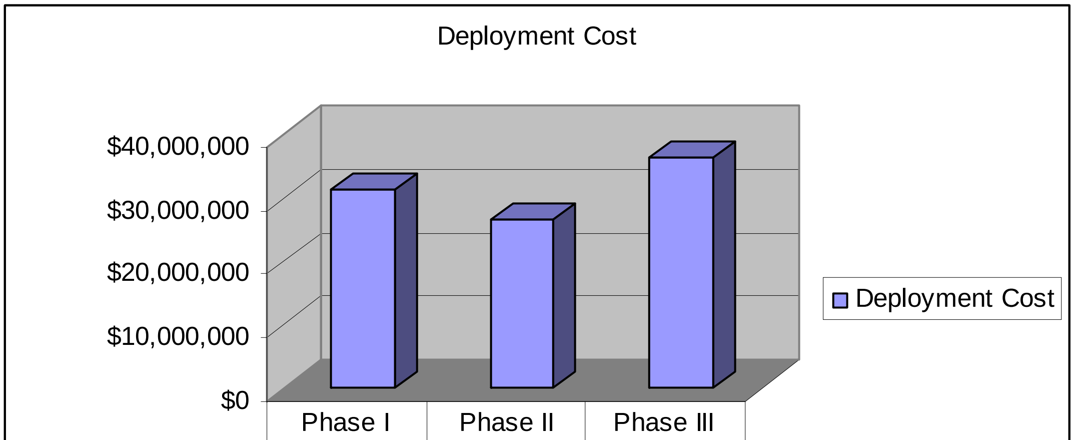
Item	Total Cost
ATMS Field Devices	$9,885,743
Field Communications	$7,279,231
Mobilizations	$858,249
Maintenance of Traffic	$858,249
Engineering Design	$2,832,221
System Testing, Integration, and Configuration	$2,059,797
Construction Engineering and Inspection	$1,132,888
Contingency	$1,716,497
Total Cost	$26,622,875
Annual Operations and Maintenance Cost	$2,662,287

Table ES-12: ATMS Program Cost Summary – Deployment Phase III

Item	Total Cost
ATMS Field Devices	$12,643,568
Field Communications	$10,885,808
Mobilizations	$1,176,469
Maintenance of Traffic	$1,176,469
Engineering Design	$3,882,347
System Testing, Integration, and Configuration	$2,823,525
Construction Engineering and Inspection	$1,552,939
Contingency	$2,352,938
Total Cost	$36,494,062
Annual Operations and Maintenance Cost	$3,649,406

Figure ES-4 presents the Pinellas Countywide ATMS deployment phases and associated costs. This estimated cost assumes deployment of ATMS elements, advanced controllers and cabinets, and adaptive traffic control technology along all operational corridors countywide excepting that traffic signals along operational corridors, located within the City of St. Petersburg, will not operate under adaptive traffic control operations at this time.

Figure ES-4: Pinellas County ATMS Deployment Cost by Phase



	Phase I	Phase II	Phase III
Deployment Cost	$31,342,874	$26,622,875	$36,494,062

As previously stated, the county must invest in the needed staffing, resources, training, and operational improvements during incremental deployment stages. This is essential to proactively support and sustain the critical functions such as system operations, maintenance, management, and training. The county should leverage lessons learned and best practices from real-world deployment of ATMS solutions to assess need, opportunity, and viability of outsourcing some of these functions where appropriate. Typically, the annual cost for these functions is about 10 percent of deployed ATMS cost. This translates into the need for approximately $3,134,287 of additional funding upon completion of all phase 1 corridors. Table ES-13 presents estimated stage-based cost for operational corridors included in deployment phase I assuming full-built ATMS scenario. Care needs to be exercised to provide the needed funding to ensure program success by sustaining ATMS system support functions.

Table ES-13: Operations and Management Costs

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total
$974,682	$567,751	$322,232	$432,277	$837,346	$3,134,287

Table ES-14 presents the deployment cost for establishing interim center-to-center connectivity between the Primary Control Center and the county's ATMS program stakeholders for sharing streaming video, data, and operations plans as well as cooperation and coordination for regional transportation management. The interim connectivity leverages wireless communications media until fiber optic cabling is deployed along priority corridors that will facilitate permanent connectivity. The interim center-to-center connectivity is essential for optimizing transportation management regionally by sharing valuable traffic data and video for better decision making by the ATMS program stakeholders such as Clearwater, St. Petersburg, PSTA, Pinellas Emergency Management Center, Clearwater 911 Center, Clearwater Fire Department, Clearwater Police Department, St. Petersburg Police Department, Pinellas County Sheriff's Office, etc.

Table ES-15 through ES-21 and Figures ES-5 though ES-7 present the Pinellas Countywide

ATMS investment representative of existing and programmed ATMS elements for operational corridors included in deployment phases I, II, and III. Section 4 contains many additional tables that:

- Itemize, by deployment phase, total quantities and costs associated with ATMS devices, equipment, structures, infrastructure, operational strategies, and communications network as well as development and deployment costs.
- Present ATMS devices, equipment, structures, infrastructure, operational strategies, and communications network as well as development and deployment costs by deployment phase, ranked operational corridors, and signalized intersections along the operational corridors.
- Present a high-level summary of ATMS elements and costs by deployment phases I, II, and III and associated ranked operational corridors.
- Present project costs for each ranked operational corridor by field equipment, field communications, and development costs graphically.
- Itemize, by deployment phase and operational corridors, total quantities and costs associated with ATMS devices, equipment, structures, infrastructure, operational strategies, and communications network as well as development and deployment costs.

Together, these tables and figures present a detailed investment plan for each deployment phase, ranked priority corridor, and associated ATMS elements and serve Pinellas County as a summary representation of work scope and engineer's estimate for project budgeting and programming purposes since ATMS quantities and costs are segregated by:

- Field devices including ATC (ATC Type 2070s and ITS cabinets), CCTV cameras, VIDS, DMS signs, adaptive traffic control, and associated foundations and structures as applicable
- Field communications including MPEG-2 encoders, MPEG-4 encoders, terminal servers, edge switches, backbone switches, communications infrastructure, and communications media
- Maintenance of traffic (MOT), mobilization, engineering design, construction engineering and inspection (CEI), and contingency.

These elements represent the ATMS instrumentation needed to provide surface street control (adaptive traffic control countywide excepting St. Petersburg), network surveillance, traveler information system, and incident management, which are presented in Figures ES-8 through ES-11.

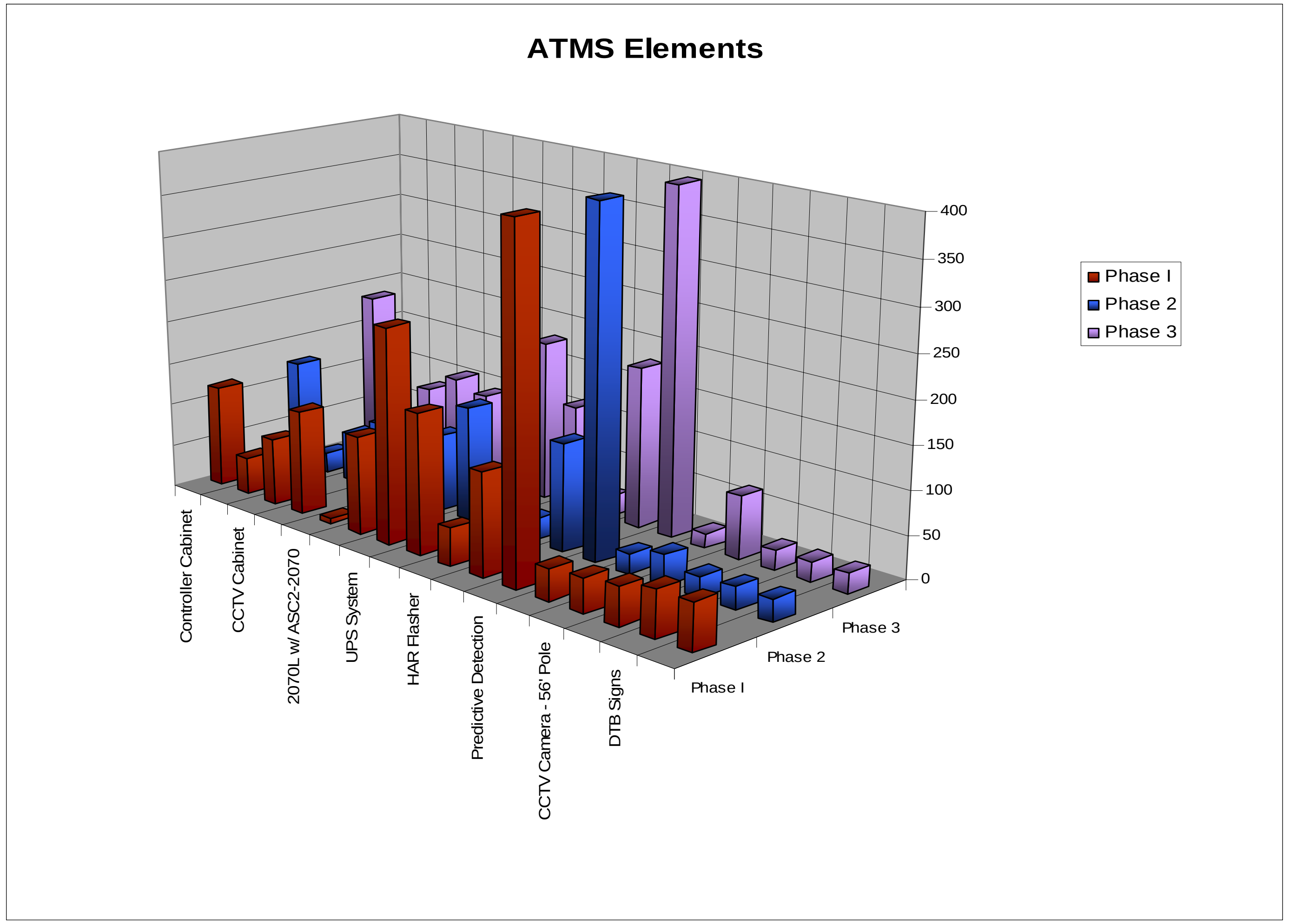
Table ES-14: Pinellas Countywide ATMS Investment

From	Center	Comm. Media	Communications Path	Center Elements								Total Cost
				Communications equipment & termination (F&I)	Software-based video decoder client (F&I) and system training	Ethernet Hub Switch (F&I)	Support ITS Server (TOC, map, web, equipment polling, adaptive control, etc.)	ITS Operator Workstation (1/center)	Work Stations Monitors (2/ workstation)	TOC LCD Displays (2x 42" LCD displays)	UPS 5 KVA for 120/208VAC rack-mount (F&I)	
Primary Control Center	TOC-Clearwater	FO	Existing fiber link		$1,100		$7,200				$4,000	$12,300
Primary Control Center	TOC-St. Petersburg	FO-wireless	US19 S (FO), SR 688 E (FO), 49th St S (FO), US 19 S (FO), 54th St to I-275 (wireless), I-275 S (FO), 4th Ave to midpoint (wireless repeater), St. Pete TOC (wireless)	$35,680	$1,100	$16,000	$7,200			$8,000	$4,000	$71,980
Primary Control Center	PSTA	FO-wireless	US19 S (FO), SR 688 E up to 49th St (FO), SR 688 E (wireless), 34th St (wireless repeater point), PSTA TOC (wireless)	$23,120	$1,100	$16,000	$7,200	$3,000	$1,400	$8,000	$4,000	$63,820
Primary Control Center	Pinellas EOC	FO-wireless	US19 S (FO), SR 60 W up to Fort Harrison Ave. (FO), Fort Harrison Ave. S (wireless), EOC (wireless)	$12,560	$1,100	$16,000		$3,000	$1,400	$8,000	$4,000	$46,060
Primary Control Center	Clearwater 911 Center	FO-wireless	US19 S (FO), SR 60 W up to Fort Harrison Ave. (FO), existing Fort Harrison Ave. S (wireless), EOC (wireless repeater), 911 Center (wireless)	$11,560	$1,100	$16,000		$3,000	$1,400		$4,000	$37,060
Primary Control Center	Clearwater Fire Dept.	FO	Existing fiber link	$1,000	$1,100			$3,000	$1,400	$8,000	$4,000	$18,500
Primary Control Center	Clearwater PD	FO	Existing fiber link	$1,000	$1,100			$3,000	$1,400	$8,000	$4,000	$18,500
Primary Control Center	St. Pete PD	FO-ATM	Connection to RTMC by others		$1,100	$16,000		$3,000	$1,400	$8,000		$29,500
Primary Control Center	PCSO	FO-ATM	Connection to RTMC by others		$1,100			$3,000	$1,400	$8,000		$13,500
Subtotal (F&I)												$311,220
Mobilizations	5%											$15,561
Engineering Design	18%											$58,821
System Testing, Integration, and Configuration	18%											$58,821
Construction Engineering and Inspection	6%											$19,607
Contingency	10%											$32,678
TOTAL												$496,707

Table ES-15: Pinellas Countywide ATMS Investment

ITS Component	Item	Unit	Unit Cost	Total ATMS Program	Pinellas Countywide ATMS Investment											
					Existing Investment		Phase I		Phase 2		Phase 3		New ATMS Program		Existing and New ATMS Program	
					QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	430	72	$734,400	119	$1,213,800	125	$1,275,000	186	$1,897,200	430	$4,386,000	502	$5,120,400
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	91	10	$50,000	44	$220,000	24	$120,000	23	$115,000	91	$455,000	101	$505,000
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	225	55	$192,500	77	$269,500	58	$203,000	90	$315,000	225	$787,500	280	$980,000
	Device Cabinet Foundation	Each	$1,000	316	65	$65,000	121	$121,000	82	$82,000	113	$113,000	316	$316,000	381	$381,000
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	144	0	$0	6	$19,800	36	$118,800	102	$336,600	144	$475,200	144	$475,200
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	286	72	$444,960	113	$698,340	89	$550,020	84	$519,120	286	$1,767,480	358	$2,212,440
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	567	0	$0	248	$1,488,000	133	$798,000	186	$1,116,000	567	$3,402,000	567	$3,402,000
	TVSS Surge Protection (Data/Power)	Each	$600	337	137	$82,200	162	$97,200	55	$33,000	120	$72,000	337	$202,200	474	$284,400
	HAR Sign and Flashers (post-mount)	Each	$1,500	91	0	$0	44	$66,000	24	$36,000	23	$34,500	91	$136,500	91	$136,500
	VIDS at Traffic Signals	Each	$20,700	430	72	$1,490,400	119	$2,463,300	125	$2,587,500	186	$3,850,200	430	$8,901,000	502	$10,391,400
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	1556	416	$498,333	678	$812,188	469	$561,823	409	$489,948	1556	$1,863,958	1972	$2,362,292
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	77	55	$1,661,000	37	$1,117,400	23	$694,600	17	$513,400	77	$2,325,400	132	$3,986,400
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	148	0	$0	40	$608,000	35	$532,000	73	$1,109,600	148	$2,249,600	148	$2,249,600
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	91	10	$750,000	44	$3,300,000	24	$1,800,000	23	$1,725,000	91	$6,825,000	101	$7,575,000
	DTB Signs (post-mount)	Each	$16,000	103	0	$0	54	$864,000	26	$416,000	23	$368,000	103	$1,648,000	103	$1,648,000
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	103	0	$0	54	$162,000	26	$78,000	23	$69,000	103	$309,000	103	$309,000
					Total	$5,968,793	Total	$13,520,528	Total	$9,885,743	Total	$12,643,568	Total	$36,049,838	Total	$42,018,632
Communications Network	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	581513	0	$0	148236	$3,112,956	173633	$3,646,289	259644	$5,452,524	581513	$12,211,769	581513	$12,211,769
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	581513	0	$0	148236	$1,630,596	173633	$1,909,961	259644	$2,856,084	581513	$6,396,641	581513	$6,396,641
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	0	153437	$3,222,173	0	$0	0	$0	0	$0	0	$0	153437	$3,222,173
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	0	153437	$1,687,805	0	$0	0	$0	0	$0	0	$0	153437	$1,687,805
	Fiber Optic Splice Box and Grounding System	Each	$1,500	700	137	$205,500	240	$360,000	207	$310,500	253	$379,500	700	$1,050,000	837	$1,255,500
	Fiber Optic Pull Box with Grounding System	Each	$800	1454	384	$306,874	371	$296,472	434	$347,266	649	$519,288	1454	$1,163,026	1837	$1,469,899
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	225	55	$165,000	77	$231,000	58	$174,000	90	$270,000	225	$675,000	280	$840,000
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	430	72	$324,000	119	$535,500	125	$562,500	186	$837,000	430	$1,935,000	502	$2,259,000
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	700	137	$205,500	240	$360,000	207	$310,500	253	$379,500	700	$1,050,000	837	$1,255,500
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	5	1	$10,000	5	$50,000	0	$0	0	$0	5	$50,000	6	$60,000
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	46	0	$0	0	$0	0	$0	46	$165,600	46	$165,600	46	$165,600
	Fiber Splices	Each	$22	2984	548	$12,056	960	$21,120	828	$18,216	1196	$26,312	2984	$65,648	3532	$77,704
	Hub Cabinet	Each	$30,000	3	1	$30,000	3	$90,000	0	$0	0	$0	3	$90,000	4	$120,000
					Total	$6,168,907	Total	$6,687,644	Total	$7,279,231	Total	$10,885,808	Total	$24,852,683	Total	$31,021,590
Summary Cost	**Corridor Subtotal**			$60,902,522		$12,137,701		$20,208,172		$17,164,974		$23,529,376		$60,902,522		$73,040,222
	Mobilizations			$3,045,126		$606,885		$1,010,409		$858,249		$1,176,469		$3,045,126		$3,652,011
	MOT			$3,045,126		$606,885		$1,010,409		$858,249		$1,176,469		$3,045,126		$3,652,011
	Engineering Design and Survey			$10,048,916		$2,002,721		$3,334,348		$2,832,221		$3,882,347		$10,048,916		$12,051,637
	System Testing, Integration, and Configuration			$7,308,303		$1,456,524		$2,424,981		$2,059,797		$2,823,525		$7,308,303		$8,764,827
	Construction Engineering and Inspection			$4,019,566		$801,088		$1,333,739		$1,132,888		$1,552,939		$4,019,566		$4,820,655
	Contingency			$6,090,252		$1,213,770		$2,020,817		$1,716,497		$2,352,938		$6,090,252		$7,304,022
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$33,557,289		$6,687,873		$11,134,702		$9,457,901		$12,964,686		$33,557,289		$40,245,162
	Total Capital Costs			$94,459,811		$18,825,574		$31,342,874		$26,622,875		$36,494,062		$94,459,811		**$113,285,384**
	Annual Operations and Maintenance Cost			$9,445,981		$1,882,557		$3,134,287		$2,662,287		$3,649,406		$9,445,981		$11,328,538

Figure ES-5: ATMS Elements



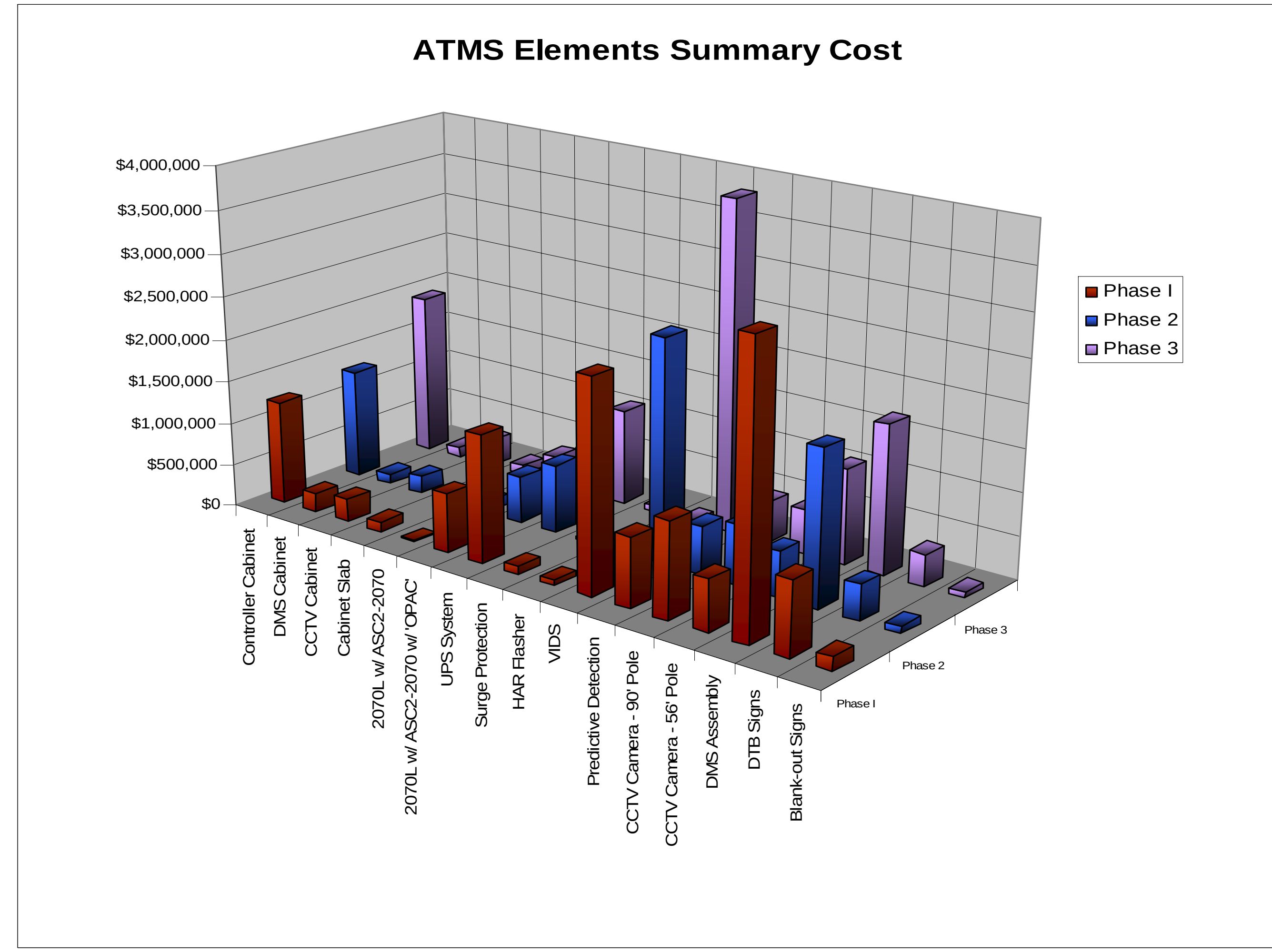
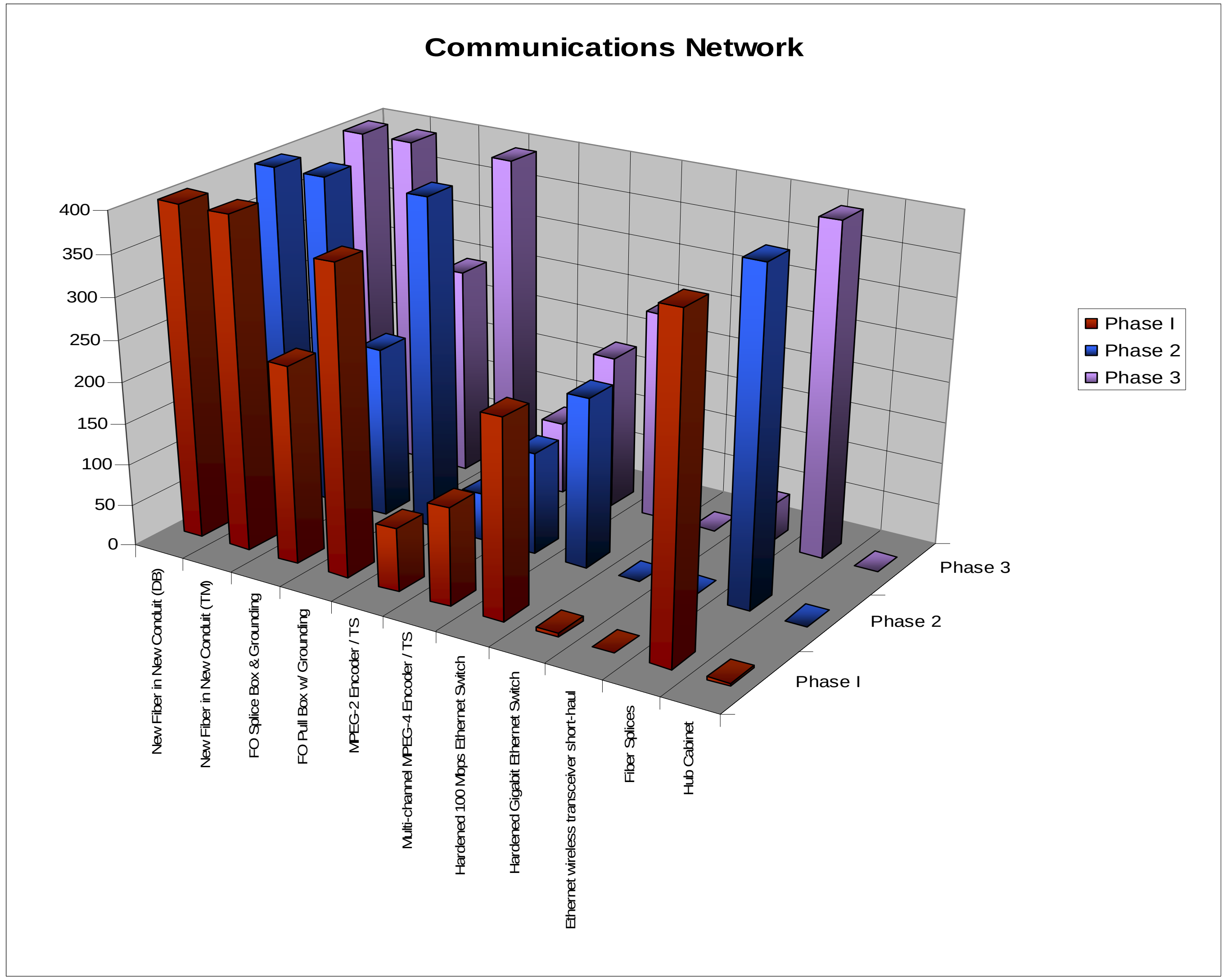


Table ES-16: ATMS Elements

Item	Unit	Unit Cost	Phase I		Phase 2		Phase 3		ATMS Program Future Projects	
			QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost
Controller Cabinet	Each	$10,200	119	$1,213,800	125	$1,275,000	186	$1,897,200	430	$4,386,000
DMS Cabinet	Each	$5,000	44	$220,000	24	$120,000	23	$115,000	91	$455,000
CCTV Cabinet	Each	$3,500	77	$269,500	58	$203,000	90	$315,000	225	$787,500
Cabinet Slab	Each	$1,000	121	$121,000	82	$82,000	113	$113,000	316	$316,000
2070L w/ ASC2-2070	Each	$3,300	6	$19,800	36	$118,800	102	$336,600	144	$475,200
2070L w/ ASC2-2070 w/ 'OPAC'	Each	$6,180	113	$698,340	89	$550,020	84	$519,120	286	$1,767,480
UPS System	Each	$6,000	248	$1,488,000	133	$798,000	186	$1,116,000	567	$3,402,000
Surge Protection	Each	$600	162	$97,200	55	$33,000	120	$72,000	337	$202,200
HAR Flasher	Each	$1,500	44	$66,000	24	$36,000	23	$34,500	91	$136,500
VIDS	Each	$20,700	119	$2,463,300	125	$2,587,500	186	$3,850,200	430	$8,901,000
Predictive Detection	Det	$1,198	678	$812,188	469	$561,823	409	$489,948	1556	$1,863,958
CCTV Camera - 90' Pole	Each	$30,200	37	$1,117,400	23	$694,600	17	$513,400	77	$2,325,400
CCTV Camera - 56' Pole	Each	$15,200	40	$608,000	35	$532,000	73	$1,109,600	148	$2,249,600
DMS Assembly	Each	$75,000	44	$3,300,000	24	$1,800,000	23	$1,725,000	91	$6,825,000
DTB Signs	Each	$16,000	54	$864,000	26	$416,000	23	$368,000	103	$1,648,000
Blank-out Signs	Each	$3,000	54	$162,000	26	$78,000	23	$69,000	103	$309,000

Figure ES-6: Communications Network



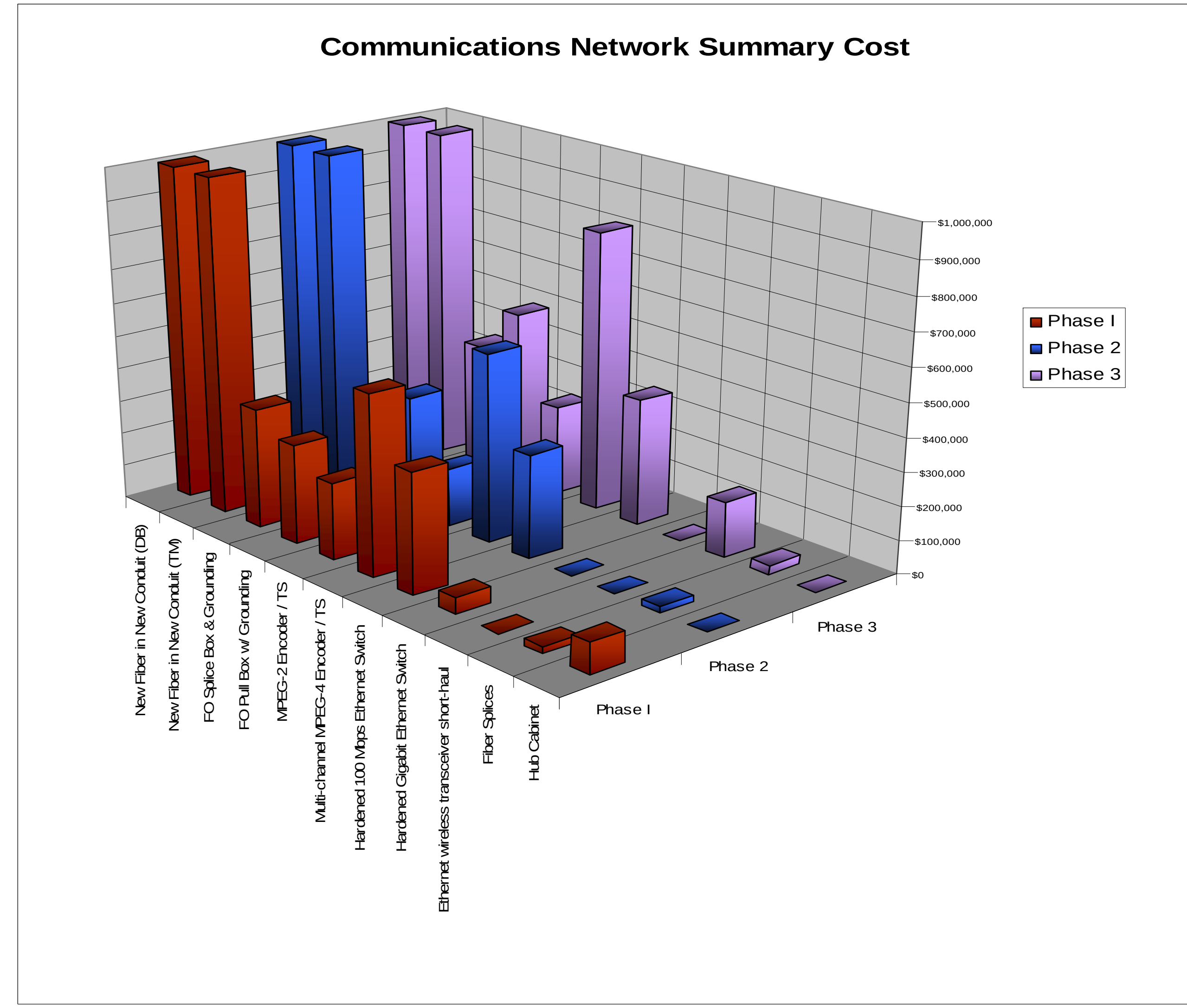


Table ES-17: Communications Network

Item	Unit	Unit Cost	Phase I		Phase 2		Phase 3		ATMS Program Future Projects	
			QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost
New Fiber in New Conduit (DB)	Ft	$21	148236	$3,112,956	173633	$3,646,289	259644	$5,452,524	581513	$12,211,769
New Fiber in New Conduit (TM)	Ft	$11	148236	$1,630,596	173633	$1,909,961	259644	$2,856,084	581513	$6,396,641
FO Splice Box & Grounding	Each	$1,500	240	$360,000	207	$310,500	253	$379,500	700	$1,050,000
FO Pull Box w/ Grounding	Each	$800	371	$296,472	434	$347,266	649	$519,288	1454	$1,163,026
MPEG-2 Encoder / TS	Each	$3,000	77	$231,000	58	$174,000	90	$270,000	225	$675,000
Multi-channel MPEG-4 Encoder / TS	Each	$4,500	119	$535,500	125	$562,500	186	$837,000	430	$1,935,000
Hardened 100 Mbps Ethernet Switch	Each	$1,500	240	$360,000	207	$310,500	253	$379,500	700	$1,050,000
Hardened Gigabit Ethernet Switch	Each	$10,000	5	$50,000	0	$0	0	$0	5	$50,000
Ethernet wireless transceiver short-haul	Each	$3,600	0	$0	0	$0	46	$165,600	46	$165,600
Fiber Splices	Each	$22	960	$21,120	828	$18,216	1196	$26,312	2984	$65,648
Hub Cabinet	Each	$30,000	3	$90,000	0	$0	0	$0	3	$90,000

Table ES-18: ATMS Investment Plan for Implementation Phase I

Phase	Corridor Rank	Roadway	Limits: From	Limits: To	Miles	Non-Adaptive Signals	Adaptive Signals	TS-2 Cabinet	DMS Cabinet	CCTV Cabinet	Adaptive Control	VIDS	Detection	CCTV Level 1	CCTV Levels 2-3	MPEG-2 Encoder	MPEG-4 Encoder	DMS Assembly	DTB Signs	Blank-out Signs	Ethernet Switch	TVSS	HAR Sign and Flashers	UPS	Proposed Fiber in Conduit	Existing UG Fiber	COM HUB	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor	Phase
1	1-1	US 19/SR 55	Beckett Way	54th Avenue N.	25.26		12	12	8	11	12	12	204	5	6	11	12	8	12	12	31	31	8	12	3.03	21.88	2	$2,091,979	$534,701	$1,447,300	$4,073,980	$31,342,874
	1-2	McMullen Booth/East Lake Rd.	Trinity	Gulf to Bay/SR 60	15.17				2	1			106	1		1		2	6	6	3	3	2		1.21	13.27		$579,500	$120,874	$385,906	$1,086,279	
	1-3	I-275	Howard Frankland Bridge	Skyway Bridge	11.44																											
	1-4	Gulf to Bay/SR 60	Hillcrest Ave.	Damascus Drive	4.54				2	4			78	1	3	4		2	3	3	6	6	2			4.23		$427,400	$50,528	$263,338	$741,266	
	1-5	Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	7.42		9	9	1	2	9	9	55	2		2	9	1	1	1	12	12	1	9	3.42			$631,705	$390,535	$563,255	$1,585,495	
	1-6	SR 686†	49th St.	Bryan Dairy	1.25		1	1	1	3	1	1	9	2	1	3	1	1	1	1	5	5	1	1	1.25			$247,461	$141,140	$214,119	$602,721	
	1-7	Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	8.32	1	11	9	4	8	9	9	47	6	2	8	9	4	4	4	21	21	4	9	8.32			$1,238,382	$898,915	$1,177,651	$3,314,948	
	1-8	Main St./ SR 580	McMullen Booth	SR 584/Tampa Rd.	3.28		3	4	1	2	4	4	12		2	2	4	1	1	1	7	7	1	4	3.28			$288,115	$332,441	$341,926	$962,482	
	1-9	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR 694	3.11	4		4		1		4		1		1	4				5	5		4	3.11			$198,500	$315,594	$283,266	$797,359	
	1-10	Tampa Rd*	Belcher Rd.	McMullen Booth	2.34		1	1		2	1	1	22	1	1	2	1				3	3		1		1.73		$120,876	$19,764	$77,493	$218,132	
	1-11	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd.	0.94		1	1	1		1	1	12				1	1	1	1	2	2	1	1		0.84		$161,955	$10,676	$95,120	$267,751	
	1-12	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	6.78		6	6	2	3	6	6	51		3	3	6	2	3	3	11	11	2	6		3.43		$603,674	$69,968	$371,177	$1,044,818	
	1-13	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd.	3.00					2			4		2	2					2	2			3.00			$47,192	$281,456	$181,085	$509,733	
	1-14	East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	2.83		7	7	1	2	7	7	100	1	1	2	7	1	1	1	10	10	1	7	2.83			$580,252	$322,401	$497,362	$1,400,014	
	1-15	Curlew Rd./SR 586*	Belcher Rd.	McMullen Booth	2.34		1	1		1	1	1	22	1		1	1				2	2		1		1.77		$95,176	$13,676	$59,977	$168,829	
	1-16	Main St./ SR 580*	Belcher Rd.	McMullen Booth	2.42		2	2	1	2	2	2	33	2		2	2	1	1	1	5	5	1	2	1.33	1.03		$317,591	$149,821	$257,544	$724,956	
	1-17	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	8.11	1	14	12	4	11	12	12	80	6	5	11	12	4	4	4	27	27	4	12	3.55	4.55	1	$1,454,853	$551,788	$1,105,659	$3,112,301	
	1-18	Countryside Blvd	Belcher Rd.	Main St.	1.14		3	3		1	3	3	7	1		1	3				4	4		3				$175,325	$28,852	$112,502	$316,679	
	1-19	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	5.01		6	6	3	1	6	6	45	1		1	6	3	3	3	10	10	3	6	2.61	2.20		$666,586	$295,154	$529,919	$1,491,659	
	1-20	66th St. N./SR 693	US 19/SR 55	46th Avenue N.	6.01		11	11	4	5	11	11	66	2	3	5	11	4	4	4	20	20	4	11	6.01			$1,090,443	$665,718	$967,644	$2,723,804	
	1-21	Belcher Rd.	Klosterman Rd.	Druid Rd	8.89		16	19	5	11	19	19	60	4	7	11	19	5	5	5	35	35	5	19	8.89			$1,548,355	$1,001,782	$1,405,126	$3,955,263	
	1-22	Drew St.	Belcher Rd.	McMullen Booth	2.28		2	2			2	2	18				2				2	2		2		1.32		$115,535	$15,176	$72,022	$202,733	
	1-23	Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	4.31		7	8	4	4	8	8	42		4	4	8	4	4	4	16	16	4	8	4.31			$839,673	$476,686	$725,313	$2,041,671	
				Total	136.20	6	113	118	44	77	114	118	1073	37	40	77	118	44	54	54	239	239	44	118	56.15	56.25	3	$13,520,528	$6,687,644	$11,134,702	$31,342,874	

Column groups: Limits (From, To); Proposed ATMS Field Devices (Non-Adaptive Signals through COM HUB); Implementation Cost by Component (Field Equipment, Field Communication, Design, MOT, Mobilization, CEI, Contingency); Total Implementation Cost (Corridor, Phase).

Table ES-19: ATMS Investment Plan for Implementation Phase II

Phase	Corridor Rank	Roadway	Limits		Miles	Proposed ATMS Field Devices																						Implementation Cost by Component			Total Implementation	
			From	To		Non-Adaptive Signals	Adaptive Signals	TS-2 Cabinet	DMS Cabinet	CCTV Cabinet	Adaptive Control	VIDS	Detection	CCTV Level 1	CCTV Levels 2-3	MPEG-2 Encoder	MPEG-4 Encoder	DMS Assembly	DTB Signs	Blank-out Signs	Ethernet Switch	TVSS	HAR Sign and Flashers	UPS	Proposed Fiber in Conduit	Existing UG Fiber	COM HUB	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor	Phase
	2-24	Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19/SR 595	Tampa Rd.	19.29	1	29	29	9	20	29	29	142	8	12	20	29	9	9	9	58	58	9	29	19.29			$2,890,124	$2,108,662	$2,754,331	$7,753,118	
	2-25	Trinity	East Lake Rd.	County Line	1.71																				1.71			$3,000	$153,490	$86,226	$242,715	
	2-26	Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	11.97	1	17	18	7	11	17	18	86	4	7	11	18	7	7	7	36	36	7	18	11.97			$1,865,781	$1,299,595	$1,744,122	$4,909,498	
	2-27	49th St.	Park Blvd. N.	US 19/SR 55	1.60		4	4	1		4	4	27				4	1	1	1	5	5	1	4	1.60			$309,164	$177,056	$267,907	$754,127	
	2-28	Sunset Point Rd.	Belcher Rd.	McMullen Booth	2.22		3	3			3	3	16				3				3	3		3	2.22			$151,407	$222,031	$205,764	$579,202	
2	2-29	Belleair CSWY/ (West/East) Bay Drive/ SR	Gulf Blvd	Belcher Rd.	6.58	1	11	11	3	5	11	11	2	2	3	5	11	3	3	3	19	19	3	11	5.50	0.56		$952,476	$624,440	$868,881	$2,445,796	$26,622,875
	2-30	US 19/SR 55	54th Avenue S.	54th Avenue N.	7.40	19		19	3	4		19	102	1	3	4	19	3	5	5	26	26	3	19	7.40			$1,373,288	$842,012	$1,220,630	$3,435,930	
	2-31	Belcher Rd.	Ulmerton Rd./SR 688	Park Blvd	4.00		3	4	1	3	4	4	30		3	3	4	1	1	1	8	8	1	4	4.00			$328,778	$403,156	$403,295	$1,135,229	
	2-32	54th Avenue N.	66th St. N.	I-275	5.06	1	7	8		2	7	8	28	1	1	2	8				10	10		8	5.06			$432,702	$527,066	$528,832	$1,488,599	
	2-33	66th St. N./SR 693	46th Avenue N.	Gulf Blvd	5.35	13	7	20		7	7	20	26	5	2	7	20				27	27		20	5.35			$1,071,206	$674,592	$961,935	$2,707,732	
	2-34	Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	3.66		8	6		6	6	6	10	2	4	6	6				12	12		6	1.67	1.31		$507,819	$247,131	$415,978	$1,170,928	
				Total	68.84	36	89	122	24	58	88	122	469	23	35	58	122	24	26	26	204	204	24	122	65.77	1.87		$9,885,743	$7,279,231	$9,457,901	$26,622,875	

Table ES-20: ATMS Investment Plan for Implementation Phase III

Phase	Corridor Rank	Roadway	Limits		Miles	Proposed ATMS Field Devices																						Implementation Cost by Component			Total Implementation Cost	
			From	To		Non-Adaptive Signals	Adaptive Signals	TS-2 Cabinet	DMS Cabinet	CCTV Cabinet	Adaptive Control	VIDS	Detection	CCTV Level 1	CCTV Levels 2-3	MPEG-2 Encoder	MPEG-4 Encoder	DMS Assembly	DTB Signs	Blank-out Signs	Ethernet Switch	TVSS	HAR Sign and Flashers	UPS	Proposed Fiber in Conduit	Existing UG Fiber	COM HUB	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor	Phase
	3-35	Gandy Blvd	I-275	Hillsborough County	5.01			1	1			1					1	1	1	1	2	2	1	1	3.28			$104,500.00	$297,500.80	$221,502	$623,503	
	3-36	Sunset Point Rd.	Keene Rd.	Belcher Rd.	1.10		1	1			1	1	8				1				1	1		1	1.10			$55,663.33	$106,324.00	$89,255	$251,242	
	3-37	Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Se	5th Avenue N./ SR 595	5.59	5	2	8		5	2	8	12	3	2	5	8				13	13		8	5.59			$448,035.00	$585,314.40	$569,376	$1,602,725	
	3-38	Tarpon Ave	Alt. US 19/ SR 595	US 19/ SR	1.44		2	2		1	2	2	1	1		1	2				3	3		2	1.44			$125,057.92	$150,518.40	$151,843	$427,419	
	3-39	Keystone Rd.	East Lake Rd.	County Line	2.84								1												2.84			$4,197.92	$254,918.40	$142,773	$401,889	
	3-40	Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore Blvd./Broadway /Edgewater Dr./ Myrtle Avenue	Klosterman Rd	Gulf to Bay/SR 60	11.96	3	11	18		14	15	18	20	5	9	14	18				32	32		18	11.96			$972,238.33	$1,264,993.60	$1,232,715	$3,469,947	
	3-41	49th St. N.	Park Blvd./ SR 694	38th Avenue N.	2.26	1	3	4		2	3	4	30	1	1	2	4				6	6		4	2.26			$262,777.50	$245,385.60	$279,998	$788,161	
	3-42	Missouri Ave/ Seminole Blvd./SR 595/SR 6	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	9.04		18	18	4	7	18	18	123		7	7	18	4	4	4	29	29	4	18	9.04			$1,469,683.75	$1,002,982.40	$1,362,439	$3,835,105	
	3-43	Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.	2.32	4	1	5	1	3	1	5	16	1	2	3	5	1	1	1	9	9	1	5	2.32			$401,646.67	$267,535.20	$368,719	$1,037,901	
	3-44	38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	6.79	11		11		4		11		1	3	4	11				15	15		11	6.79			$539,000.00	$717,290.40	$692,216	$1,948,506	
	3-45	Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	25.38	23		26	4	19		26		1	18	19	26	4	4	4	49	49	4	26				$1,722,900.00	$330,148.00	$1,131,229	$3,184,277	
	3-46	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	Gulf Blvd	Seminole Blvd/Alt. US 19/ Bay Pine Blvd.	1.51	1	1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1	1.51			$222,480.00	$159,889.60	$210,686	$593,055	
3	3-47	Courtney Campbell	Damascus Rd.	Hillsborough County	3.51				1				2					1	1	1	1	1	1					$106,895.83	$3,088.00	$60,601	$170,585	$36,494,062
	3-48	Curlew Rd./SR 586	Alt US 19/SR 595/ Bayshore Blvd	Belcher Rd.	2.06				1				12					1	1	1	1	1	1		2.06			$118,875.00	$187,993.60	$169,085	$475,953	
	3-49	4th St. N.	22nd Avenue S.	I-275	7.71	27		27	1	7		27		1	6	7	27	1	1	1	35	35	1	27	7.71			$1,342,800.00	$942,629.60	$1,259,272	$3,544,701	
	3-50	22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	7.56	8	4	12	2	5	4	12	16	1	4	5	12	2	2	2	19	19	2	12	7.56			$832,586.67	$806,257.60	$903,003	$2,541,847	
	3-51	9th St. S.	54th Avenue S.	22nd Avenue S.	3.42	4		4		2		4		1	1	2	4				6	6		4	3.42			$218,200.00	$349,507.20	$312,807	$880,514	
	3-52	5th Avenue N./ SR 595/Bay Pines Blvd.	Tyrone Blvd/ SR 595	4th St. N.	4.63	10		10	2	3		10			3	3	10	2	2	2	15	15	2	10	4.63			$667,100.00	$515,908.80	$651,838	$1,834,847	
	3-53	Alt. US 19/SR 595/ Pinellas Ave.	Klosterman Rd.	Pasco County Line	3.65		5	2		3	2	2	9		3	3	2				5	5		2	3.65			$288,281.25	$383,828.00	$370,332	$1,042,441	
	3-54	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	11.76		19	19	4	9	19	19	76		9	9	19	4	4	4	32	32	4	19	11.76			$1,495,861.67	$1,266,893.60	$1,522,278	$4,285,033	
	3-55	Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	3.29		8	8		2	8	8	26		2	2	8				10	10		8	3.29			$418,185.83	$368,190.40	$433,293	$1,219,670	
	3-56	Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	2.80	1	7	8		1	7	8	41		1	1	8				9	9		8	2.80			$413,574.58	$318,120.00	$403,164	$1,134,858	
	3-57	54th Ave. S.	I-275	9th St. S.	2.01	4		6	1	2		6			2	2	6	1	1	1	9	9	1	6	2.01			$304,700.00	$226,033.60	$292,434	$823,168	
	3-58	Tampa Rd	Alt US 19/SR 595/ Palm Harbor Blvd	Belcher Rd.	1.33		2	2			2	2	16				2				2	2		2	1.33			$108,326.67	$134,556.80	$133,829	$376,712	
				Total	128.97	102	84	193	23	90	85	193	409	17	73	90	193	23	23	23	306	306	23	193	98.35			$12,643,568	$10,885,808	$12,964,686	$36,494,062	

Figure ES-7: Pinellas Countywide ATMS Investment

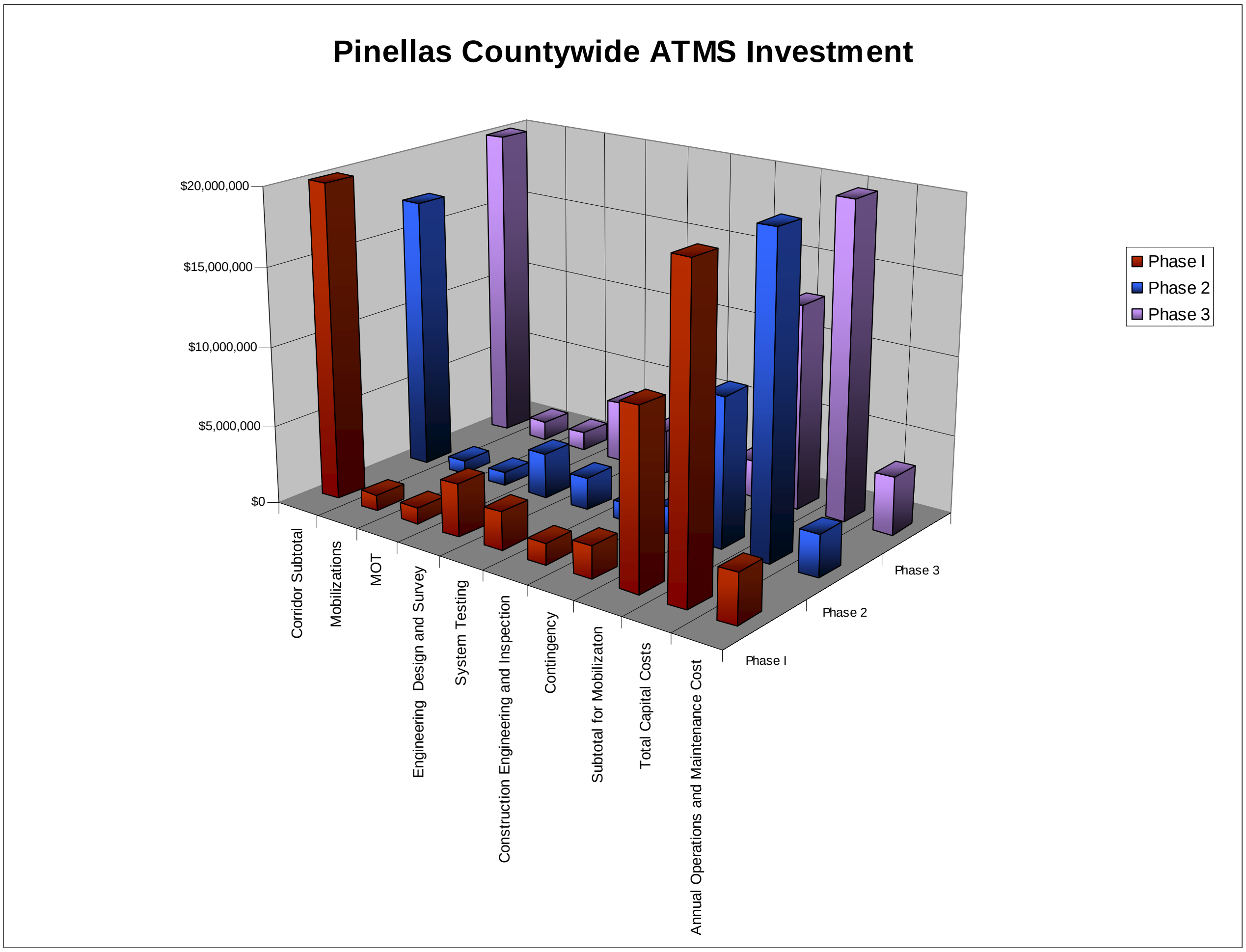


Table ES-21: Pinellas Countywide ATMS Investment

Pinellas Countywide ATMS Investment				
Item	**Phase I**	**Phase 2**	**Phase 3**	**ATMS Program Future Projects**
	Total Cost	**Total Cost**	**Total Cost**	**Total Cost**
Corridor Subtotal	$20,208,172	$17,164,974	$23,529,376	$60,902,522
Mobilizations	$1,010,409	$858,249	$1,176,469	$3,045,126
MOT	$1,010,409	$858,249	$1,176,469	$3,045,126
Engineering Design and Survey	$3,334,348	$2,832,221	$3,882,347	$10,048,916
System Testing, Integration, and Configuration	$2,424,981	$2,059,797	$2,823,525	$7,308,303
Construction Engineering and Inspection	$1,333,739	$1,132,888	$1,552,939	$4,019,566
Contingency	$2,020,817	$1,716,497	$2,352,938	$6,090,252
Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency	$11,134,702	$9,457,901	$12,964,686	$33,557,289
Total Capital Costs	$31,342,874	$26,622,875	$36,494,062	**$94,459,811**
Annual Operations and Maintenance Cost	$3,134,287	$2,662,287	$3,649,406	**$9,445,981**

ASSESSMENT PLAN

To ensure program success, it is recommended the county establish an ATMS program Evaluation Oversight Team to direct evaluation design, execution, and reporting associated with the overall ITS program and priority corridors. The Team members should be composed of the county staff responsible for day-to-day system management, operations, and maintenance. The Team should hold monthly meetings to discuss evaluation activities, findings, conclusions, and recommendations. Lessons learned and best practices from previous deployments should be used to shape future assessments and planned deployments. The Chair of the ATMS program Evaluation Oversight Team should serve as a liaison with the county's higher level executives and report critical evaluation findings at strategic milestones to influence future investment choices and tasks including project development, deployment, operations, and management. The evaluation framework for each priority corridor should be designed to reflect the overall ATMS program goals and objectives. The Pinellas County's ATMS program must overcome a variety of potential challenges to be successful including:

- ❑ Achieve uniformity with the regional ITS Architecture
- ❑ Attain seamless integration across deployed systems and jurisdictional boundaries – technically, institutionally, and procedurally
- ❑ Share video and transportation/traveler data with program stakeholders
- ❑ Meet performance specifications applicable to deployed ATMS technologies, strategies, and devices
- ❑ Serve the needs of program stakeholders, system operators, and the motoring public and be perceived as valuable
- ❑ Forge and sustain institutional partnership, cooperation, and coordination in support of deployment objectives.

These challenges provide a multitude of evaluation opportunities that will help guide program development and deployment efforts including:

- ❑ **System deployment** – addressing deployment cost and challenges pertaining to system design, implementation, operations and management, training, integration, and design-build procurement strategy
- ❑ **System performance** – addressing conformity to the regional ITS Architecture, system functions, component interoperability, open-architecture standards-based solutions, video/data sharing and management attributes, concept of operations, user interface, system integration and configuration, system security, etc.
- ❑ **System impacts/benefits** – addressing system impacts/benefits
- ❑ **User perceptions and acceptance** – addressing acceptance and perceived value of deployed ATMS systems, technologies, and strategies by project stakeholders, system operators, and the motoring public
- ❑ **Institutional issues** – addressing institutional agreements, procedures, policy changes, coordination and cooperation, and legal issues

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Pinellas County, Florida

Pinellas County ATMS Master Plan

Figure ES-8
ATMS Elements

Legend

CCTV Cameras

- Existing CCTV Phase 1 / Stage 1
- Existing CCTV Phase 1 / (Wireless)
- CCTV Phase 1 / Stage 2
- CCTV Phase 1 / Stage 3
- Future CCTV (Primary)
- Future CCTV (Secondary)
- Future CCTV (Tertiary)
- Future CCTV (Wireless)

Traffic Signals

- Existing Adaptive Phase 1 / Stage 1
- Adaptive Phase 1 / Stage 2
- Adaptive Phase 1 / Stage 3
- Future Adaptive
- Future Non-Adaptive
- Future Non-Adaptive (Wireless)

Dynamic Message Signs

- Existing DMS Phase 1 / Stage 1
- DMS Phase 1 / Stage 2
- DMS Phase 1 / Stage 3
- Future DMS
- Future DMS (Wireless)
- Dynamic Trailblazing Sign
- Blankout

ROADS

- Major Roads
- Minor Roads
- Local Roads

BOUNDARIES

- Hillsborough County
- Pinellas County
- Water

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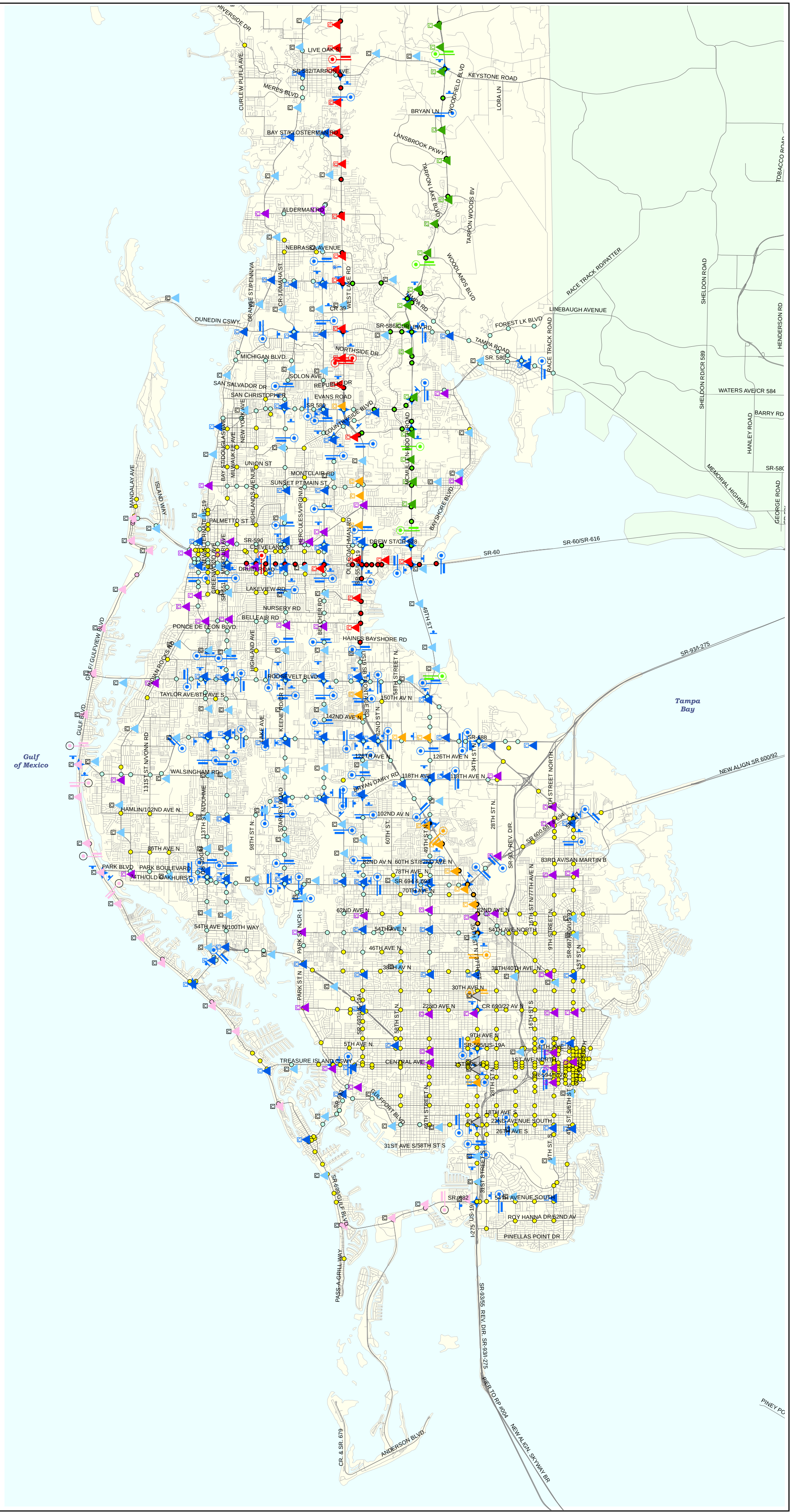

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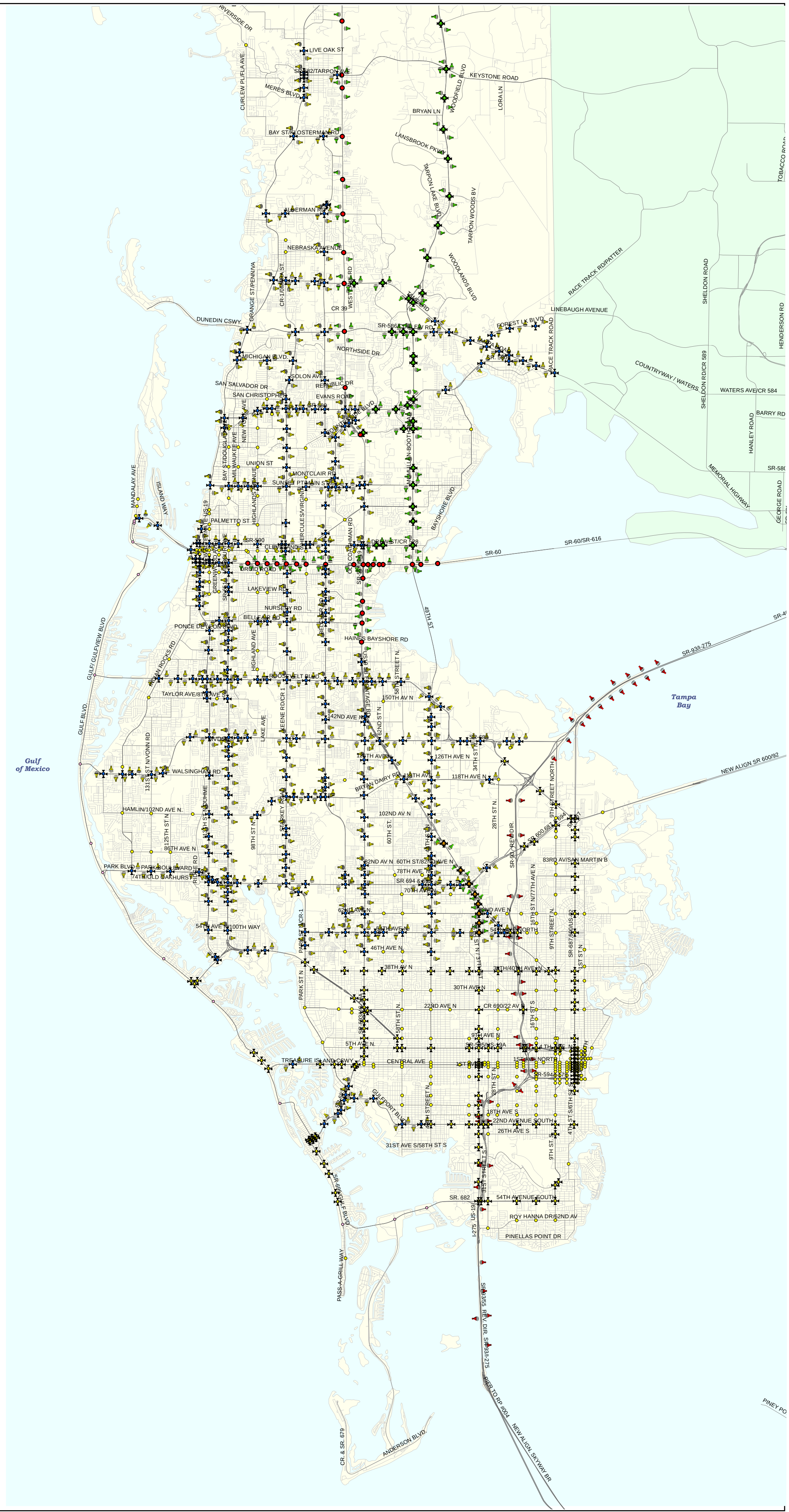
Pinellas County ATMS Master Plan

Figure ES-9
Proposed Detection



Legend

EXISTING DETECTION

- I-275 MVDS
- MVDS

FUTURE DETECTION

- VIDS
- Sensys / MVDS

TRAFFIC SIGNALS

- Existing Adaptive Phase 1 / Stage 1
- Adaptive Phase 1 / Stage 2
- Adaptive Phase 1 / Stage 3
- Future Adaptive
- Future Non-Adaptive
- Future Non-Adaptive (Wireless)

ROADS

- Major Roads
- Minor Roads
- Local Roads

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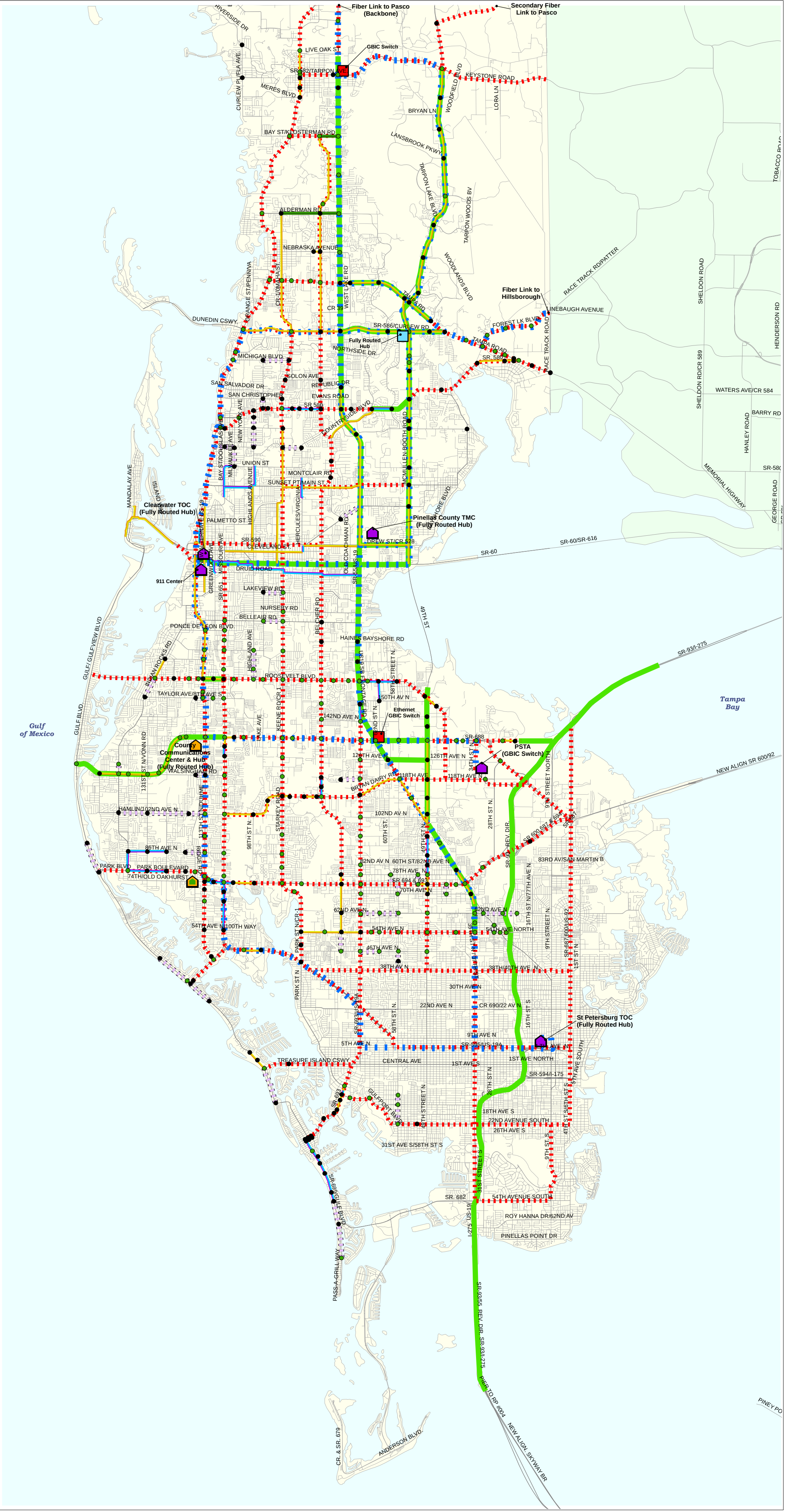
Pinellas County ATMS Master Plan

Figure ES-10
Legacy and Proposed Communications Infrastructure



Legend

EXISTING

- Hubs
- Centers
- Seminole EOC
- Single Telephone Drop
- No Comm
- Existing Conduit Only
- Existing Aerial Twisted Pair
- Existing Underground Twisted Pair

FUTURE

- Hubs
- Centers
- Future Fiber Optic Backbone
- Future Fiber
- Future Wireless Link
- Existing Underground Fiber

ROADS

- Major Roads
- Minor Roads
- Local Roads

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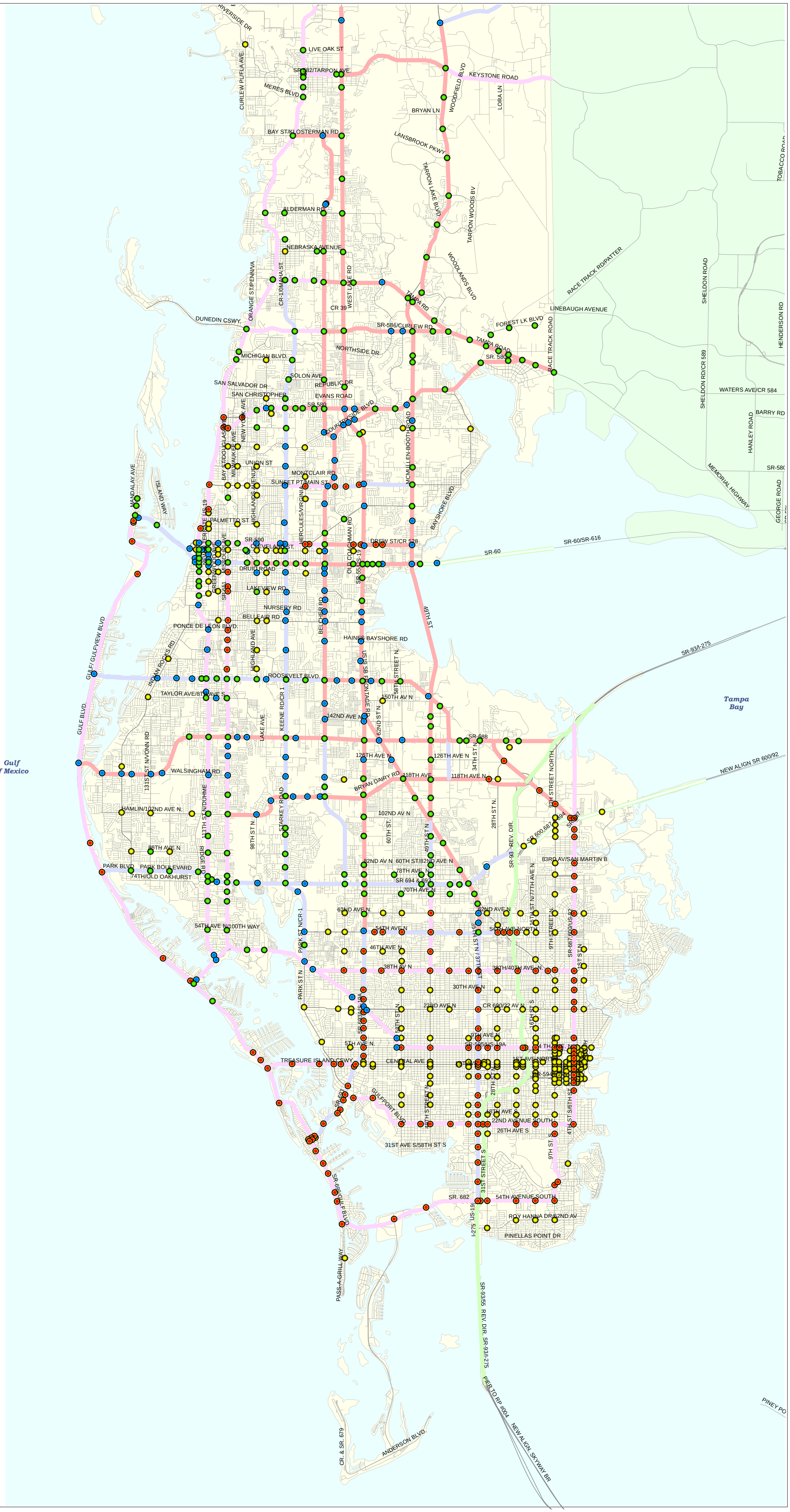
Figure ES-11 Countywide Signal Preemption Deployment Stages



Legend

Opticom GPS

- Stage 1
- Stage 2
- Stage 3
- Stage 4

Phases

- Phase 1
- Phase 2
- Phase 3
- State Freeway (Funded)
- State Freeway (Unfunded)

Roads

- Major Roads
- Minor Roads
- Local Roads
- Water

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1.0 INTRODUCTION

1.1 BACKGROUND

Sustained growth in traffic demand coupled with limited available land has burdened Pinellas County's surface street system with high levels of traffic congestion and safety risks. Though the county's traditional investments in roadway construction and reconstruction projects have helped improve traffic operations, they are insufficient to keep pace with growing demand for travel. Growth in travel has elevated traffic safety risks, caused long delays during peak periods, and frustrated motorists. In addition, many operational corridors traverse across jurisdictional boundaries with disparate control systems that limit the opportunity for holistic regional transportation management control. Many of the east-west and north-south arterial streets within the county are currently congested during peak periods. The result has been long commute times, stop-and-go operations, and expanding peak periods.

Given the significant growth in traffic demand and increasing levels of traffic congestion and safety risks, Pinellas County clearly faces a transportation challenge to sustain its economic vitality, public health, and safety. The county cannot build its way out of traffic congestion due to a multitude of constraining factors such as increasing traffic demand, environmental impacts, right-of-way limitations, and costs of building new and/or expanded highways. The county must augment traditional investments by increasing roadway capacity with Intelligent Transportation Systems (ITS) solutions to optimize use of existing infrastructure capacity through improved operations management, demand management, and staff productivity across jurisdictional boundaries, operational corridors, and transportation modes.

A policy release by the Brookings Institution Center on Urban and Metropolitan Policy, January 2004, holds that governments may never be able to eliminate roadway congestion, and that increasing levels of traffic congestion are an inescapable condition in large and growing metropolitan areas, with peak-hour congestion being an inherent result of how modern society operates. Nevertheless, and in spite of attempted remedies by government entities, commuters are increasingly frustrated by worsening traffic congestion and government's perceived inability to eliminate it. Congestion is identified as stemming from people's widespread desires for pursuing certain goals on a daily basis that inevitably overload existing roads. The policy offers several suggestions on how to reduce traffic congestion, including leveraging traffic management centers equipped with television and electronic surveillance of roadway conditions, to detect, respond, and more rapidly remove crashes and incidents that constrain roadway capacity. The county has historically strived to improve traffic safety and congestion via traditional investments in roadway capacity, such as roadway construction and reconstruction projects. Though these investments have enhanced travel demand distribution and management, they have proven insufficient to keep pace with growing demand for travel resulting from increases in total county population (permanent, seasonal, and tourist) as presented in Table 1-1.

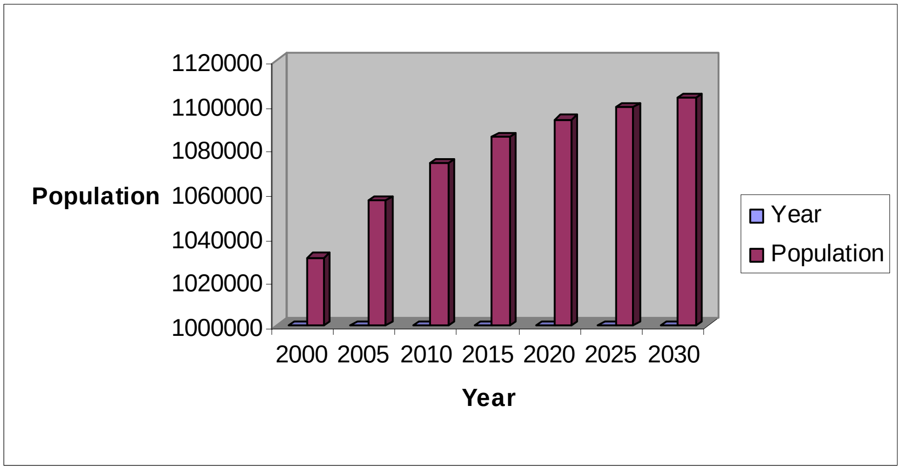
Table 1-1: Projected Growth in Population in Pinellas County

Year	2000	2005	2010	2015	2020	2025	2030
Permanent Total Population	921,495	924,136	930,508	978,264	991,502	1,002,058	1,010,585

Intelligent transportation systems are bundles of enabling technologies and strategies that leverage the latest in telecommunications, computers, software, sensing, and electronics technologies to save lives, time, and money. ITS solutions empower system operators and managers to optimize operations management of surface transportation systems. This is achieved through collection, analysis, application, and dissemination of real-time transportation and travel data during recurrent congestion, incidents, special events, and emergency conditions across jurisdictional boundaries, transportation modes, and operational corridors. Traditional transportation improvement strategies (building new capacity) must therefore be augmented with technology-based solutions to improve management of infrastructure capacity, travel demand, and operations. Homeland security concerns have also elevated the need for timely problem detection and response plans founded on judicious transportation management.

Figure 1-1 presents the projected growth in population between 2000 and 2030, highlighting that the rate of growth for Pinellas County's population is slowing significantly, in part due to the fact that Pinellas County is considered to be a densely populated county.

Figure 1-1: Projected Growth in Population and Travel in Pinellas County



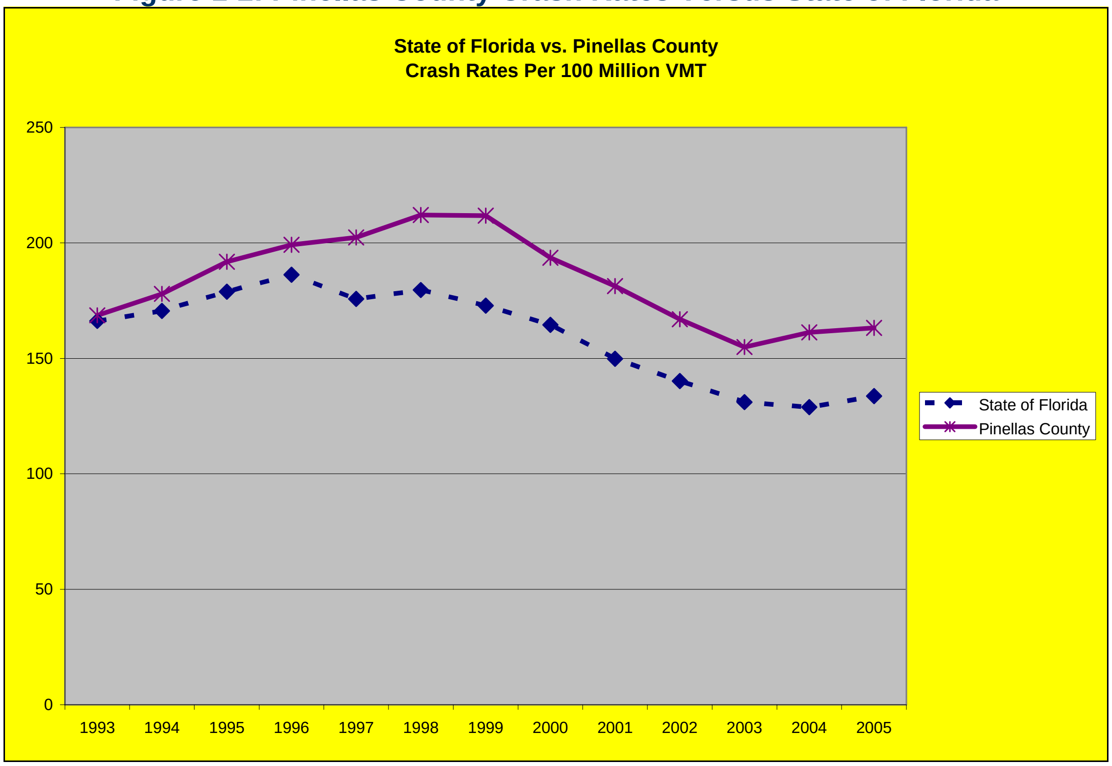
Similarly, there has been a steady growth in vehicle-miles of travel in Pinellas County as presented in Table 1-2. However, the state of the economy and rising fuel prices during the past two years have contributed to reducing in-migration to Florida and vehicle-miles of travel in Pinellas County, this trend is anticipated to reverse when the economy rebounds and fuel prices are stabilized.

Table 1-2: Historical Growth in Vehicle Miles Travel in Pinellas County

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
100 Million VMT	16.9	17.0	17.0	19.6	22.3	23.0	23.9	23.4	23.8	24.2	23.6

The total annual crash rates in Pinellas County, per 100 million vehicle miles of travel, average about 15 percent higher than average crash rates experienced in the state of Florida each year during the 1993 – 2005 study period, as presented in Figure 1-2.

Figure 1-2: Pinellas County Crash Rates Versus State of Florida



Furthermore, as presented in Table 1-3, Pinellas County's annual crash rates have been consistently higher than those in the state of Florida in many crash categories, including:

- Total crashes
- Injury crashes
- Pedestrian fatality
- Bicycle fatality.

Table 1-3: Pinellas County Crash Rates Versus State of Florida

Crash Rates per 100 Million VMT	Injury Rates per 100 Million VMT	Fatality Rates per 100 Million VMT	Pedestrian Fatality Rates per 100,000 population	Bicycle Fatality Rates per 100,000 population	Motorcycle Fatality Rates per 100,000 population	Alcohol Related Fatality Rates per 100 Million VMT
14.8%	18.1%	-17.0%	8.7%	8.7%	-10.6%	-17.6%

In April 2007, under Work Order Contract Number 19, the Florida Department of Transportation (FDOT) commissioned Gord & Associates, Inc. to undertake a study to define the Pinellas County Advanced Traffic Management System (ATMS) Master Plan to govern the development and deployment of surface streets related ITS solutions in Pinellas County. The plan aims to sustain the county's economic vitality, safety, and mobility by identifying and recommending technology-based solutions for implementation along priority corridors within the county during the next ten years.

This document presents the county's ATMS master plan report, which is organized into five sections and three appendices including:

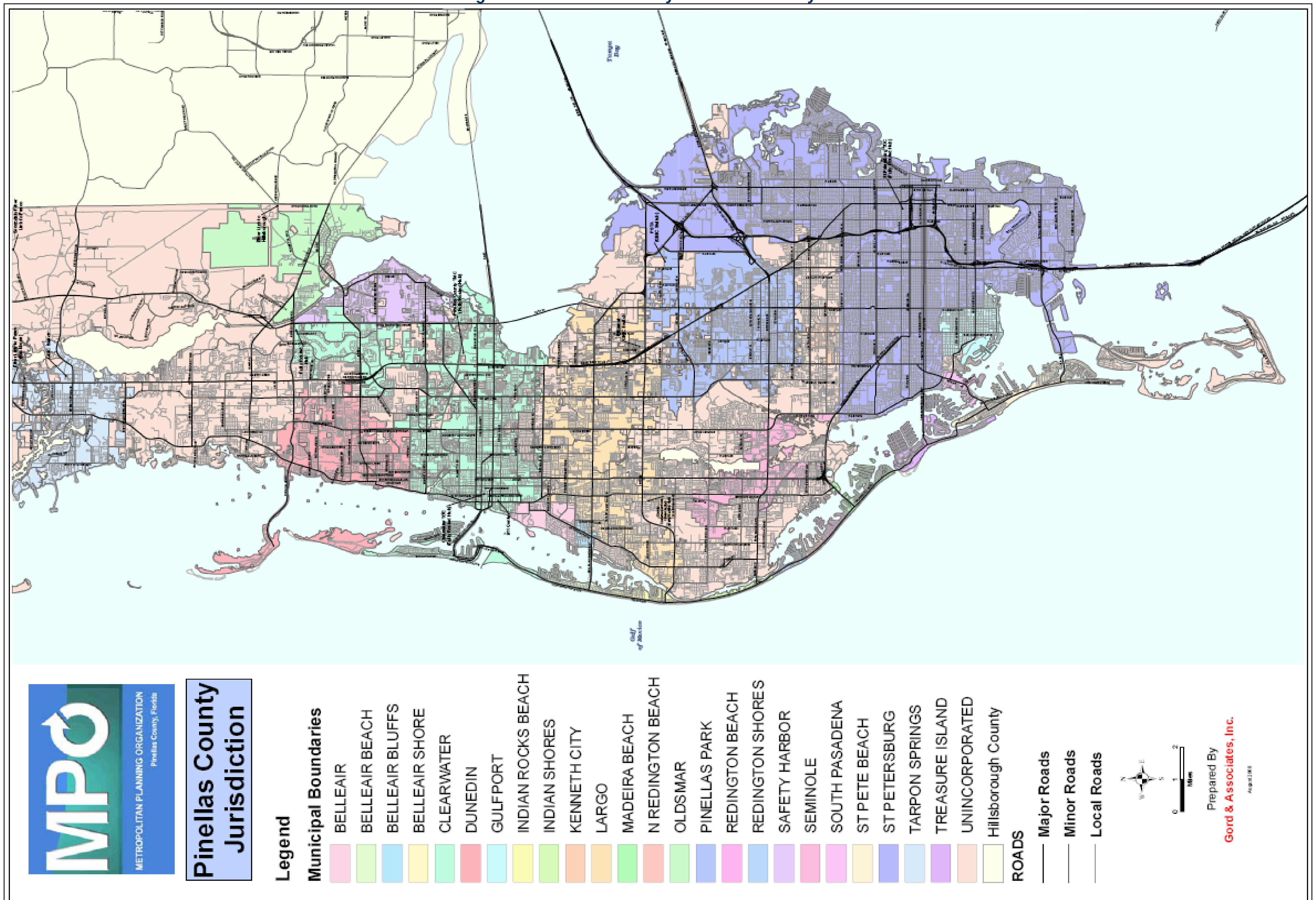
- ❑ Introduction
- ❑ Legacy System
- ❑ Conceptual Plan
- ❑ Implementation Plan
- ❑ Appendix A – Graphs
- ❑ Appendix B – Tables
- ❑ Appendix C - Glossary.

1.2 STUDY AREA

Pinellas County is a peninsula that is bordered by the Gulf of Mexico to the west and Tampa Bay to the east. Pinellas County is Florida's second smallest county in land mass encompassing 24 municipalities. It is 38 miles long and 15 miles wide at its broadest point with its land area covering approximately 264 square miles. Geographically, Pinellas County is subdivided by several east-west and north-south arterial streets interconnecting it to Hillsborough County to the east, Pasco County to the north, and Manatee County to the south through the Sunshine Skyway Bridge. One major freeway corridor (I-275) serves both interstate and regional travel needs within the county, while providing access to Manatee County to the south via the Sunshine Skyway Bridge, and Hillsborough County to the east via the Howard Franklin Bridge. US 19 corridor is a prominent regional north-south arterial street providing accessibility to and from east-west arterial streets while interconnecting with Pasco County to the north and Manatee County to the south via the Sunshine Skyway Bridge. Due to the presence of Tampa Bay to the east and the Gulf of Mexico to the west, uniform distribution of regional surface street travel is limited. In addition, the county's transportation network is influenced by presence and proximity of other highway infrastructure and systems owned by adjoining jurisdictions such as the Cities of Clearwater and St. Petersburg. These constraints make a strong case for embracing a holistic, regional, and coordinated approach to traffic management to close current gaps between regional and local transportation needs and priorities.

Recurrent congestion, traffic incidents and special events frequently tax the capacity of the region's freeways and surface street system, resulting in unmanaged traffic diversion and pattern changes, which further compound an already congested transportation network. Proactive transportation management can only be achieved by a holistic consideration of both local and regional transportation needs across freeways and arterial street systems, which are owned by a myriad of stakeholders including Florida Department of Transportation, Pinellas County, City of Clearwater, City of St. Petersburg, and others. This study focuses on the overall needs of the surface street system within Pinellas County, as shown in Figure 1-3, controlled and operated by the county's Primary Control Center.

Figure 1-3: Pinellas County Surface Street System



1.3 STUDY PURPOSE AND APPROACH

The Pinellas County ATMS master plan is intended to provide guidance for phased deployment of ATMS countywide. The Plan identifies and prioritizes the county's operational corridors for instrumentation with ATMS technologies and strategies in phased implementation. It considers a build-out scenario of the countywide ATMS and subsequently provides programming information (i.e., costs, schedules, and funding sources) for adding component projects into the Transportation Improvement Program. The Plan serves as the roadmap for developing a detailed work program for ATMS implementation, developing and maintaining a cost loaded schedule, and identifying associated project elements in support of the Pinellas County ATMS program. Table 1-4 provides the elements of the Pinellas County ATMS master plan.

Table 1-4: ATMS Master Plan Elements

Plan Element	Element Description
Inventory of Legacy System	❑ Field Equipment ❑ Communications ❑ Traffic Operations Centers
Mission Statement of Pinellas County ATMS	❑ Goals and Objectives ❑ Performance Measures
Vision of ATMS Build-out	❑ ATMS Field Components ❑ Communications System ❑ Concept of Primary Control Center
Procurement Strategies	❑ Traditional "Design-Bid-Build" ❑ Design - Build ❑ System Manager
Cost Estimates	❑ Mobilization and Maintenance of Traffic ❑ Design ❑ Construction and CEI ❑ Operations and Maintenance
Phased Deployment Plan	❑ Prioritization of Operational Corridors ❑ Prioritization of ATMS Devices ❑ Prioritization of Component Projects ❑ Packaging and Staging of Implementation Projects ❑ Schedule of Design and Construction Packages
Recommendations	❑ Ranked Operational Corridors ❑ Phased/Staged Implementation Plan ❑ Costs of Implementation Phases and Stages ❑ Funding Requirements for input to the TIP

A myriad of data sources were used to define the ATMS concept including review of the county's legacy system; numerous face-to-face interviews and group discussions with county staff; presentation to Pinellas County Metropolitan Planning Organization's ITS Committee and associated feedback; extensive research and consultation with applicable product manufacturers; considerations of information available on traffic safety and operations along operational corridors; and review of studies previously performed by the county consultants and staff. The stakeholders' input and contributions were invaluable in guiding this planning effort.

The previous studies, interviews, presentations, and historical deployments have collectively set the foundation for building ATMS in Pinellas County. The Tampa Bay Regional ITS Architecture

(TBRIA) was also used to identify applicable prioritized user services and market packages. Use of this regional ITS architecture provided a basis for ensuring consistency with the National ITS Architecture, and in identifying user services and market packages that reflect the county's needs. The specific tasks and subtasks of the study are presented in Table 1-5**.**

Table 1-5: Study Tasks and Subtasks

Task	Subtasks
Identify goals, objectives, problems, needs, opportunities, and constraints	❑ Identify stakeholders ❑ Research regional ITS architecture ❑ Define study goals and objectives ❑ Review inventory of legacy system ❑ Identify existing opportunities and constraints ❑ Conduct interviews and literature research to identify needs ❑ Identify prioritized user services and market packages ❑ Review historical ATMS deployments and effectiveness
Develop system framework and conceptual plan	❑ Conduct interviews and literature review to define requirements ❑ Identify ATMS functional requirements ❑ Develop system framework ❑ Identify viable technology solutions ❑ Study basis for prioritized operational corridors ❑ Define corridor-based conceptual design
Develop implementation plan	❑ Develop criteria for prioritizing operational corridors ❑ Group/package ATMS devices and operational strategies ❑ Develop integration strategy ❑ Develop a 10-year investment program and associated projects, staging, schedule, and budget for instrumenting operational corridors with ATMS
Prepare GIS Drawings	❑ Develop various GIS based drawings that depict the county's legacy and future ATMS devices by type and location along prioritized operational corridors countywide
Develop ATMS master plan report	❑ Prepare ATMS master plan report
Study deliverables	❑ Presentations to MPO ITS Committee ❑ ATMS master plan report encompassing legacy ATMS system, conceptual plan, and implementation plan

It is important to highlight that the focus of this study is not to reinvent the wheel by questioning investment decisions and choices made historically by program stakeholders, some of which have been founded on other studies. The focus of this study is to leverage historical studies, choices, and ATMS deployments; as well as associated technologies, operational strategies, lessons learned, and priorities. These will be used to assemble a comprehensive ATMS master plan for systematic and incremental implementation along operational corridors countywide within ten years.

1.4 STUDY GOALS AND FOCUS

The primary goal of the Pinellas County ATMS program is to optimize traffic safety, operations, and staff productivity (to do more with less) so that the county is empowered to meet the current and future mobility needs of its residents, businesses, and visitors. This goal can be achieved by improving traffic management along arterial street systems during recurrent congestion, incidents, evacuations, and special events, which will need to be done in coordination with the regional freeway management system. Integral to achieving this goal will also be automation of support tools used for records tracking, customer relationship management, work order management, and traffic management. These automated tools will augment operational strategies and institutional strengthening. This will play a pivotal role in transportation management by enabling the county to gather traffic data and measures of effectiveness and to make better decisions in real-time; therefore enhancing mobility countywide. Real-time collection, processing, and sharing of transportation, travel, and environmental data and streaming video are essential for proactive mobility choices. ATMS solutions help optimize operations management across transportation modes, systems, and routes to save lives, time, and money.

The focus of the Pinellas County ATMS master plan is to:

- ❑ Consider needs and requirements
- ❑ Identify advanced technologies and strategies
- ❑ Prioritize operational corridors
- ❑ Instrument priority corridors
- ❑ Develop 10-year implementation plan comprised of prioritized projects, deployment elements, deployment costs, and deployment schedule
- ❑ Achieve a holistic, regional, and integrated approach to transportation management across jurisdictional boundaries, routes, systems, and transportation modes
- ❑ Optimize management of capacity, travel demand, and traffic operations to save lives, time, and money.

2.0 LEGACY ATMS SYSTEM

This section provides a summary description of legacy systems for traffic control and management within Pinellas County. Various studies have previously treated the legacy systems comprehensively, which have included US 19 and SR 60 corridors instrumented under the Pinellas Countywide ATMS projects (Stages I and II). These projects were the first step in a multi-staged, multi-phased implementation program that built the foundation for future ATMS deployments countywide by deploying a Primary Control Center.

2.1 PRIMARY CONTROL CENTER

The Primary Control Center is currently located on the second floor of Building 10 at 22211 US 19 in Clearwater. The Primary Control Center houses servers, software and hardware, end communications equipment, workstations, operators' consoles, video wall, uninterrupted power supply, etc. The current central control systems are MIST and i2TMS. The county has recently elected to invest in enhancing MIST functionality so that it will become the county's standard central control platform, capable of supporting more than one adaptive traffic control systems. The Pinellas County ATMS central and adaptive control platforms, MIST/OPAC and i2TMS/RHODES, were originally deployed to function independently of each other. The MIST/OPAC system resides within the Pinellas County Primary Control Center, whereas the i2TMS/RHODES system is housed within the City of Clearwater Traffic Operations Center. Being part of a local area network, each control center; however, is equipped to operate both i2TMS and MIST. The county's vision is to establish a common MIST platform interfacing with Econolite ASC2/OPAC along US 19 and NextPhase/RHODES along SR 60. The county hopes that MIST integration with RHODES will empower system operators to monitor RHODES operational activities in the field; as well as leverage upload/download functionality.

2.2 LEGACY COMMUNICATIONS NETWORK

Pinellas County's legacy infrastructure is comprised of empty underground conduit (2 miles), aerial twisted pair copper cabling (20 miles), underground twisted pair copper cabling (77 miles), and underground fiber optic cabling (58 miles), as shown in Figure 2-1. The twisted pair copper cabling has historically been used to interconnect the traffic operations center with traffic signals primarily within the City of Clearwater. The City of St. Petersburg has historically used a leased telephone drop for each traffic controller cabinet and has experienced significant recurrent cost. In some cases, this existing base of twisted pair copper cabling can be used as local communications loops or access to remote devices instead of installing fiber optic cabling; thus reducing deployment costs associated with installing new fiber optic cabling.

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Pinellas County ATMS Master Plan

Figure 2-1
Legacy Communications Network

Legend

- Existing Underground Twisted Pair
- Existing Conduit Only
- Existing Aerial Twisted Pair
- Existing Conduit Only

Roads

- Major Roads
- Minor Roads
- Local Roads

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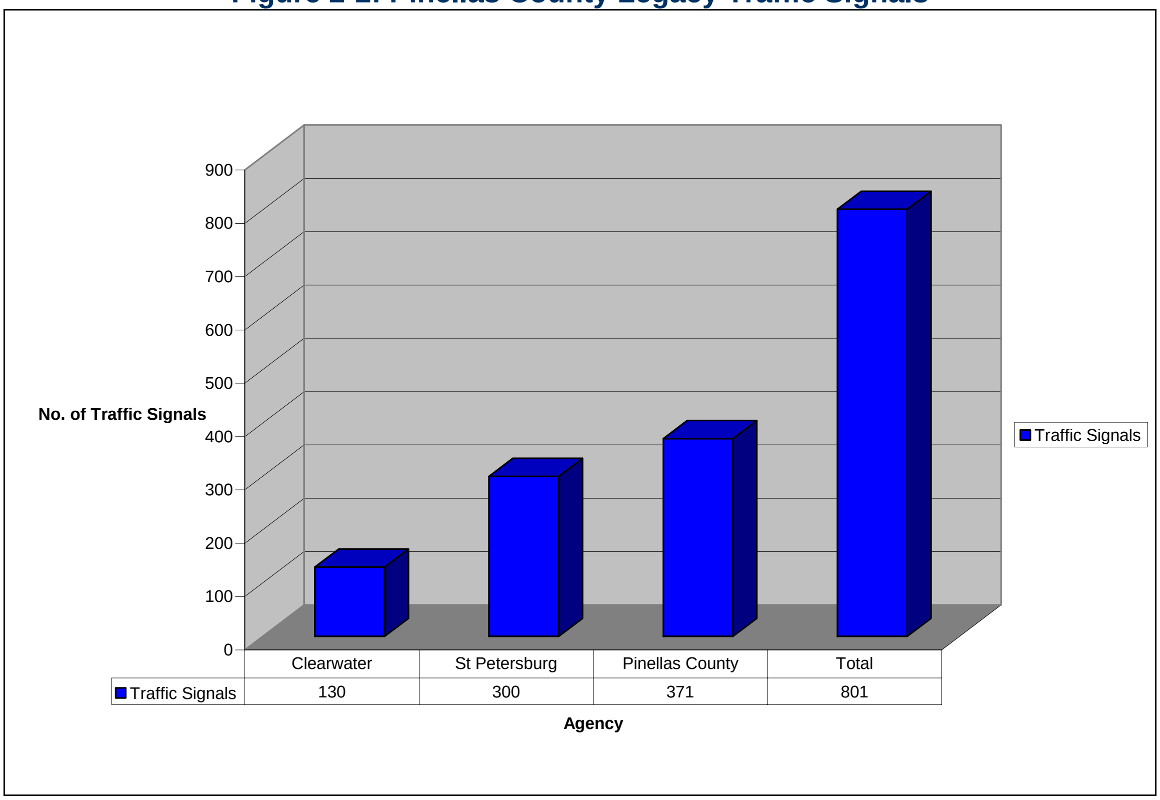
2.3 TRAFFIC SIGNALS

Pinellas County has 801 traffic signals subdivided among Pinellas County (371, 46%), City of Clearwater (130, 16%), and City of St. Petersburg (300, 38%) as presented in Figure 2-2. The county has an existing deployed base of 226 traffic signals that are equipped with Opticom Infrared (IR) receivers and phase selectors, which are currently used primarily for signal preempting to accommodate fire trucks enroute to emergency situations.

Figure 2-3 presents the county's legacy signalized intersections (801), which are equipped with adaptive traffic control (23) and non-adaptive (778) traffic signals. Figure 2-3 also presents traffic signals that are equipped with Opticom Infrared (IR) receivers and phase selectors (216), fire station activated flashers (16), flashing beacons (38), and school flashers (141). Most of the legacy non-adaptive traffic signal equipment is based on the TS-1 technology in Type IV cabinets. The reader is referred to other studies conducted for Pinellas County, which provide more details on the county's existing base of traditional traffic signals.

Figure 2-2: Pinellas County Legacy Traffic Signals



2.4 LEGACY ATMS AND OPERATIONAL STRATEGIES

Pinellas County has already instrumented three operational corridors within the county with ATMS devices, fiber optic network, and operational strategies. These corridors include US 19, SR 60, and McMullen Booth Road (underway). The types of ATMS technologies deployed include advanced traffic controller and cabinet; wireline Closed Circuit Television (CCTV) cameras; wireless CCTV cameras; Dynamic Message Signs (DMS); underground conduit system and fiber optic cabling; and adaptive traffic control system as shown in Figure 2-4.

The traffic signals along portions of US 19 (8) and SR 60 (15) were upgraded, as part of the Pinellas County ATMS Project, Stages I and II, to advanced traffic controllers (2070) and associated cabinet (332). The traffic signals along portions of McMullen Booth Road are being upgraded, as part of the Pinellas County ATMS program, to advanced traffic controllers (2070) and associated cabinet (TS-2 shelf-mount). The county has determined that the TS-2 shelf-mount Type IV cabinets provide more space and flexibility for signal technicians to perform maintenance functions. In addition, the county has elected to use separate cabinets (no co-location) for CCTV cameras located at signalized intersection to demarcate in-house and outsourced maintenance work between device cabinets supporting traffic signals and CCTV cameras.

The advanced traffic controller (23), CCTV cameras (51) and DMS signs (12) are interconnected to the Primary Control Center via a fiber optic based communications network. In addition, there are four CCTV cameras that are interconnected to the City of St. Petersburg via wireless communications network. The CCTV cameras are primarily located at major signalized intersections following a one-mile spacing to provide full CCTV camera coverage. These CCTV cameras were deployed in Pinellas County ATMS projects Stages I, II, and III.

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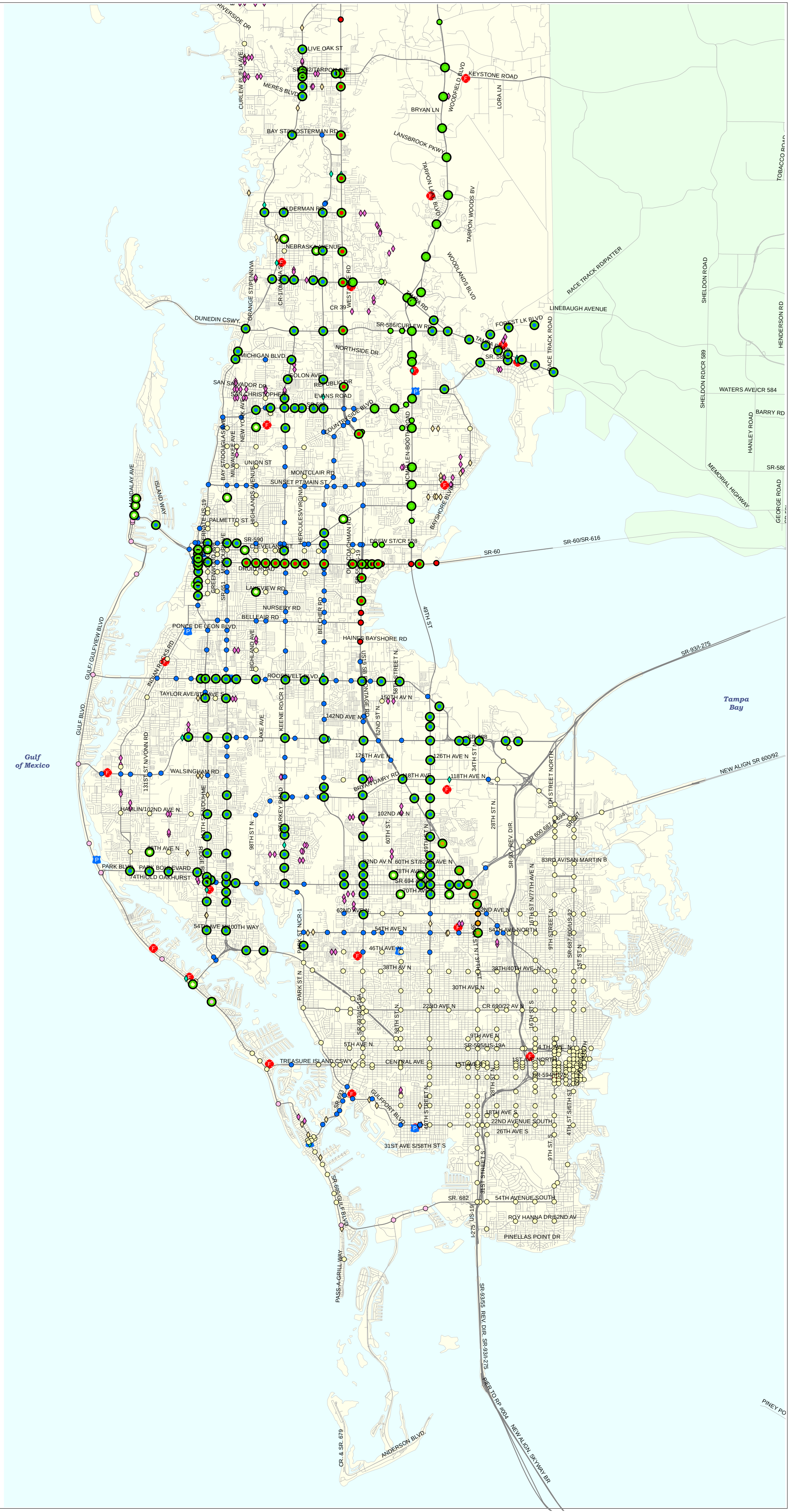
Pinellas County ATMS Master Plan

Figure 2-3 Traditional Traffic Signals



Legend

Opticom

- Opticom Preempted County Signals

Traffic Signals

- Existing Adaptive Phase 1 / Stage 1
- Adaptive Phase 1 / Stage 2
- Adaptive Phase 1 / Stage 3
- Future Adaptive
- Future Non-Adaptive
- Future Non-Adaptive (Wireless)

Existing Flashers

- Fire Preempt
- Flashing Beacons
- School Flashers

Centers

- Police Dept.
- Fire Dept.
- Hospital

Roads

- Major Roads
- Local Roads

N W E S

0 1 2
Miles

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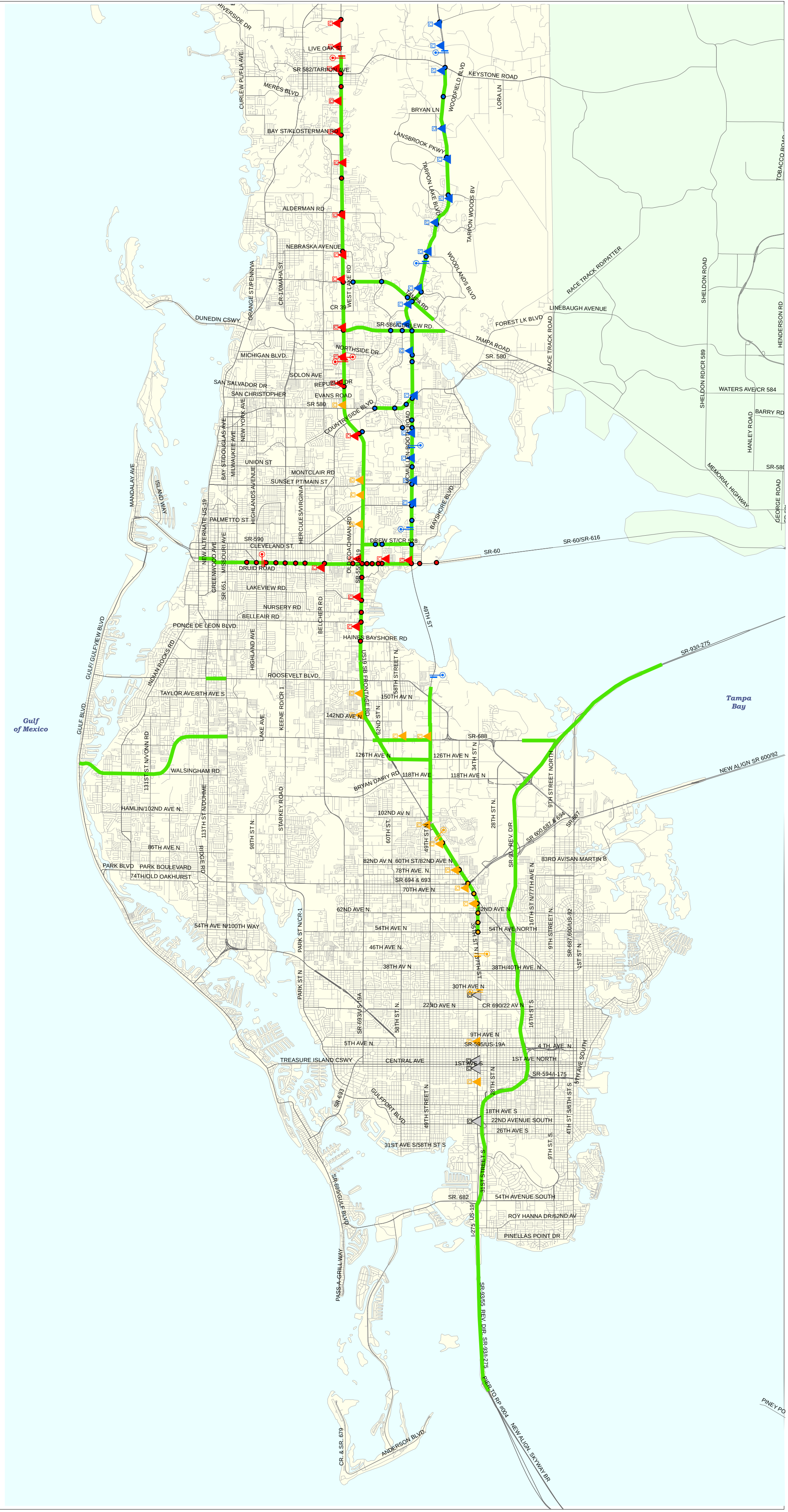
Pinellas County, Florida

Pinellas County ATMS Master Plan

Figure 2-4
Legacy ATMS and Operational Strategies



Legend

Dynamic Message Signs

- Existing DMS Phase 1 / Stage 1
- DMS Phase 1 / Stage 2
- DMS Phase 1 / Stage 3

CCTV Cameras

- Existing CCTV Phase 1 / Stage 1
- Existing CCTV Phase 1 / (Wireless)
- CCTV Phase 1 / Stage 2
- CCTV Phase 1 / Stage 3

Traffic Signals

- Existing Adaptive Phase 1 / Stage 1
- Adaptive Phase 1 / Stage 2
- Adaptive Phase 1 / Stage 3

Roads

- Major Roads
- Minor Roads
- Local Roads

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Miles

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3.0 ATMS Conceptual Plan

ATMS encompasses technology-based solutions for surveillance, control, management, and operations of surface transportation. These solutions include advanced detection (e.g., video image detection, microwave vehicle detection, wireless vehicle detection, etc.); CCTVs; DMS, Dynamic Trailblazing (DTB) signs and blankout signs; highway advisory radios (HARs); advanced traffic controllers and cabinets; central control software and local control software; adaptive traffic control, etc. These technologies are to be leveraged by the county for managing recurrent congestion, incidents, special events, and emergency conditions including regional evacuations.

This section presents the Pinellas County Master Plan for a full-build ATMS vision. It presents the county's transportation needs, requirements, and solution alternatives including ATMS devices, operational strategies, and communications network. This section also provides a detailed presentation of field components, primary control center electronic components, and center-to-center and center-to-field devices communications network comprised of fiber optic cabling, twisted pair copper cabling, communications hubs, and end communications equipment. The overall concept is further explained by a set of conceptual plans depicting:

- Legacy Field Components—traffic signals, CCTV cameras, DMS signs, fire preemption, fiber optic based communications infrastructure, copper-based communication infrastructure, communications hubs, etc.
- Proposed Field Components—advanced traffic controllers and cabinets; CCTV cameras; DMS, DTB, and blankout signs; HAR; traffic signals equipped with Opticom for signal preemption (fire trucks) and transit signal priority; fiber optic based communications infrastructure; communications hubs; advanced detection (for adaptive traffic control, incident detection, and operations measures of effectiveness); VIDS; adaptive control corridors; incident management; etc.

3.1 Needs

Pinellas County faces several interrelated transportation challenges, including traffic safety, traffic congestion, constrained mobility associated with being a peninsula, and disconnected transportation modes and systems. These are exasperated by limitations in financial and budgetary resources, densely populated urbanized terrain, and prevalence of jurisdictional boundaries. These challenges are typical for large metropolitan areas like Pinellas County, where travel demand has outpaced investments in transportation infrastructure. Pinellas County is, however, required to pay immediate attention to these challenges given the gravity of impacts on the welfare and economic vitality of the county. Traffic safety and congestion are typically the most fundamental transportation needs of major metropolitan areas. Since Pinellas County cannot build its way out of congestion by solely investing in new capacity, investments in technology-based solutions are necessary to address these challenges. The county professionals recognize that the ultimate solution lies in an integrated, multi-modal, and regional approach to transportation management – one that leverages new capacity as well as improved management of traffic operations and demand management through ITS. Table 3-1 summarizes the county's ATMS program areas and associated needs.

Table 3-1: Pinellas County Transportation Needs

ITS Program Focus	Pinellas County Needs
Needs, Problems, Issues, Challenges, Barriers	❑ Improve traffic safety countywide ❑ Reduce traffic congestion ❑ Address reactive traffic management ❑ Provide timely, accurate, and comprehensive transportation data ❑ Create automated centralized cohesive transportation databases
Actions	❑ Upgrade obsolete and proprietary traffic control equipment ❑ Deploy a hybrid fiber-copper-wireless communications network using open communications standards ❑ Utilize existing twisted pair copper cabling ❑ Improve traffic operations along coordinated corridors ❑ Improve signal operations by updating signal timings and operational design ❑ Deploy ATMS devices and operational strategies along priority corridors ❑ Establish relational databases for transportation and travel data ❑ Identify funding sources and partners to support and sustain ATMS program ❑ Address limitations in staffing, training, and resources to proactively operate and maintain ATMS systems and associated components ❑ Establish regional institutional framework for ATMS
Vision	❑ Improving transportation for a strong and prosperous Pinellas County
Mission	❑ Enhancing traffic safety, operational efficiency, mobility, and staff productivity through technology, innovation, leadership, and public service
Vital Few Priorities	❑ Safety improvement ❑ Congestion mitigation ❑ Environmental stewardship ❑ Proactive traffic management and customer service ❑ Timely, accurate, and comprehensive transportation data for better decisions ❑ ATMS technologies, strategies, and automated tools
Goals	❑ Improve traffic safety ❑ Increase surface street efficiency ❑ Improve mobility ❑ Reduce fuel congestion and environmental cost ❑ Improve productivity (do more with less)
Requirements	❑ User services ❑ Market packages ❑ Devices, end communications equipment, communications infrastructure ❑ Strategies ❑ Funding ❑ Staffing/resources ❑ Training ❑ Phased instrumentation of prioritized operational corridors

ATMS solutions are founded on advanced technologies that offer the opportunity to address surface transportation needs such as traffic safety, congestion, mobility, and quality of life. These technologies are represented by 64 market packages that support 32 user services and augment conventional solutions to transportation management in addressing traffic congestion and safety. Table 3-2 presents an example of how the conventional and technology-based solutions can complement one another in managing traffic congestion in the county.

Table 3-2: Conventional and Advanced Solutions

Problem	Conventional Solutions	Technology-based Solutions	
		User Services	Technologies (Market Packages)
Traffic Congestion	❑ Increasing roadway capacity through new roads, new lanes, and improved operations ❑ Enhancing passenger throughput through HOV lanes, carpooling, fixed transit routes, and preferential treatment of transit vehicles ❑ Reducing travel through flextime programs and timely traveler information for better decisions by travelers.	❑ Traffic control ❑ Travel demand management ❑ Incident management ❑ Public transportation management ❑ Archive data function ❑ Maintenance and construction operations	❑ Surface Street Control ❑ Traffic Information Dissemination ❑ Network Surveillance ❑ Multi-modal Coordination ❑ Incident Management System ❑ ITS Data Mart ❑ Work Zone Management

The scarcity of financial resources requires Pinellas County to prioritize its investment needs in traffic control and management technologies for phased implementation. These needs are represented by priority user services, which are customer-oriented strategies for meeting the county's envisioned requirements for traffic control, operations, and management. The delivery of each user service requires investment in a myriad of interrelated intelligent technologies or market packages, which are deployment-oriented strategies that enable delivery of user services.

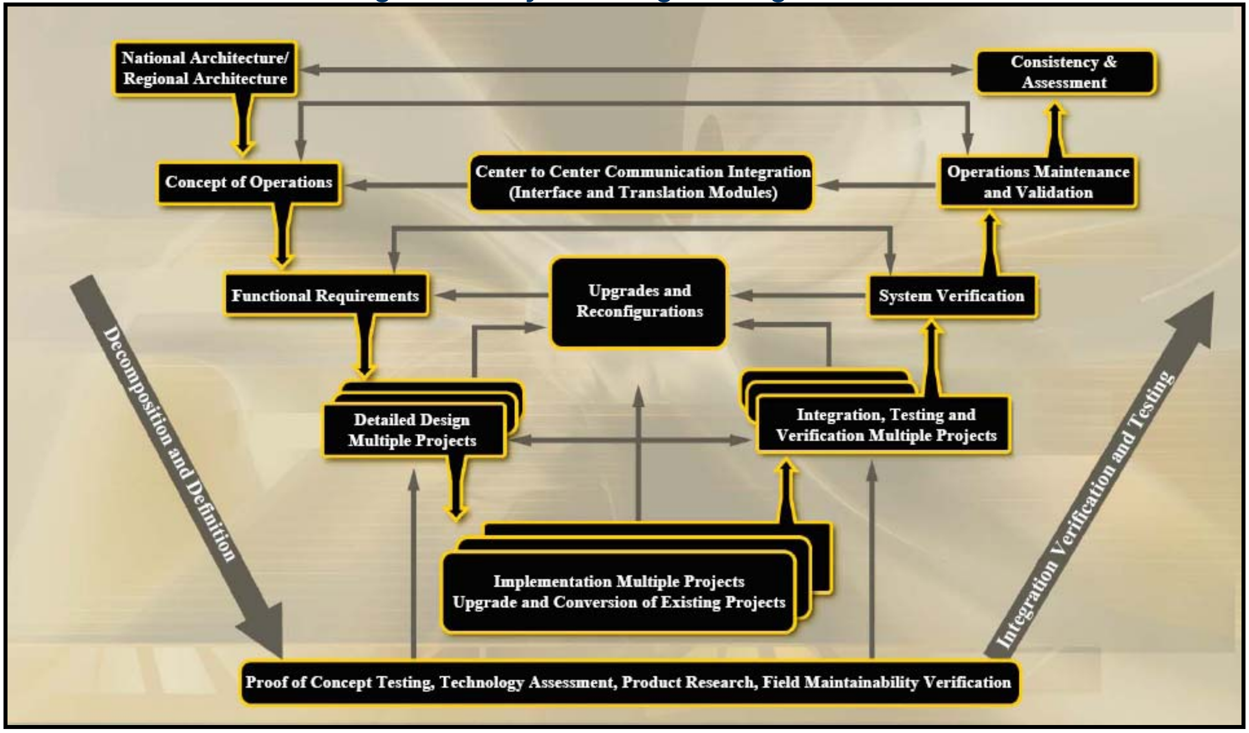
3.2 Priority User Services and Market Packages

Literature reviews, interviews with the staff of stakeholder agencies, and various presentations were used to identify the county's needs for traffic control, operations, and management. Early on in the planning process, it was deemed prudent that the Pinellas County ATMS master plan be built on historical investments and associated technology choices, previously made by the ATMS program stakeholders. The stakeholders represent a variety of transportation users including Pinellas County, City of Clearwater, City of St. Petersburg, other smaller cities and towns within Pinellas County, Florida Department of Transportation, and representatives from law enforcement and fire organizational entities.

The TBRIA provided an initial set of prioritized user services and market packages applicable to Pinellas County as presented in Table 3-3**.** To identify priority user services and market packages for addressing the county's immediate and short-term needs, the ranking of user services and market packages leveraged historical investment choices and associated deployment lessons learned regarding their value and effectiveness. These historical choices effectively captured the perception of importance and relative deployment priority of each user service and market package. Screening market packages is founded on consideration of transportation problems, needs, improvements, and alternatives and associated mapping to priority user services. This process resulted in identifying most essential user services and market packages that should be deployed in Pinellas County in the short-run.

The strategy used for developing the county's ATMS master plan followed a System Engineering process for defining and refining county needs, requirements, and viable solution alternatives. The System Engineering process, V-chart shown in Figure 3-1, leveraged the priority user services and market packages, previously adopted by the county and used in support of several historical and ongoing projects such as US 19, SR 60, and McMullen Booth Road. This approach was followed to maintain conformity with the Regional ITS Architecture, which in turn assured consistency with the National ITS Architecture. User services and market packages represent customer- and deployment-oriented strategies, respectively. They highlight the county's requirements and pave the way for defining the overall conceptual plan and ultimately technology-based solutions that meet the county's traffic management needs. The System Engineering process leverages a feedback loop mechanism that enhances future choices and decisions based on lessons learned from previous choices and decisions at each step of way ranging from concept definition to system operations and assessments. It is this aspect of the System Engineering process that makes the ATMS master planning process valuable during all phases of program development and deployment.

Figure 3-1: System Engineering V-Chart



The Concept of Operations is also based on ATMS investments and associated lessons learned by the county as part of several corridor improvements including US 19, SR 60, and McMullen Booth Road. These projects provided a context for determining functional requirements for deploying ATMS solutions countywide. These requirements are represented by prioritized improvement strategies or market packages that help realize the county's priority user services as presented in Table 3-3.

Table 3-3: Priority User Services and Market Packages

Market Packages (How?)	User Services (What?)			
	Traffic Control	Incident Management	Demand Management and Operations	Pedestrian Safety and Access
Network Surveillance	X	X	X	X
Surface Street Control	X		X	
Traffic Information Dissemination	X	X		
Regional Traffic Control	X		X	
Incident Management System	X		X	
ITS Planning	X	X	X	X
Multi-modal Coordination	X			
Pedestrian Safety	X			X

The priority user services and market packages define the framework for traffic control and management investments in the county designed to address current and future transportation needs. Each market package is supported by the technologies and functionality defined below.

- **Network Surveillance**—includes traffic detectors, environmental sensors, other surveillance equipment, supporting field equipment, and communications to transmit collected data to the Traffic Management Subsystem. The derived data can be used locally, such as when traffic detectors are connected directly to a signal control system, or remotely, such as when a CCTV camera system sends data back to the Traffic Management Subsystem. The data generated by this market package enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect operational problems, and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.
- **Surface Street Control**—provides the central control, monitoring equipment, communication links, and signal control equipment that support local surface street control and/or arterial traffic management. A range of traffic signal control systems are represented herein, ranging from static pre-timed control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. Additionally, general advisory and traffic control information can be provided to drivers while en route. This market package is intra-jurisdictional in nature without relying on real-time communications between separate control systems to achieve area-wide traffic signal coordination. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would be represented by this package. This market package is consistent with typical urban traffic signal control systems.
- **Traffic Information Dissemination**—allows traffic information to be disseminated to drivers and vehicles using roadway equipment such as dynamic message signs or highway advisory radio. This package provides a tool that can

be used to notify drivers of incidents. Careful placement of the roadway equipment provides the information at decision-making points within the network where drivers have recourse allowing them to tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance, via a direct tie-in between a traffic management center and radio or television station computer system), transit management center, emergency management center, and information service provider.

- **Incident Management System**—manages both predicted and unexpected incidents so that the impact on the transportation network and traveler safety is minimized. Requisite incident detection capabilities are included in the freeway control market package and through regional coordination with other traffic management center, emergency management agencies, weather service entities, and event promoters supported by this market package. Information from these diverse sources is collected and correlated to detect and verify incidents and implement appropriate responses. This market package provides Traffic Management Subsystem equipment that supports traffic operations personnel in developing appropriate responses to confirmed incidents in coordination with emergency management and other incident response personnel. The response may include traffic control strategy modifications and presentation of information to affected travelers using the Traffic Information Dissemination market package. The same equipment assists system operator to monitor incident status as the response unfolds. Coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other field service personnel.
- **ITS Planning**—Replaced with Archived Data User Service (ADUS), this market package provides for archived data function to control the archiving and distribution of ITS data. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data. ADUS helps achieve the ITS information goal of unambiguous interchange and reuse of data and information. It includes ITS Data Mart, which provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction, collected from an operational data store and archived for future use. It also includes ITS Data Warehouse, which encompasses all the data collection and management capabilities provided by the ITS Data Mart, while adding the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats.
- **Regional Traffic Control**—advances the Surface Street Control and Freeway Control market packages by adding the communications links and integrated control strategies that enable integrated inter-jurisdictional traffic control. This market package provides for the sharing of traffic information and control among traffic management centers to support a regional control strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on

roadside instrumentation supported by the Surface Street Control and Freeway Control market packages and adds hardware, software, and communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported, from information sharing through sharing of control between traffic management centers.

- **Multi-Modal Coordination** —establishes two-way communications between multiple transit and traffic agencies to improve service coordination. Intermodal coordination between transit agencies can increase traveler convenience at transfer points and also improve operating efficiency. Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading overall performance of the traffic network. More limited local coordination between the transit vehicle and the individual intersection for signal priority is also supported by this package.
- **Pedestrian Safety**—this market package was introduced by regional stakeholders for inclusion in the Tampa Bay Regional ITS Architecture. Though it has not been incorporated into the National ITS Architecture at this time, it elevates the importance of pedestrian safety in this region and the need for leveraging advanced technologies and strategies to enhance pedestrian safety.

3.3 Functional Requirements

The market packages deliver the envisioned user services through a multitude of functions, including:

- Detection system
- Traffic control, including local controller and central system software
- Traffic monitoring
- Information dissemination
- Signal priority system
- Emergency preemption
- Uninterrupted power supply
- Communications
- Data processing and management
- Operational strategies, including fully actuated mode of operation for isolated traffic signals, optimized operational designs, traffic responsive, traffic adaptive control, incident management, and special event management.

The proposed elements of the Pinellas County ATMS master plan are summarized in Table 3-4. These ATMS elements will be briefly discussed below.

Table 3-4: Pinellas County ATMS Elements

Technology	Deployment Criteria
Central Control Platform	❑ MIST
Adaptive Control	❑ OPAC ❑ RHODES ❑ Other
Signal Priority	❑ Conditional Service for Buses
Signal Preemption	❑ Fire Trucks En-route to Emergencies
Shared Detection for Adaptive Control & Incident Management	❑ Sensys Wireless Detectors & Microwave Detectors
Traffic Signal Controller	❑ 2070L
Traffic Signal Controller Firmware	❑ NextPhase with ASC2 2070 (Non-adaptive) ❑ NextPhase with ASC2 2070 'OPAC' version (Adaptive)
Adaptive Control Hardware	❑ Single Board Computer (OPAC) ❑ Gecko Board (RHODES)
Device Cabinet	❑ Co-locating ATMS Devices at Traffic Signals (Share Power, Communications, UPS, Batteries, Slab, Grounding, and Cabinet) where R/W is Limited (TS-2 Type 1, Shelf-mount) ❑ Separate Device Cabinets and UPS Cabinets ❑ Type 334 Cabinets for ATMS Devices
Signal Priority & Preemption	❑ Opticom (216 Signals and 130 Fire Trucks are Equipped with Opticom IR Technology). Future System Expansion to Consider Replacement of Opticom IR with Opticom GPS)
Uninterrupted Power Supply (UPS)	❑ Meet FDOT Standard
Detection (IP based) Tactical Control (Signalized Intersections)	❑ Inductive Loops ❑ VIDS at Mastarm based Traffic Signals (MPEG-4) ❑ Sensys Wireless Detectors
Detection Strategic Control (Advanced Detection)	❑ Sensys Wireless and/or MVDSs Upstream of Traffic Signals ❑ Support Adaptive Control and Incident Management
Closed Circuit Television (CCTV) Cameras	❑ Located at Traffic Signals at Intersections of Two Priority Corridors (Primary), Traffic Signals at Intersections of Priority Corridors With Minor Arterials (Secondary), Following One Mile Spacing along Priority Corridors And Horizontal Curves (Tertiary), and for Special Events Needs
Dynamic Message Signs (DMSs) Dynamic Trailblazing Signs (DTBs) Highway Advisory Radios (HARs)	❑ Regionally Significant Corridors and Evacuation Routes (Augment Capacity Of Arterial and Freeway Corridors)
Communications	❑ Open Standards using MPEG-2 Encoders (CCTV Cameras), MPEG-4 Encoders (VIDS), Terminal Servers for CCTV Pan-Tilt-Zoom Control, 100 Mbps Ethernet Switches for Fiber based Local Loops, 1 GigE Ethernet Switches in Air-Conditioned Communications Hubs, 1 GigE Expandable to 10 GigE Core Switch in the Primary Control Center ❑ VDSL for Legacy Twisted Pair Copper Cabling ❑ 4.9 GHz Band for Use in Public Safety Designated by FCC
Primary Control Center	❑ Interconnected to Secondary Control Centers, Communications Hubs Housing Backbone Switches, Field ATMS Devices, and Other Centers

Many of these elements have previously been deployed along several operational corridors within the county for which the county has gained in-depth understanding and experience applicable to their functionally and requirements for sustained operations and management. The county's ATMS master plan is built on proven technologies, operational strategies, and historical deployments within the county where applicable so as to assure a uniform base of deployment that minimizes maintenance and operations costs while providing the system operators the needed functionality to optimize traffic operations and safety countywide. This approach reflects the stakeholders' election not to reinvent the wheel, during ATMS program definition phase, considering that the county has made significant investments in ATMS as part of the Pinellas Countywide ATMS projects (stages I and II).

3.3.1 Detection System

The continued evolutionary development of the National Transportation Communications for ITS Protocol (NTCIP) standard for real time detection systems will further improve the opportunity for an integrated detection strategy. The Transportation Sensor Systems Working Group has created a sensor system standard to be used in real time detection models, including video detection, smart loops, etc. This standard provides basic detection needs, as well as collection of data and effectiveness measures such as volume, speed, and occupancy. It is important to note that NTCIP communications protocol pertains only to data and control with no provisions made for video standardization. Moving Pictures Working Group (MPEG) has developed video standards (e.g., MPEG-2 and MPEG-4) completely outside the NTCIP development effort that can be leveraged to support Pinellas County ATMS program. A variety of detection strategies and technologies are required to support the envisioned traffic control and management functions in the county:

- ❑ **Tactical Control Detection**—This technology senses the presence of approaching vehicles or pedestrians on applicable controller phases at local intersections to provide for traffic control detection and dilemma zone protection. Tactical level detection is interfaced with the local controller within the roadside cabinet. In the case of adaptive control, both tactical level and strategic level detection may be required to provide needed data to the operational strategy's predictive algorithms.
- ❑ **Strategic Control Detection**—This technology is used for system surveillance and strategic traffic control as required by traffic responsive, traffic adaptive, and incident management algorithms. Strategic level detection is interfaced with downstream traffic controller and/or the Primary Control Center, depending on intended application. In either case, the collected data is typically transmitted to the Primary Control Center's system management software for real-time processing. In the case of adaptive control, both tactical level and strategic level detection may be required to provide needed data to the operational strategy's predictive algorithms.
- ❑ **Data and Measures of Effectiveness Detection**—This technology is used exclusively or in concert with other control detection for collecting and warehousing real-time data and measures of effectiveness (speed, travel time, occupancy, etc.). This may also include collecting intersection turning movement counts on a near real-time basis. This is achieved by aiming detection devices (VIDS cameras) to also count departing traffic movements associated with each green interval.

- **Incident Detection**—This technology is commonly used with uninterrupted flow facilities such as freeways. The success varies based on deployed algorithms and available surveillance data. A variety of researchers have studied the application of automated incident detection on interrupted flow facilities such as arterial streets. In the case of Pinellas County, the network of detection units, deployed in advance of signalized intersections for adaptive traffic control, can be used to also detect incident conditions (sudden reductions in approaching flow speed). There are many technology options for traffic detection, including inductive loops, video image detection systems, radar, sonic, microwave, wireless, etc. Application of video image and microwave detection systems has been widespread though the wireless vehicle detection system is gaining increased base of deployment and acceptance in the marketplace.

3.3.2 Traffic Control System

The Pinellas Countywide ATMS project, Stage I deployed two independent central control systems, MIST and i2TMS. The county has adopted MIST as its standard central control platform and plans to further improve this central control platform to provide additional features and functionalities including interface with RHODES adaptive traffic control system. The traffic control system encompasses local controllers, controller software, adaptive control software, roadside cabinets, and central control system software. The investment plan for these system components have considered the county's desired functionality, staffing and training requirements, system costs, and migration and integration strategies.

Co-locating equipment for various ATMS devices within the roadside cabinet will enable respective devices to access the cabinet's electrical power, communications infrastructure, and surge protection equipment, resulting in an integrated communications system that is managed at the device level. This approach will minimize system deployment costs, as well as ongoing operations and maintenance costs. This strategy requires the traffic cabinet to have sufficient spare space available to accommodate equipment for a myriad of devices, including traffic signals, VIDS, CCTV cameras, blank-out signs, communications encoders, terminal servers, edge switches, surge protectors, and uninterrupted power supply. As part of the Pinellas County ATMS Project, Stages I and II, traffic signals located along portions of US 19 (8) and SR 60 (15) were upgraded to advanced traffic controllers (2070) and associated cabinet (332). In addition, the CCTV cameras used their own exclusive device cabinet. This separation of device cabinets intends to demarcate separation of maintenance responsibilities between in-house and outsourced staff for traffic signals and CCTV cameras, respectively. The county has also elected to use the TS-2 shelf-mount Type IV cabinets as its standard. This election reflects the county's perception that a shelf-mount cabinet provides more space and flexibility to the signal technicians for performing maintenance functions.

3.3.3 Traffic Monitoring

CCTV cameras are used for monitoring traffic flow and verifying traffic incidents. CCTV cameras play a significant role in traffic operations and management since they enable the system operators and engineers to observe current operational conditions, identify and launch mitigating measures and response plans, and assess their effectiveness. The recommended strategy is to equip Pinellas County with CCTV cameras generally following one-mile spacing for full countywide coverage. This will enable system operators to observe a half-mile distance of each intersection approach assuming use of CCTV cameras with half-mile visibility reach. To this end, it is recommended that CCTV cameras be deployed with the following priority:

- Traffic signals at intersections of two priority corridors
- Traffic signals at intersections of priority corridors with minor arterial streets
- One mile spacing along priority corridors and horizontal curves.

3.3.4 Information Dissemination

Information dissemination to travelers can leverage a myriad of devices including DMS signs, DTB signs, blankout signs, HARs, the Pinellas County ATMS web page, and value added resellers such as news media and 511. DMS, DTB, and blank-out signs as well as HARs are used to share traffic information to roadway users at critical and strategic decision making points. These devices can be used along arterial streets for incident management, special events, and regional emergencies, especially along highway segments that serve as alternate routes to freeway corridors or vice versa.

The value of these devices depends greatly on whether or not a regional approach to traffic management is utilized. This approach is one that is founded on an institutional framework for cooperation, coordination, and holistic management strategies. Response scenarios must be developed and agreed upon by the regional stakeholders for a variety of situations and operational conditions requiring regional intervention. Deployment of these devices along the designated routes is contingent upon establishing the required institutional framework, as well as stakeholders' willingness and ability to contribute funding for implementation, operations, and maintenance.

It is recommended that regionally significant corridors and evacuation routes be equipped with DMS signs to augment capacity of arterial and freeway corridors. The DMS signs should be placed about a half-mile upstream of critical decision-making signalized intersections. The DTB signs should be placed in between DMS signs and critical decision-making points (signalized intersections) to positively guide approaching traffic. Blank-out signs should be placed at critical decision-making points (signalized intersections) to positively control appropriate turning movement in effect during incident conditions or special events. HAR static signs and flashers could also be placed along regionally significant corridors and evacuation routes. Interfaces to the Pinellas County web page, news media, 511, and value added resellers make the opportunity to share data and video in real-time feasible, and further the reach and value of collected travel and transportation data and video.

3.3.5 Signal Priority and Signal Preemption

Signal priority and signal preemption are addressed under this heading since the same equipment supports both functionalities. The purpose of transit signal priority systems is to reduce transit travel time and improve transit schedule reliability. These goals are supported by objectives such as increasing ridership; reducing costs for transit operations and capitol investments; and reducing transit vehicle environmental cost as measured by emissions and energy consumption. Signal priority technology has proven effective in improving transit bus delays, adherence to bus schedules, and reducing total person delays along bus routes. Findings from national studies indicate potential travel time savings during peak periods and peak direction, including an 8-10% improvement in transit vehicle schedule reliability. However, if not managed properly, transit signal priority can also lead to clustering of buses, longer passenger waiting time, and irregular passenger loadings. The effectiveness of transit signal priority as an operational strategy depends on a variety of factors, including public acceptance, potential benefits, impacts on coordinated traffic operations along bus routes, and technology used for transit priority. These concerns must be carefully considered and addressed prior to instituting a transit signal priority system for any corridor. Signal priority systems can also serve both the efficiency and safety needs of the county, since the equipment used for signal priority also supports signal preemption, which enables preferential treatment of emergency vehicles (e.g., fire trucks).

Signal priority can be supported on a conditional basis. A bus equipped with automated vehicle location and GPS can maintain a real-time status of its location, speed, direction, and schedule, and can request priority treatment only when it is behind schedule by more than a predefined time period established by policy. Alternatively, the signal priority request can be made conditional to presence of on-board passengers exceeding a preset quantity (established by policy) as determined by the automated passenger count system on the bus, and/or intersection excess capacity at the time the signal priority is requested. These conditions can be combined, if necessary, for a more restrictive strategy. For example, if the intersection is still recovering from the impacts of a previous signal priority or signal preemption request, it may not be prudent operationally to accommodate a request for signal priority.

Signal preemption is an emergency management strategy for preferential treatment of fire and law enforcement vehicles responding to incidents and emergency conditions. As previously stated, emergency preemption is achieved via the same equipment used for signal priority. A phase selector device is mounted inside the roadside cabinet and provides input to the traffic controller through the control cabinet once it receives input from an external detector. Emergency signal preemption results in timely termination of active phases and provision of green indication to the preempted approach. The county currently does not use signal preemption for accommodating emergency vehicles other than fire trucks en route to emergency conditions. Another characteristic of emergency management is the need for operational response to incidents. This involves development of operational strategies for traffic diversion to alternate routes, increased throughput on critical intersection approaches along diversion routes, etc. This aspect of emergency management is a central management system software function and is typically incorporated in modern systems with no impact on the local control equipment.

Several technologies are available for signal priority and signal preemption. Vehicle detection can be achieved through inductive loops, radio frequency tags and readers, optical (infrared or IR) emitters and detectors, and satellite based Global Positioning System (GPS). Vehicle interface with downstream traffic controllers can leverage lead-in cabling, infrared receivers and phase selector, or a wireless (radio) link and phase selector. The county has already equipped 130 fire trucks and 226 signalized intersections with Opticom Infrared (IR) within Pinellas County. However, the application of this technology has been limited to signal preemption for fire trucks en route to emergency condition.

Figures 3-2 through 3-5 present system components and operations of Opticom IR and Opticom GPS. In the case of Opticom IR, an emitter sends an IR signal to a detector via line of sight (1320 ft). The detector receives and relays the IR signal to the phase selector in the controller cabinet. The phase selector validates IR signal and submits a request to the traffic controller, which activates a *predetermined* signal priority or preemption routine to provide green indication in a safe manner. The signals will display green indication until the detector no longer receives IR signal (for signal preemption).

Figure 3-2: Opticom IR Components

Figure 3-3: Opticom IR System Operations

Figure 3-4: Opticom GPS Components

Figure 3-5: Opticom GPS Operations

In the case of Opticom GPS, a GPS unit mounted on the vehicle uses the Department of Defense satellites to determine vehicle speed, heading, and position. The vehicle sends speed, heading, position, identification, and turn signal status to a phase selector in the controller cabinet in real-time via a radio link between the vehicle and controller cabinet. The phase selector validates and submits a request for preemption to the traffic controller when either a distance or an estimated time of arrival criterion (established by policy) is met. The traffic controller activates a *tailored* signal preemption routine to provide green indication for applicable movements. The traffic signal indications will remain green until the vehicle reaches the downstream stop bar (for signal preemption). Opticom GPS is a promising technology that can be considered for upgrading the existing deployed base of Opticom IR units, as well as accommodating system expansion needs in the future. As presented in Table 3-5, Opticom GPS has considerable advantages over Opticom IR. These advantages pertain to system expansion cost; system features, functionality, and robustness; and, most importantly, reduced impacts to corridors traffic operations.

Table 3-5: Opticom IR versus GPS

Comparative Element (IR versus GPS)	Advantage	
	IR	GPS
Installation Cost per Intersection: Single Unit		☑
Preventive Maintenance Cost Per Intersection		☑
Hardware Cost per Vehicle (One-time)	☑	
Cost per Intersection as Number of Approaches Increase		☑
Installation Cost per Vehicle (One-time)	☑	
Line of Sight Dependency for Activation		☑
Impacted by Curves and Grades		☑
Increased Range (2500 ft vs. 1320 ft) for Activation		☑
Potential for System Abuse (GPS System Coding is Mandatory)		☑
Need for Monitoring and Enforcement of Abuse		☑
Customized Approach Map for Each Intersection		☑
Left Turn Recognition and Relay		☑
Customized Preemption of Downstream Signals		☑
Non-Intrusive Maintenance (for Cabinet-mounted Radio Antenna)		☑
Detailed Logging and Reporting with GPS Data Output		☑
Robustness in Minimizing Traffic Disruption		☑
Activation Based on Estimated Time of Arrival or Distance from Stop Bar		☑

Tables 3-6 through 3-9 and Figure 3-6 present costs associated with system expansion for Opticom GPS and IR systems, assuming the need to equip a total of 150 fire trucks (130 existing) and 600 signalized intersections (226 existing) countywide with Opticom technology. The analysis reflects the county's receipt of partial reimbursement for the return of existing IR equipment, while taking into account costs for acquiring system training and a three-year additional equipment warranty. The analysis results in the conclusion that, in addition to the provision of enhanced features, functionality, flexibility, and robustness, the system expansion to the GPS system will have an overall lower cost than the IR system.

Table 3-6: Opticom GPS System Expansion (Equipment)

Cost Element	Deliverables	Stock #	Qty	List Price	Itemized Cost	Total Cost
Intersection	Opticom GPS Intersection Matched Components - Pole Mount	78-8125-0420-3	600	$5,300	$3,180,000	$5,577,000
	Opticom GPS Auxiliary Interface Panel Kit	78-8125-0435-1	600	$300	$180,000	
	Opticom GPS Card Rack w/ Power Supply	78-8125-0455-9	600	$425	$255,000	
	GPS Installation Cable 2500' @ $0.60/ft)	78-8125-0423-7	48	$1,500	$72,000	
	Opticom GPS ITS Explorer Software Kit	78-8125-0450-0	1	$0	$0	
	Opticom Installation Hardware	75-0301-2189-3	600	$150	$90,000	
	Opticom GPS Site Survey Intersection	75-0301-1397-3	600	$150	$90,000	
	Opticom GPS Intersection Installation	75-0301-1393-2	600	$2,500	$1,500,000	
	Opticom GPS Turn-on Service	75-0301-1394-0	600	$350	$210,000	
Vehicle	Opticom GPS Preemption Vehicle Kit	78-8125-0430-2	150	$3,000	$450,000	$550,500
	Opticom GPS ITS Explorer Software Kit	78-8125-0450-0	1	$1,000	$1,000	
	Opticom GPS Site Survey Vehicle	75-0301-1398-1	1	$2,000	$2,000	
	Opticom GPS Vehicle Installation	75-0301-1395-7	150	$650	$97,500	
Trade-In Allowance	Opticom IR Intersection Equipment	n/a	226	$1,325	$299,450	$396,950
	Opticom IR Vehicle Equipment	n/a	130	$750	$97,500	
					Equipment + Installation (GPS)	**$5,730,550**
					Equipment (GPS)	**$3,741,050**
					Installation (GPS)	**$1,989,500**

Table 3-7: Opticom GPS System Expansion (Support)

Contingency						
Cost Element	**Deliverables**	**Stock #**	**Qty**	**List Price**	**Itemized Cost**	**Total Cost**
Contingency Allowance	Intersection Contingency	n/a	600	$1,000	$600,000	$630,000
	Vehicle Contingency	n/a	300	$100	$30,000	
	Equipment In Warranty Trade-In Value (Intersections)	n/a	TBD	-$265	assumed 0	
	Equipment In Warranty Trade-In Value (Vehicles)	n/a	TBD	-$150	assumed 0	
Other Cost (Optional)						
Cost Element	**Deliverables**	**Stock #**	**Qty**	**List Price**	**Itemized Cost**	**Total Cost**
Training	Opticom GPS Training - Installation & Maintenance	76-1000-1012-0	2	$5,000	$5,000	$15,000
	Opticom GPS Training - Operator	75-0301-1401-3	1	$5,000	$5,000	
Extended Warranty	Intersection Equipment Extended Warranty 3-Year Warranty	75-0301-3433-4	600	$900	$540,000	$660,000
	Vehicle Equipment Extended Warranty 3-Year Warranty	75-0301-3434-2	150	$800	$120,000	
					Equipment + Installation (GPS)	$5,730,550
					Total Implementation Cost (GPS)	**$7,035,550**

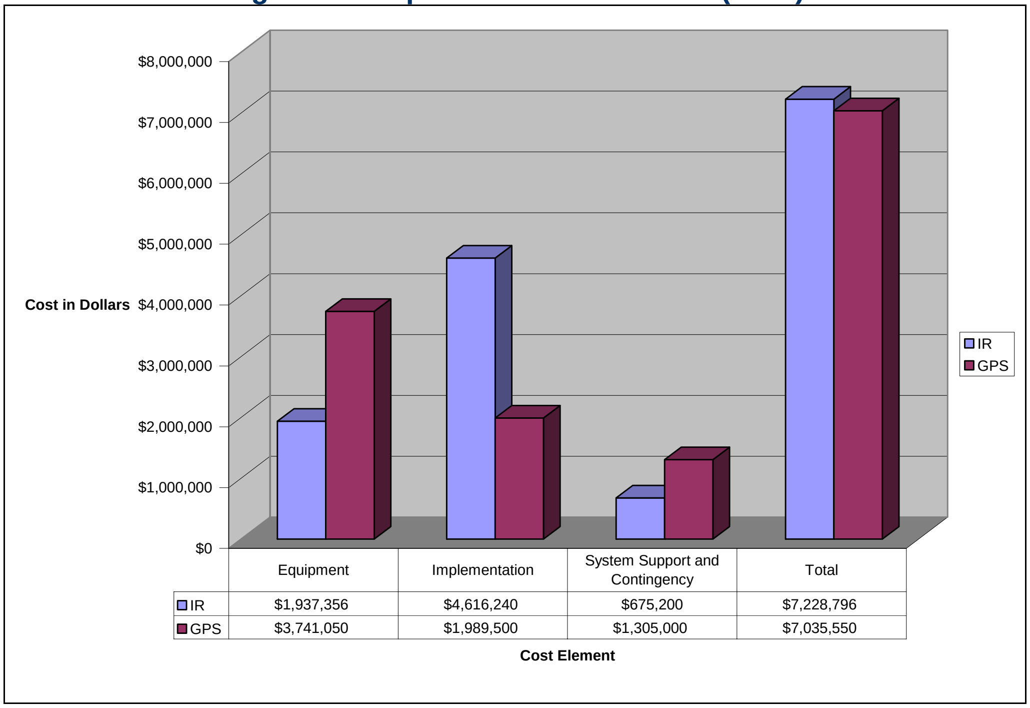
Table 3-8: Opticom IR System Expansion (Equipment)

Cost Element	Deliverables	Stock #	Qty	Unit Price	Itemized Cost	Total Cost
Intersection	Opticom Model 754 Phase Selector (4 Channel)	78-8113-4740-6	374	$2,751	$1,028,874	$6,521,301
	Opticom Model 758 Auxiliary Interface Panel	78-8114-5340-2	374	$200	$74,613	
	Opticom Model 711 Optical Detector, Single Channel, One Directions	78-8095-3852-9	1496	$402	$600,644	
	Detector Cable 1000' @ $0.41/ft)	78-8009-6557-2	374	$410	$153,340	
	Opticom Model 750CS Configuration Software	78-8125-0481-5	1	Free	$0	
	Opticom 750C User Configuration Software Communications Cable	78-8113-4921-2	1	$50	$50	
	Opticom Installation Hardware Note 4 (per intersection)	n/a	374	$160	$59,840	
	Opticom IR Intersection Installation	n/a	374	$12,310	$4,603,940	
Vehicle	Opticom Model 792H Emitter (High Priority)	78-8113-4540-0	20	$995	$19,900	$32,295
	Opticom Model 790CS Emitter Configuration Software	78-8125-0484-9	1	Free	$0	
	Opticom 790C User Configuration Software Communications Cable	26-1014-5721-1	1	$20	$20	
	Opticom 790CS Emitter Programming Y-Cable	78-8113-4559-0	1	$75	$75	
	Opticom IR Vehicle Installation	75-0300-9902-4	20	$615	$12,300	
					Equipment + Installation (IR)	$6,553,596
					Equipment (IR)	$1,937,356
					Installation (IR)	$4,616,240

Table 3-9: Opticom IR System Expansion (Support)

Contingency						
Cost Element	**Deliverables**	**Stock #**	**Qty**	**List Price**	**Itemized Cost**	**Total Cost**
Contingency Allowance	Intersection Contingency	n/a	374	$1,800	$673,200	$675,200
	Vehicle Contingency	n/a	20	$100	$2,000	
Training	Not needed	n/a	n/a	n/a	n/a	$0
Extended Warranty	5-year Warranty is Standard	n/a	n/a	n/a	n/a	$0
					Equipment + Installation (GPS)	$6,553,596
					Total Implementation Cost (GPS)	$7,228,796

Figure 3-6: Opticom GPS versus IR (Cost)



As presented in Table 3-10, the county could invest in a three-stage deployment program for system expansion using Opticom GPS technology:

- Stage I – Retrofit existing deployed base of Opticom equipment on 130 fire trucks and 226 traffic signals along priority corridors and equip the remaining traffic signals along these corridors that currently lack Opticom IR
- Stage 2 – Equip signalized intersections along priority corridors that are not currently equipped with Opticom IR
- Stage 3 – Equip signalized intersections that are not located along priority corridors, most of which operate under fully actuated mode of operations.

This information is presented for consideration and discussion among the ATMS program stakeholders. Signal priority and signal preemption represent technologies and operational strategies that pertain to market packages of multi-modal coordination and incident management, respectively, which are perceived as priority market packages by the ATMS program stakeholders.

Traffic engineering must consider and accommodate both traffic safety and operational efficiency. There will be significant operational and safety impacts if traffic signals along operational corridors are not equipped with signal preemption. Drivers, perplexed by sudden nature of approaching fire trucks and active siren, behave erratically especially when they are blocked by traffic queues from downstream traffic signals. This erratic behavior adversely compromises not only the safety of the fire truck and other roadway vehicles but also the corridor's traffic operations. The Opticom GPS and adaptive traffic control system, however, will provide traffic managers robust tools to proactively manage operational impacts of signal preemption while optimizing traffic safety along the route and citizen safety countywide by minimizing the response time to life-critical incidents.

Since OPAC and RHODES (adaptive traffic control) do not have background cycles, loss of signal coordination or ‘synchronization' is not as prominent as it has historically been with traditional coordinated signal systems. The adaptive control systems can be enhanced operationally and calibrated to recover from impacts of signal preemption much more robustly than the traditional time-of-day plans (which used fixed cycle lengths). Also, the impacts of signal preemption can be assessed and managed by exploring the historical frequency of requests for signal preemption during peak hours and limiting, if warranted, frequency of signal preemptions during peak periods for traffic signals along operational corridors. The Opticom GPS system also is a better tool to use to enforce system abuse by users.

Choices of local controller hardware and associated firmware, adaptive control software, controller cabinet, and central control system platform must reflect signal priority and signal preemption functionalities. The controller firmware needs to accommodate a variety of priority treatments, including passive priority, early green (red truncation), green extension, actuated transit phase, phase insertion and phase rotation, and adaptive/real-time control. Space within the controller cabinet must be managed to ensure sufficient room exists to accommodate the phase selector device in conjunction with other ATMS elements.

Table 3-10: Countywide Deployment of Opticom GPS

Project	Stage	Project Focus	Quantity	Deployment Cost
1	1	Retrofitting Signals already Equipped with Opticom IR to Opticom GPS - along Existing Operational Corridors	226	$2,650,057
1		Equipping Remaining Signals along Existing Operational Corridors with Opticom GPS	103	$1,207,769
1	2	Equipping Remaining Operational Corridors with Opticom GPS	205	$2,403,813
1	2	Equipping New Signals along Operational Corridors with Opticom GPS	66	$773,911
Total for Operational Corridors			600	**$7,035,550**
1	3	Equipping Remaining Signals within Pinellas County with Opticom GPS	267	$3,130,820
Total Countywide			867	**$10,166,370**

Figure 3-7 presents a map depicting priority corridors where signalized intersections could be instrumented with Opticom GPS equipment to support signal preemption for fire trucks en route to emergency conditions. This map is introduced to generate dialogue between the county and fire chiefs of various jurisdictions within the county who are potential stakeholders of the envisioned system. The county and program stakeholders have embraced Traffic Control and Incident Management as priority user services. One of the program’s goals is to optimize operational efficiency, traffic safety, and community safety countywide. This context creates an opportunity for the program stakeholders to explore related options and approaches for signal preemption and signal priority. Stakeholders may also develop, apply, and enforce policies and procedures to bring forth a regional transportation system that addresses safety and operational efficiency needs in balance.

If selected by the ATMS program stakeholders for countywide deployment, the recommended funding source for signal preemption is SAFETEA-LU, an acronym for Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. Under the Equity Bonus Program for priority control systems, grant money is allowed for states to capture additional funds as a ‘Donor State’ for having paid more funds than received up to a predefined percentage. The Equity Bonus Program allows a certain percentage of its funds to be used in the same manner as the Highway Safety Improvement Program (HSIP) and Surface Transportation Program (STP). A component of the HSIP and STP programs, the Equity Bonus Program allows funding for priority control systems. As required for any project, the Opticom GPS project would need to follow the Metropolitan Planning Organization (MPO) Technical Committee’s prioritization process. Approval from the Pinellas County MPO will be required for these funds.

MPO
METROPOLITAN PLANNING ORGANIZATION
Pinellas County, Florida

Pinellas County ATMS Master Plan

Figure 3-7 Countywide Signal Preemption Deployment Stages

Legend

Opticom GPS

- Stage 1
- Stage 2
- Stage 3
- Stage 4

Phases

- Phase 1
- Phase 2
- Phase 3
- State Freeway (Funded)
- State Freeway (Unfunded)

Roads

- Major Roads
- Minor Roads
- Local Roads
- Water

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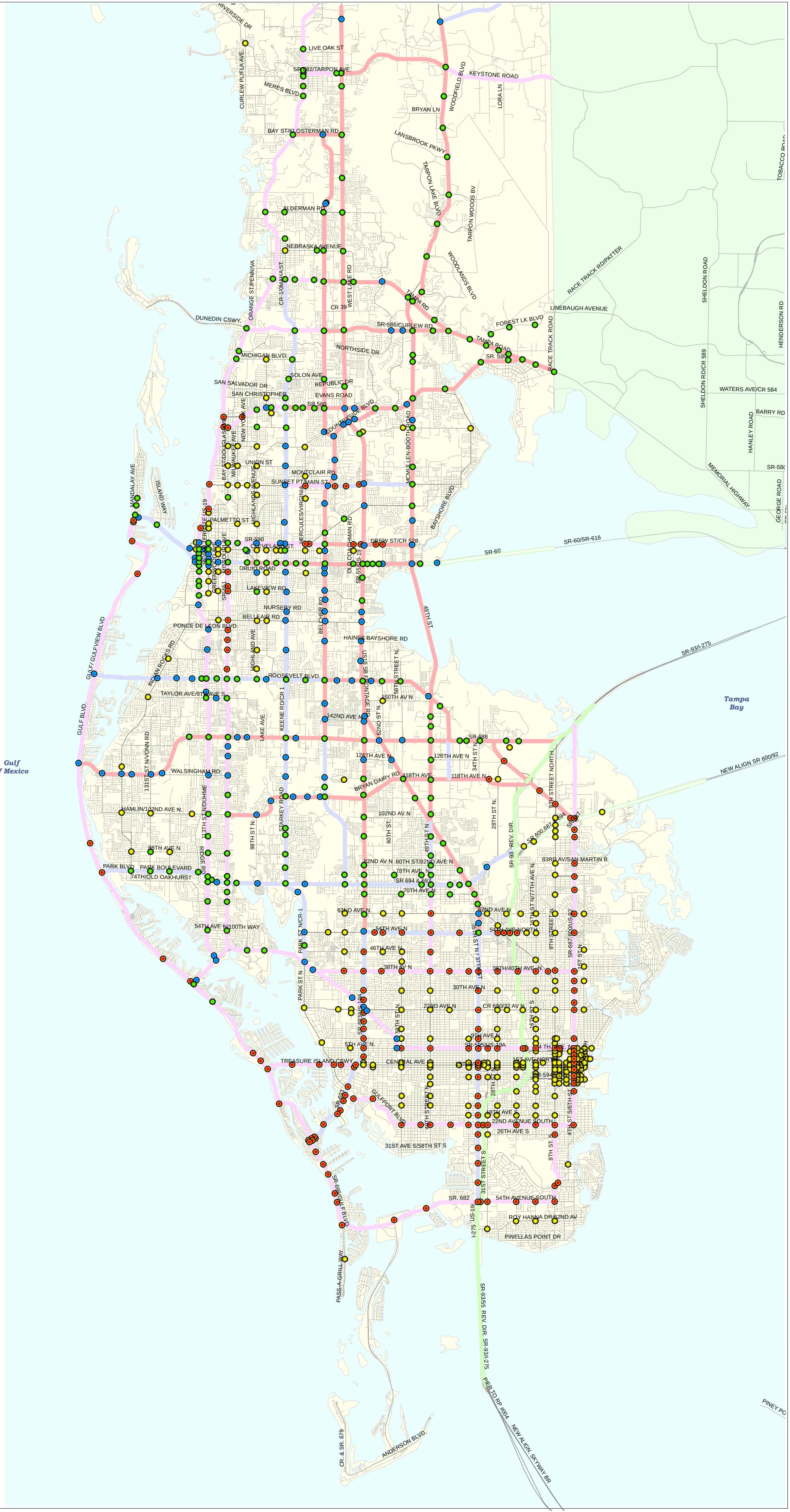
Prepared By
Gord & Associates, Inc.

November 2008



3.3.6 Uninterrupted Power Supply (UPS)

Power outages are a source of concern when trying to effectively manage the movement of traffic in urbanized areas. It is often impossible to adequately respond to power outages with portable generators due to a lack of resources, or an inability to access an impacted location resulting from congestion and traffic queues. Historically, battery backup systems have been cumbersome in size and did not provide enough hold-up time to outweigh the perceived liability concerns associated with providing delayed response to power outages. Modern battery backup systems are now more capable of meeting the uninterruptible power needs of LED based signalized intersections, and other ATMS elements, such as DMS signs, CCTV cameras, and end communications equipment. Reduced power consumption needs, along with technology enhancement in battery backup systems, have now made it feasible to equip ATMS device cabinets with UPS solutions so that they maintain full or partial functionality for a period of time after power loss.

Alpha and Clary are two prominent suppliers of UPS systems. These are housed in stand-alone cabinets affixed to controller cabinets, mounted on controller cabinet foundations (slabs), or co-located within controller or device cabinets. These UPS systems provide two to four hours of hold-up power for LED-based traffic signals operating in stop-and-go mode, and longer periods of operation for flashing operations. Co-location within controller cabinets will eliminate the need for external enclosures in which a backup system would be housed. This reduces urban clutter and negative aesthetic impact, while minimizing deployment costs by eliminating the need to construct new slabs, conduit system, grounding, power, and connectivity to controller or device cabinets.

The power requirements for uninterrupted power supply system need to be sized to meet the power needs of LED-based traffic signals and/or ATMS devices supported by the controller and/or device cabinets. In addition, the uninterrupted power supply system should have the capability to monitor battery use, have automated configuration, and contain alarms to warn system operators (e.g., low batteries, run time exceeding preset time interval, battery activation status, etc.). The UPS systems should be equipped with USB/RS-232 and Ethernet ports to interface with laptops and the Primary Control Center (via terminal servers/IP based edge switches), respectively.

3.3.7 Surge Protection and Grounding

The diversity of recommended equipment for traffic control and communications in Pinellas County brings forth the need for properly designed and applied surge protection and equipment grounding. Weather conditions and high-moisture soil characteristics in the Tampa Bay area, especially during rainy summers and hurricane season, further underscore this need.

Surge protection for ATMS applications is available from several reputable manufacturers such as Atlantic Scientific, EDCO, etc. The device cabinets should have basic AC power protection to protect all equipment housed within the cabinet. The communications hubs, especially those equipped with HVAC components, also require such protection. The copper-based conductors used for power, video, and data at the device level and cabinet levels need to be protected by surge protection units. Protection should also be placed on DMS signs and adjacent to CCTV camera locations using properly located Franklin rods. Fiber links will require no protection except that the trace wires included in the fiber optic conduit system need to be properly grounded at each pull box.

3.3.8 Operational Strategies

A myriad of operational strategies are available for application in Pinellas County, which have influenced the county's choices for central control software, local controller firmware, CCTV camera and DMS sign management software (Cameleon), etc. Examples include fixed-time, traffic actuated, traffic responsive, and traffic adaptive control, as well as signal preemption, signal priority, and incident management. There are various communications architectures for system surveillance and control including centralized, distributed, hybrid, and peer-to-peer. Modern, large-scale traffic control systems tend to use the hybrid communications architecture, which utilize distributed intelligence for local control at the intersection level, and central intelligence for strategic or system wide control and monitoring from the Primary Control Center. The hybrid communications architecture also works well with the fixed-time, traffic actuated, traffic responsive and adaptive, as well as incident management strategies.

The adaptive control systems of today make use of hybrid communications architectures. However, future adaptive control systems may well make use of peer-to-peer communications (localized). The county has deployed two adaptive traffic control technologies along segments of US 19 (MIST/OPAC) and SR 60 (i2TMS/RHODES) corridors. The county envisions expanding the MIST/OPAC based technologies along the remaining operational corridors, enhancing MIST capacity to interface with RHODES, and exploring other adaptive traffic control systems that emerge in the future. This vision is founded on a standards-based central control system that is flexible and robust to support application of several adaptive control systems. The choice of adaptive traffic control system to be deployed along operational corridors will reflect the functional and performance requirements of the corridor.

3.4 TECHNOLOGIES

This section presents various recommended ITS technologies that address the functional needs and requirements of the county in building the envisioned ATMS system. The merits, limitations, and critical considerations associated with each technology option are discussed, followed by a conceptual plan for their deployment. These ATMS devices are generally used for control, monitoring, and management of traffic conditions during recurrent congestion, incidents, special events, and regional emergencies. They augment other critically needed improvements that should be deployed to improve traffic safety and congestion countywide. These improvements include optimizing signal timing and operations engineering. It is imperative to emphasize that advanced technologies will have a limited value in improving traffic safety and congestion without investment in the complementary operational improvements.

3.4.1 Traffic Controller and Controller Cabinet

In support of the county's strategy for system expansion, the market offers a variety of open-architecture, standards-based technologies for traffic controllers, including National Electrical Manufacturers Association (NEMA), model 170, and 2070 controllers. Model 170 traffic controllers are based on standardized hardware specifications for controller, cabinet, component modules, and associated wiring harnesses. Model 170 controllers use proprietary controller software. Type 2070 is a member of the Advanced Transportation Controller (ATC) family, which can be retrofitted into industry cabinet standards including 170, NEMA, and emerging ATC cabinets. Type 2070 is available in its full-version with VME bus slots, or a light-version without the VME bus. The ATC technology represents nonproprietary computer architecture, using off-the-shelf operating systems with the capacity to accommodate open communications protocols. The modular structure of ATC technology simplifies system maintenance, while providing the opportunity for supporting future upgrades and forgoing the need for replacing the entire controller. The county has considered the pros and cons associated with traffic controller and cabinet and made its investment choices for traffic control equipment as detailed below.

- ❑ Traffic Controller – Type 2070L (light version) as the preferred local controller configured with 10-amp power supply to be deployed at the majority of locations within the county. The 10-amp power supply (instead of 3.5-amp) would empower the county to add VME chassis in the future, if necessary, in support of emerging technologies for adaptive traffic control, encoders, edge switches, etc.
- ❑ VME Chassis – VME chassis in the future, if required, for enhanced functionality.
- ❑ Controller Cabinet – TS2 Type-1 shelf-mount one-door cabinet as the preferred controller cabinet. A two-door cabinet (Naztec Type 6 or Type 333 SD) may be considered for intersections where right-of-way is very limited to allow deployment of one cabinet for co-locating equipment for traffic signals, CCTV cameras, VIDS, communications, and UPS.
- ❑ Device Cabinet – Type 334 cabinet for ATMS devices such as CCTV cameras, DMS signs, etc.
- ❑ Cabinet Configuration – Separate cabinets for traffic signals and ATMS devices even at signalized intersections to physically demarcate maintenance responsibilities for traffic signals (in-house staff) and ATMS elements (outsourced). Equip each cabinet with end communications equipment (e.g., integrated encoder, terminal server, and edge switch) as required.
- ❑ NTCIP – Use the National Transportation Communications for ITS Protocols (NTCIP) as the communications protocol between field devices and the central control system.

3.4.2 ATC 2070 Firmware

A variety of local controller firmware packages are available in the marketplace for Type 2070 controller. Some are similar to the existing NEMA traffic control software packages. The local controller software must integrate effectively with the central control system software while accommodating local (e.g., intersection) and strategic (time-of-day plans, traffic responsive, traffic adaptive, etc.) control needs. The NEMA TS2-2003 standard for *Traffic Controller Assemblies with NTCIP Requirements*, Version 02.06, has standardized the essential functions and features needed to provide basic intersection traffic control. Most modern traffic control firmware for local controllers uses the NEMA standard to derive their core functionality and feature set. Manufacturers, who provide local controller software for Type 2070 controller, support basic traffic control functions and features prescribed by the NEMA TS2-2003 standard. As such, the choice of local controller firmware for the Pinellas County ATMS program is largely dependent on which package is most easily supported by the central system software selection. The county has completed its consideration of these requirements and selected the Econolite ASC/2 software as its standard local controller firmware.

3.4.3 Central Control System

As previously noted, the ability of central control system software to seamlessly integrate with local controller software is a key consideration for Pinellas County. Another major consideration is how the central control system communicates with local field devices. Does the system use standards-based communications protocols between central and field devices? What communications system architecture is accommodated by the system? Does the system accommodate field masters or similar distributed intelligence? What other ATMS field devices does the system accommodate? Does the system support adaptive traffic control strategies? Is the vendor willing and able to enhance software functionality to meet the growing needs of the county in the future? These are questions that should be considered when reviewing potential candidates for selection. The central control system should accommodate current control and management needs, but be scalable, modular, and robust to support system expansion countywide, not only geographically, but also functionally. It should also be cost-effective and time-effective as the system grows to encompass all ATMS devices and operational strategies, especially deployment of adaptive traffic control countywide. Specifically, the central control system must address the following high-level needs of the county:

- ❑ Capability for simultaneous support of varied system topology and operations concepts (field master based closed loop, direct control, adaptive control, etc.)
- ❑ Ability and versatility for real-time and near real-time monitoring and control
- ❑ Ability and versatility of data outputs in appropriate formats to support traffic engineering studies (requiring no manipulations)
- ❑ Interface capability with Synchro (two-way flow)
- ❑ Map-based, real-time monitoring of operational measures of effectiveness
- ❑ Salability (ability to add modules in the future for more functionality)
- ❑ Expandability (ability to add more intersections and ATMS devices to the system)
- ❑ Ease and intuitiveness of user interface and navigation
- ❑ Diversity and ease of generated reports and data outputs
- ❑ Web based application support
- ❑ Seamless integrated system/solution across ATMS devices
- ❑ Compliance with NTCIP and other communications standards
- ❑ Support for applicable center-to-center standards
- ❑ Compliance with applicable Management Information Base (MIBs)
- ❑ Compliance with Traffic Management Data Dictionary (TMDD)
- ❑ Ability to support diverse types of controller hardware, controller software, and manufacturers
- ❑ Ability for data archiving and sharing of data and video with operators and other centers
- ❑ Support for conditional signal priority
- ❑ Support for signal preemption
- ❑ Support for adaptive control
- ❑ Life cycle cost, or total cost of ownership.

The county has explored these considerations and selected the Management Information System for Transportation (MIST) as its standard central control platform. The county plans to enhance MIST functionality and features, including interface with RHODES adaptive traffic control system for reporting and monitoring purposes.

3.4.4 Video Image Detection System

Vehicle detection technologies, similar to the communications network, are the backbone of the advanced traffic management systems. They are used strategically and tactically for traffic control, incident management, and collection of operational measures of effectiveness. Detection technologies support a multitude of operational modes applicable to isolated traffic signals (i.e., semi-actuated and fully-actuated) and coordinated traffic signals (i.e., time-of-day plans, traffic responsive, and traffic adaptive). If used optimally, detection technologies can provide significant safety and operational benefits, even in traditional traffic engineering applications. Their value and contribution will increase exponentially when applied in conjunction with other advanced technologies.

Considerations of operational and maintenance requirements will influence choices of detection technologies. Inductive loops have traditionally been prone to damage caused by pavement movements and pavement cuts induced by utilities and contractors. In addition, their installation and repair adversely impact the structural integrity of the pavement, traffic operations, and risk exposure to workers and motorists. A variety of non-intrusive solutions have been available in the marketplace for some time. These include video image detection systems, wireless, microwave, sonic, etc. The use of video image detection technology has been more widespread with the opportunity to use Ethernet/IP for transmitting both detection data and video. A battery-operated, wireless detection technology has also emerged that leverages magnetic fields, similar to inductive loops, providing the same degree of accuracy, while requiring minimal infrastructure for conduit, cabling, structures, and power. The evolutionary improvements in detection technology have eliminated many deployment challenges such as adverse lighting, glare and shadows (for VIDS) or the need for electrical power and wireline connectivity to traffic controllers (for wireless detection).

It is recommended that the county consider using VIDS detection data and streaming video, as well as wireless detection and a surveillance subsystem. MPEG-4 compression algorithm uses lower bandwidth than MPEG-2, supports placement of streaming video on the county traffic website, and provides law enforcement access to video via wireless communications, if deemed valuable by the program stakeholders. The VIDS equipment must be co-located within the control cabinet if used for tactical control. For strategic control and data/MOE collection purposes, VIDS will require both device cabinets and a power source. Use of wireless detection technology will eliminate the need for device cabinets, power source, and wireline connectivity to downstream signalized intersections (via underground conduits or aerially) while providing the opportunity to place strategic detectors up to 2,000 feet upstream of traffic signals. VIDS or wireless detection is recommended for tactical control at mastarm and span-wire traffic signals, respectively.

The wireless detection technology uses battery-operated in-pavement sensors to detect the presence and passage of vehicles, transmit detection information to downstream local controller and/or Primary Control Center via an access point located at traffic signals. The access point is interconnected to controller cabinet and uses power-over-Ethernet via Category 5 cabling. Battery-operated repeaters are located upstream (up to 2,000 feet) of the intersection for advanced sensors that could be used for adaptive traffic control and/or incident detection. Figures 3-8 and 3-9 present the concept of operations and characteristics of the wireless detection system, respectively. The intersections-based cost reflects equipping a signalized intersection with advanced detection for adaptive/incident management purposes. It does not include presence sensors at the intersection stop-bars.

Figure 3-8: Sensys Detection Technology Concept of Operations

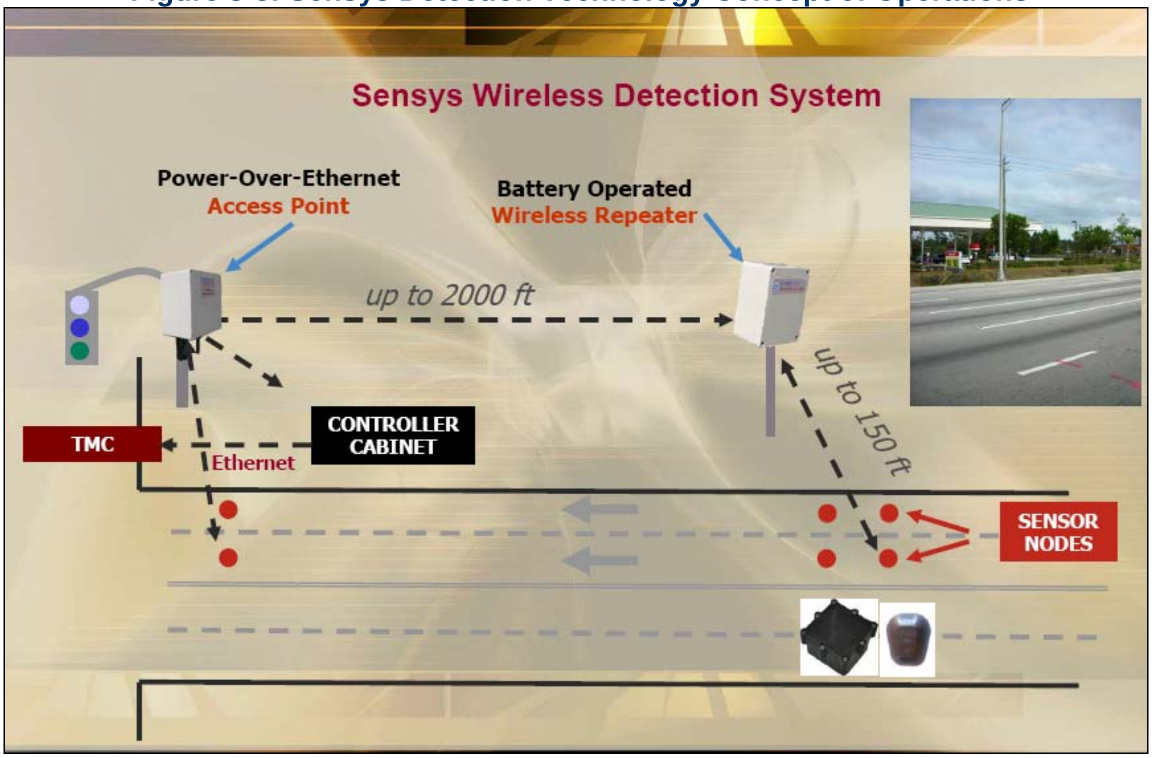
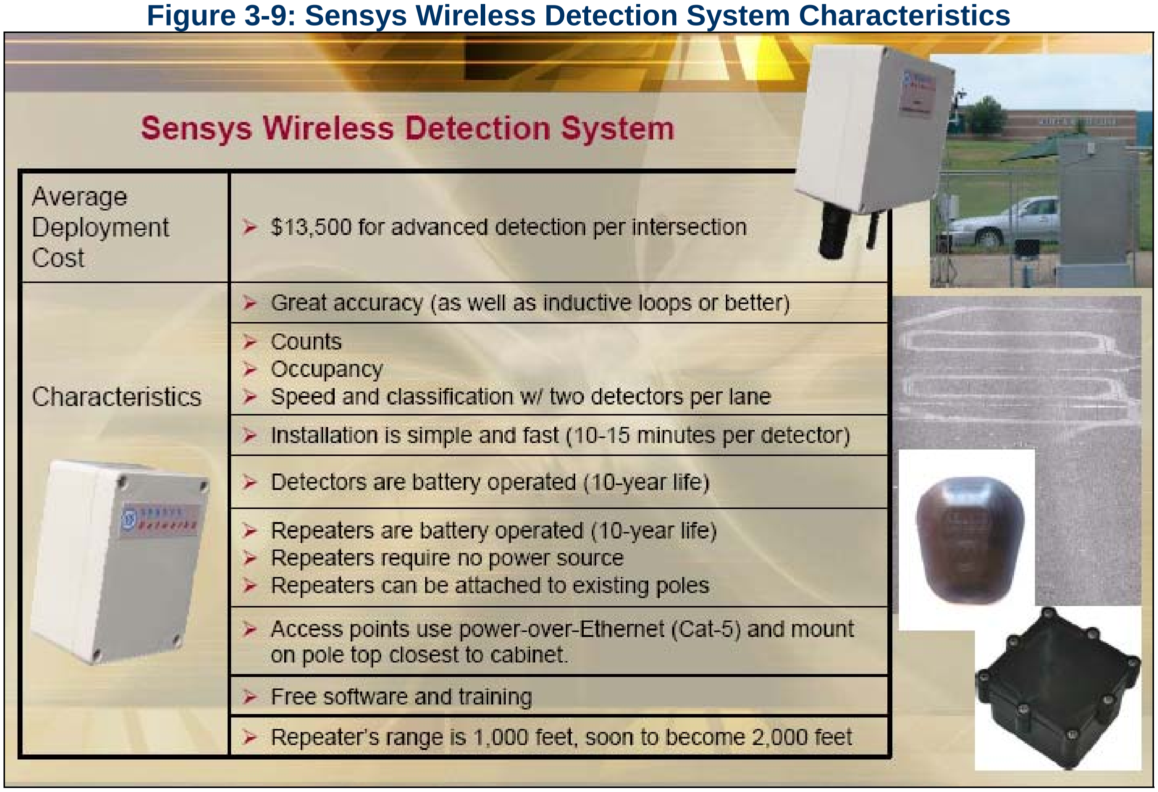


Figure 3-9: Sensys Wireless Detection System Characteristics



Average Deployment Cost	➢ $13,500 for advanced detection per intersection
Characteristics	➢ Great accuracy (as well as inductive loops or better)
	➢ Counts ➢ Occupancy ➢ Speed and classification w/ two detectors per lane
	➢ Installation is simple and fast (10-15 minutes per detector)
	➢ Detectors are battery operated (10-year life)
	➢ Repeaters are battery operated (10-year life) ➢ Repeaters require no power source ➢ Repeaters can be attached to existing poles
	➢ Access points use power-over-Ethernet (Cat-5) and mount on pole top closest to cabinet.
	➢ Free software and training
	➢ Repeater's range is 1,000 feet, soon to become 2,000 feet

Ease of installation, 10-year battery life for sensor and repeater, power-over-Ethernet for access point, wireless connectivity between repeater and access point, and accuracy better than inductive loops make wireless detection an ideal technology in support of the Pinellas County ATMS program. FDOT, Pinellas County, and Hillsborough County are currently testing this technology for large-scale deployment.

3.4.5 CCTV Cameras

Pinellas County has deployed CCTV cameras in an effort to help monitor traffic conditions along several corridors. The county wishes to use stand-alone cabinets for CCTV cameras. At signalized intersections, the CCTV camera equipment (encoder) could be placed within the controller cabinet if sufficient space is available to share electrical power, end communications equipment (edge switches), cabinet slab and grounding, etc. thus reducing deployment cost. However, the county wishes to segregate maintenance functions associated with signal control and CCTV cameras, since maintenance of CCTV cameras and associated equipment is typically outsourced.

Each CCTV camera needs to be interconnected to the Primary Control Center via a fiber-based communications system for transmitting video and camera control. With the development of the NTCIP for CCTV camera control, there has been a desire to combine CCTV camera control with data generated to/from other ATMS devices, resulting in the emergence of NTCIP conformant CCTV camera devices. Video signals are covered by a variety of analog and digital standards that are treated separately from data communications. CCTV cameras can use MPEG-2/MPEG-4 compression algorithms to provide quality video at low bandwidth.

It is recommended that CCTV cameras be located at key traffic signals along priority corridors following one-mile spacing. This will enable the system operators to view a half-mile distance along each intersection approach. Figure 3-10 presents both legacy and proposed CCTV camera locations within Pinellas County. The proposed CCTV cameras also help the system operator verify the message of DMS signs for incident management purposes. CCTV cameras and vehicle detection are two monitoring subsystems for roadways that serve different functions, but combine to provide the system operator a real-time status of traffic conditions during a myriad of operational conditions. CCTV cameras provide the system operators with a visual tool to verify and assess the operational conditions reported by the vehicle subsystem and to formulate and launch tailored response plans as appropriate. Use of video image detection system for vehicular detection at signalized intersections can also generate low bandwidth video images VIDS cameras that can augment the county's surveillance and monitoring subsystem where CCTV cameras have not been deployed.

3.4.6 Transportation Information System

Availability of timely, accurate, and comprehensive transportation, traffic, and travel information is critical to the mission of Pinellas County and its ability to realize the vision of a safe and efficient surface transportation network within the county. A core infrastructure element required for collecting, processing, sharing, and disseminating related data would be the county's Transportation Information System. ATMS solutions have typically been founded on such redundant infrastructure components as servers, uninterrupted power supplies, air conditioning, and hybrid communications plants, while neglecting the central server system and associated databases. Pinellas County has envisioned the need for leveraging redundant central server system architecture that is capable of ensuring

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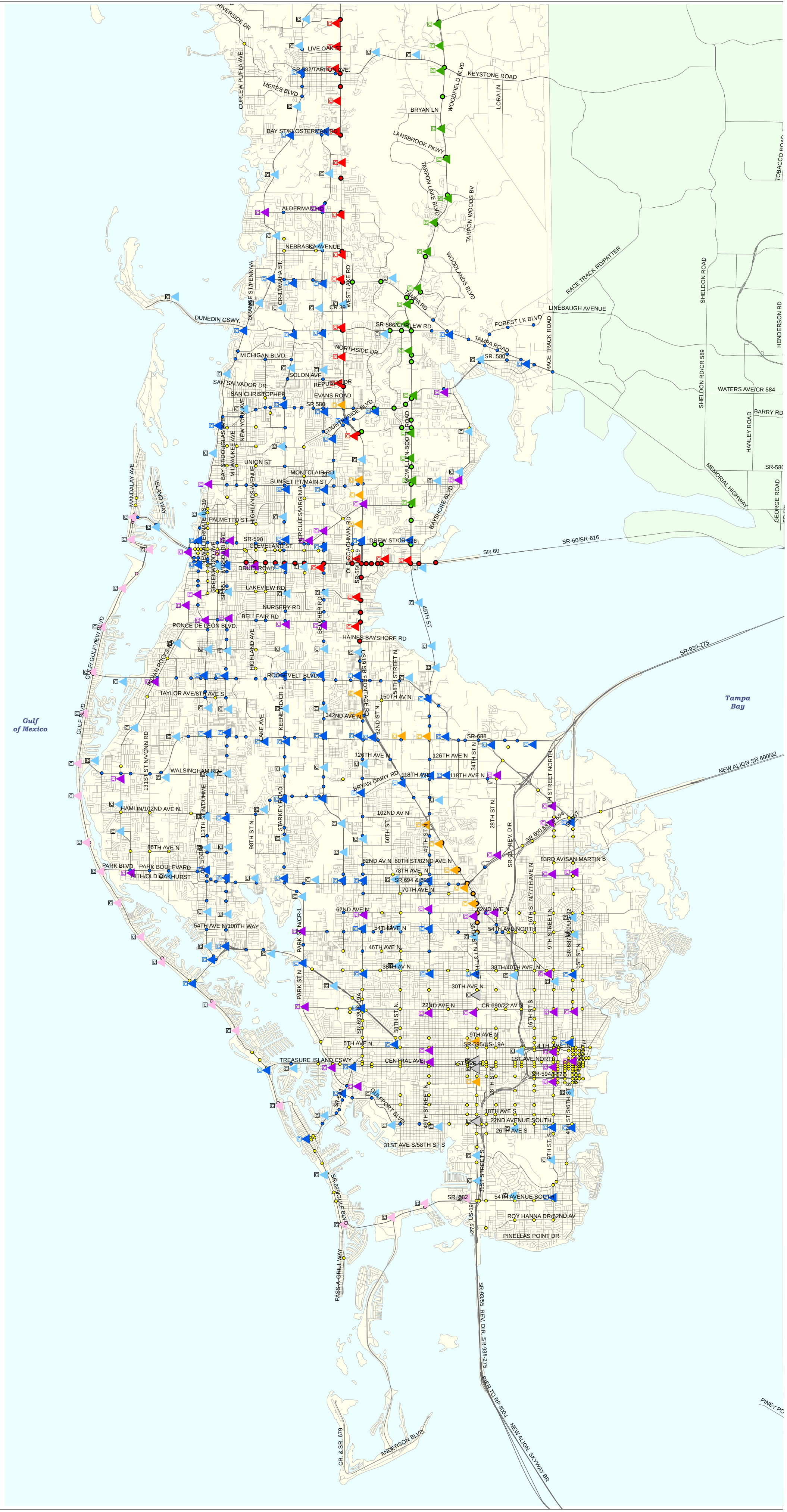
Figure 3-10
Legacy and Proposed CCTV Cameras

Legend

CCTV Cameras
- Existing CCTV Phase 1 / Stage 1
- Existing CCTV Phase 1 / (Wireless)
- CCTV Phase 1 / Stage 2
- CCTV Phase 1 / Stage 3
- Future CCTV (Primary)
- Future CCTV (Secondary)
- Future CCTV (Tertiary)
- Future CCTV (Wireless)

Traffic Signals
- Existing Adaptive Phase 1 / Stage 1
- Adaptive Phase 1 / Stage 2
- Adaptive Phase 1 / Stage 3
- Future Adaptive
- Future Non-Adaptive
- Future Non-Adaptive (Wireless)

Roads
- Major Roads
- Minor Roads
- Local Roads



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Gord & Associates, Inc.

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system availability 24 hours a day, 365 days a year. The county has already made significant investments in establishing such a redundant system, which is founded on redundant equipment located at the county's Primary Control Center and the City of Clearwater Traffic Operations Center. The county has realized that server utilization will be small at the onset of the ATMS program deployment; but that data needs and central system resource requirements will grow exponentially as field devices and associated end communications equipment are deployed for center-to-field devices and center-to-center connectivity. The county's server environment has addressed this initial requirement while allowing the opportunity for incremental sizing of central system resources for deployment of future ATMS devices. This approach provides for the needed robustness, flexibility, scalability, and reliability in mission-critical functions associated with the ATMS program. This includes large-scale deployment of adaptive traffic control systems and associated detectors that can also support incident management. The redundant servers will need to operate in a synchronized fashion, using an external time source (i.e. Colorado Time Clock, GPS or Internet) to ensure drift-free server timing, which is essential for maintaining progressive signal systems. This time synchronization is critical for ATMS elements, especially for traffic signal control systems.

3.4.7 Traveler Information System Devices

Aside from 511, the Internet, the county's website, and radio and television broadcasts, the traveler information system is founded on a myriad of devices strategically placed along the priority corridors at critical decision-making points (upstream of and at signalized intersections). These devices include DMS signs, STB signs, blankout signs, and HARs. The control equipment used for DMS signs tend to vary across manufacturers. Some manufacturers use a Model 170 as DMS field controller and locate it within a nearby device cabinet. Others use a proprietary field controller and co-locate within the sign itself in a nearby device cabinet. In cases where DMS field controller is co-located within traffic control equipment, space within the controller cabinet must be managed to ensure availability of adequate room. The county's choice to use separate cabinets for traffic signals and ATMS devices addresses this requirement. The NTCIP standard for DMS is mature and most transportation industry manufactures provide NTCIP implementations.

DMS signs, DTB signs, blankout signs, and HARs are recommended for deployment in Pinellas County for incident management purposes including support for regional evacuations. Deployment and application of these devices, however, will require formation of a regional partnership among numerous stakeholders, such as Pinellas County, local governmental entities, FDOT, Sheriff's Office, Police Department, Emergency Operations Center, Florida Highway Patrol, etc. Considering local and regional priorities, there is a need for the partnership to embrace a concerted, coordinated, cooperative, and holistic regional approach to traffic management, founded on tailored response plans for incidents, special events, and emergencies. The incident management plans need to identify criteria for traffic diversion, diversion scenarios, response plans, message sets, and roles and responsibilities of applicable stakeholders within the context of priority corridors, diversion routes, and ATMS instrumentations recommended by this study. Figure 3-11 presents the travelers information system elements to be deployed along regionally significant corridors and evacuation routes that augment capacity of arterial and freeway corridors within the county. This information is intended to support discussions and dialogue among the ATMS regional stakeholders and in formulating a regional incident management and evacuation plan.

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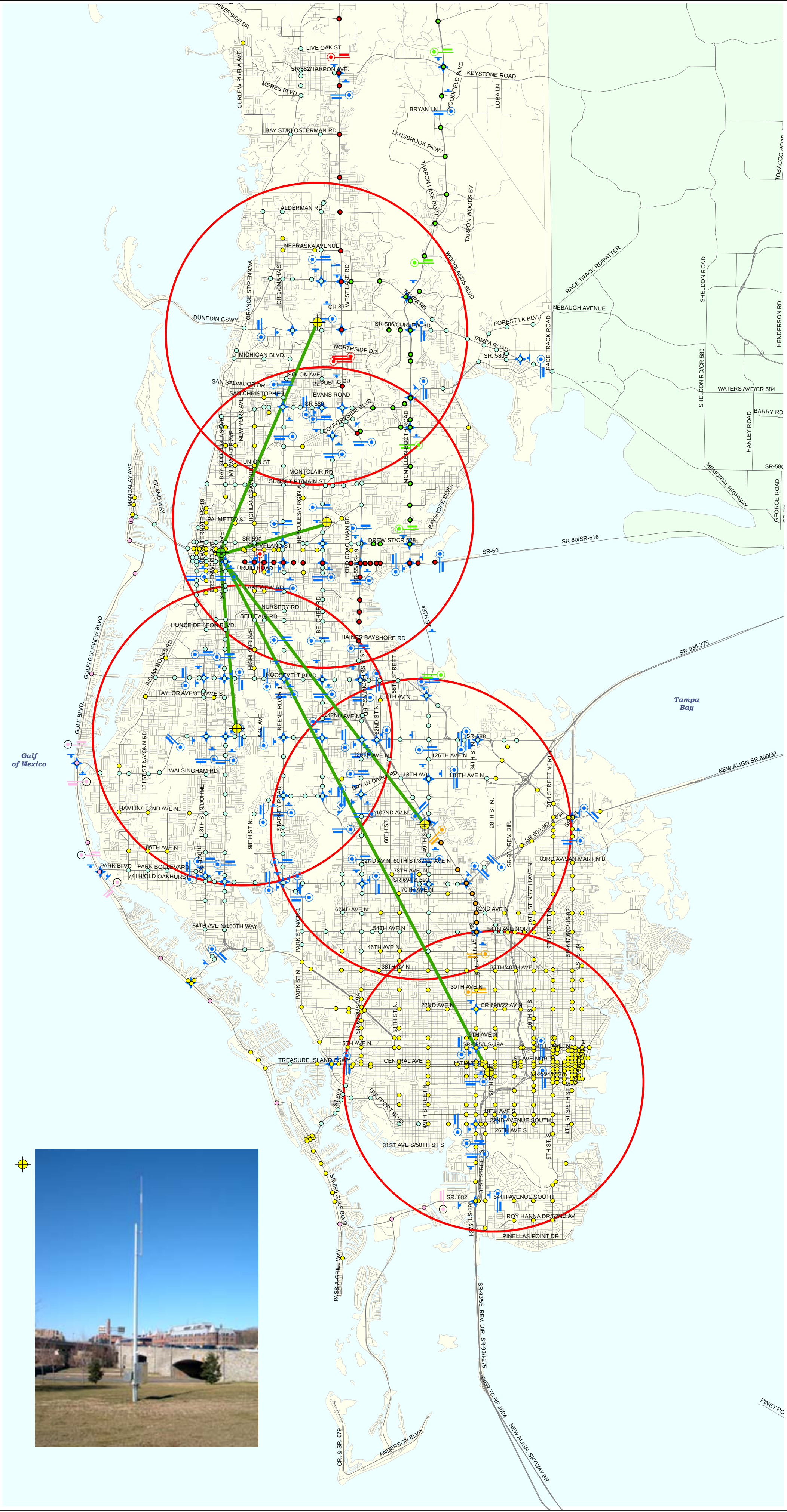
Figure 3-11 Travelers Information System Elements



Legend

HAR

- HAR Tower
- Main HAR Tower

Traffic Signals

- Existing Adaptive Phase 1 / Stage 1
- Adaptive Phase 1 / Stage 2
- Adaptive Phase 1 / Stage 3
- Future Adaptive
- Future Non-Adaptive
- Future Non-Adaptive (Wireless)

Dynamic Message Signs

- Existing DMS Phase 1 / Stage 1
- DMS Phase 1 / Stage 2
- DMS Phase 1 / Stage 3
- Future DMS
- Future DMS (Wireless)
- Dynamic Trailblazing Sign
- Blankout

ROADS

- Major Roads
- Minor Roads
- Local Roads

BOUNDARIES

- Hillsborough County
- Pinellas County
- Water

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3.4.7.1 Pinellas Suncoast Transit Authority

The Pinellas Suncoast Transit Authority (PSTA) has already invested in an automated vehicle location system and automated passenger count system, as shown in Figure 3-12. PSTA hopes to leverage the county's legacy investment in Opticom IR (used exclusively for preempting traffic signals for preferential treatment of fire trucks enroute to emergencies) to accommodate transit signal priority (as discussed previously). PSTA is considering two candidate corridors (SR 60 and US 19) as test beds for evaluating the feasibility of conditional service for transit signal priority. In addition, PSTA hopes to share the county's existing and growing communications backbone for center-to-center connectivity between the Primary Control Center and PSTA center and transit passenger information system or electronic boards deployed at major bus transfer stations

Figure 3-12: PSTA Elements

As shown in Figure 3-13, several options were explored for PSTA to share the county's communications network. These options included dedicated strands of fiber, dedicated VLANs, and/or wireless communications. A detailed presentation was delivered to the PSTA Board in 2007 regarding available options and associated benefits and disbenefits. The PSTA Board elected to embrace dedicated VLANs rather than dedicated strands of fiber optic cabling, which would have required PSTA to deploy its own communications hubs and maintain the associated components. In addition, a hybrid fiber-wireless communications link could be established between the county's Primary Control Center and PSTA Center, as shown in Figure 3-14 (US 19, Ulmerton Road, 34th Street), as an interim measure until a fiber-based communications link can be established in the future. This connectivity option also provides the opportunity to provide for center-to-center connectivity between the Primary Control Center and the FDOT Regional Traffic Management Center via wireless connectivity on Ulmerton Road, between 34th Street and Feather Sound Drive, where fiber optic cabling runs along Ulmerton Road to I-275.

Figure 3-13: Infrastructure Sharing

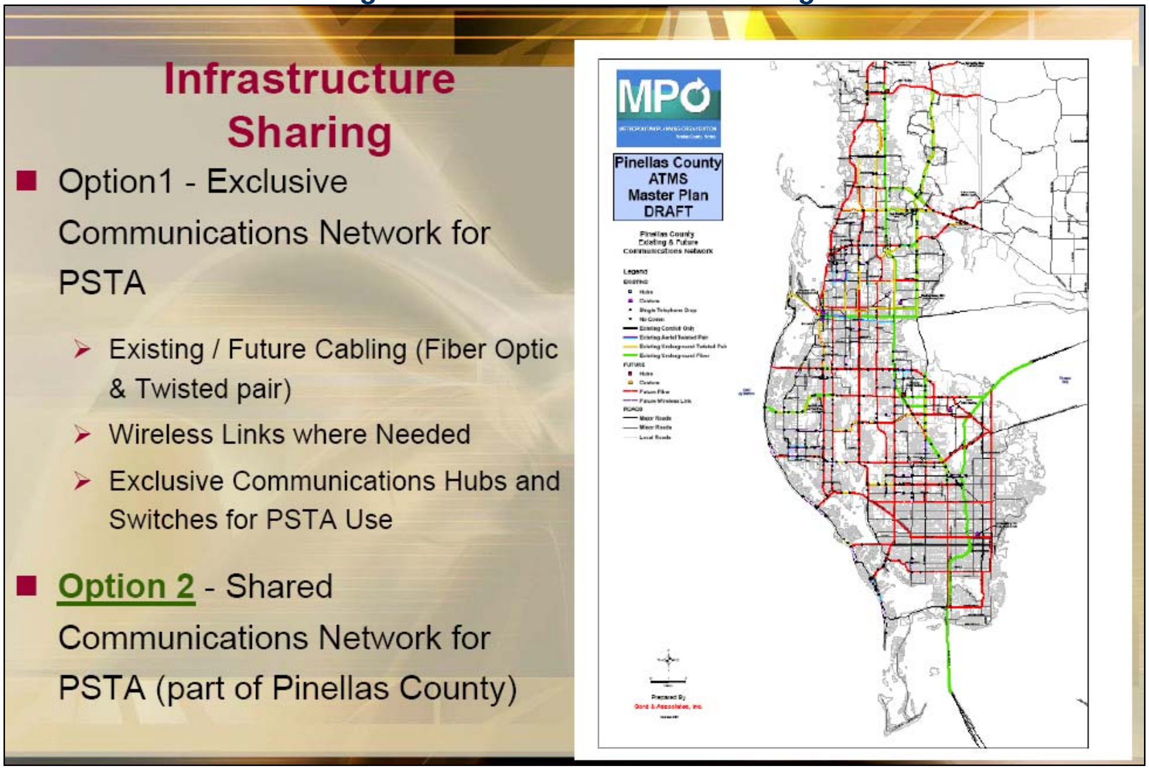
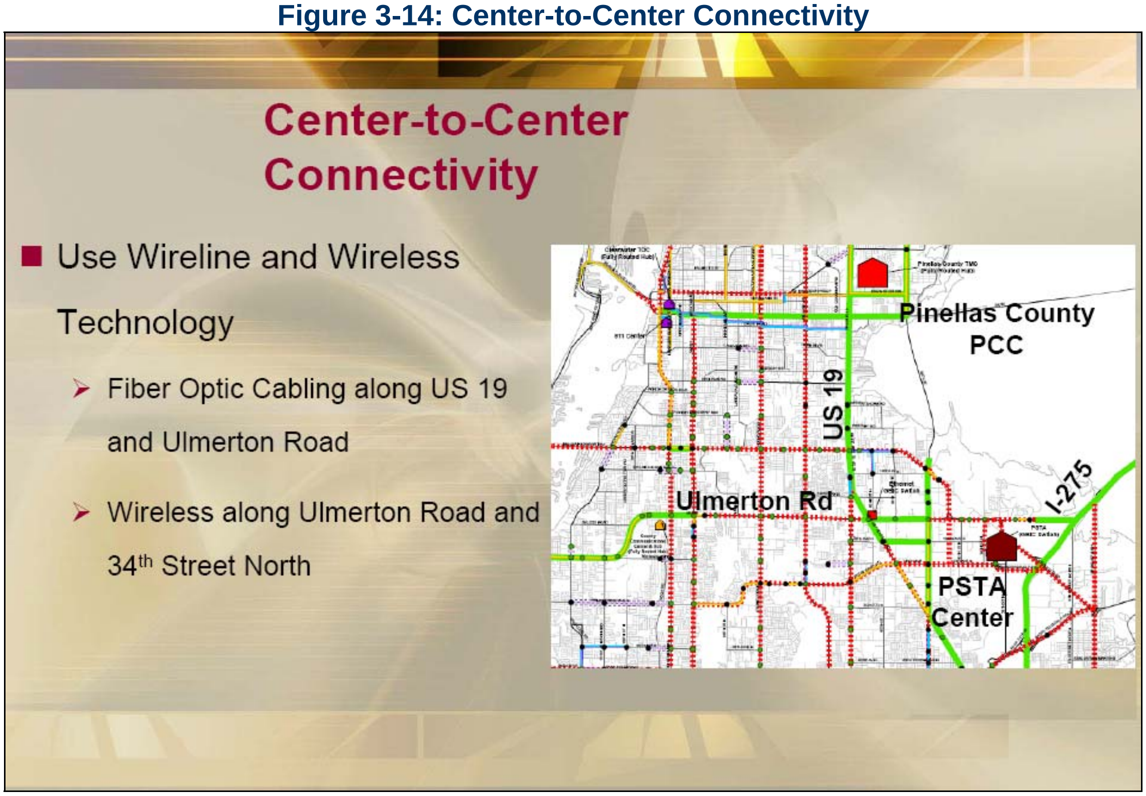


Figure 3-14: Center-to-Center Connectivity



PSTA envisions using its own funds to deploy transit related passenger information system via electronic boards, located at major transit transfer stations, as listed in Figure 3-15. Field investigations of some of these sites provided the basis for developing preliminary design and costs, as presented in Figures 3-15 through 3-20, to interconnect each electronic board to the Primary Control Center and subsequently to the PSTA Center via center-to-center connectivity previously recommended.

Figure 3-15: PSTA Passenger Information System – Electronic Boards

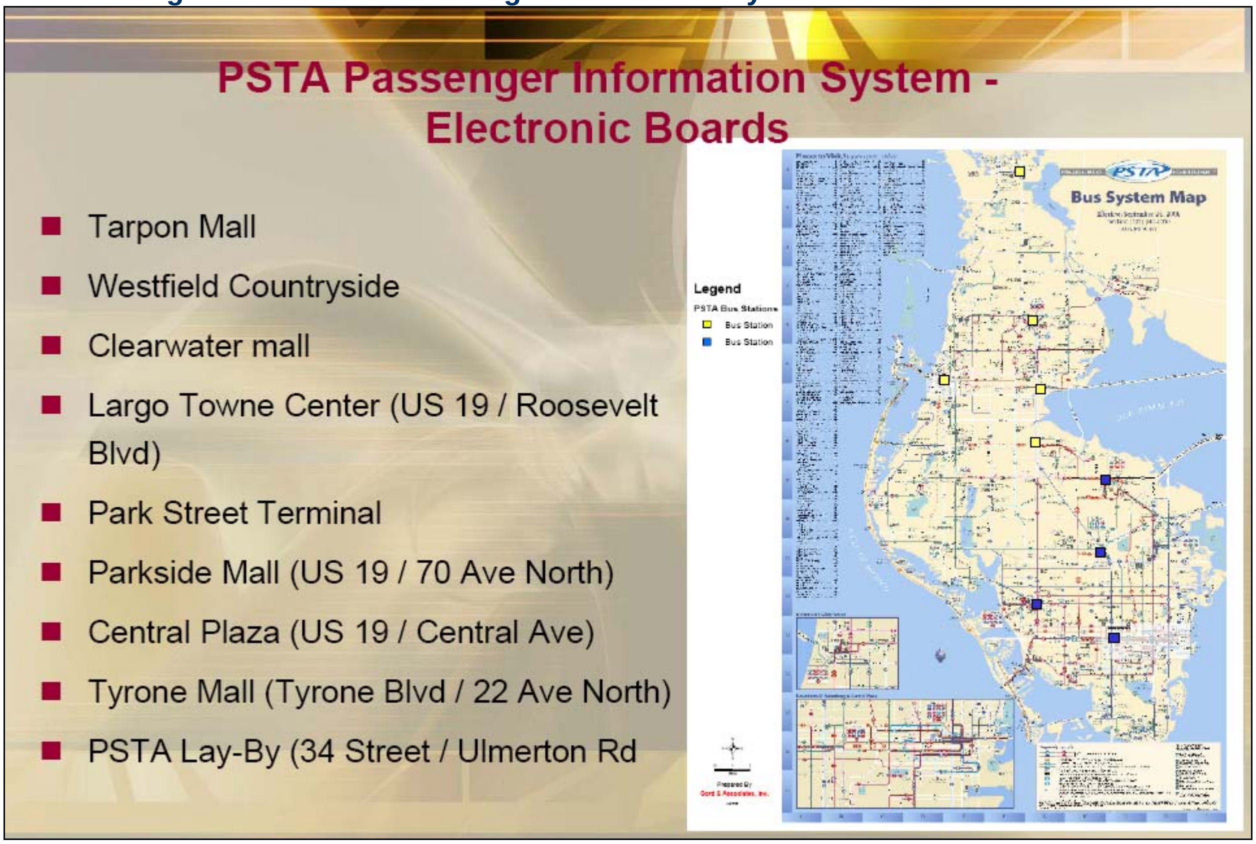


Figure 3-16: Tarpon Mall – Electronic Boards

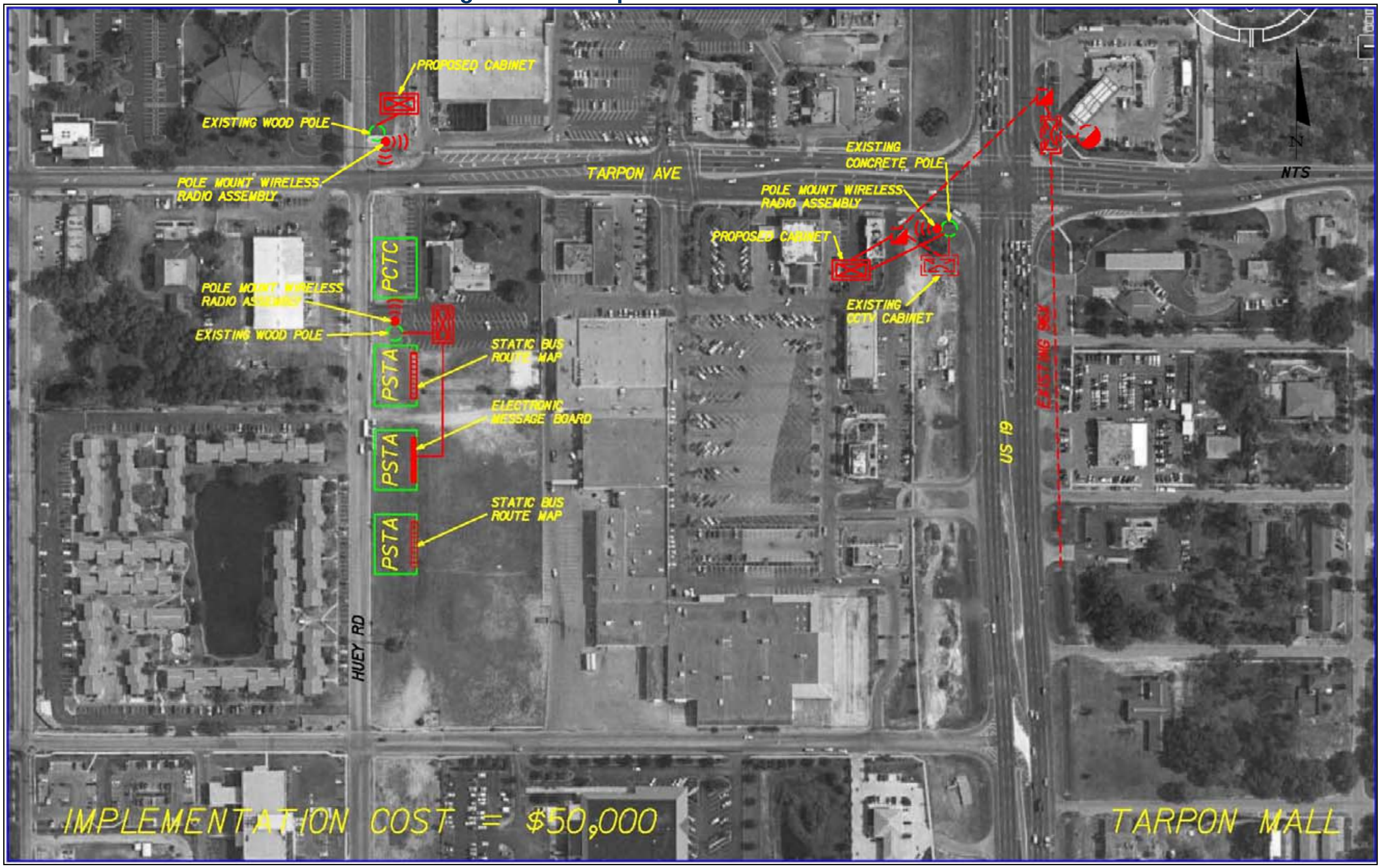


Figure 3-17: Westfield Countryside – Electronic Boards

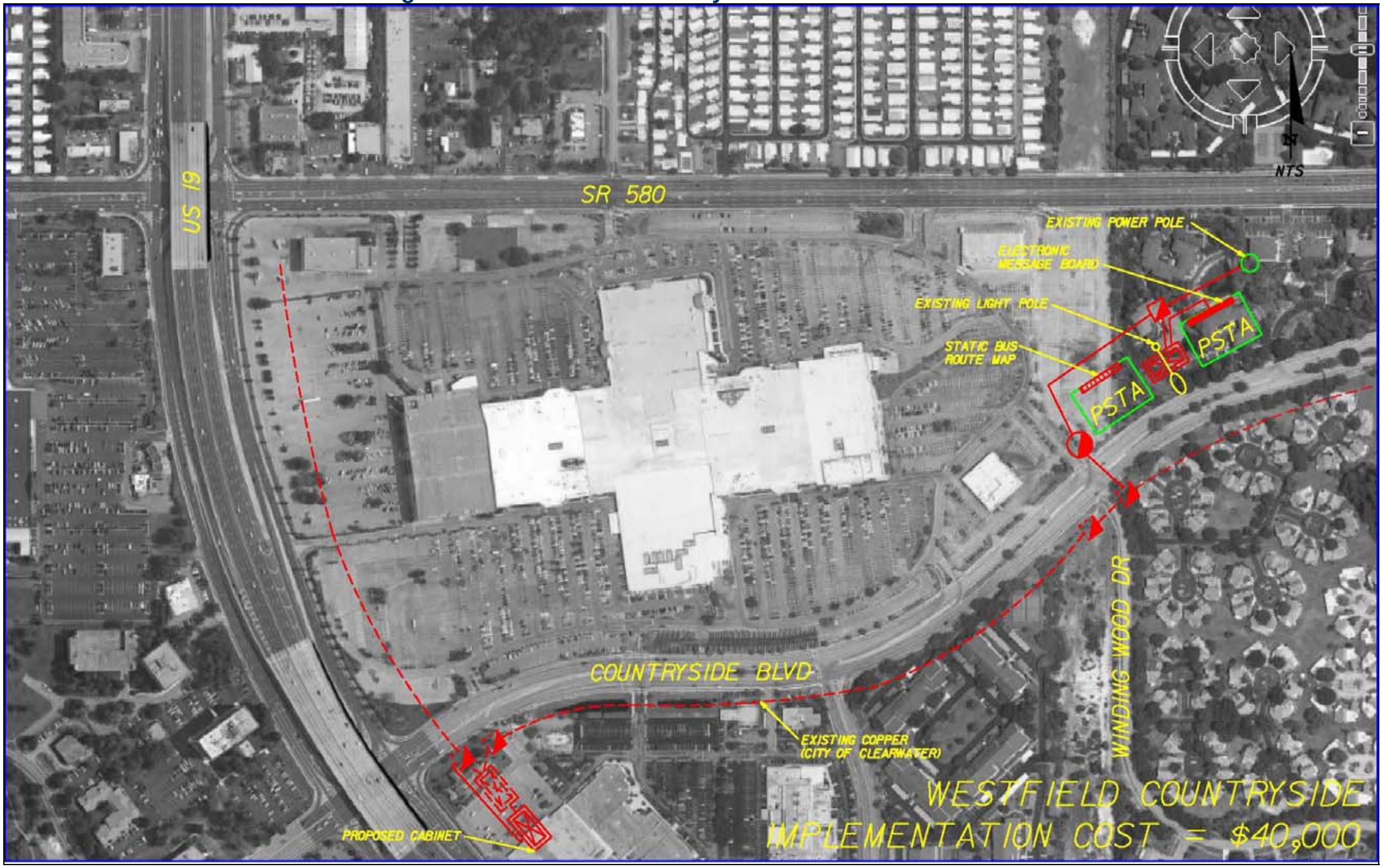


Figure 3-18: Clearwater Mall – Electronic Boards

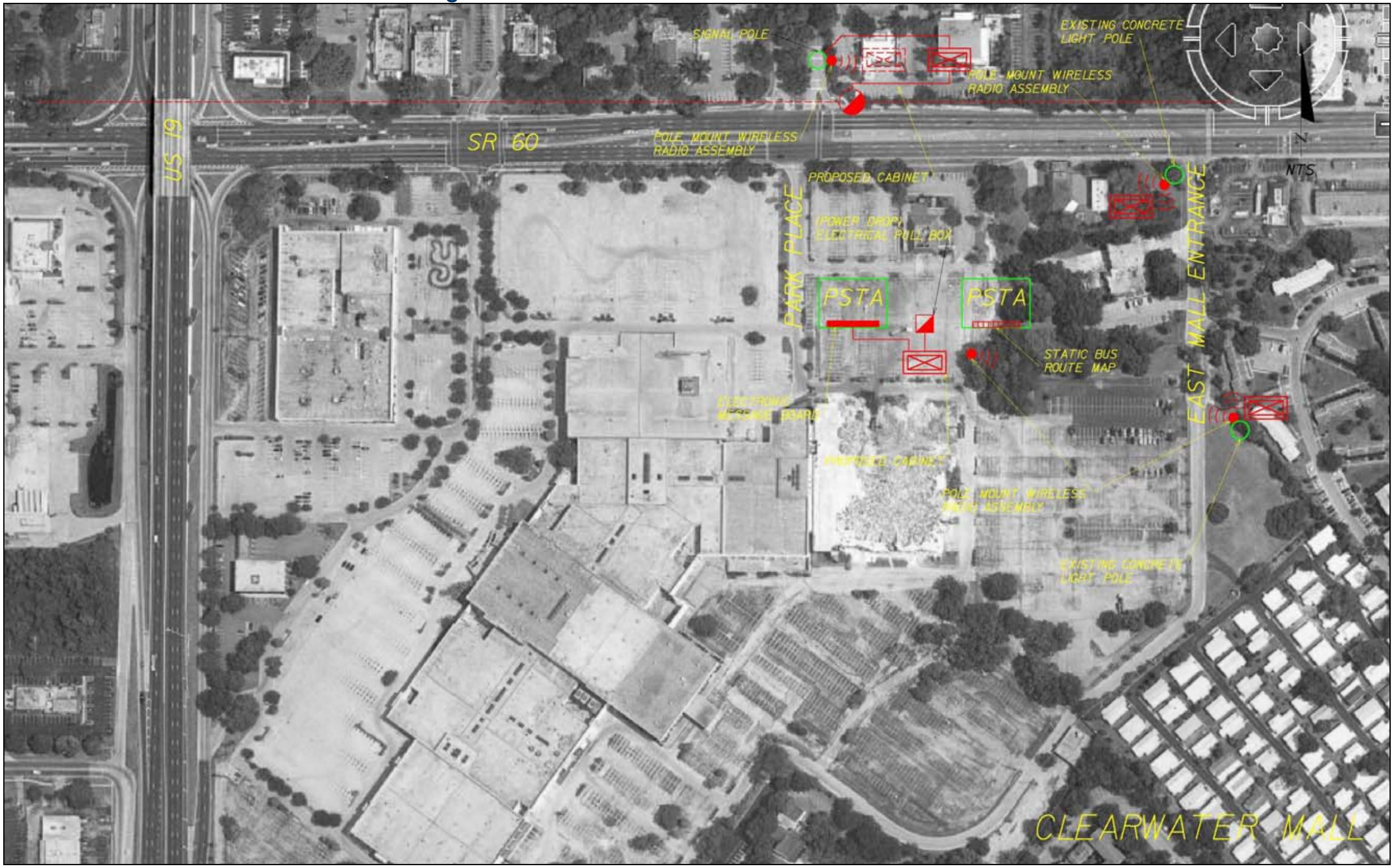


Figure 3-19: Tri-City Plaza – Electronic Boards

Figure 3-20: Park Street Terminal – Electronic Boards

3.5 PEDESTRIAN MANAGEMENT

There are a myriad of technologies available for pedestrian-bike management as presented in Figure 3-21.

Figure 3-21: Field Devices – Pedestrian/Bike Management

Other than the countdown traffic signals that can be deployed strategically, these technologies are tactical in nature. This signifies that deployment choices for these technologies must be made by considering the specific needs, on a location-by-location basis, to ensure they meet five basic requirements per Manual on Uniform Traffic Control Devices (MUTCD), before they are to be administered:

- Fulfill a need
- Command attention
- Convey a clear simple meaning
- Command respect from road users
- Give adequate time for proper response.

Since the focus of this study is strategic in nature (not tactical), determination of specific locations warranting deployment of pedestrian-bike technologies is beyond the scope of services. However, these technologies were researched and presented to the Pinellas County MPO ITS Committee to provide some related guidance for the county's consideration and application in the future. Figures 3-22 through 3-24 present a description of these technologies for the stakeholders' considerations.

Figure 3-22: Pedestrian and Bike Management

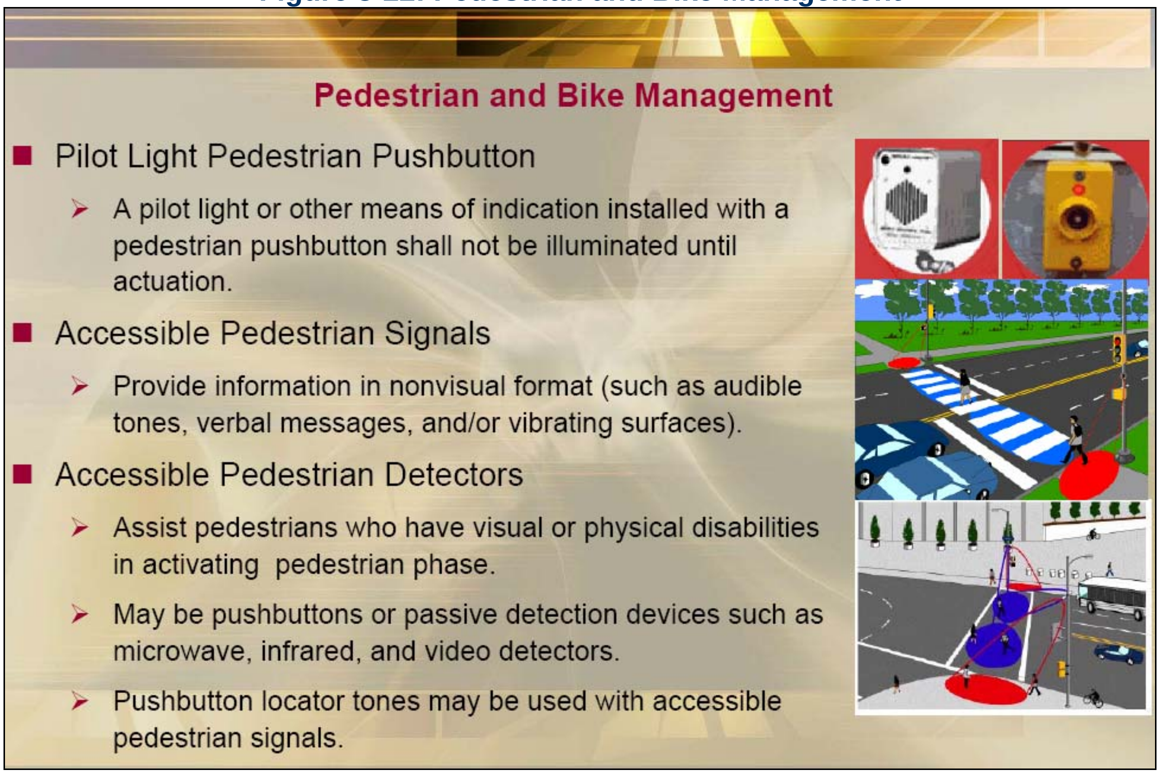


Figure 3-23: Pedestrian and Bike Management

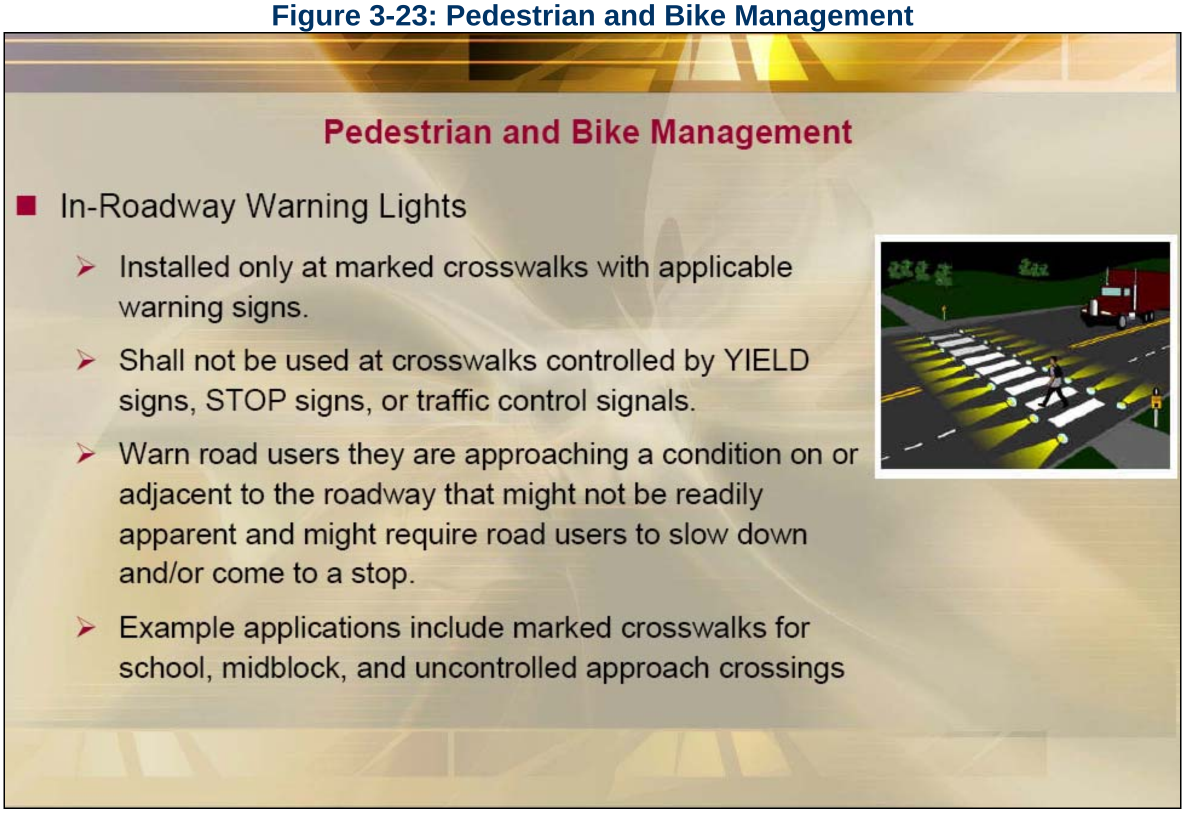


Figure 3-24: Pedestrian and Bike Management

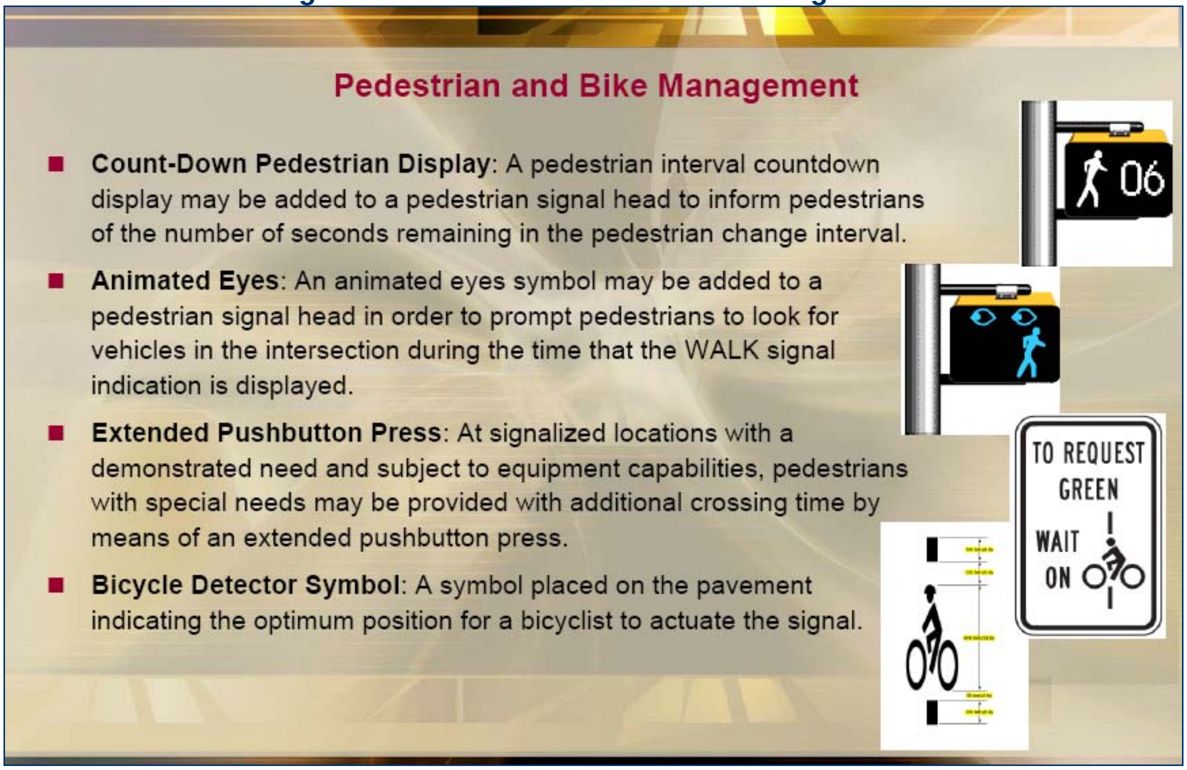
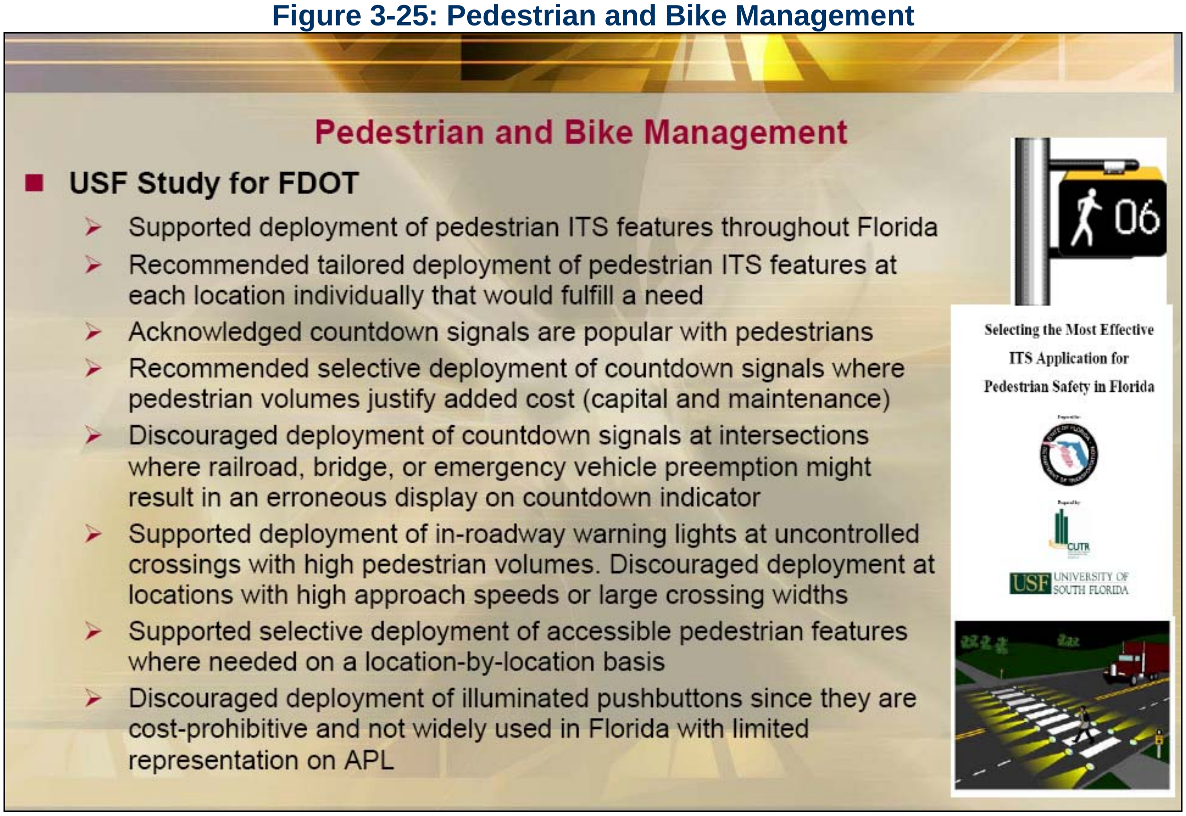


Figure 3-25: Pedestrian and Bike Management



In addition, MUTCD also provides language in support of several technologies for pedestrian-bike management as presented in Figure 3-26.

Figure 3-26: Pedestrian and Bike Management

High-intensity Activated crossWalk or HAWK is a combination of a beacon flasher and traffic control signaling technique for marked crossings. HAWK is an extension of traditional school bus flashing warning signal when children are crossing the road as presented in Figure 3-27.

Figure 3-27: HAWK Pedestrian and Bike Management

HAWK functions as a traffic signal for a period of time and requires stop-and-go operations by approaching vehicles. MUTCD encompasses several definitions that are in direct conflict with HAWK operating as a traffic signal including:

- ❑ Traffic Control Signal – Any highway traffic signal by which traffic is alternately directed to stop and permitted to proceed.
- ❑ Traffic – Pedestrians, bicyclists, ridden or herded animals, vehicles, streetcars, other conveyances either singularly or together while using any highway for purposes of travel.
- ❑ Signal Face – Each signal face at a signalized location shall have three, four, or five signal sections. A single-section signal face shall be permitted at a traffic control signal if it consists of a continuously illuminated GREEN ARROW signal lens that is being used to indicate a continuous movement.

3.5.1 Operational Corridors

The county has 55 operational corridors that need to be instrumented with ATMS technologies and operational strategies, and interconnected to the Primary Control Center via a hybrid communications network comprised of wireline (fiber optic and twisted pair cabling) and wireless media. The legacy communications network uses a combination of single-mode fiber optic cabling, twisted pair copper cabling, and leased telephone line to interconnect local traffic controllers to respective management centers operated by Pinellas County (mostly fiber optic), City of Clearwater (mostly twisted pair), and St. Petersburg (mostly leased telephone lines). To effectively provide for the operational needs of the county, there is a need to establish a Primary Control Center that interconnects directly with all ATMS devices countywide. These include advanced traffic controllers and associated cabinets deployed along operational corridors countywide via a network of fiber optic cabling and end communications equipment. The existing traffic operations centers of Clearwater and St. Petersburg will become secondary control centers. Ethernet switches deployed within the existing traffic operations centers, interconnected to the Primary Control Center, will be aggregation points of the county's Ethernet-based communications backbone. These will intercept ATMS devices deployed along operational corridors via local drops (fiber optic, twisted pair, and wireless).

3.6 ADAPTIVE TRAFFIC CONTROL

Today's prominent adaptive traffic control systems can be divided into proven and emerging technologies. The proven adaptive traffic control systems (SCOOT and SCATS) were developed outside the United States and leverage traffic control terminology that is unfamiliar to U.S. signal technicians. The emerging adaptive traffic control systems (RHODES and OPAC) were developed within the United States and continue to evolve. Both groups of adaptive systems are proprietary and not standards-based, since the associated algorithm and data element standards are currently nonexistent.

- ❑ SCOOT – an acronym for Splits, Cycle-time, and Offset Optimization Technique, is a dynamic, real-time adaptive traffic control system. The system minimizes network stops and delays by reducing the sum of average traffic queues within the network. It was developed in the United Kingdom and has been deployed in several cities and counties within the United States (Arlington, Virginia; Orange County, Michigan; and Minneapolis, Minnesota).

- SCATS – an acronym for Sydney Coordinated Adaptive Traffic System, is a dynamic real-time adaptive traffic control system. The system minimizes overall delay by optimizing splits through a projected degree of saturation on each approach. Degree of saturation on each intersection-approach is used as a measure to compute cycle lengths and splits. Offsets are selected based on cycle length and traffic volumes. The system was developed by the Roads and Traffic Authority of New South Wales, Australia, and has been deployed in several cities within the United States (Detroit, Michigan and Twin Cities, Minnesota).
- RHODES – an acronym for Real Time Traffic Signal Control System, is an add-on adaptive traffic signal control module to the Econolite Icons traffic signal system. RHODES is founded on a distributed architecture, which places analysis and decision making on signal phases, timings, and offsets at local intersection level, with no background cycle length for coordination purposes. The central control system simply monitors traffic signal operations.
- OPAC – an acronym for Optimized Policies for Adaptive Control, is an add-on adaptive traffic signal control module to the Telvent Farradyne's MIST traffic signal system. OPAC is founded on a distributed architecture, which places analysis and decision making on signal phases, timings, and offsets at the local intersection level, with no background cycle length for coordination purposes. The central control system simply monitors traffic signal operations.

ITS standards strive to bring forth plug-and-play solutions (hardware and software) that facilitate universal interchangeability and interoperability across open architecture and standards-based systems. Though this vision will not be fully realized for many years to come, progress has been made in a multitude of areas, such as fully actuated traffic control, DMS signs, NTCIP for center-to-field device communications, etc. No standards, however, have thus far been developed for adaptive traffic control systems and associated strategies.

Adaptive control strategies differ significantly across adaptive platforms. Care must be exercised to ensure the chosen adaptive control system meets the operational needs and requirements of candidate corridors. Otherwise, the inherent benefits of deploying adaptive control will not be realized. In addition, adaptive control technologies mandate significant investment in infrastructure (detection and communications) and staffing to sustain operations (calibration and optimization) and maintenance. Without this investment, the deployed system will revert to a cost-prohibitive, non-adaptive solution. Some agencies have seriously considered postponing deployment of adaptive traffic control as a long-term solution after the support infrastructure such as detection, communications, staffing, training, and resources have been instituted. These agencies envision that the deployment of adaptive traffic control should be well timed given its direct impact on support resources and since adaptive control requires further evolutionary development to mature, stabilize, and become based on established and open standards. The current implementations of adaptive traffic control are founded on proprietary hardware and approaches since there are no governing standards for adaptive traffic control at this point in evolutionary development of control systems.

Some adaptive control technologies use a centralized architecture (e.g. OPAC, SCATS, SCOOT) while others use peer-to-peer communications (RHODES). The choice of adaptive control technology influences the choice of central control system and communications architecture. These choices have been made at the onset of the ATMS program deployment. Otherwise, future changes to central control system and communications architecture would have been cost-prohibitive undertakings. The Pinellas Countywide ATMS project, Stages I and II, deployed along two corridors (US 19 and SR 60) in Pinellas County encompassed two adaptive control systems, two central control software, centers based equipment, and field based ATMS devices including:

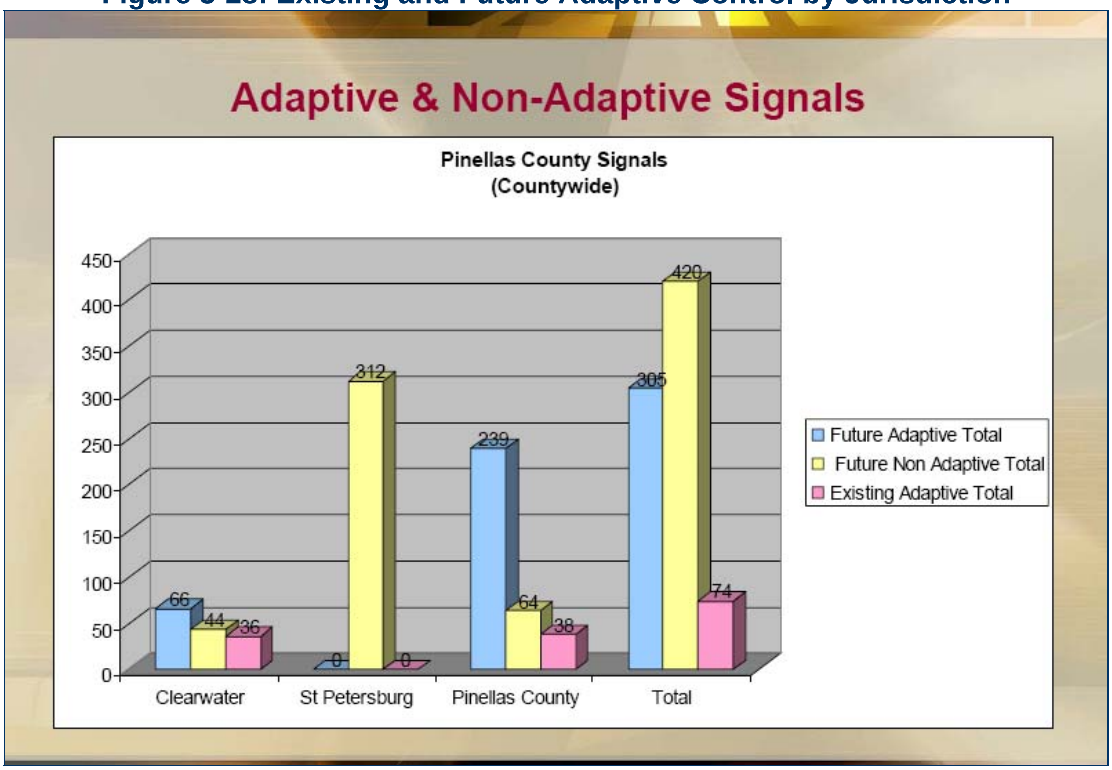
- Subsystems comprised of servers, switches, video wall, decoders, communications racks, and patch panels housed in the Pinellas County TMC and City of Clearwater Traffic Operations Center
- MIST and i2TMS central software, residing on servers within the Pinellas County TMC and City of Clearwater Traffic Operations Center
- Econolite ASC2/2070 and NextPhase controller firmware, operating local intersections and communicating with central control systems
- Adaptive control software (OPAC and RHODES) and associated processor boards
- Traffic controllers running Econolite ASC2/2070 and NextPhase firmware
- Controller cabinets providing intersection control components such as detection equipment, load switches, power supplies, power conditioning, conflict or malfunction monitoring units, emergency vehicle preemption equipment, wiring, etc.
- Fiber optic communications media and end communications equipment for center-to-center and center-to-field devices connectivity
- CCTV cameras and DMS along each corridor at strategic locations.

Pinellas County has leveraged lessons learned from deployment of ATMS elements along US 19 and SR 60 corridors. The county has selected MIST as its standard central control platform. Instrumentation of future corridors within Pinellas County with adaptive control systems may leverage OPAC, RHODES, or other adaptive control systems whose operations will be demarcated across independent corridors or by time-of-day within the same corridor. To this end, the county has taken the initiative to enhance MIST functionality and features, including its interface with RHODES adaptive control system, in addition to OPAC. Since RHODES leverages peer-to-peer interface with adjacent traffic signals and does not require central supervision and intervention, the MIST/RHODES interface may be facilitated to enable system operators to monitor RHODES operational activities in the field, as well as leverage upload/download functionality. The county envisioned a MIST-based common platform for interfacing with future adaptive control systems.

The county's experience with deployment of OPAC and RHODES adaptive control systems along US 19 and SR 60 has been favorable, resulting in the decision to instrument all priority corridors with adaptive traffic control system. Incident management can also benefit from strategic detection stations deployed upstream of signalized intersection for adaptive traffic control. The county perceives that deployment of adaptive traffic control technology along operational corridors now (rather than later) will help system operators to more effectively manage high levels of traffic congestion associated with flow fluctuations during peak hours. These flow fluctuations are attributed to high density population, constrained terrain (peninsular topography), limited roadway infrastructure, seasonal changes in traffic demand, and presence of major trip generators and attractors within the county. The county's vision is founded on deployment of all ATMS elements along priority corridors as each corridor is instrumented with ATMS elements.

All ATMS program stakeholders envision and support deployment of adaptive traffic control along operational corridors countywide, as well as other ATMS elements and communications infrastructure for traffic monitoring, surveillance, incident management, and traveler information purposes. The City of St. Petersburg, however, wishes to postpone deployment of adaptive control technologies along priority corridors within the city until national standards for adaptive traffic control have been established that can address the operational needs of grid transportation networks. The City's current time-of-day plans for north-south and east-west corridors provide for green-band coordination across the intersecting operational corridors, thus maintaining progressive systems along both corridors. The stakeholders' assigned priority to operational corridors (deployment phase III) and associated deployment cost for adaptive traffic control reflect the City's wish not to be a participant in adaptive traffic control systems at this time. Figure 3-28 presents the existing and future adaptive and non-adaptive traffic signals countywide, segregated by owner/maintaining agencies.

Figure 3-28: Existing and Future Adaptive Control by Jurisdiction



3.7 TRAFFIC MANAGEMENT CENTER

The planning and formulation of the county's ATMS program must consider both ATMS and the command and control center (Primary Control Center). The county's ATMS program is founded on plug-and-play, standards-based, open-architecture, interchangeable, and interoperable components. The county is constructing a new facility for day-to-day operations and management of ATMS elements. The Primary Control Center will need to be equipped with a myriad of tools, procedures, and policies to support the county's ATMS program including:

- ❑ Advanced systems, electronics, servers, databases, monitors, communications equipment, etc.

- Productivity improvement automated tools
- Performance measures and measures of effectiveness
- Business process reengineering
- Institutional strengthening, agreements, procedures, and coordination
- Customer management system
- Work-order management system
- Asset management system
- Defined and articulated roles and responsibilities for all program stakeholders within and outside the center
- Integrated video and data sharing, and management across organizational units, agencies, jurisdictional boundaries, systems, modes, and routes
- Unified and integrated approach to transportation management in response to recurrent congestion, incidents, special events, inclement weather, evacuation, and local/regional emergencies.

This study documents the program stakeholders, needs and requirements, user services, market packages, and technology-based solutions, as well as types, locations, cost, and schedule for instrumenting priority corridors with ATMS elements. Pinellas County has been prudent to develop this ATMS master plan since ATMS requirements directly impact the needs and requirements of the Primary Control Center and vice versa. This study focuses on the ATMS elements, especially since many development aspects of the Primary Control Center have been previously addressed. However, improvements to the Primary Control Center information technology infrastructure can increase the value and use of the existing investment. The current information technology infrastructure is fragmented, as summarized below:

- Servers located within the county's Primary Control Center and Clearwater's operations center run in independent environments with limited correlation (localized architecture)
- Database storage/ backup/ recovery is conducted separately for different ATMS sub-systems (central control, adaptive, video)
- Data repositories are distributed (not stored centrally)
- User access is application-dependent, requiring user activities to be logged separately for each application and without any centralized monitoring and supervision, which could pose a potential security risk
- System failover and recovery is manual, rather than automated, resulting in higher response times to system failures, need for continuous support, and elevated vulnerability to human errors and omissions
- System updates, maintenance, replacement, and troubleshooting are dispersed.

To address the above deficiencies, there is a need to establish a seamlessly integrated, automated, and redundant information technology infrastructure across the primary and secondary control centers. This can be achieved by embracing an "enterprise-wide" systems approach. All applicable servers should be treated, regardless of their locations, as part of a common hardware platform distributed across centers. Such an integrated infrastructure will improve system maintenance, operations, and management by leveraging:

- Centralized data repository at the Primary Control Center, augmented by mirrored back-up databases at secondary center(s)
- Automated data backup/storage procedures
- Centralized system access, monitoring, and security across the network, with such features as access logs, virus protection, and password protection
- High-availability architecture, leveraging full redundancy in hardware, software, power source, and centers, for immediate recovery from hardware/application crashes, power failures, or emergency evacuations/shutdowns
- Ease of maintenance, updates, replacement, and troubleshooting.

3.7.1 Center-to-Center Connectivity

Figure 3-29 thru 3-34 present how the Pinellas Countywide ATMS components must fit from a regional perspective as defined by the Pinellas County's 'priority market packages' and associated data flows. The figures document the applicable subsystems (such as the Primary Control Center, PSTA Center, FDOT Regional Traffic Management Center, Pinellas County MPO, etc.), terminators (such as Media, National Weather Service, etc.), Information Service Providers, and associated architectural flows and direction of flows. Analysis of these data flows helps identify center-to-center connectivity projects whose deployment will enhance operational coordination and sharing of data, video, and management plans across centers in support of regionally important user services such as Traffic Control, Incident Management, etc. The figures also highlight data flows associated with center-to-roadway connectivity that support real-time decision-making by system operators and data archiving for planning applications in the future in support of planning, design, and assessment of the county's ATMS program.

Figure 3-29: Network Surveillance Market Package

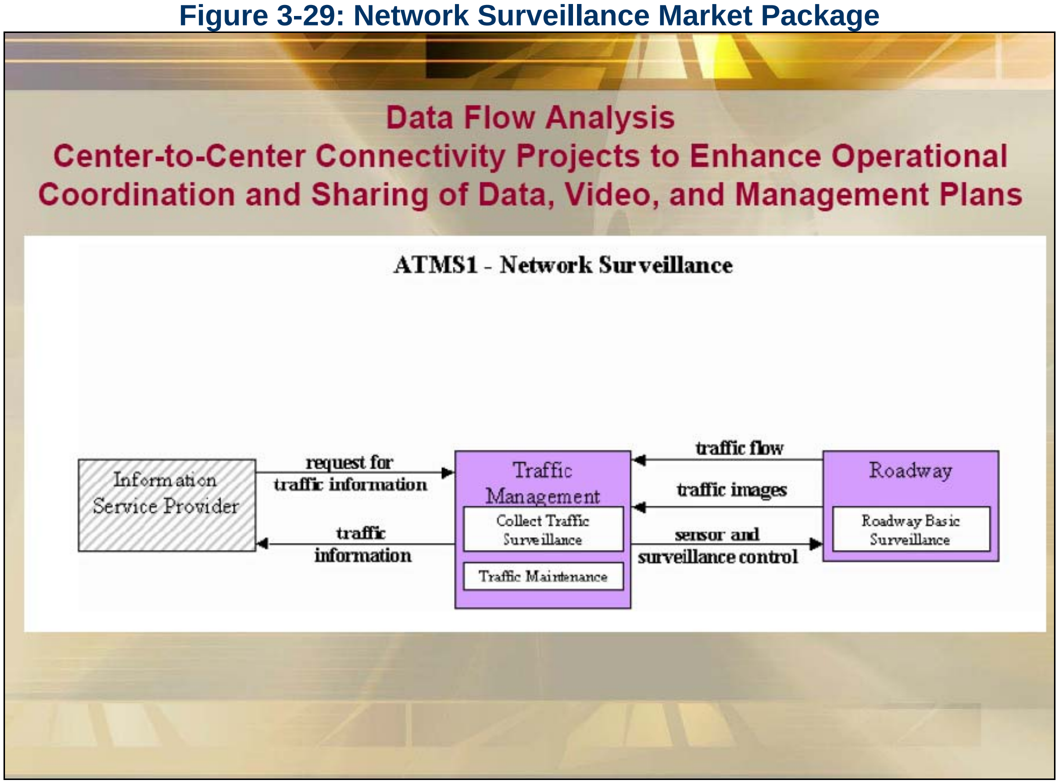


Figure 3-30: Surface Street Control Market Package

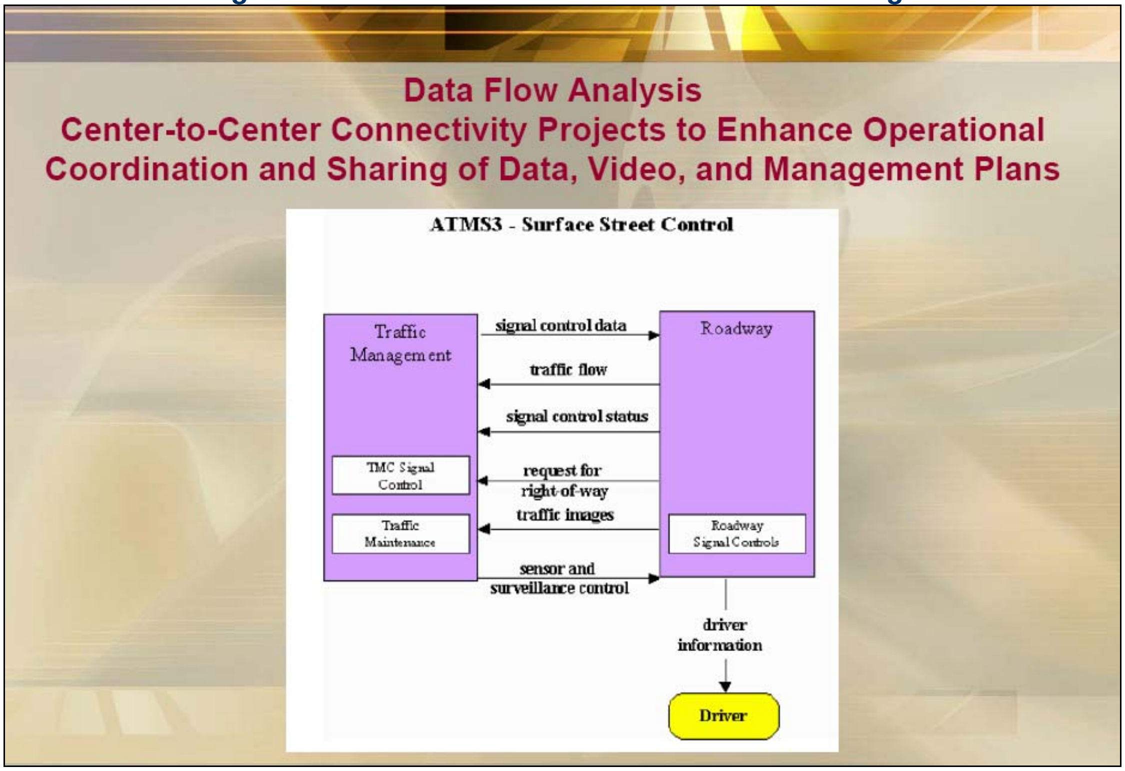


Figure 3-31: Traffic Information Dissemination Market Package

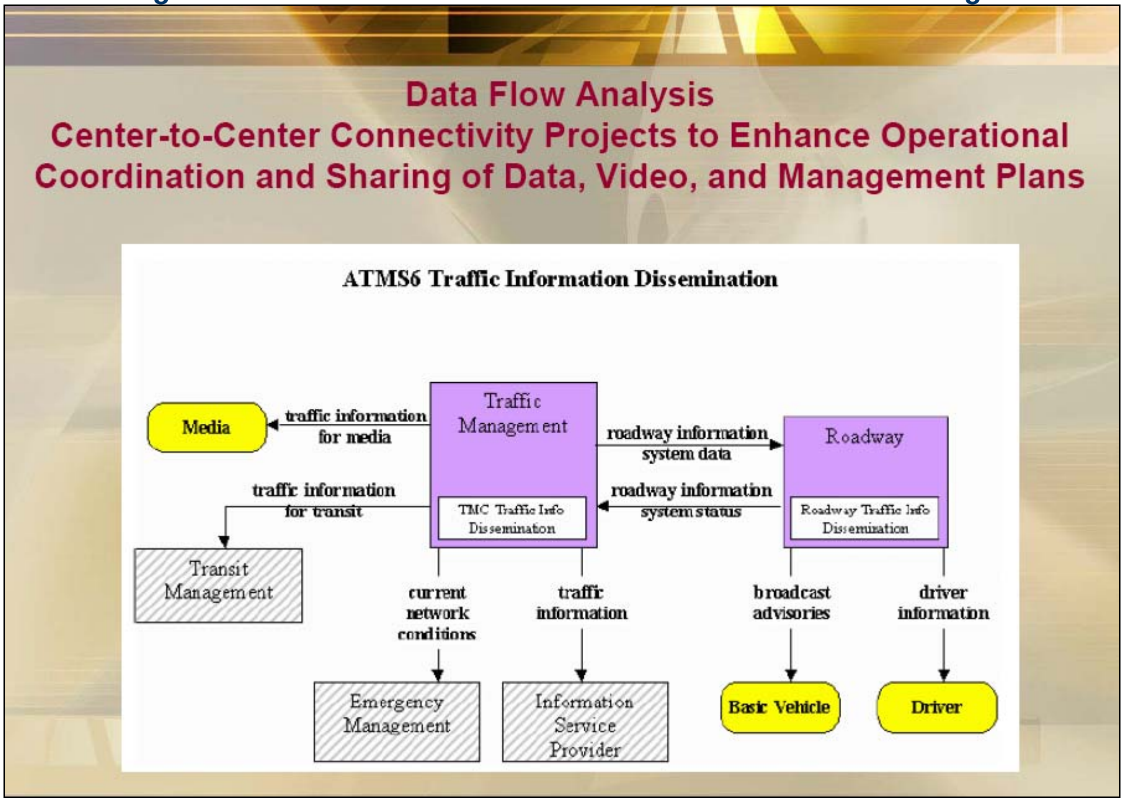


Figure 3-32: Regional Traffic Control Market Package

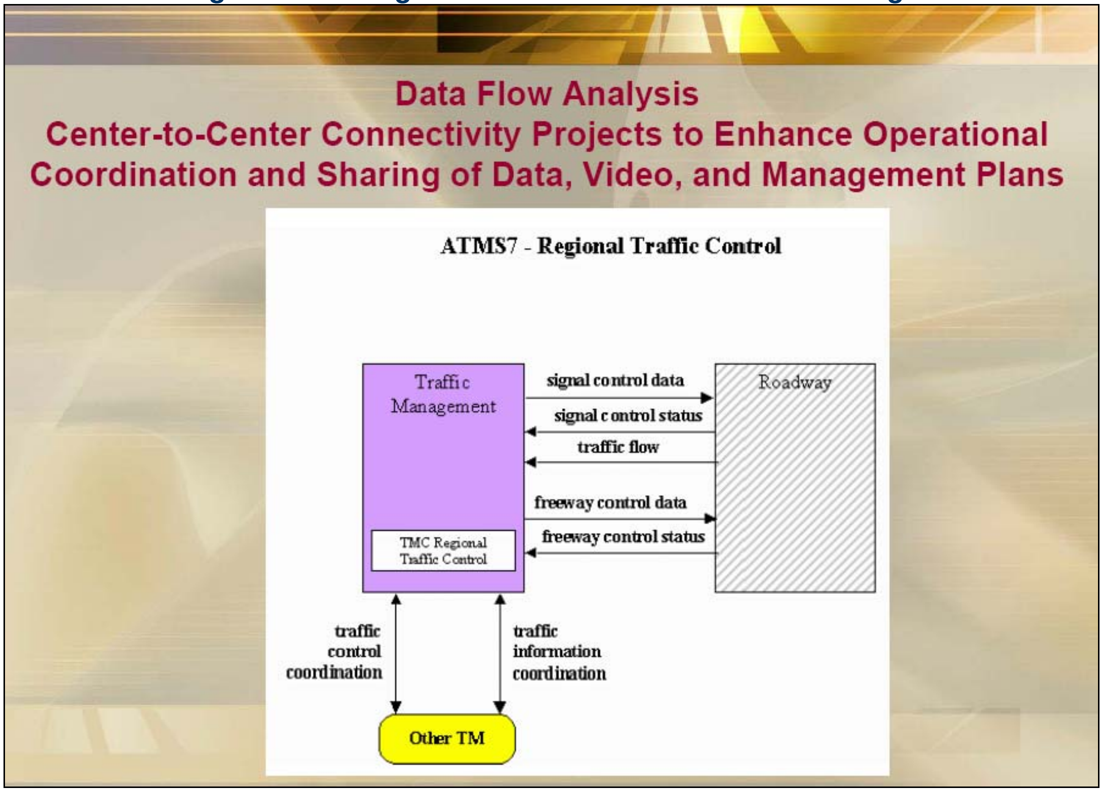


Figure 3-33: Incident Management System Market Package

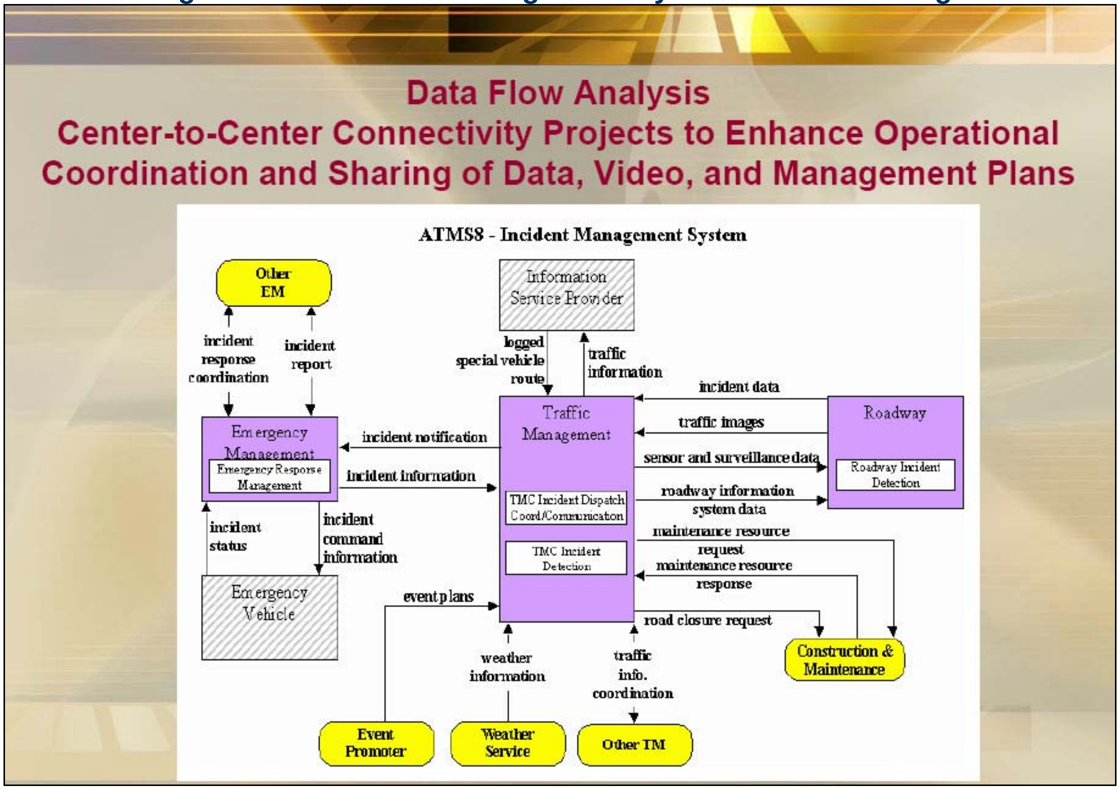


Figure 3-34: Multi-Modal Coordination Market Package

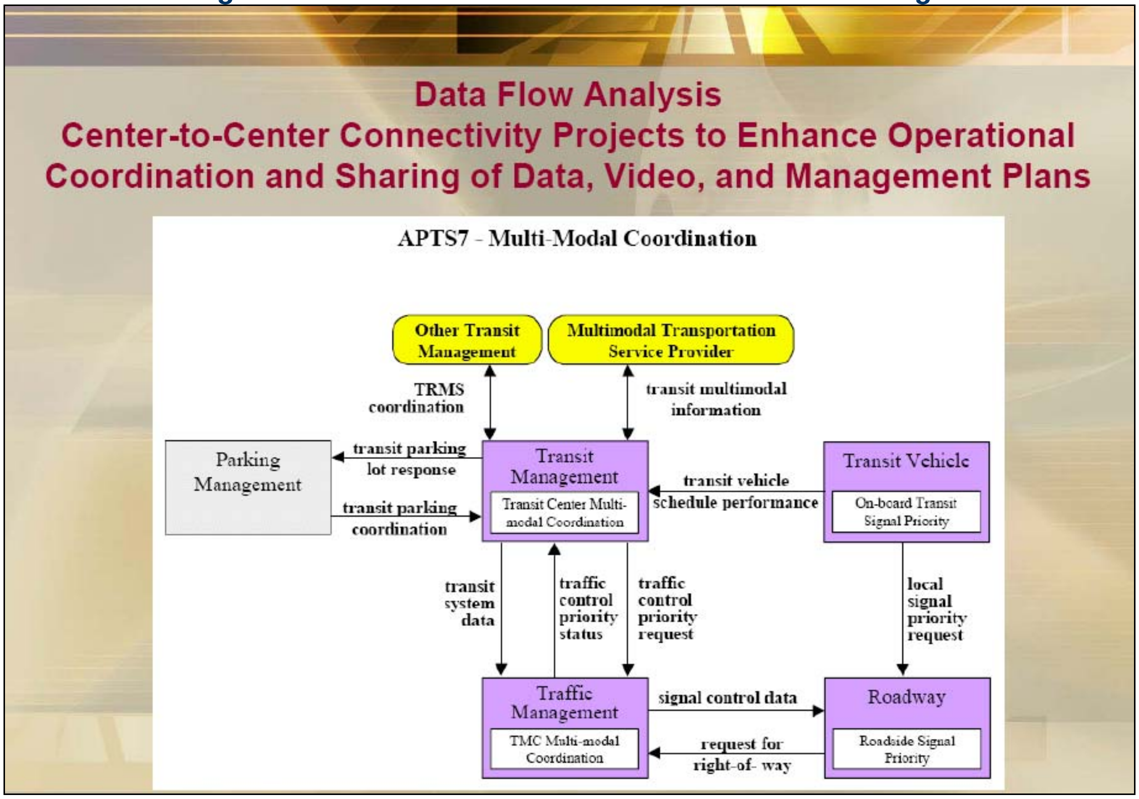


Table 3-11 summarizes the specific data flows to and from the Roadway Subsystem and applicable Center Subsystems. The rows highlighted in gray represent data flows to and from the Pinellas County Primary Control Center and the Roadway Subsystem. The rows highlighted in pink represent data flows from the Primary Control Center to other Center Subsystems or Terminators whereas the rows highlighted in yellow represent data flows from other Center Subsystems and Terminators to the Primary Control Center.

The Center-to-Roadway Subsystem data flows include traffic flow information (volume, occupancy, classification), traffic video (CCTV, VIDS), driver information (signals, pedestrian indications), signal control data, signal control status, incident data, broadcast advisories, roadway information system status, sensor and surveillance control, sensor and surveillance data, etc. The data flows from Primary Control Center to other Center Subsystems and Terminators include traffic information (video, traffic flow, and travel time), current network conditions, incident notification, transit information, maintenance resource request, road closure request, multimodal service data, etc. The data flows from other Center Subsystems and Terminators to the Primary Control Center include traffic information coordination (video, traffic flow), incident information and status, maintenance resource response, transit system data, transit multimodal information, event plans, freeway control status and information (traffic flow, video), weather information, logged special vehicle route, etc. The data flow analysis highlights the need to interconnect the Primary Control Center with Construction and Maintenance Unit, Emergency Management, 511, Media, Weather Service, FDOT, PSTA, Fire Department, Law Enforcement, FDOT District Seven, Pasco County, and Event Promoter. Sharing of traffic data and video with ATMS program stakeholders will be invaluable to safeguarding Pinellas County by proactive and timely management recurrent congestion, incidents, emergencies (including regional evacuations), and special events.

Table 3-11: Center-to-Roadway and Center-to Vehicle Data Flows

Market Package	From	To	Data description
ATMS01 Network Surveillance	Roadway	Pinellas RTMC	Traffic flow information (volume, occupancy, classification)
	Roadway	Pinellas RTMC	Traffic video (CCTV, VIDS)
	Pinellas RTMC	Roadway	Sensor & surveillance control
ATMS03 Surface Street Control	Roadway	Pinellas RTMC	Traffic flow information (volume, occupancy, classification)
	Roadway	Pinellas RTMC	Signal control status
	Roadway	Pinellas RTMC	Request for right-of-way (traffic demand)
	Roadway	Pinellas RTMC	Traffic video (CCTV, VIDS)
	Roadway	Driver	Driver information (signals, pedestrian indications)
	Pinellas RTMC	Roadway	Sensor & surveillance control
	Pinellas RTMC	Roadway	Signal control data
ATMS06 Traffic Information Dissemination	Roadway	Pinellas RTMC	Roadway information system status
	Roadway	Driver	Driver information (signals, pedestrian indications)
	Roadway	Basic vehicle	Broadcast advisories
	Pinellas RTMC	Roadway	Roadway information system data
	Pinellas RTMC	Media	Traffic information (video, traffic flow)
	Pinellas RTMC	Transit (PSTA)	Traffic information (travel time, traffic flow)
	Pinellas RTMC	Emergency Management	Current network conditions
	Pinellas RTMC	Information Service Provider	Traffic information
ATMS07 Regional Traffic Control	Roadway	Pinellas RTMC	Traffic flow
	Roadway	Pinellas RTMC	Signal control status
	Pinellas RTMC	Roadway	Roadway information system data
	Pinellas RTMC	FDOT District Seven	Traffic information (video, traffic flow)
	FDOT District Seven	Pinellas RTMC	Freeway control status and information (traffic flow, video)
	Pinellas RTMC	Pasco County	Traffic information coordination (video, traffic flow)
	Pasco County	Pinellas RTMC	Traffic information coordination (video, traffic flow)

Market Package	From	To	Data description
ATMS08 Incident Management System	Roadway	Pinellas RTMC	Incident data
	Roadway	Pinellas RTMC	Traffic video & images
	Pinellas RTMC	Roadway	Sensor & surveillance data
	Pinellas RTMC	Roadway	Roadway information system data
	Pinellas RTMC	Construction & Maintenance	Maintenance resource request
	Pinellas RTMC	Construction & Maintenance	Road closure request
	Construction & Maintenance	Pinellas RTMC	Maintenance resource response
	Pinellas RTMC	FDOT District Seven	Traffic information coordination (video, traffic flow)
	FDOT District Seven	Pinellas RTMC	Traffic information coordination (video, traffic flow)
	Pinellas RTMC	Pasco County	Traffic information coordination (video, traffic flow)
	Pasco County	Pinellas RTMC	Traffic information coordination (video, traffic flow)
	Weather Service (RWIS)	Pinellas RTMC	Weather information
	Event Promoter	Pinellas RTMC	Event plans
	Pinellas RTMC	Law enforcement	Incident notification
	Law enforcement	Pinellas RTMC	Incident information and status
	Pinellas RTMC	Fire Department	Incident notification
	Fire Deptartment	Pinellas RTMC	Incident information and status
	Pinellas RTMC	Information Service Provider	Traffic information
	Information Service Provider	Pinellas RTMC	Logged special vehicle route
APTS07 Multi-modal Coordination	Pinellas RTMC (Multimodal service provider)	Transit (PSTA)	Request transit information
	Transit (PSTA)	Pinellas RTMC	Transit system data
	Transit (PSTA)	Pinellas RTMC	Transit multimodal information
	Pinellas RTMC (Multimodal service provider)	Transit (PSTA)	Multimodal service data

3.8 COMMUNICATIONS

The communications network interconnecting center-to-center and center-to-field devices in Pinellas County will be scalable and based on a hybrid wireline (single-mode fiber optic and legacy twisted pair copper cabling) and wireless media (4.9 GHz band for use in public safety designated by Federal Communications Commission). The network must address ATMS program needs, requirements, and provide sufficient bandwidth capacity to support system modernization countywide. The envisioned communications network will fully leverage legacy aerial and underground twisted pair copper cabling and underground fiber optic cabling. Leveraging the county's legacy communications infrastructure will help optimize return on investment by minimizing deployment costs. The communications infrastructure for supporting the field devices is a critical component of the ATMS program and must be based on national and international standards as applicable.

The communications backbone must be scalable to support an integrated communications solution for transporting video, data, and voice via Ethernet/IP-based technology, and migrate to a fully redundant self-healing mesh topology in the long-run. The Ethernet/IP-based communications backbone will be capable of simultaneously monitoring many video output channels and field devices selected at the Regional Control Center. It must be designed and implemented based on open-architecture, standards-based technologies offering end-to-end solutions that allow for integration of video, data, and voice at controller cabinets or device cabinets. This strategy minimizes implementation costs by co-locating device equipment within the controller cabinets if/when embraced by the county. The communications system must:

- Provide an integrated network that provides for system management at the device level
- Share slab, cabinet, power, grounding, and communications by co-location within traffic controller cabinet, where feasible
- Maintain interoperability across various end communications equipment providers, as well as ATMS systems of the county's regional stakeholders
- Support standard Ethernet/IP communications; standard MPEG-2 video compression for CCTV cameras; MPEG-4 video compression for VIDS; standard serial communications (EIA 232, 422, and 485) for CCTV cameras PTZ data, VIDS data, legacy traffic controllers, and DMS signs
- Be scalable to support modernization and expansion of the county's ATMS through systematic instrumentation of priority corridors with ATMS field devices and communications network.

MPEG is an acronym for Moving Pictures Expert Group, named after an industry committee who created the standard. It represents a family of standards for digital video and audio signals using discrete cosine transform (DCT) compression algorithm. MPEG defines how DCT should be used to reduce data rate and how packets of video and audio data should be combined to be understood by an MPEG decoder. Over the past years, significant video coding developments have occurred in the industry. These developments have led to the standardization of MPEG-1, MPEG-2, and MPEG-4, which address a range of applications with different requirements (such as bit rates, quality, and latency). These standards made interactive video on CD-ROM and Digital Television possible. MPEG-2 and MPEG-4 standards are used for coding high and low bit video. MPEG-2 coding ranges from 1.5 Mbits/second (similar to VHS quality) to 15 Mbits/second. MPEG-4 coding can range from a few hundred to eight Mbits/second, depending on the manufacturer.

The interoperability requirements stated above encompass all communications equipment that interconnects ATMS devices to the Primary Control Center (e.g., encoders, terminal servers, edge switches, backbone switches, core switches, and decoders). The communications equipment (excepting backbone switches, core switches, and decoders) must be field-hardened at the component level (without use of any cooling fans) for sustainable operations in Pinellas County. To ensure an orderly design and roll-out of the entire communications system, a countywide Communications Master Plan was previously developed to guide detailed design efforts. The county's Communications Master Plan defines the communications architecture and makes infrastructure recommendations for various portions of the overall system. The Communications Master Plan is intended to serve as a ”roadmap” from which detailed communications designs will ultimately emerge.

3.8.1 Ethernet

Ethernet, also known as IEEE 802.3, is a frame-based technology that emerged in the 1970s for computer networking. Today it can operate at data rates ranging from ten million bits per second (Mbps) to ten Gigabit per second (Gbps). Virtually all corporate networks use Ethernet for data communications today. Ethernet has a large installed base in data transmissions and is universally understood in the Information Technology industry. Use of IP based Gigabit Ethernet for video transmission in ATMS applications is relatively new, compared with SONET and ATM technologies, but well established and stable. Ethernet has surpassed legacy RS-data communication schemes. It has positioned itself as a very attractive choice for many ATMS deployments in view of the increased demand for CCTV cameras (MPEG-2) to remotely monitor traffic flow and capture low band-width video (MPEG-4) from video image detection systems. Over the years, there have been several variations of Ethernet, with the most common being:

- 10BASE-T – an early form of Ethernet, which operated at ten Mbps, was originally based on Carrier Sense Multiple Access with Collision Detection. Today's variations are switched, full-duplex, and mainly encountered in advanced traffic signaling networks in conjunction with low-speed (802.11b) wireless applications, where bandwidth limitations preclude the use of higher Ethernet speeds.
- 100BASE-T – also known as Fast Ethernet (FE) is ideal for local edge loops interconnecting ATMS devices to backbone switches housed in communications hubs, especially when used with IP multicasting for video. It is the dominant variation of Ethernet today in edge layer, with capacity to operate over distances of up to 15 Km or more between switches. It is switched, full-duplex for ATMS applications offering average utilization, or throughput limits, of up to 95% (190% for full-duplex operation).
- 1000BASE-T – also known as Gigabit Ethernet (GigE), it was standardized in June 1998, providing a ten fold increase in speed to 1,000 Mbps, due to increased bandwidth demands in Wide Area Network and Metropolitan Area Network applications. A well designed network using a combination of full-duplex, switched FE and GigE can effectively carry hundreds of video channels, while delivering near-ATM levels of service quality. This flavor of Ethernet is ideal for backbone network interconnecting a multitude of 1000Base-T switches with one another and to the core Ethernet switch, housed in the Primary Control Center, to create a redundant mesh communications topology.

The county has chosen Ethernet/IP as its communications technology. This choice capitalizes on the many advantages Ethernet has over other communications technologies (e.g., ATM and SONET) including:

- Founded on open-architecture and fully standards-based technology, which is growing rapidly in the industry
- Readily capable of supporting ATMS devices that are integrated and managed at the device level via Ethernet/IP based edge switches. The ATMS devices integrated at the edge switch include ATC Type 2070 controllers via Ethernet port; CCTV cameras via MPEG-2 encoders; VIDS via MPEG-4 encoders; PTZ control, DMS signs, and legacy controllers using serial ports via terminal servers
- Readily supports peer-to-peer communications capabilities for emerging adaptive control systems
- Effectively enhances performance for high-overhead NTCIP communications through faster IP data rates than legacy fiber optic modems
- Proactively supports a scalable, robust, expandable, integrated, and managed communications network for convergence of video, data, and voice, sized to meet the county's growing requirements, resulting from cumulative and incremental instrumentation of priority corridors
- Capacity to integrate with emerging 802.11b and 802.16b wireless technologies to accommodate the county's future need for wireless communications in support of remote ATMS devices, thus eliminating cost-prohibitive installations of fiber optic cabling
- Lower deployment costs
- Compatibility with communications technologies being deployed by other regional stakeholders, such as FDOT, Pasco County, Hillsborough County, City of Tampa, etc., who have elected to invest in Ethernet technology for center-to-center and center-to-field devices communications.

3.8.2 Topology

There are a variety of architectures for the Ethernet/IP-based communications network, including star, ring, and full mesh as presented in Figures 3-35, 3-36, and 3-37. These communications topologies provide increasing levels of redundancy in communications path for center-to-field devices connectivity and in cost for system deployment and maintenance. They are flexible and scalable and capable of accommodating the growing communications needs of Pinellas County as more and more priority corridors are instrumented with ATMS technologies and operational strategies.

Network survivability is a critical design criterion in ATMS applications. The network must be capable of sustaining fiber damage caused by contractors, utility companies, public and private construction projects, and inclement weather. The Primary Control Center, being a mission-critical entity, cannot afford to lose communications to other centers and field devices. The communications topology must provide for the needed levels of redundancy to ensure survivability. Mesh topology is the optimum solution, in the long run, in supporting and sustaining the ATMS system's capacity for traffic monitoring, control, and data dissemination. Mesh topology will enable the county to reap significant benefits from redundant communications paths as its investments in communications infrastructure will materialize and converge over time. Mesh topology is comprised of a scattered network of backbone switches, housed in communications hubs or nodes, each interconnected to the core switch in the Primary Control Center and field-based backbone switches through a multitude of communications paths. There should be redundancy, not only in network topology, but also physically. For example, the entry points of redundant fiber cables into the Primary Control Center should be dispersed around the building as opposed to being constrained to one point of entry.

Communications networks are typically designed and implemented in incremental stages leveraging a three-layer communications architecture founded on switching at the Primary Control Center (core level), communications hubs (backbones/aggregate level), and field devices (device level). As deployment progresses, the communications topology typically migrates from star to ring and ring to mesh. A critically important aspect of the county's ATMS communications network is that all ATMS field devices are interconnected to the core switch located within the Primary Control Center via edge and backbone switches, some of which may be located within other centers. This mesh communications topology is distinctly different from a center-to-center communications topology, presented in Figure 3-38, which is governed by three independent control centers whose cores switches are interconnected to one another, with each core switch interconnected with its own exclusive set of ATMS devices deployed along respective priority corridors. Consolidation of system operations within the Primary Control Center requires a communications topology that is presented in Figure 3-37 where all ATMS devices directly report to the Primary Control Center.

Figure 3-35: Ring Communications Topology

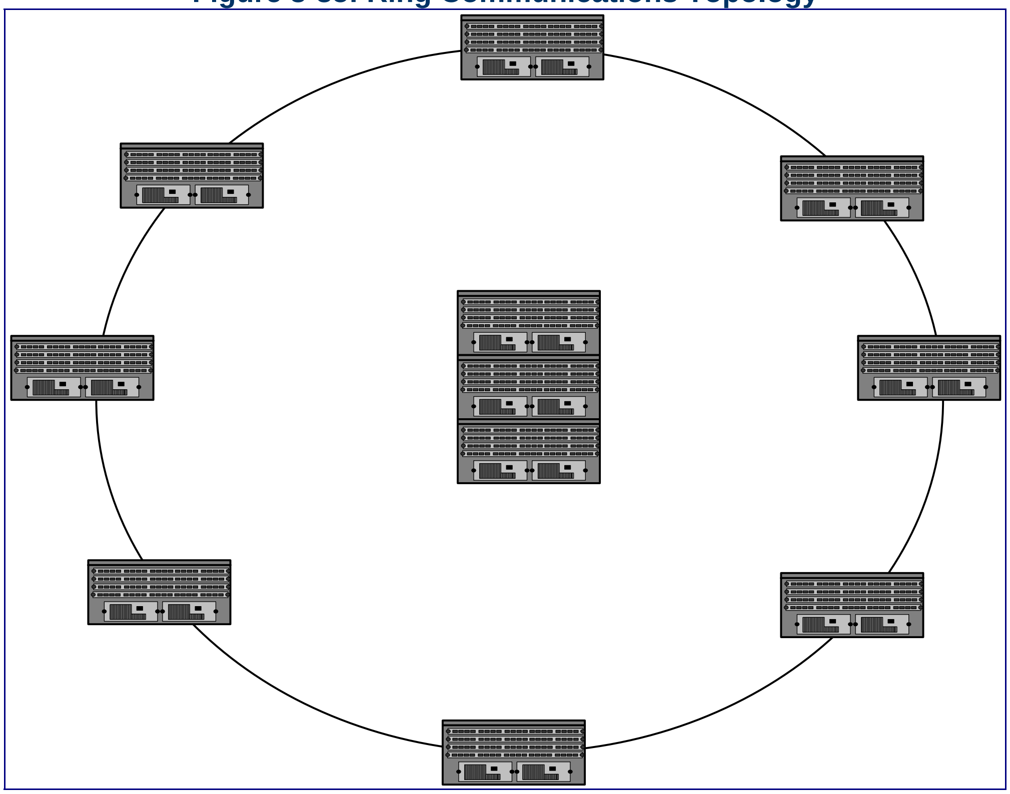


Figure 3-36: Star Communications Topology

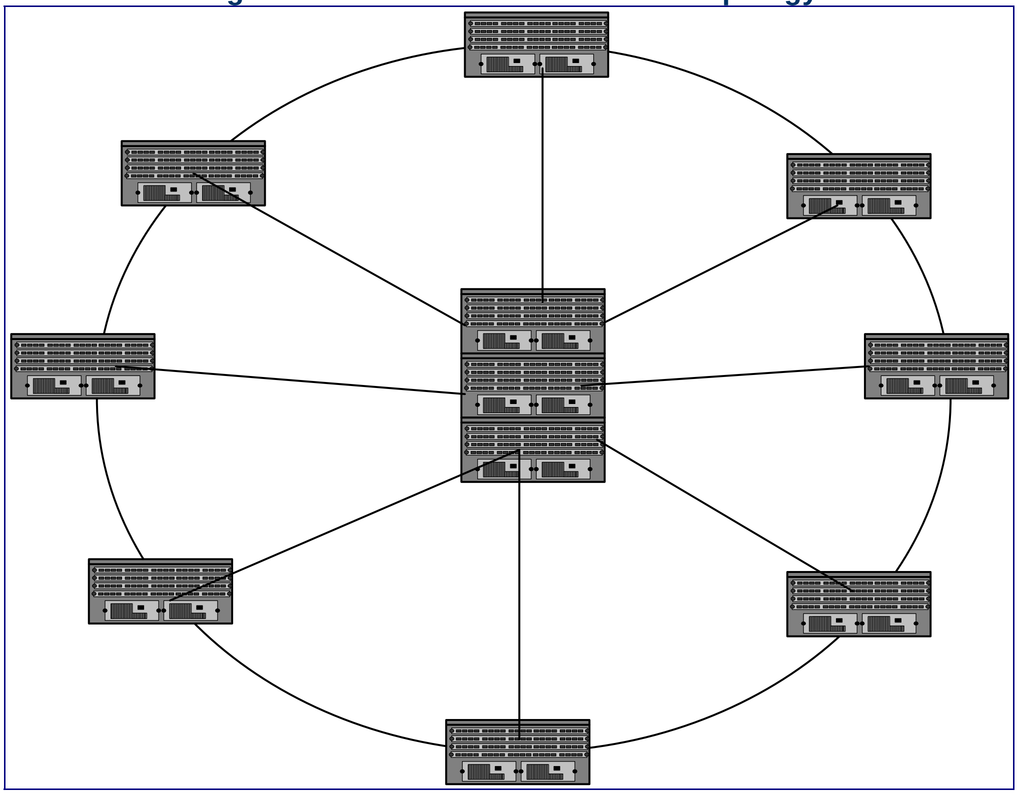


Figure 3-37: Full-Mesh Communications Topology

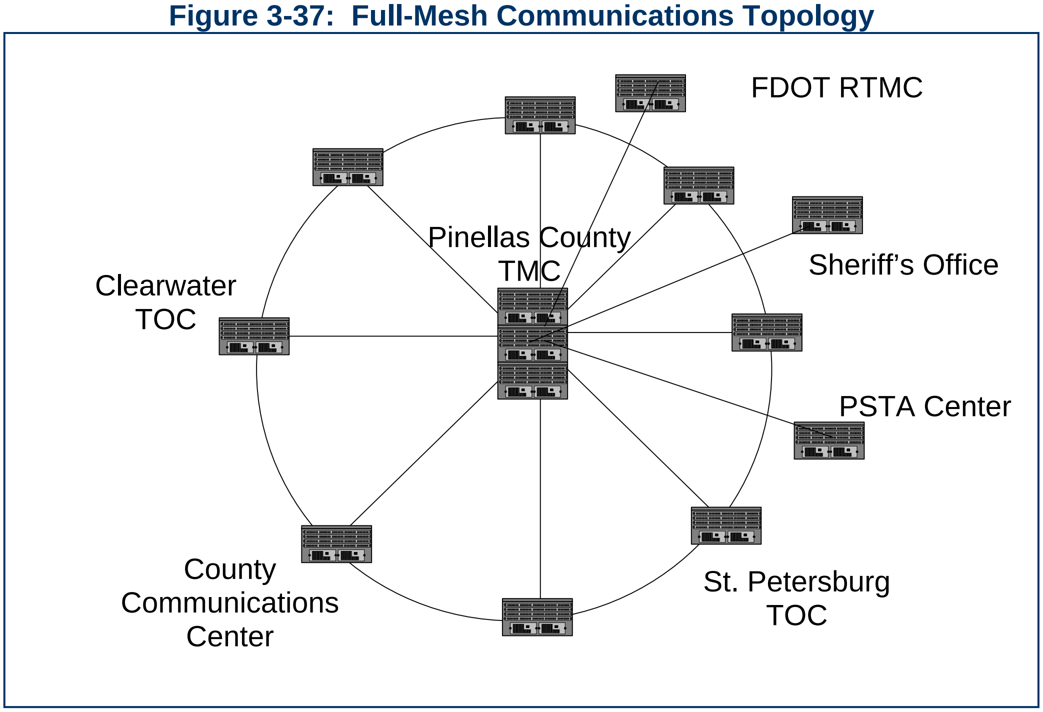
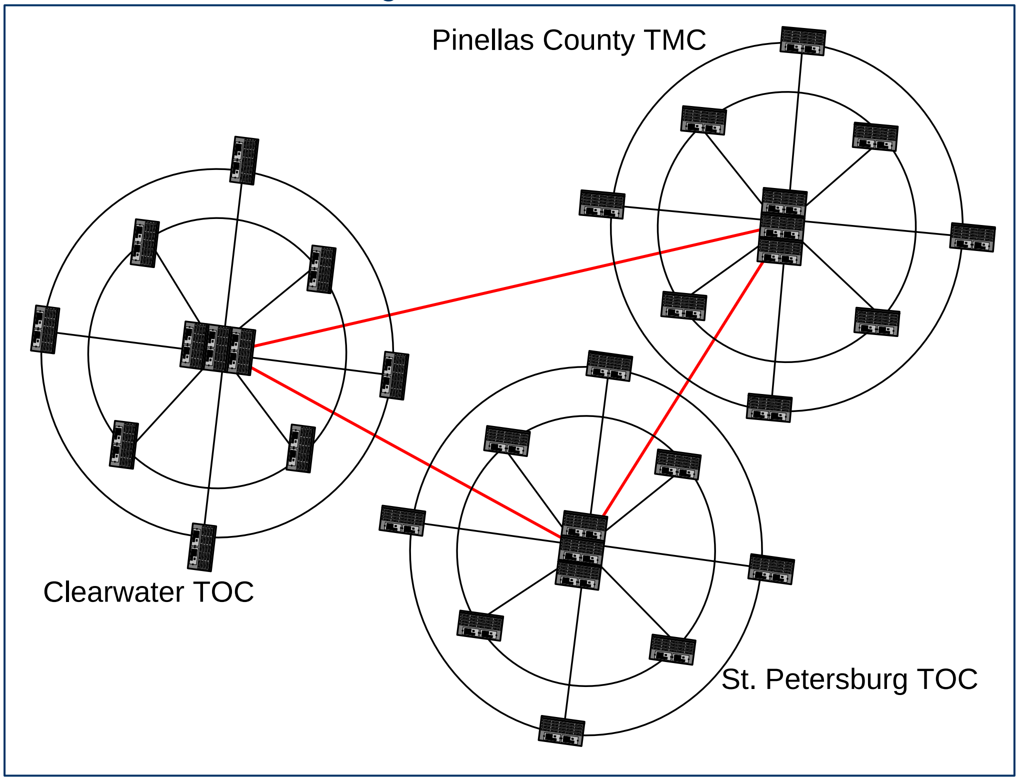


Figure 3-38: Center-to-Center



3.8.3 Communications Equipment

This section presents the communications concepts at the device level (edge), backbone level (aggregate), and core level (Primary Control Center).

3.8.3.1 Edge Communications Equipment

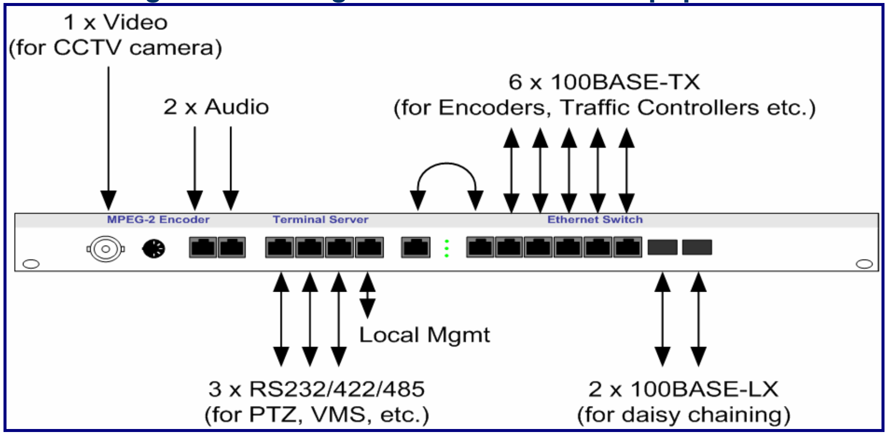
The availability of Layer 2 edge switches offers Pinellas County numerous cable plant topologies, ranging from simple fault tolerant loops to fully redundant local run/backbone topologies. Local loops can either stand alone or connect to backbone aggregation switches for larger networks. Local loops typically begin and end at a common point (i.e., backbone or core switch) and provide a very high degree of fault tolerance. They can also begin and end at different end points (two backbone switches or backbone/core switches) for more redundancy in communications topology.

Edge switches coupled with encoders and decoders (hardware and software based) are designed specifically for the ATMS market. The field-based products are hardened at the component level and housed in device cabinets (or device level) for integrating video, data, and audio, as well as managing system components. Since hardware or software decoders are typically housed in an environmental controlled facility (center), they do not need to be field hardened. This integrated approach supports deployment of ATMS devices along priority corridors without requiring air-conditioned device cabinets. The end communications equipment used at device cabinet will depend on the application. For example:

- ❑ MPEG-2 encoder is used for compressing CCTV camera video at six Mbps/camera for DVD quality image
- ❑ MPEG-4 encoder is used for compressing VIDS camera videos at 1Mbps/camera
- ❑ Terminal server is used to interface PTZ data, DMS signs, and/or legacy controllers using serial protocols (i.e., RS-232, RS-422, and RS-485).

A separate or combined edge switch is used to interface with MPEG-2 or MPEG-4 encoders, terminal servers, and Ethernet-based Type 2070 controller (via a 10/100Base-T port), as presented in Figure 3-39.

Figure 3-39: Edge Communications Equipment



Repeating this connectivity concept at each device level, a series of device level edge switches are daisy-chained together using 100BASE-LX Fast Ethernet single-mode dual fiber local loops for redundancy and fault tolerance. The local loops are interconnected to 100Base-T ports of 1000Base-T backbone switches that are located within air-conditioned communications hubs strategically deployed within the county. Each backbone switch is interconnected to other adjacent backbone switches, and a core switch is housed within the Primary Control Center. This connectivity concept creates a fully redundant mesh topology. Each local loop can interconnect many ATMS devices. The actual number of devices per local loop will primarily depend upon number and video resolution of CCTV/VIDS cameras within the local loop and link management protocol used for providing path redundancy (e.g., spanning tree, rapid spanning tree, etc.). Generally, it is not recommended to exceed more than 60% of total capacity of each local loop (or 600 Mbps). Figures 3-40, 3-41, and 3-42 present the communications equipment and associated interfaces at the cabinet and hub levels.

Figure 3-40: Ethernet Interface at Controller Cabinet – Video and Data

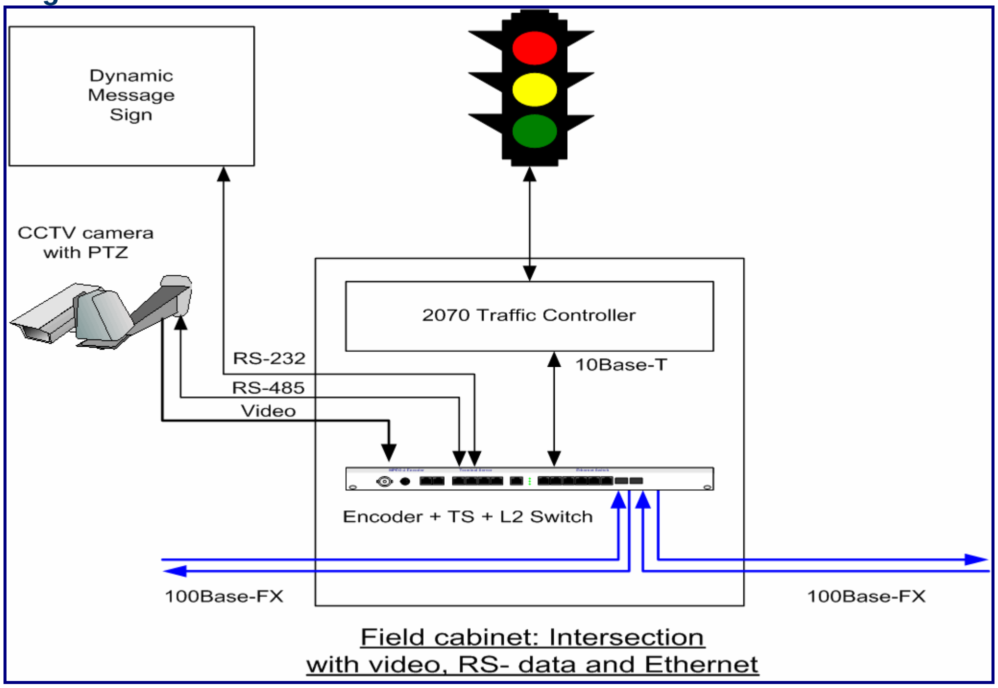


Figure 3-41: Ethernet Interface at Controller Cabinet – Data Only

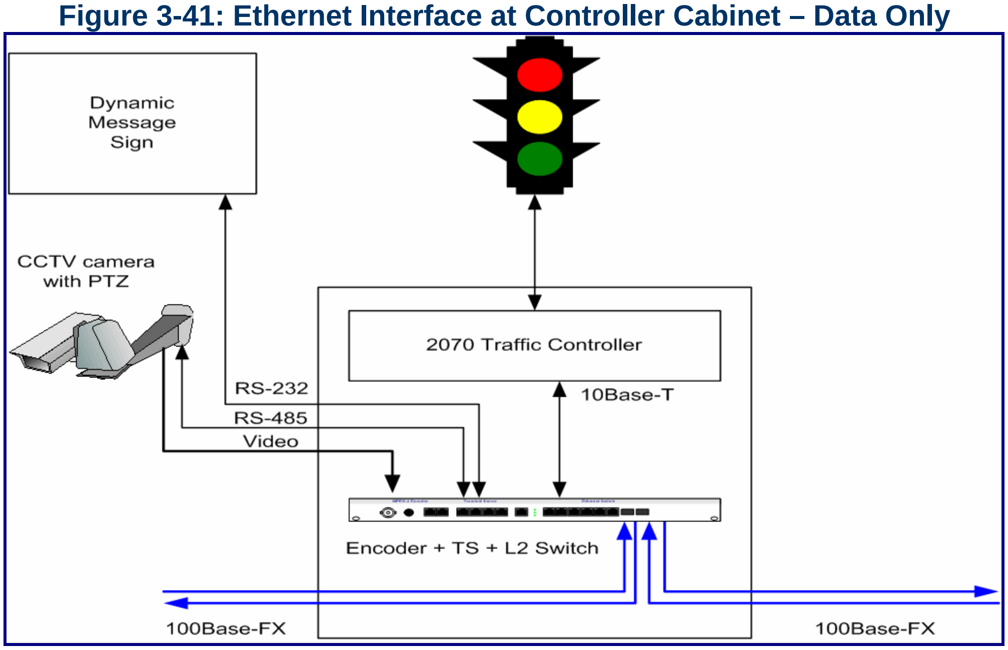
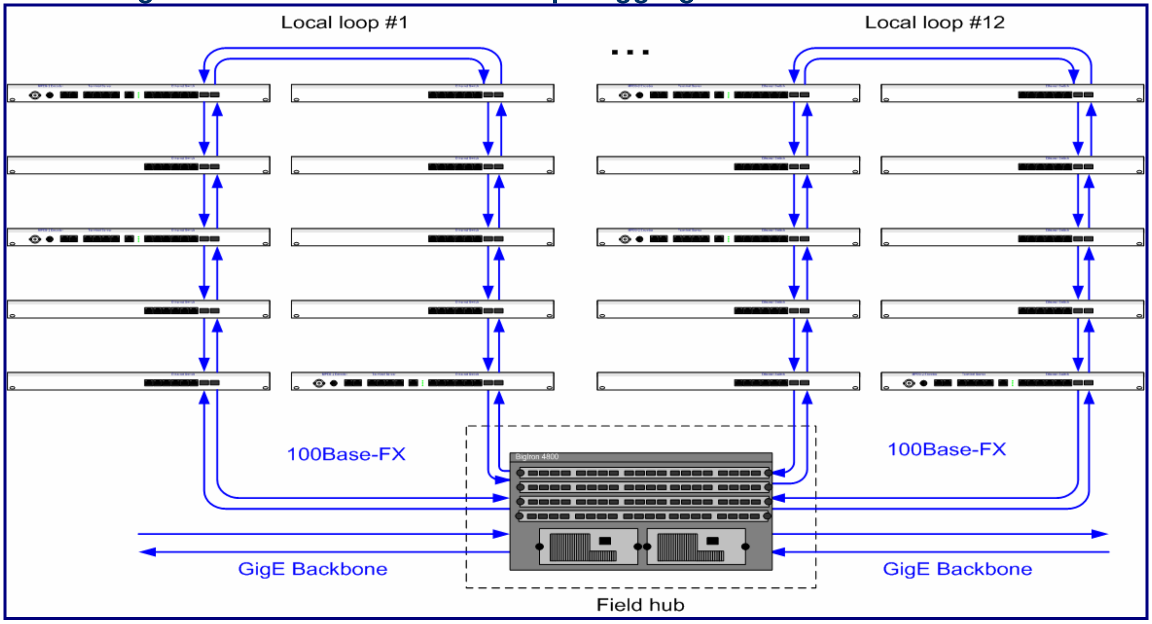


Figure 3-42: Local Ethernet Loops Aggregated at Backbone Switch



The encoders, decoders, and Ethernet/IP based edge switches must:

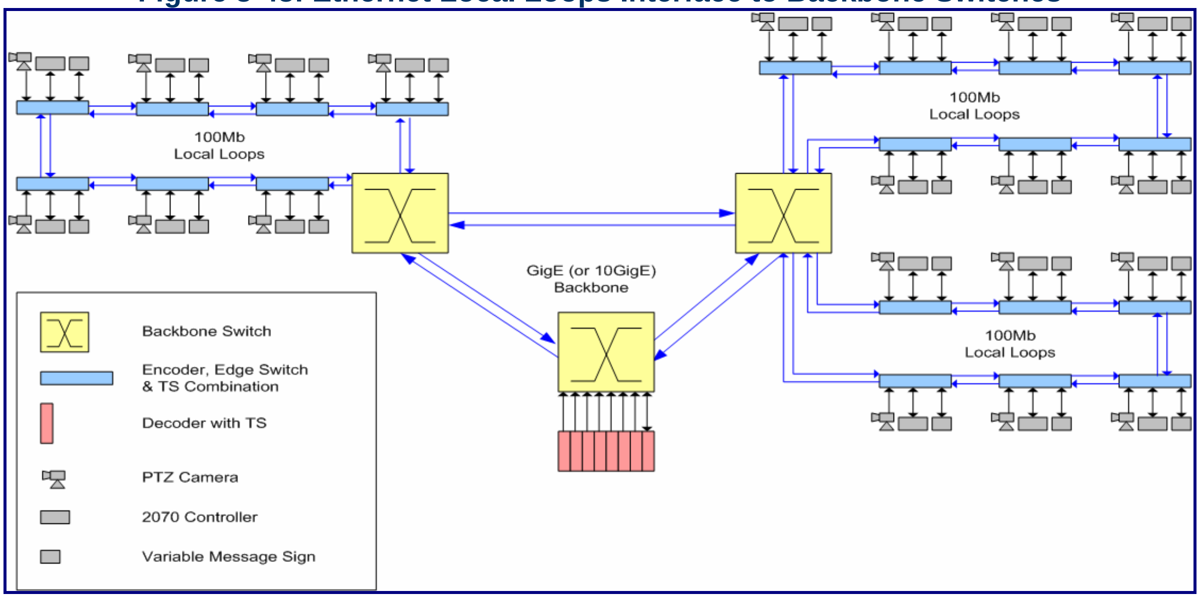
- Be field hardened at component level (excepting decoders) and capable of withstanding environmental conditions in Pinellas County
- Provide the required functionality and features
- Be standards based
- Be interoperable with other manufacturers
- Be cost competitive, as measured by the total cost of ownership
- Be supported by a customer friendly vendor, as measured by quality, reliability, and responsive service.

The end communications equipment must meet a required set of functions and features including support for:

- Remote configuration and management from the traffic management center
- IP multicast in video transmissions for efficient video bandwidth management
- Prioritization for various types and classes of data including controller communications and video transmissions
- VLANs for network segmentation
- Spanning Tree algorithms for fault tolerant, self-healing ring operation
- Dual, standards-based, optical uplink ports for daisy-chain and redundant ring operation
- Programmable data ports for accommodating various serial protocols, including RS-232, RS-422, and RS-485, without using external data converters.

MPEG-4 standard is not backward compatible with MPEG-2 standard, since each is based on different compression standards. This signifies that MPEG-2 devices are not interoperable with MPEG-4 devices and vice versa. However, equipment is emerging which is capable of supporting simultaneously both MPEG-2 and MPEG-4 standards. In addition, the county has already invested in a universal software-based decoder (Cameleon), which provides the county the needed flexibility to decode MPEG-2 and MPEG-4 video streams, as well as NTCIP based communications with DMS signs. This investment will provide interoperability across various vendors providing CCTV cameras, VIDS, DMS signs, etc. as well as cross ATMS networks of other regional stakeholders who have made a similar investment such as Hillsborough County and Plant City. Figure 3-43 presents a block diagram interfacing Ethernet local loops to edge switches at device cabinets. The edge switch interface typically uses optical 1310nm single-mode 100BASE-LX with LC connectors.

Figure 3-43: Ethernet Local Loops Interface to Backbone Switches



3.8.3.2 Backbone Switches

An aggregation or backbone switch is a network switch that collects video and data from multiple sources and combines them for transmission as a whole. These switches may operate at either Layer 2 or 3 and typically aggregate video and data based on network characteristics, technology, signal rate, and protocols used. Backbone switches are used primarily to connect several communications hubs that make up a common backbone and to provide connectivity to ATMS field devices via Ethernet local loops connected to edge switches. A backbone switch is the key to linking the smaller networks to the larger common backbone. For ATMS applications, backbone switches would be housed at field communications hubs or secured facilities (such as traffic operations centers, fire stations, stadiums, etc.) where several local loops converge and cascade to the common backbone.

The role of backbone switches is to pass network traffic rapidly and efficiently from edge-to-core switches and visa versa. Some desired features include tag-based VLAN (802.1q), Spanning Tree algorithm (802.1d), Link Aggregation (802.3ad), and priority control and packet classification. Packet classification takes the packets and classifies them into four classes based on an address list and priority field (defined in 802.1q). Flow control is another important feature because it discards packets if bandwidth is exceeded based on predefined user parameters. Another important feature is filtering function; for example, broadcast filtering or Ethernet type-based filtering. VLANs at this layer are important not only for security but also for providing optimal network performance. In addition, the backbone switches need to support link aggregation and Quality of Service and be able to block individual ports on the switch. The number and type of ports is also an important design capacity consideration. Twelve local FE 100BASE-FX ports are usually considered the minimum. Dual GBICs are the standard for the GigE uplink ports and offer a greater level of flexibility compared to fixed GigE sockets, particularly as the system grows.

The county's communications architecture leverages field communications hubs, strategically located within the county, that house the 1000Base-T backbone switches. The backbone switches interface with a multitude of 100Base-T local loops, each containing a myriad of ATMS field devices located along priority corridors. The 1000Base-T backbone switches will be interconnected to a high capacity core switch (1GigE expandable to 10 GigE) located within the county's Primary Control Center and adjacent backbone switches to create a redundant mesh topology. The number of field communications hubs and associated switches is a function of potential physical constraints and/or barriers, as well as distribution and allocation of respective 100Base-T local loops interconnecting to ATMS field devices. From a technical point of view, traffic signals can be daisy-chained into one 100Base-T Ethernet local loop with each loop supporting ten ATC Type 2070s, ten VIDS system, four CCTV cameras, and as many DMS signs as needed. This device configuration will use approximately 60% to 70% of the 100 Mbps capacity of each local loop, assuming 6Mbps for each CCTV camera and 1Mbps for each VIDS camera. The required communications bandwidth is not significant for ATC Type 2070, PTZ data, legacy controllers, and DMS signs, compared to streaming videos generated from CCTV and/or VIDS cameras, to govern communication design.

This configuration reflects a 1000Base-T switch housed in a field communications hub with 24 configurable ports (100Base-T or 1000Base-T) interfaced with ten 100Base-T local loops (using 20 of the 24 configurable ports). This configuration will accommodate a total of 100 ATC Type 2070s, 100 VID system, 40 CCTV cameras, and as many DMS signs as required. Four ports remain to interconnect with core switch within Primary Control Center and adjacent backbone switches to form a redundant mesh topology. The design criteria must reflect fault tolerance requirements while ensuring that capacity of the backbone switch and local loop switch are not exceeded. Though the maximum bandwidth for each local loop is theoretically 100 Mbps, it is recommended that the design does not exceed 60 to 70 Mbps.

The number of necessary backbone switches will be dependent on switch capacity; number of local loops per backbone switch; level of desired redundancy; and number, type, and bandwidth requirements of ATMS devices along each local loop. A strategy for reducing the number of backbone switches is to place more configurable ports (100Base-T) into each switch (if modular), or acquiring switches that provide more ports for local loops. Though this strategy can help reduce the number of backbone switches, good communications design must consider system impacts of backbone switch failures and avoid allocating too many ATMS devices or local loops to too few backbone switches. In addition, redundant communications paths between core and backbone switches should be implemented to manage potential port failures and cable cuts. Generally, design of the communications backbone should strive to maintain a uniform distribution of local loops to respective backbone switches if possible. A recent communications study, conducted for Pinellas County, has provided guidance regarding number and locations of backbone switches within Pinellas County as presented in Table 3-12.

Table 3-12: Proposed Locations for Core and Backbone Switches

Node	Switch Type	Locations
1	Core	Pinellas County Primary Control Center
2	Backbone	City of Clearwater Traffic Operations Center
3	Backbone	City of St. Petersburg Traffic Operations Center
4	Backbone	Ulmerton Road and Pinellas Trail
5	Backbone	Curlew Road and McMullen Booth Road
6	Backbone	Tampa Road and US 19
7	Backbone	Keystone Road and US 19
8	Backbone	Ulmerton Road and US 19

3.8.3.3 Core Switches

For center-to-field devices communications, the county has already invested in Foundry Networks FastIron 800 switch (with full layer 3 upgrade path) to serve as its core switch. Housed in the Primary Control Center, this switch can be equipped with both 100BASE-TX electrical interfaces and 1000BASE-LX optical interfaces for interconnection with decoders and the communications backbone, respectively. This approach will require only one core switch at the Primary Control Center and potentially a second one at the Clearwater Traffic Operations Center for redundancy purposes. The core switches will also accommodate center-to-center communications and must be capable of supporting full layer 3 functionality, including IP routing, multicast support (DVMRP, PIM-DM, PIM-SM), and OSPF. The county's core switch is a high density gigabit switch with upgrade path to 10 gigabit capacity.

3.8.4 Conduit Infrastructure

A four-inch outerduct containing three 1 inch innerducts would be best suited as the conduit system for deployment along priority corridors to serve future center-to-center and center-to-field devices connectivity. This is also consistent with the FDOT conduit standard for ATMS deployment along State routes comprising many of the county's priority corridors. Figure 3-44 depicts the existing and proposed communications infrastructure and associated conduit system in support of the county's ATMS program.

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Figure 3-44
Legacy and Proposed Communications Infrastructure

Legend

EXISTING

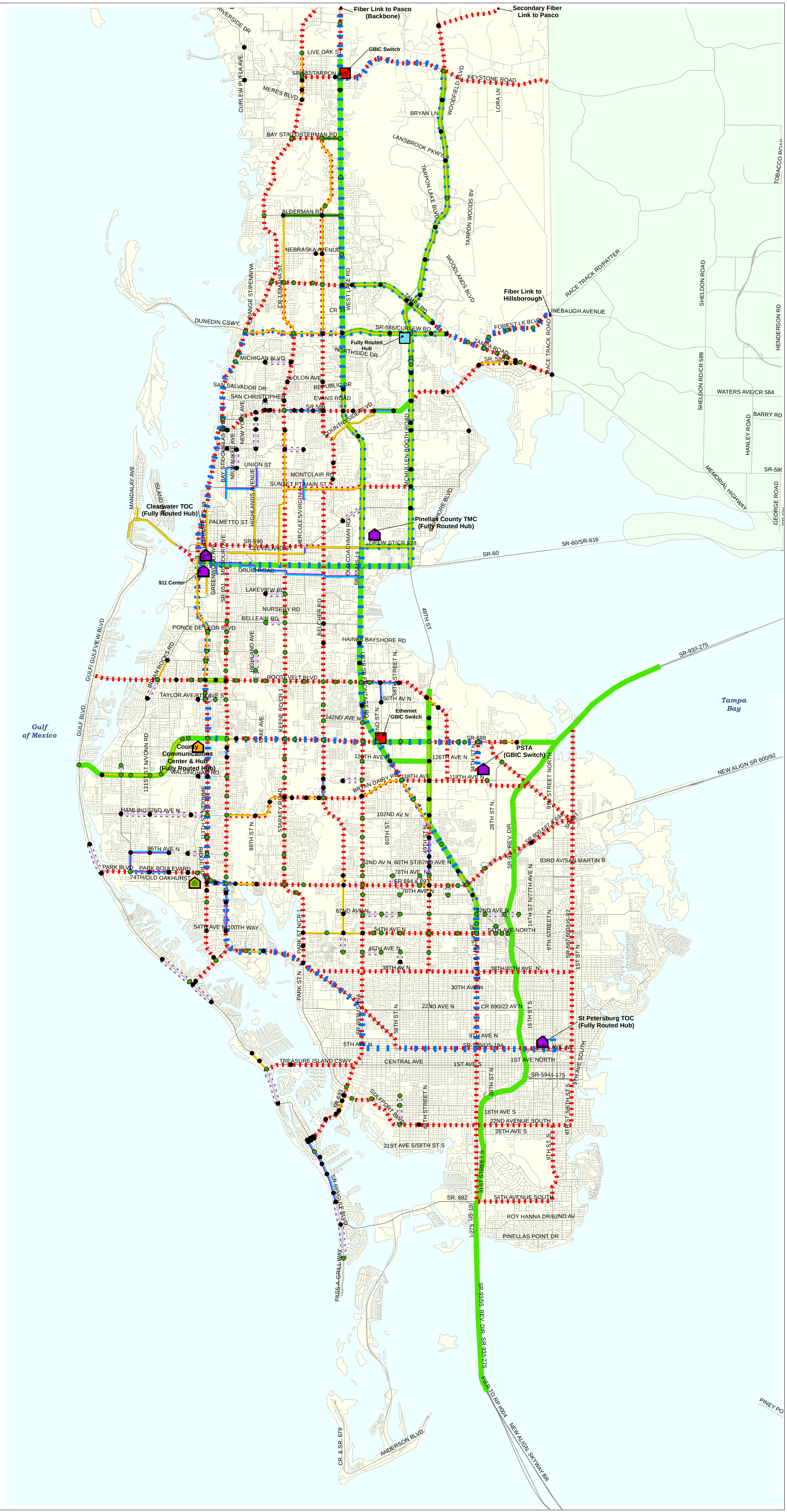
- **Hubs**
- **Centers**
- Seminole EOC
- **Single Telephone Drop**
- **No Comm**
- **Existing Conduit Only**
- **Existing Aerial Twisted Pair**
- **Existing Underground Twisted Pair**

FUTURE

- **Hubs**
- **Centers**
- Future Fiber Optic Backbone
- **Future Fiber**
- **Future Wireless Link**
- **Existing Underground Fiber**

ROADS

- Major Roads
- Minor Roads
- Local Roads



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3.8.5 Communications Standards

There are two categories of ITS communications standards – those that deal with exchange of information from center-to-field devices, and those that deal with communications between centers. The following subsections will explore both of these categories and provide recommendations on how ITS communications standards might be used by Pinellas County.

3.8.5.1 Center-to-Field Communications Standards

The ITS communications standards consist of a family of NTCIP protocols designed to accommodate commonly used ITS applications. Table 3-13 presents a listing of the NTCIP center-to-field standards, highlighting those standards that are recommended for application in the Pinellas County ATMS program.

Table 3-13: NTCIP Center to Field Standards

Pinellas County User Need	Application Area	NTCIP Standard	Recommended for Use	Comments
---	Global Objects	NTCIP 1201	☑	
Traffic Control	Actuated Signal Control	NTCIP 1202	☑	
Dynamic Message Signs	Dynamic Message Signs	NTCIP 1203	☑	
---	Environmental Sensor Systems	NTCIP 1204	Potential for future use	See Note 1
Closed Circuit Television	Closed Circuit Television Control	NTCIP 1205	☑	
Data/MOE Collection	Data Collection & Monitoring	NTCIP 1206	Potential for future use	See Note 2
---	Ramp Meter Control	NTCIP 1207	☒	
---	CCTV Switching	NTCIP 1208	Potential for future use	See Note 3
Detection	Transportation Sensor Systems	NTCIP 1209	☑	
---	Signal System Masters	NTCIP 1210	Under development	
---	Signal Control & Prioritization	NTCIP 1211	Under development	
---	CCTV Network Cameras	NTCIP 1212	Under development	
---	Electrical & Lighting Management Systems	NTCIP 1213	Potential for future use	See Note 4

Note 1: There is potential for future use of NTCIP 1204 (Environmental Sensor Systems).
Note 2: The NTCIP 1206 (Data Collection & Monitoring) standard is essentially for the non-real-time file transfer of traffic data. This standard is for use with permanent count stations that have an infrequent transfer of large amounts of traffic data.
Note 3: The NTCIP 1208 (CCTV Switching) standard has recently emerged and currently there are no known implementations. It is recommended that this standard be considered for future use when manufacturers begin implementing the standard.
Note 4: The NTCIP 1213 (Electrical & Lighting Management Systems) standard is emerging and might be considered for future use in long-term systems planning.

The NTCIP center-to-field Information Level standards are described as follows:

- *NTCIP 1201 (Global Object Definitions* – provides vocabulary (commands, responses, and information) necessary for general device management, including those data elements (objects) required for device identification, time-based schedule configuration, and event log configuration. All roadside devices that are required to communicate with a central system should support the device identification objects.
- *NTCIP 1202 (Actuated Signal Control)* – provides vocabulary (commands, responses, and information) necessary for traffic management and operations personnel to control, manage, and monitor actuated traffic signal controller units. The standard contains data elements (objects) to support the functionality of actuated traffic signal controller units used for transportation and traffic control applications.
- *NTCIP 1203 (Dynamic Message Signs)* – provides vocabulary (commands, responses, and information) necessary for traffic management and operations personnel to advise and inform vehicle operators of current highway conditions by using DMS. Since DMS require multiple objects to operate (information object, paging object, flashing object, etc.), this standard also includes a message syntax, called MULTI (Mark-Up Language for Transportation Information), which allows data elements (objects) to be grouped into a message. The message is analogous to a sentence in that both the message and a sentence require syntax, or ordering of the information data elements (words), to be understood.
- *NTCIP 1204 (Environmental Sensor Systems)* – provides vocabulary (commands, responses, and information) necessary to describe ambient conditions (including air pressure, wind, temperature, precipitation, sunlight, visibility, and air quality) and pavement conditions (including surface and subsurface temperature, moisture, and treatment)
- *NTCIP 1205 (Closed Circuit Television Camera Control) – p*rovides vocabulary (commands, responses, and information) necessary for controlling CCTV cameras and the movement of pan/tilt units. This standard includes features like pan, tilt, zoom, focus, and iris. Other data elements (objects) provide a generic mechanism for controlling internal menus within cameras. The video component is not addressed since there are a variety of standards already available for this purpose.
- *NTCIP 1206 (Data Collection & Monitoring)* – provides vocabulary (commands, responses, and information) necessary for collecting and maintaining traffic data, in a file-based format, over a prescribed period of time. Implementations typically include permanent traffic count stations, vehicle classification stations, etc.
- *NTCIP 1207 (Ramp Meter Control)* – provides vocabulary (commands, responses, and information) necessary for controlling, managing, and monitoring signal devices that are used to manage access to freeways. These signals meter the flow of traffic from ramps onto freeways or other controlled access facilities
- *NTCIP 1208 (CCTV Switching)* – provides vocabulary (commands, responses, and information) necessary for controlling video switches used to associate camera outputs to monitor inputs, enabling operators to view the returned video.

- *NTCIP 1209 (Transportation Sensor Systems)* – provides vocabulary (commands, responses, and information) necessary for controlling traffic sensor operations and data collection in a real-time fashion.
- *NTCIP 1210 (Signal System Masters)* – provides vocabulary (commands, responses, and information) necessary for controlling traffic control field masters, which are devices commonly found in closed-loop traffic signal systems. The signal system master typically has two functions: 1) Broker communications between the central system and the local traffic signal controller, and 2) Supervise the implementation of patterns (cycle, split, offset) used to provide coordination along a corridor.
- *NTCIP 1211 (Signal Control & Prioritization)* – provides vocabulary (commands, responses, and information) necessary for originating and performing triage on vehicle priority treatment requests at signalized intersections and subsequently submits those requests to the traffic signal controller on the basis of importance and priority.
- *NTCIP 1212 (CCTV Network Cameras)* – provides vocabulary (commands, responses, and information) necessary for controlling image capture devices and the setup of file transfer mechanisms for the publication of captured images.
- *NTCIP 1213 (Electrical & Lighting Management Systems)* – provides vocabulary (commands, responses, and information) necessary for controlling illumination systems for highways, bridges, and tunnels.

In addition to the application area standards for center-to-field devices, there are a host of subordinate level NTCIP standards that facilitate the implementation of a complete communications system. These standards include a selection of standards at the Application Level that provide rules for the processing of data, a selection of standards at the Transport Level that provide the rules for how data is transported through the network, and a selection of standards at the Subnetwork Level that provide for the rules on interfacing with the physical network infrastructure.

The selection of NTCIP standards for use at the Application, Transport, and Subnetwork Levels is dependent on the communications system architecture and infrastructure choices. NTCIP standard selections for these levels will need to be made during the communications system design process. For example, a system such as the county's MIST central control software, which supports a direct-connect architecture between the central control system and field devices through a hybrid fiber-copper communications infrastructure and point-to-multipoint topology, will utilize the following lower level standards:

- Application Level Standards
  - *Simple Network Management Protocol (SNMP)* – provides basic data exchange in setting up dynamic objects that are used to more efficiently package data
  - *Simple Transportation Management Protocol* – provides a more efficient data transfer mechanism (essential for data intensive devices such as actuated traffic signal controller and unessential for less data intensive devices such as DMS signs and CCTV cameras).
- Transport Level Standards
  - *Transportation Transport Protocol* – provides a non-routable transport mechanism for directly connected field communications channels.

- Subnetwork Level Standards
  - *Point to Multi-Point Protocol* – provides a mechanism for connecting more than one device on a field communications channel
  - *FSK Modem* – provides a mechanism for connecting to the physical communications infrastructure.

Selection of the lower level standards is appropriate for the communications architecture described above regardless of intervening communications infrastructure. For instance, the communications link between a hub and central server via a switched link with a different or unique transport protocol would be invisible to the use of NTCIP. In essence, the NTCIP communications packet would be wrapped in the different/unique protocol for transport over the backbone communications infrastructure and subsequently unwrapped at the other end to reflect NTCIP. The result is that NTCIP will be used on the link going into and out of the backbone communications infrastructure. What happens on the backbone portion of the communications infrastructure is of no consequence as long as the NTCIP data packet is undamaged during transport. The lower level standards selections applicable to the Pinellas County's Ethernet/IP based infrastructure include:

- Application Level Standards
  - *Simple Network Management Protocol* – to provide basic data exchange in setting up dynamic objects that are used to more efficiently package data
  - *Simple Transportation Management Protocol* – to provide a more efficient data transfer mechanism.
- Transport Level Standards
  - *Transmission Control Protocol/Internet Protocol* – to provide a routable transport mechanism for connection-oriented communications with a guarantee of delivery.
  - *User Datagram Protocol/Internet Protocol* – to provide a routable transport mechanism for broadcast communications (typical for use with actuated traffic signal controllers).
- Subnetwork Level Standards
  - *Ethernet* – to provide a mechanism for connecting to field devices using an Ethernet communications channel.

Wireless communications infrastructure is more challenging since it requires non-traditional methods for NTCIP data exchange. Wireless networks require more extensive use of the SNMP trap mechanism, which must also be accommodated by the central system software. Hence, central system software modifications will likely be needed to accommodate extensive use of the SNMP trap mechanism. The central system software selection should be reviewed with wireless use in mind. The communications master plan should serve as a precursor to the development of detailed design plans and specifications.

3.8.5.2 Center-to-Center Communications Standards

Effective center-to-center communications facilitates regional interoperability and is often perceived as critical in successful deployment of a Regional ITS Architecture. There are two standardized center-to-center protocols, which are being surpassed by the emergence and evolutionary development of a third one. Selection of a center-to-center protocol is not a decision that is unique to an individual agency. Rather, the decision should be made through careful consultation with agency partners throughout the region. Table 3-14 presents a listing of the NTCIP center-to-center standards and highlights the recommended standard for consideration as Pinellas County influences a regional decision.

Table 3-14: NTCIP Center to Center Standards

NTCIP Center to Center Standard	Recommended for Use	Comments
DATEX (DATa Exchange)	☒	See Note 1
CORBA (Common Object Request Broker Architecture)	☒	See Note 2
XML (eXtensible Markup Language)	☑	See Note 3
Note 1: The NTCIP DATEX standard was one of the first center-to-center standards developed. The standard was adapted from earlier work done by the European community. The United States has sought international approval of the revised standard; however, support is now considered minimal and efforts to ballot DATEX as an international standard have been dropped. Currently, there is only one manufacturer of a tool set for use in doing development work using DATEX and there are questions as to the long-term viability of the standard. Note 2: The NTCIP CORBA family of standards is still evolving and has minimal development resources. The greatest unknown with respect to implementation of the CORBA standards has been in the development of a data reference model. Presently, there is a standards development effort to create a generic transportation data reference model. To date, all of the CORBA implementations have used unique data models. Additionally, CORBA is considered by many to be the most expensive approach for center-to-center communications. The NTCIP center-to-center Working Group has suspended the work on this standard. There are only three known deployments using CORBA and no known plans for future use. This standard is withdrawn. Note 3: The current work on the standardization of XML is limited to the development of an Information Report. The report describes an approach for standardizing XML for use as a center-to-center standard. Work in this area continues to evolve.		

The NTCIP center-to-center Information Level standards are described as follows:

- *DATEX (DATa Exchange)* – is message based and does not use object models. It uses the ASN.1 format (the format of the NTCIP center to field data elements) and is directly compatible with message set developments now available. DATEX is based upon a subscriber-publisher (request-response) paradigm and is fixed message based. DATEX is unique to the transportation industry and, as such, training will likely be needed for traditionally trained network administrators.
- *CORBA (Common Object Request Broker Architecture)* – is a computer industry standard specification that has been adopted from other industries. CORBA is essentially an object-oriented middleware technology that provides standardized communications and services. Since CORBA is a computer industry standard, training and development resources are plentiful.
- *XML (eXtensible Markup Language)* – is an approach to support robust command and control by leveraging the existing standards of the World Wide Web Consortium (W3C) that include Simple Object Access Protocol (SOAP) and Web Services Description Language (WSDL), a file-based sharing approach with a focus on information sharing and aggregation (referred to as XML Direct). The existing ASN.1 message sets are expected to be translated for reuse with XML. A grassroots effort has begun to implement XML-based center to center communications in many locations, including the Florida Department of Transportation.

As previously mentioned, the selection of a protocol for center-to-center communications is a regional decision. FDOT has considered developing SunGuide software for arterial management system, which can be provided to local agencies for center-to-center communications. Another option that is being deployed to provide center-to-center connectivity between the FDOT Regional Traffic Management Center and traffic management centers of Hillsborough County and Plant City has been to provide FDOT a client license for central control system for viewing traffic signal operations and Cameleon for viewing and control of CCTV cameras. Pinellas County should engage in discussions with partner agencies throughout the region and advance the dialog toward a center-to-center protocol decision. The implementation of disparate central control software (MIST for Pinellas County, SunGuide for FDOT, Naztec for Hillsborough County and Plant City, SCATS for Pasco County, etc.) will add complexity for a common standards-based center-to-center communications. The data elements used in message exchange between centers is defined in the *Traffic Management Data Dictionary (TMDD).* In addition to the protocol selection previously discussed, the TMDD is an essential standard for use in center-to-center communications and is therefore recommended for use in the Pinellas County system.

3.9 PROPOSED ATMS ELEMENTS

Figures 3-45 through 3-47 present the proposed ATMS elements for Pinellas County. The improvements recommended to be deployed along the priority corridors as part of incremental deployment stages include advanced traffic controllers and associated cabinets, wireless detection, CCTV cameras, support infrastructure, end communications equipment, communications infrastructure and media, DMS signs, DTB signs, Blankout signs, HARs, UPSs, adaptive traffic control, etc.

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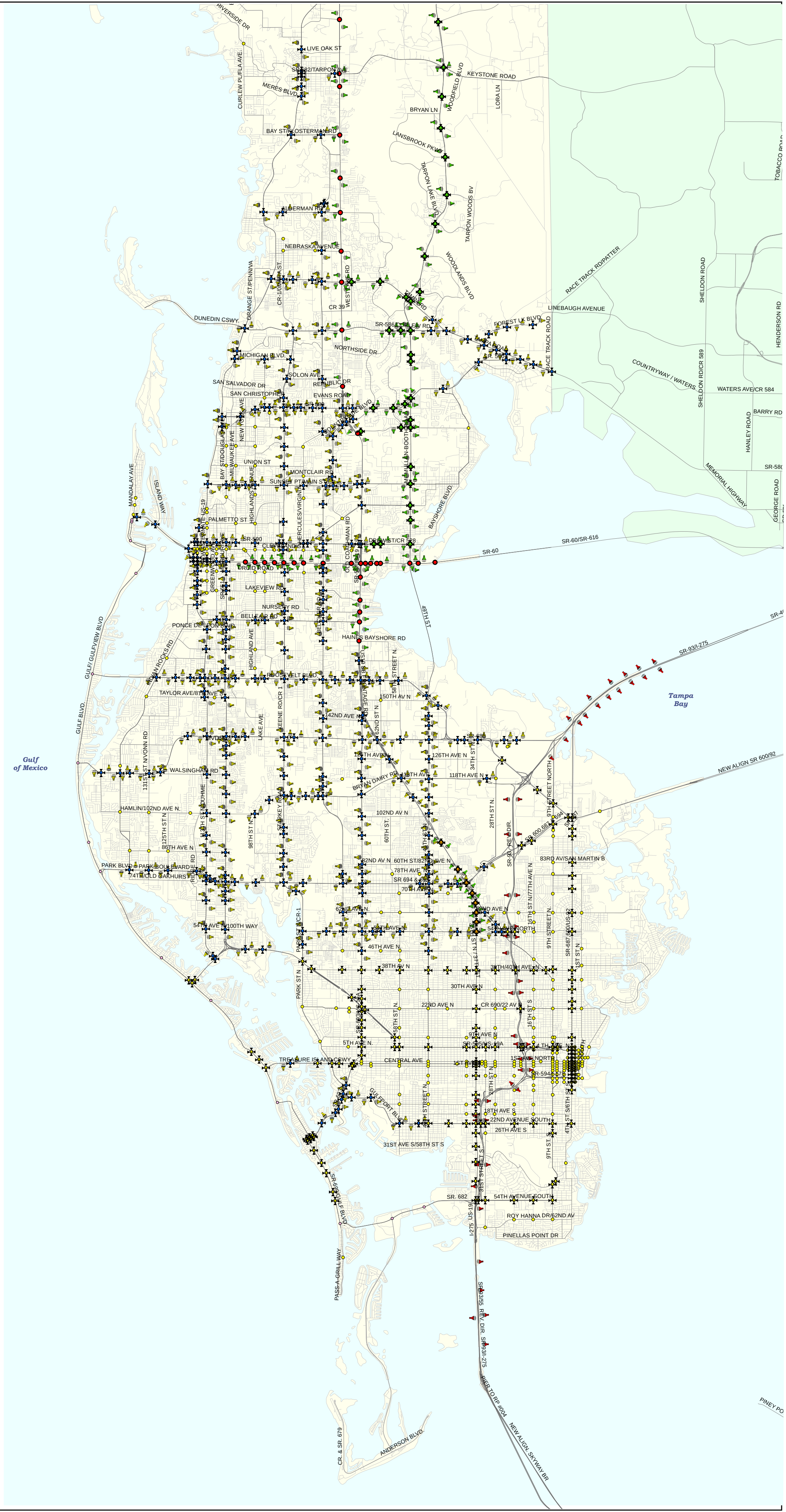
Figure 3-45
Proposed Detection



Legend

EXISTING DETECTION

- I-275 MVDS
- MVDS

FUTURE DETECTION

- VIDS
- Sensys / MVDS

TRAFFIC SIGNALS

- Existing Adaptive Phase 1 / Stage 1
- Adaptive Phase 1 / Stage 2
- Adaptive Phase 1 / Stage 3
- Future Adaptive
- Future Non-Adaptive
- Future Non-Adaptive (Wireless)

ROADS

- Major Roads
- Minor Roads
- Local Roads

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Figure 3-46
Proposed CCTV and DMS

Legend

CCTV Cameras
- Future CCTV (Primary)
- Future CCTV (Secondary)
- Future CCTV (Tertiary)
- Future CCTV (Wireless)

HAR
- HAR Tower
- Main HAR Tower

Traffic Signals
- Existing Adaptive Phase 1 / Stage 1
- Adaptive Phase 1 / Stage 2
- Adaptive Phase 1 / Stage 3
- Future Adaptive
- Future Non-Adaptive
- Future Non-Adaptive (Wireless)

Dynamic Message Signs
- Future DMS
- Future DMS (Wireless)
- Dynamic Trailblazing Sign
- Blankout

ROADS
- Major Roads
- Minor Roads
- Local Roads

BOUNDARIES
- Hillsborough County
- Pinellas County
- Water

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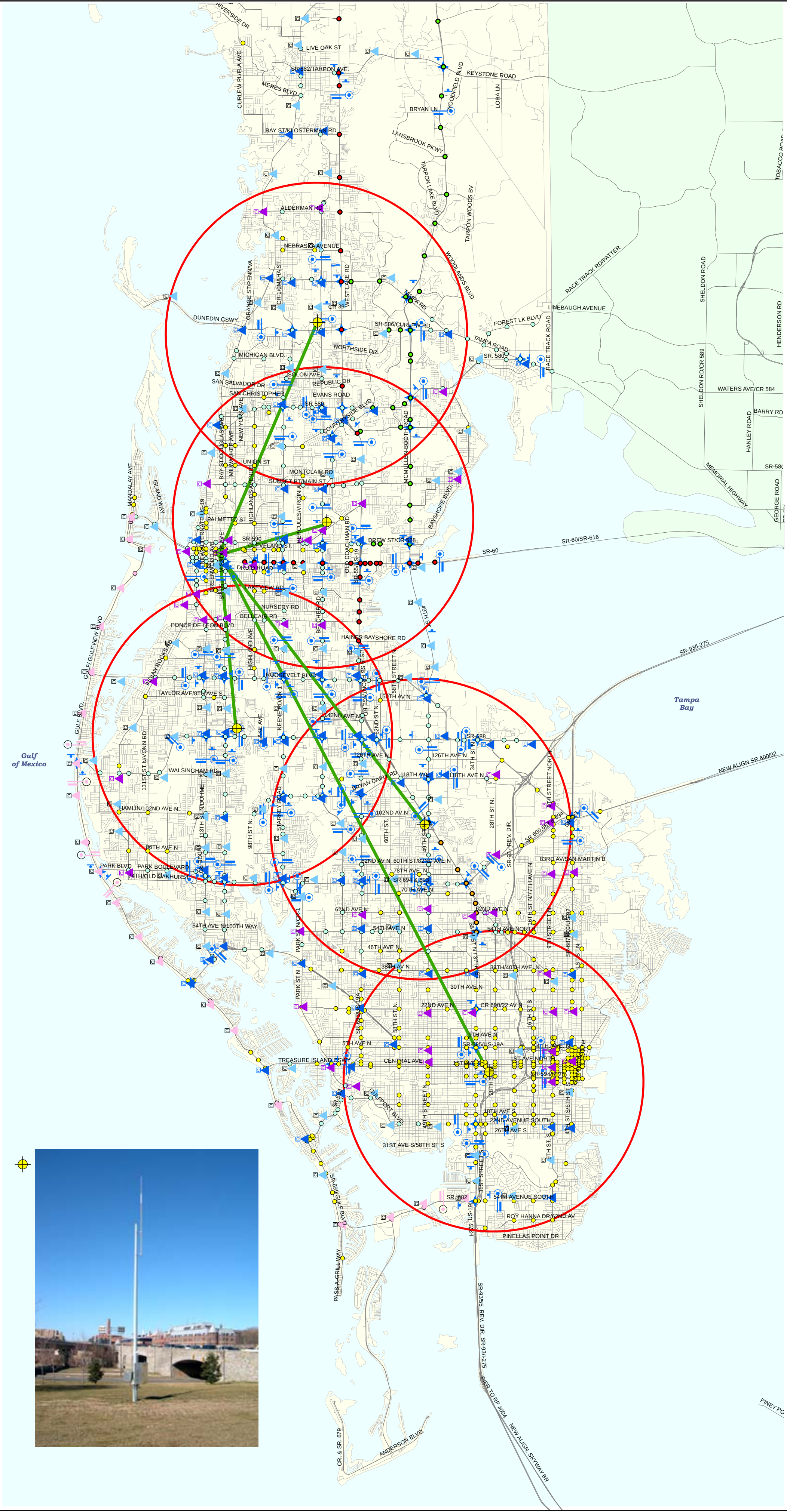

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Figure 3-47 Proposed Communications Network

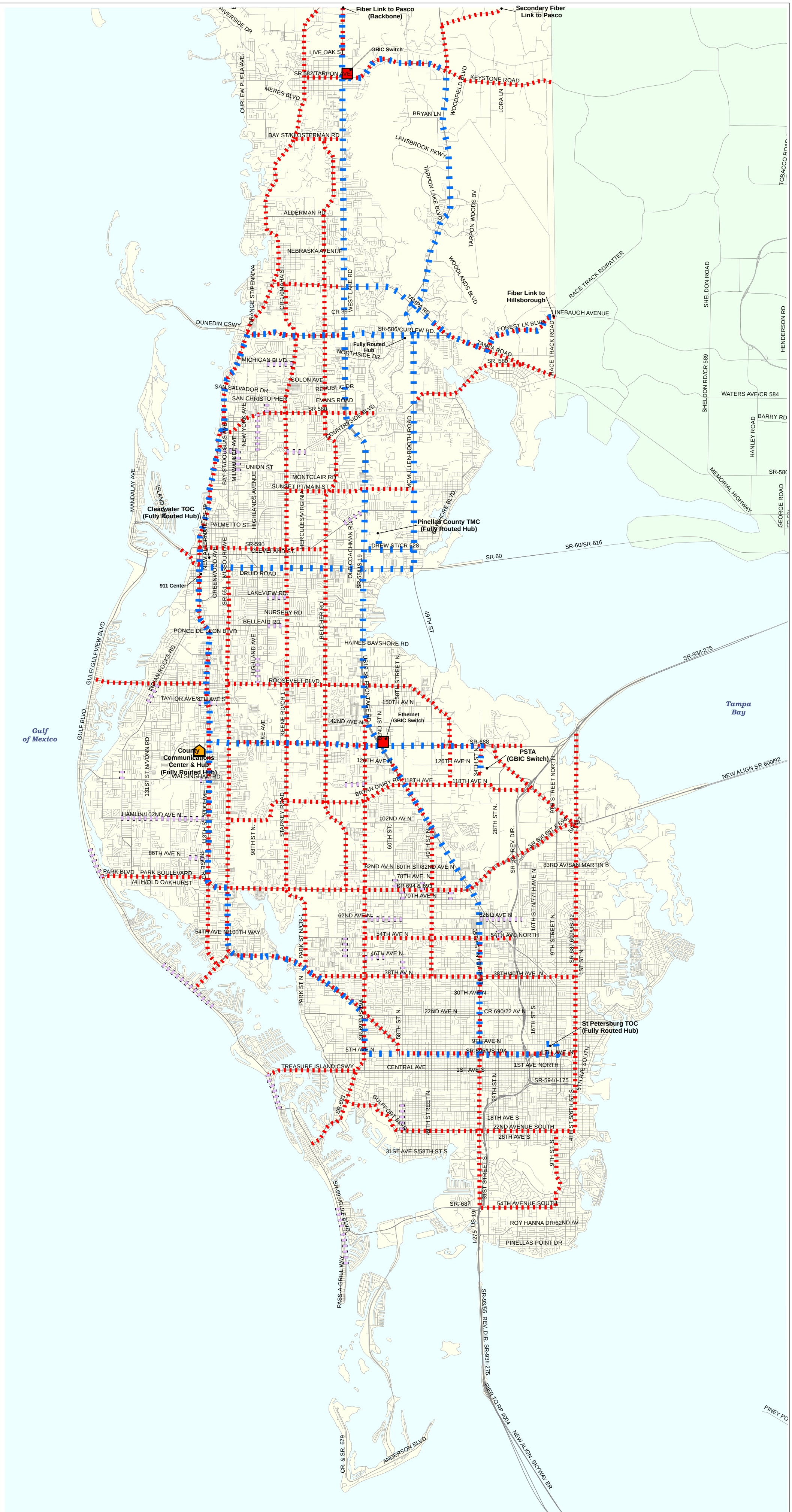
Legend

FUTURE

- Hubs
- Centers
- Future Fiber Optic Backbone
- Future Fiber
- Future Wireless Link

ROADS

- Major Roads
- Minor Roads
- Local Roads



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4.0 IMPLEMENTATION PLAN

The conceptual design of the county's advanced traffic management system guides the development of a cost-effective and incremental approach for implementing advanced ATMS technologies and strategies along priority corridors. This approach strives not only to modernize but also expand the county's traffic management system to meet the current and future safety, efficiency, and mobility needs. Building on this conceptual framework, this section identifies:

- Procurement strategies
- Program support
- Program procedures
- Priority corridors
- Implementation strategy
- Program deployment.

4.1 PROCUREMENT STRATEGIES

Pinellas County's ATMS program procurement choices will impact deployment effectiveness and return on investment. Many procurement options are available, including design-bid-build, system manager-system integrator, and design-build. The challenge in choosing the optimum procurement strategies lies in demarcating or grouping design and construction requirements in terms of systems, devices, and services. These requirements need to be packaged into component projects that balance technical sophistication, system quality, cost effectiveness, and deployment schedule. ATMS systems are complex, versatile, and rapidly changing, while leveraging the latest in telecommunications, computers, software, sensing, databases, and electronics technologies. They can be deployed incrementally or all at once along a given corridor. The associated technologies can be included in tailored or standalone projects or as part of traditional roadway construction projects.

Because the requirements of some ATMS projects may be difficult to specify at the project onset, procurement of ATMS projects presents a set of unique challenges. This difficulty often results in the challenge for establishing realistic low bids and ensuring end-product quality. Adding unfamiliar and rapidly evolving technologies to elements more familiar to transportation agencies (such as construction) may compound the challenge since the familiar elements often represent the majority of the project costs and lead to the selection of a traditional contracting technique.

Mixing sophisticated technologies with traditional construction projects must be done with care and effective planning and only when the required ATMS systems, devices, and services can be specified at the onset of the project and acquired off-the-shelf. This is especially true if the traditional contracting technique of design-bid-build is the procurement vehicle. Design-bid-build procurement strategy, which takes advantage of competition during the construction phase, may hinder design and construction innovations for complex ATMS projects. Design-bid-build strategy may also impact the deployment schedule, because separation of design and construction activities may prolong implementation.

Another option available to Pinellas County is to leverage competitively procured vendor contracts established by other Florida government entities that have a ‘piggyback’ clause, which allow the county to directly purchase the complex elements, have them delivered to a system manager for testing, configuration, installation, and integration. Such items may include edge switches, backbone switches, encoders, etc. The more traditional control equipment, such as controllers and cabinets, could also be programmed and tested by the system manager and furnished to the contractor to install in the field. This approach will result in significant savings to the county (contractor’s equipment markup sometimes up to 30% of equipment cost). Pinellas County will benefit from considering any and all procurement strategies that help minimize deployment schedule, cost, and risks while addressing the complexity, diversity, and rapidly changing nature of ATMS technologies and operational strategies. This section presents a summary of procurement strategies available to the county for deploying advanced ATMS technologies. It is based on a procurement report, developed by the author, for the Federal Highway Administration in June 1997

4.1.1 Design-Bid-Build

Design-bid-build is a procurement strategy that uses two independent and sequential contracts to develop and deploy a project. The first contract retains the services of an engineering consulting firm to develop plans, specifications, and engineer’s estimate (PS&E) awarded on the basis of qualification-based selection, followed by competitive negotiations. Using the plans and specifications, contractors are invited to submit bids. The second contract retains the services of a contractor to construct the project awarded to the responsive and responsible bidder with the lowest submitted bid.

The consultants and contractors can be prequalified to ensure consideration is given to firms that possess the required skills, familiarity, and experience for designing or constructing the project. Contractor’s prequalification may be based on work experience, personnel, equipment, financial resources, and performance history. For consultants, selection may be based on technical experience, ability to perform the work, staff capability, project approach, and level of efforts on tasks. The benefits associated with this feature include:

- ❑ Enhances potential for quality project
- ❑ Increases the likelihood of selecting a qualified contractor while using a competitive bidding process, especially for technical and complex projects
- ❑ Can prequalify prime and subcontractors
- ❑ Requires agency to identify specific skills and experience desired from firms and individuals to complete specific tasks
- ❑ Optimizes proposal review process.

Design-bid-build strategy has traditionally been used for designing and implementing construction projects. This strategy can effectively be used to deploy physical ATMS components including field devices, communications infrastructure (fiber optic cable, conduit system, pull boxes, etc.), foundations, and structures. It may not be best suited for ATMS projects that encompass rapidly-changing technologies, software development, computer hardware, system integration, and system configuration. Since these items cannot be effectively demarcated between design and construction services, use of this strategy would be counterproductive to establishing PS&Es that could result in realistic low bids and selection of contractors capable of performing all required services.
The typical characteristics of ATMS projects that are suited for design-bid-build strategy include

constructing the traffic management center building; deploying off-the-shelf ATMS subsystems, devices, communications infrastructure, foundations, and structures; and expanding legacy systems using previously implemented PS&Es. Some of the potential benefits and drawbacks associated with this procurement strategy are presented in Table 4-1.

Table 4-1: Benefits and Drawbacks of Design-Bid-Build

Benefits	Drawbacks
❑ Competition ❑ Well-known, traditional method for transportation agencies, designers, and contractors ❑ Larger universe of potential bidders ❑ Simple process ❑ No requirements for justifying use of this technique	❑ Less flexibility in procuring advanced or rapidly changing technologies since system components, detailed integration requirements, and specifications may not be easily definable ❑ More contract administration challenges caused by dissimilar work between the prime contractor and subcontractors ❑ Difficulty in preparing project estimates or establishing life cycle costs for ATMS projects involving unknown factors, complex systems, and rapidly changing technologies ❑ Lack of ATMS experience and expertise by consultants and contractors who are otherwise familiar with traditional construction projects

4.1.2 Design-Build

Design-build is a procurement strategy in which the design and construction services are provided by one entity under one contract. Design-build strategy combines the procurement procedures used in the traditional engineering and design services contracts with those used in the traditional construction contracts, and thus embodies characteristics of both. The procedures may include pre-qualification, competitive sealed bidding, and award criteria that encompass other factors in addition to price. Design-build is instrumental in overcoming some of the challenges of the traditional contracting techniques, including:

- ❑ Specifying detailed project requirements at the project onset
- ❑ Establishing realistic low bids
- ❑ Finding vendors capable of performing all required services at a fixed price
- ❑ Minimizing deployment schedule.

The design-build strategy is best suited for ATMS projects that:

- ❑ Can best be defined by functional or performance-based specifications
- ❑ Benefit from innovations in design and construction solutions
- ❑ Involve unknown and indefinable factors and rapidly-changing advanced technologies
- ❑ Contain complex systems/subsystems requiring significant integration efforts
- ❑ Require streamlined deployment schedules to address emergencies and traffic safety or minimize road user impact/cost associated with a prolonged deployment process.

Project specifications and design criteria need to be properly defined to obtain optimum results. If functional specifications are too detailed, the opportunity for innovation may be reduced. Conversely, if functional specifications are too vague, a different technical solution may emerge or contractors may submit high cost proposals to provide for contingencies and risk management. The key is to provide maximum flexibility for innovation in design and construction activities to reap the benefits of design-build projects.

The transportation agency typically develops a Request for Proposal document that includes scope of work, detailed or functional specifications, design criteria, and preliminary plans – which may be as much as 30% complete. The contract documents are used by prospective bidders to develop and submit proposals for designing and constructing the project. The proposals are typically ranked on such factors as design quality, timeliness, management capability, and cost. Contract awards are typically based on cost and other factors that maintain the element of competition. Though there is no prescribed method, (other than cost being a factor for defining the award criteria), design-build contracts have been awarded based on:

- ❑ Highest composite score based on weighted criteria for cost and quality factors
- ❑ Adjusted bid score computed by dividing price by the qualification score
- ❑ Best value-fixed budget, where the available funds are advertised and best value designs are invited
- ❑ Best value, price, and other factors
- ❑ Lowest bidder who meets criteria.

A single contract is awarded based on the specified award method to a design-build team who will be responsible for system engineering, design, and specifications; procurement and provision of all products, systems, and services; construction of all system elements; testing, inspection, and integration of various subsystems; application of quality control measures; and final system deployment.

The decision to proceed with the design-build strategy requires upfront analysis and evaluation of applicable local procurement regulations. The absence of enabling legislation may preclude some agencies from using this technique. The selection of the design-build strategy also requires the transportation agency to undertake several key actions, including:

- ❑ Developing an informed vision of the completed project, including how it will be operated and maintained after the deployment phase is completed. This vision will affect equipment selection, control facility layouts, and the feasibility of the overall project in meeting the expectations of the agency.
- ❑ Considering who will operate and maintain the system over its expected lifetime. A decision to use agency resources to operate and maintain the system may result in different equipment selections and system configurations than a system expected to be operated and maintained by outside subcontractors. The agency should consider these costs on a life-cycle basis and ensure that they are communicated clearly to the design team.
- ❑ Examining many issues related to the expected evolution of the system, which should be clarified before system design is started. The geographical layout of system expansions, expected frequency of equipment upgrades, and availability of funding for future system enhancements may all drive the selection of equipment during design.

Some of the potential benefits and drawbacks associated with this procurement strategy are presented in Table 4-2.

Table 4-2: Benefits and Drawbacks of Design-Build

Benefits	Drawbacks
❑ Provides maximum flexibility for innovation in the selection of complementary design and construction techniques and result in efficiencies from optimizing project development and deployment ❑ Minimizes implementation timeline, since construction activities can be initiated prior to finalizing all design details, thus allowing seamless transition from design to construction ❑ Results in project development and deployment consistency, continuity, and overall quality assurance throughout the project due to a single point of responsibility for design, construction, integration, testing, and start-up operation of the project ❑ Enables the contractor to optimize work force and equipment use ❑ Shifts risks to the contractor for design related issues within the confinements of project budget ❑ Reduces the potential for contractor claims for design errors or construction delays due to redesign	❑ Requires well-defined and articulated functional or performance-based specifications ❑ May place smaller construction and design companies at a competitive disadvantage since design-build projects usually require large up front investment of time and funds for preparing detailed proposals without compensation ❑ Potential for misapplication or overuse of this technique due to the assumption that it may be easier than the traditional techniques ❑ Burdens the contractor with greater responsibility associated with increased innovation flexibility ❑ May require the contractor to meet extended bonding, liability insurance, or warranty provisions as the transportation agency strives to protect project quality and performance ❑ The typical highway design and construction firms may have difficulty bidding on design-build projects due to the overlapping skills and work experiences requirement applicable to system design, integration, and construction ❑ May increase the potential for contract award protests ❑ Shifts greater risks to the contractor for unforeseen factors and project issues that should be resolved prior to contract award (e.g., right-of-way)

4.1.3 System Manager-System Integrator

The system manager-system integrator (SM-SI) is a procurement strategy in which a consultant performs or oversees the performance of all system/project engineering, design, interface, integration, and configuration functions (under engineering and design services contracts), while one or more contractors perform all related construction activities (under construction contracts). The SM-SI strategy combines design and selected implementation components such as testing, integration, configuration, and procurement support under one contract. The implementation components, however, are generally considered incidental to the total work effort. The services of SM-SI are typically governed by the engineering and design services contracts established between the agency and consultant, and are procured on the basis of qualifications-based selection followed by competitive negotiations.

The SM-SI strategy is sometimes misunderstood. It is also referred to as ‘system manager’ or ‘system integrator’ depending on how scope of work reflects consultant’s limited or expanded role in system testing, integration, and configuration activities. The SM-SI strategy incorporates characteristics of both design-bid-build and design-build strategies and uses separate contracts for engineering and design and construction services (similar to design-bid-build). However, it maintains a single point of authority for system *design, testing, integration, and configuration* (similar to design-build) while retaining control and management authority of the agency.

The transportation agency uses the PS&Es and issues multiple contracts to construct or install various subsystems of the project following the typical process of bid invitation, review, and award. Examples include construction of the traffic management center, construction of support structures, installation of computer hardware, installation of communications media and hubs, as well as installation of field devices (electronic devices, vehicle detectors, surveillance cameras, dynamic message signs, and controllers). The agency maintains direct management, administration, and control authority over the contractors, and may use its own procurement processes to acquire individual products and systems or require the contractors to furnish and install them. Some of the potential benefits and drawbacks associated with this procurement strategy are presented in Table 4-3.

Table 4-3: Benefits and Drawbacks of System Manager-System Integrator

Benefits	Drawbacks
❑ Provides expertise or staff resources that the agency may lack ❑ Single point of authority and accountability for system design, software development, and system integration activities that could enhance the potential for seamless system integration, design continuity, and cost effectiveness ❑ May reduce implementation timeframe by allowing the designed project components or sub-projects to be deployed prior to 100% design completion ❑ Reduces the likelihood for design-related contractor claims ❑ Optimizes design, coordination, and integration efforts, as well as use of advanced field device, software, and hardware technologies ❑ Offers the agency more flexibility than the design-build technique due to negotiated engineering agreement, which allows joint determination of the scope of work, duties and responsibilities, costs, and system requirements ❑ Allows the transportation agency to maintain authority for project control and management ❑ Facilitates identification of sources and causes of system incompatibility issues that are the basis for change order process	❑ May result in increased project cost ❑ System manager may not have control of construction contracts ❑ Potential perception by consulting firms that engineering and design work opportunities are not distributed uniformly ❑ Traditional system managers may be relatively unfamiliar with transportation projects ❑ Potential for design errors and omissions if the systems manager inspects its own design ❑ Requires quality project oversight and management by agency to minimize change orders for design errors and omissions

The responsibilities of a SM-SI overlap both design and construction phases of the project and are frequently defined, on a task order basis, under negotiated cost-plus-fixed-fee contracts, including:

- ❑ Development of proper sequencing and coordination of the various subsystems
- ❑ Design and preparation of PS&Es
- ❑ Hardware configuration analysis and design including system architecture, interfaces, communications, equipment, devices, and computers
- ❑ Software design and development (if applicable)
- ❑ Procurement support for all equipment and devices including software dependent hardware
- ❑ Inspection, acceptance testing, and integration of various subsystems (devices, equipment, and hardware installed by contractors) into a total operating system

- Technical support during project procurement and management phases
- Timing and operations plans development
- Training
- Documentation.

4.1.4 Procurement Considerations

Deployment of ATMS projects need not follow an either-or approach in the choice of project procurement strategies. The critical element is to maintain a creative, innovative, and flexible approach for identifying optimum packaging of project requirements into various component projects to be deployed sequentially or concurrently over time. Component interrelationships and system integration requirements must be considered when effectively packaging project elements into one or more component projects. The component projects are procured using the most appropriate strategy – one that will optimize project quality, deployment schedule, and cost. Logical and creative packaging of project elements into one or more component projects and selecting appropriate procurement strategies are critical for success. For example, an ATMS project may involve such elements as:

- Products – ATC Type 2070, controller cabinets, video image detection system, CCTV cameras, dynamic message signs, surge protection system, uninterrupted power supply, LED indications for signal and pedestrian indications, communication equipment (edge, hub, and core switches), encoders, terminal servers, decoders, communications infrastructure (conduits, pull boxes, and cabling), foundations, poles and structures, hardware, software, etc.
- Systems – Central control system; local controller software; adaptive control software; incident detection, verification, and response systems; emergency dispatch systems
- Facilities – Traffic management building, climate-controlled communications hubs
- Services – Architectural, surveying, mapping, engineering, design, construction, construction management, construction engineering and inspection; software development, system testing, system integration, and system configuration.

These elements may be packaged in a variety of ways. Each product or system can be designed and implemented independently of the others. Many of the physical installations may be designed and constructed using the design-bid-build technique or included as part of roadway construction/re-construction projects. If system integration is a critical component of an ATMS project (e.g., new systems encompassing significant interface requirements to other systems, software development, and computer hardware), the systems manager can represent the agency's interests in design of the overall system and associated components. This will ensure seamless integration of system components while allowing project deployment by other contractors under the auspices of the transportation agency. The design-build technique may be appropriate if the implementation schedule is significantly constrained and/or the project is very complex. A variety of opportunities exist for mixing and matching packaging options and procurement strategies:

- Prequalification feature can be used to complement each procurement strategy

- ❑ System manager may be used for design, testing, integration, and configuration applicable to communications, devices, and subsystems, while associated components are deployed using design-bid-build or design-build techniques
- ❑ Definable physical components such as communications infrastructure, foundations, poles and structures, and cabling may be included in planned roadway construction and reconstruction projects or deployed as stand-alone projects using design-bid-build procurement strategy
- ❑ Transportation management facility, shell for the traffic management center, and climate-controlled communications hubs may be procured as standalone projects and deployed using design-bid-build or design-build procurement strategies
- ❑ If design-bid-build strategy is used, it may be augmented by SM-SI strategy for ensuring that facility design considers and accommodates functional, spatial, and systems requirements
- ❑ Design and implementation of electronic elements and software housed within the traffic management center may be procured through SM-SI strategy
- ❑ Component projects may be developed by consulting firms using engineering/design services contracts or in-house staff, especially after a few years of deployment experience
- ❑ Engineering and design services may be used to develop functional requirements and specifications that are used to deploy the project using the design-build procurement strategy.

The key elements for the county's ATMS program success include maintaining a flexible approach in packaging ATMS components into component projects, choosing the most effective procurement strategy for each component project, and providing quality and competent project administration, management, and inspection – regardless of the choice of procurement strategy.

4.2 PROGRAM SUPPORT

This section on program support considers a variety of topics for building a strong and viable ATMS program within Pinellas County. Issues discussed in the following subsections include institutional strengthening within the organization and reaching out to others in the spirit of coordination and cooperation. In addition, there are discussions on issues related to innovative funding sources that will be needed to promote the Pinellas County program. Staffing and organization of the ATMS operations and maintenance structure are also discussed. Finally, the issue of training is explored.

4.2.1 Institutional Strengthening

The success of the county's ATMS program will ultimately rest with the willingness and capacity of program stakeholders to collect, share, and apply the needed transportation and travel data in a sustainable manner over time. To accomplish this, there is a critical need to develop and institutionalize procedures, coordination, and processes for collecting, updating, sharing, and applying video and data to attain and maintain improved traffic management and operations.

Institutional strengthening is oftentimes viewed as the process of bringing together the resources of an agency to fulfill its mission. This means that the ATMS mission statement must fit within the overall mission of the county and other program stakeholders. This mission should be supported by a vision statement, goals, and objectives that relate to the services anticipated to be delivered by the ATMS program and its subsystems. These concepts should be clearly articulated and adopted by the ATMS program stakeholders. The purpose and concept for the overall ATMS program should also be communicated to other agencies and constituencies so as to manage expectations and forge strategic regional partnerships. Other institutional strengthening issues to consider include:

- ❑ Ensure adequate staffing levels, budgets, and resources
- ❑ Maintain qualified personnel
- ❑ Articulate a forward looking vision
- ❑ Address technological evolution and obsolescence
- ❑ Offer training initiatives
- ❑ Create a positive work environment
- ❑ Perform work flow and productivity studies (business process reengineering) to proactively identify and address needs and requirements – organizationally and procedurally.

Essentially, institutional strengthening is looking within the stakeholder organizations and creating a positive and proactive environment focused on improving traffic safety and reducing traffic congestion within the Pinellas County transportation network and adjoining jurisdictions.

4.2.2 Coordination and Cooperation

Reaching out beyond the agency in the spirit of coordination and cooperation with others will be an essential goal for the success of the Pinellas County transportation management system. There are a variety of partners within the region that could benefit from cooperative partnering with the county. Potential system partners include:

- ❑ Municipalities within the county
- ❑ Neighboring counties
- ❑ Surrounding counties
- ❑ Florida Department of Transportation
- ❑ Regional transit authorities
- ❑ Law enforcement at both State and local levels
- ❑ Emergency response providers
- ❑ Information service providers within the region
- ❑ Medial services
- ❑ Regional colleges and universities
- ❑ Regional towing services
- ❑ Major employers within the region.

Coordination and cooperation can take on many forms – from sharing information and video to holistic approach for regional traffic management especially during major regional emergencies. Examples include the ability to provide traffic signal coordination across jurisdictional boundaries, sharing of video images collected from CCTV and VIDS cameras, sharing of incident management information and response plans, and providing assistance during emergency situations and regional evacuations.

Relationships with each potential partner should be individually cultivated and nurtured to the benefit of both parties involved. Pinellas County should continue to strengthen its relationships with agencies with whom formal relationships already exist at other levels, including partners in the Pinellas County Metropolitan Planning Organization such as City of Clearwater, City of St. Petersburg, Pinellas Suncoast Transit Authority (PSTA), Florida Department of Transportation, Emergency Services, Law Enforcement Services, etc. Concurrently, the county should forge new partnerships with other regional partners including Hillsborough County, Pasco County, the media, etc.

It is particularly important for the county to facilitate coordination and cooperation with the media. Interacting with the media can sometimes be seen as a difficult proposition to which few agency personnel are accustomed. Positive interaction with the media can greatly benefit the Pinellas County ATMS program. The prominence of Pinellas County as a significant regional transportation partner and the positive value added by cooperative relationship with local media make it important that the ATMS program continue its investment in public relations, public education, coordination, and cooperation on a regional scale. This signifies that the Primary Control Center should provide for the needed connectivity for video transfer (possibly even a dedicated media broadcast), facilities for providing tours and outreach, and facilities to educate and serve the professional transportation community. Building public awareness of Pinellas County's efforts to alleviate traffic congestion countywide will pay significant dividends over time.

4.2.3 Funding

The primary funding source to fuel the county's ATMS program is the Pinellas County Ninth-Cent Fuel Tax levied (Ordinance 06-29) effective January 1, 2007 to continue for a period of 20 years through December 31, 2026. This funding source is designated exclusively for transportation expenditures involving design, construction, improvement, operation, and maintenance of a countywide traffic management system under county control. The funding is intended to achieve most efficient operations of specified arterial streets and other major thoroughfares across municipal boundaries under Unified Control encompassing unincorporated areas of Pinellas County and jurisdictions that enter into a countywide Unified Traffic Control Interlocal Agreement with the county. It is estimates that approximately $3.8 million in funding will become available for ATMS investments countywide annually.

There are other funding sources that need to be explored by the county to augment its Ninth-Cent Fuel Tax. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) authorized the Federal surface transportation programs for highways, highway safety, and transit for the 5-year period 2005-2009 and provided for various federal funding categories that could have been used for ATMS development, operations, and maintenance. While a new Act must make its way through Congress for 2010-20014 funding period, the basic funding categories are not expected to change dramatically. The federal funding categories typically used for ATMS include:

- ❑ *National Highway System Funds (NHS)* – The National Highway System consists of rural and urban roads serving major population centers, international border crossings, intermodal transportation facilities, and major travel destinations. The system includes the Interstate Highway System, other urban and rural principal arterials, highways that provide motor vehicle access between the NHS and major intermodal transportation facilities, the defense strategic highway network, and strategic highway network connectors. This funding category is typically used for large capital improvements. However, it should be noted that infrastructure-based intelligent transportation systems capital improvements are eligible for NHS funds (although NHS funds are typically viewed as the most difficult to obtain for ITS use).

- *Surface Transportation Program (STP)* – Controlled by the Pinellas County MPO, STP provides flexible funding that may be used by States and localities for projects on any Federal-aid highway, including the NHS, along with other specific bridge and transit related facilities. A portion of the STP funds may also be used in rural areas on rural minor collectors. STP funding can also be used to fund operations of ATMS facilities. STP funds are typically viewed as the easiest funding source for ATMS applications.
- *Congestion Mitigation and Air Quality (CMAQ)* – The CMAQ program is designed to fund projects and programs in nonattainment and maintenance areas that reduce transportation-related emissions. In December 2002, the Florida Department of Environmental Protection Division of Air Resource Management developed the Air Quality Maintenance Plan (2005-2015) for Pinellas and Hillsborough Counties. This Air Quality Maintenance Plan indicates that Pinellas County was reclassified from marginal nonattainment to attainment on February 6, 1996, when the original maintenance plan was approved by the Environmental Protection Agency. Since that time, the Tampa Bay region has taken steps to maintain its attainment status. Since Pinellas County is part of the air quality maintenance area, CMAQ funding will no longer be available as a funding source for ATMS.

The use of federal funding sources will require that projects be identified in the Pinellas County MPO, Long Range Transportation Plan Priorities, and the Transportation Improvement Program before being funded. These projects will have to compete for funding with other projects in the region. In addition to the federal funding sources, Pinellas County might consider a variety of other innovative funding methods, such as:

- Barter Exchange – Oftentimes agencies are faced with a need to accommodate media or other traffic information outlets with connections to central system facilities (video, data, etc.). Selling data rights or charging recurring fees is an alternative for generating revenue, however, such fees typically are placed in a general revenue account for the agency and the transportation department rarely has the opportunity to use these funds to augment its operations or infrastructure improvements. The barter exchange mechanism would require the media or other traffic information outlet to fund infrastructure development to accommodate the connection needs. In return for this infrastructure, the agency would grant access rights to certain video or data for a specific period of time.
- Selling Data Rights – Similar to the process mentioned in Barter Exchange, the selling of data rights can provide an ongoing revenue stream for ATMS. Selling data rights or charging recurring fees for video streams and data access can be methods for generating revenue. Unfortunately, many transportation departments

cannot directly access these funds because the associated revenues are deposited directly into general revenue accounts.

- Impact Fees – Many agencies charge transportation impact fees that contribute revenue toward the construction of transportation facilities built to benefit the impact area or region. ATMS projects may also be funded in a similar fashion through the use of impact fees for the area or region to benefit from the system deployment. To reasonably apply impact fees for ATMS facilities, the benefits of such facilities must be substantiated in a land-development setting.
- System Leases – Opportunities exist with large construction companies and large systems development companies for funding implementation of a traffic management system and leasing the system to an agency for a designated period of time. Staff leasing for operations and maintenance activities is also possible under this scenario.

4.2.4 Staffing

Staffing is one of the most difficult aspects of planning for ATMS. Inevitably, the county's existing staff will need to take on new responsibilities and new staff members will need to be added for proactive system operations and management. Qualified and well trained staff members who are eager to participate in the success of the new system are essential to the long-term success of the county's ATMS program. Meaningful career paths, coupled with clear job descriptions and competitive wages, are required investments for attracting and keeping qualified staff members.

The following list provides an overview of roles and responsibilities for operating and managing the county's ATMS system elements:

- System Operators – operate the system, respond to complaints, and interact with the public. Knowledge of system operations, system software and equipment capabilities, and traffic operations theory is required. System operators should also be personable and communicative.
- Communications Maintenance – troubleshoots and maintains communications equipment and infrastructure. Knowledge of communications, electronics, fiber-optics, and fiber-optic cable splicing is essential in this area, as well as knowledge of common communications infrastructure elements.
- CCTV Camera Maintenance – troubleshoots and maintains the CCTV camera subsystem. Knowledge of cameras, camera control equipment, and video switching equipment is required.
- DMS Maintenance – troubleshoots and maintains DMS, DTB, and Blankout signs and associated equipment. Knowledge of electronic signs and control equipment is required.
- Information Technology – provides ongoing maintenance and operations support for Primary Control Center equipment. Knowledge of systems, databases, computers, video displays, video switches, and communications equipment is required.
- Public Affairs – provides liaison and outreach through media and other official communications channels, along with marketing the ATMS system to others. An

expressive personality with skills in public speaking, writing, and reporting are essential.

The number of staff members required for these new roles and responsibilities will vary depending on details of concept of operations. For instance, what are the operating hours of the Primary Control Center? What will be the make up of the communications infrastructure and associated equipment? To what extent can staff from other program stakeholders be leveraged in day-to-day operations and management of the ATMS system? Each of these questions, and many others, will need to be answered as system design unfolds over time. Meanwhile, for planning purposes, the estimates shown in Table 4-4 might be considered.

Table 4-4: Estimated New Staff Allocations

Role	Estimated Number of Positions
System Operators	3 per shift
Operations Supervisor	1 per shift
Communications Maintenance	5
Communications Maintenance Supervisor	1
CCTV Camera Maintenance	2
DMS Maintenance	2
Information Technology	3
Public Affairs	2
Note: These estimates are made for planning purposes only. The actual number of positions will vary depending on specific system design criteria and operational needs of Pinellas County as determined its concept of operations (COO). COO explicitly describes interactions and the day-to-day use of the system including operational issues, staffing, organizational structure, facility requirements, education and training, information and control sharing, decision making hierarchy, system configuration, information content, user interfaces, and pertinent system parameters. These estimates are based on information gathered in *Metropolitan Transportation Center Concepts of Operations – Cross Cutting Study*, dated October 1999, *Traffic Control System Operations – Installation, Management and Maintenance,* published by the Institute of Transportation Engineers in 2000, and experience gained through working with systems in regions similar in size to Pinellas County.	

In addition to the specified roles and responsibilities for operating and maintaining the ATMS system, Pinellas County needs to assess the adequacy of existing staffing levels for maintaining and operating its legacy control system. The signal maintenance technicians are likely to assume elevated responsibility for maintaining advanced controller and associated cabinets as well as other equipment housed within the controller cabinets such as adaptive traffic control, Ethernet switches, VIDS, UPS controller, batteries, etc. *Traffic Control System Operations – Installation, Management and Maintenance,* published by the Institute of Transportation Engineers (ITE) in 2000, suggests one technician is needed for every 25 fully actuated traffic signals. The introduction of the aforementioned advanced technologies will require more technicians to effectively maintain and operate the envisioned control system. With a projected installed base of 800 intersections, approximately 32 signal technicians will be needed to conduct response maintenance, preventative maintenance, design modifications, as well as perform system calibration for optimized traffic operations. Based upon ITE recommendations, additional staff will be needed to effectively support operations, management, and maintenance of ATMS elements including smart traffic signal systems.

Considering that hiring and retaining qualified personnel has been a challenge in the ATMS environment nationwide, Pinellas County should investigate the possibility of training existing personnel to assume new roles and duties required by the new system or outsourcing related support functions. Logically, it is not possible to reclassify personnel for every position, but eager and willing candidates may be available within the organization who would welcome the challenge of a new position. For additional staffing needs, a local talent pool may need to be developed through area colleges and technical schools. Outsourcing some job functions may also be necessary, depending on resource availability. Continuing to leverage the county's Information Technology staff to support ATMS network and associated equipment will also be prudent as a cost-effective extension of the county's existing base of resources. Overall, staffing requirements should be a critically important but evolving exercise that should be considered proactively as additional corridors are instrumented with advanced technologies and operational strategies.

4.2.5 Operations and Maintenance Structure

A common problem faced by many organizations is a lack of close coordination between their operations and maintenance groups. Coordination issues between these organizational groups can be exacerbated when new systems are implemented, especially if they are physically separated within an organization. In addition, a fragmented organization may easily lose sight of operational priorities or overall system goals and objectives. Experience has shown that when operations and maintenance functions and personnel are grouped under a single organizational entity (department or division), system operations, management, and maintenance are streamlined resulting in exponential synergistic benefits measured in improved service delivery, reduced support costs, and enhanced traffic operations. The county should consider consolidating system management and operations under the Primary Control Center to streamline operations and management activities. To this end, Pinellas County should carefully explore the feasibility of consolidating ATMS and traffic signal staff within a combined organizational structure. As the Pinellas County ATMS elements are deployed, efforts should be made to create a cohesive organizational structure that unifies or at least facilitates interaction among all staff groups that support planning, design, procurement, implementation, operations, maintenance, management, and assessment of the overall ATMS system and associated components including traffic signals.

4.2.6 Training

Training is also an essential element in the success of ATMS. Not only should training occur on delivered devices and subsystem components, but training should occur throughout the planning and design process. Training should be provided throughout project phases to professional staff, technicians, system planners, system designers and integrators, and system partners. All too often, a few hours of training provided upon the delivery of a device or subsystem component are followed by a considerable time lag before it is placed into service. By the time the device or subsystem component is deployed, the funding allocation for training has been depleted and the opportunity for additional training is lost. Successful system deployment cannot occur unless training is viewed as an ongoing process, allowing all involved participants to feel engaged in system deployment to develop a keen and thorough understanding of system elements.

All system deliverables should include a training component. Routine training programs should be established to provide periodic updates on technologies that are being considered for use in the system. As designs take shape, the training should become more specific. At a minimum, training should be planned for delivery and implementation phases – although additional training should be considered for more complex devices and subsystem components.

The timing of training is also important. Detailed training to all staff personnel too early might be of limited value. Initially, detailed training should be provided to staff members who will immediately be involved in testing and evaluation activities. The training program should show a gradual increase in complexity, with detailed training occurring in a timeframe that coincides with general use of the component for which training is being targeted.

Training programs should include both a theoretical overview and 'hands-on' exercises. Further, the training programs should be structured for the intended audience. Successful training programs are structured such that a theoretical overview occurs at the beginning and more detail is added as the program progresses. For example, training on a sensor product should first include a theoretical overview of the capabilities of the product, how it can be used, where it can be used, deployment issues, etc. This overview portion should be geared to an audience of both staff professionals and technicians. Subsequently, as the session progresses, more detail is added for product installation details, operation, troubleshooting, and maintenance. With this approach, some participants may not need detailed training, depending on how such training applies to their job functions. For example, a system designer would benefit from the overview portion of the training, but the detailed operations and maintenance aspects of the training session would have less bearing on his or her job functions. Overall, training is a critical component in systems deployment. Sufficient time should be allocated for training throughout the various phases of system planning, design, and deployment to ensure that staff is ready and capable of utilizing the completed system to its fullest extent.

4.3 PROGRAM PROCEDURES

This section focuses on issues related to design, operations and management, and construction management. Discussions are also provided on the topics of system integration, system configuration and testing, and system start-up.

4.3.1 Design

Agencies rarely have the resources and contractors rarely have the means to provide for a complete and comprehensive single stage system deployment. As such, system design should evolve in an incremental fashion while maintaining consistency with the overall system deployment. For instance, one design stage may consist of backbone communications infrastructure, while another may consider the ATMS devices, cabinets, end communications equipment, infrastructures, and structures. Other design stages may target a series of corridor-based infrastructure upgrade projects**.** Table 4-5 presents the typical issues involved in migration approaches for design and implementation.

While the incremental approach to system deployment works quite well, there is a down side. Who is responsible for making the end-to-end system work? Ultimately, this should be the job of the system manager. However, the system manager needs to play an integral role throughout the life of project deployment to ensure proper designs and specifications are created, proper devices and subsystem components are delivered, and proper installation techniques are used in deployment. In essence, the system manager needs to take on a visible and proactive role throughout the life of the project. Clearly, the role of the system manager must be established in the project planning phases and well in advance of the system design to ensure that sufficient design review and feedback is permitted.

Table 4-5: Migration Approaches for Design and Implementation

Single Stage Approach		Incremental Approach	
Pros	**Cons**	**Pros**	**Cons**
❑ Easy planning, design, and implementation	❑ Expensive ❑ Increases deployment risk attributed to lost opportunity to incorporate lessons learned in incremental implementation approach ❑ Long system downtime	❑ Plan systems upgrades as funding becomes available ❑ System downtime practically invisible to motorists ❑ Cost effective ❑ Minimizes risk ❑ New system brought online as communications infrastructure is installed	❑ Requires sound migration planning ❑ Requires responsible system manager ❑ Requires operation of both existing and new system during migration
Note: This table provides a sampling of the pros and cons for the typical migration approaches for ATMS design and implementation.			

Regardless of whether construction contracts are led in an incremental fashion or as a complete system, the design approach should follow along the lines of major system components similar to an incremental deployment. The reason for this is simple: Entrust the design of individual components to experts in their respective fields. For example, a communications system designer should lead the design effort for the communications backbone; an architect should lead the design effort for the Primary Control Center and its interior facilities. Designers with traffic systems expertise should lead the design efforts for a series of corridor-based infrastructure upgrade projects, as well as the development of specifications needed for software enhancements.

The communications backbone of the project is relatively easy to define. However, the development of design packages for local infrastructure often requires more consideration. A recommended approach is to designate operational corridors of the Pinellas County, based on priority order, as unique 'design corridors.' Plans and specifications would be developed for the 'design corridor' as if it were going to be a unique construction project. With this approach, if the decision is made to combine all of the 'design corridors' into a single comprehensive project, minimal work would be required to combine the design packages. Each 'design corridor' would include all construction related items required between the communications hub and the local intersections. Such work would consist of local communications infrastructure, cabinet and controller upgrades, and installation of VIDS, CCTV camera equipment, DMS, and any other required local infrastructure packaged logically for deployment under a multitude of implementation stages.

As previously mentioned, the responsibility for end-to-end systems functionality (e.g., system manager) needs to be clearly assigned. Those with the responsibility for making the entire system work should also have the authority to review design documents, review and test devices and subsystems, and monitor the construction processes to ensure that the system is capable of meeting the needs of Pinellas County, while addressing issues as they arise along the way. Additionally, there are a variety of design criteria that must be adopted that will be complementary to recommendations of this study:

- Primary Control Center space needs
- Co-located partners at the Primary Control Center
- Co-location of the Pinellas County ATMS program elements (planning, design, construction/inspection, operations, and maintenance)
- Operator productivity at workstations
- Dedicated media space in the Primary Control Center
- Security of the Primary Control Center and communications network infrastructure
- UPS systems at the Primary Control Center, field communications hubs, and local intersections
- Communications network latency
- Communications network capacity
- Communications network data rates
- Communications protocols
- Number of field devices per copper-based communications channel if used
- Local communications infrastructure design to allow for the addition of new devices on a local loop
- Information transfer needs of the local traffic signal controller
- Detector placement for adaptive traffic control, incident management, and collection of data and measures of effectiveness
- DMS placement at strategic decision points
- Visibility of DMS displays via CCTV camera system
- CCTV camera placement and viewing angles for adequate intersection surveillance
- Methods of procurement and specifications needs for field devices
- Methods of procurement and specifications needs for communications equipment
- Methods of procurement and specifications needs for Primary Control Center equipment
- Methods of procurement and specifications needs for Primary Control Center facilities.

The above list provides an overview of a few of the major issues that must be considered during the Pinellas County system design process.

4.3.2 Operations and Management

A new system brings about the need for changes in operations and management procedures. The access to additional or improved information can significantly aid operations personnel, allowing them to become more efficient in conducting their daily activities. Improved access can greatly assist the system operators and traffic engineers by allowing them to handle a variety of traffic issues remotely – directly from the Primary Control Center. Overall, it is important that new procedures be documented for use as a resource to existing personnel and training materials for new personnel. Pinellas County should engage in the development of a set of operational guides and procedures manuals as part of system deployment. Documentation should include, at a minimum:

- ❑ Standard Operating Procedures – prescribes the standard practices and operator procedures to be used in system operations
- ❑ Systems User Guide – covers all operational aspects of the new system and provides guidance for overall operations of the system, devices, and subsystem components
- ❑ System Maintenance Guide – describes the procedures for periodic routine maintenance activities needed to keep the system in good working order
- ❑ Operations Supervisor Guide – defines the role and duties of the Operations Supervisor, along with procedures specific to that assignment
- ❑ Equipment Location Guide – documents the installed equipment types, manufacturers, serial numbers, configuration, and trouble history preferably in a automated database
- ❑ Information Directory – lists the points of contact for all personnel who might need to respond to trouble reports, maintenance activities, incidents, and emergency situations
- ❑ IP addressing schema for all applicable network elements.

Pinellas County should also seek to organize individual User Manuals and engineering designs for the system, all devices, and all subsystem components so that they may be easily located when needed for troubleshooting or for detailed operational information. It is necessary that multiple copies of these documents be obtained and cataloged in separate locations. Consideration should be given to maintaining a set of documents at the Primary Control Center as well as maintaining multiple sets, as necessary, for maintenance personnel. In addition, configuration management – a process of documenting and keeping current key information – is absolutely essential to operating and maintaining a successful transportation management system. The key to successfully operating and managing the new Pinellas County system rests in a significant understanding of the system, how it is to be operated, and how it can be maintained.

4.3.3 Construction Management

Quality construction is maximized through use of effective construction management. Monitoring construction activities through the use of Construction Engineering and Inspection (CEI) professionals, who are experienced in the types of work needed in systems deployment, can serve to reduce the burden on Pinellas County staff resources and help mitigate problems that might arise during construction phases of the ATMS program. It is essential that CEI staff be experienced in a variety of systems related work, including building and facilities construction, trenching, communications and electronic equipment implementation, traffic signal controller and roadside cabinet implementation, ATMS field device implementation, foundation construction, and other similar topics.

CEI professionals should be responsible for monitoring all aspects of infrastructure deployment to ensure that the work is performed in accordance with the project plans and specifications. CEI professionals will need to work closely with the system manager to ensure that equipment submittals adhere to the project plans and specifications. The system manager role, however, should be as reviewer and advisor to Pinellas County when working in this capacity. It is essential that CEI professionals be brought on-board with sufficient time to become familiar with project plans and specifications, prior to construction and continue to work throughout the project until system start-up is complete for all portions of the system. Likewise, it is important to maintain a contractual relationship with key contractors so that any issues arising in the later stages of system deployment can be readily addressed. CEI professionals should work as an extension of Pinellas County staff to ensure quality construction. However, the county should be the final arbiter of any disputes that might arise during the construction phase of the project.

4.3.4 System Integration

From a program procedures perspective, system integration deals with the high-level interaction between the various subsystems that make up the system as a whole. Simply stated, this means that the system needs to work seamlessly with the dynamic management system, which in turn works seamlessly with the closed circuit television system, and all of these subsystems work seamlessly with the transportation sensor systems, as well as any other subsystem components deployed. As such, efforts should be made to ensure quality system planning and design so that system integration risks are minimized.

Seamlessly working together is a term that means the operator is not required to close one application before starting another. It means that subsystem components will coexist without conflicts and competition, either on the same server platform or on the same communications network. This term should *not* be perceived as a requirement that all of the subsystem components must be from the same manufacturer, or part of the same software package.

Pinellas County has carefully considered its choices for central system software and local controller software and ensured that these products meet its needs and requirements and the various subsystem components seamlessly will work together. In addition to this critical software decision, consideration should be given to selecting a system manager or designating qualified in-house staff to perform these functions. The systems manager should assist the county in a review capacity by providing feedback on the design and construction phases of various projects within the ATMS program.

It is important to understand that system integration begins upon the first implementation and continues throughout the life of the deployment program. System integration is much more than simply connecting a multitude of wires prior to system start-up. System integration involves working with all parties involved in the project – including designers, specification writers, software developers, device manufacturers, and contractors – to create a venue for a successful transportation system deployment.

4.3.5 System Configuration

System configuration consists of populating and maintaining data in the new system. Configuration includes development of graphics for the system map and individual intersections, migration of existing system and controller databases, assignment of communications channels if applicable, establishment of sensor assignments, etc. A multitude of issues associated with system configuration are relevant to the Pinellas County ATMS program. Proper system configuration is a vital step in the successful deployment of a modern transportation system. To this end, the county should continue to seriously consider potential needs listed below and undertake the necessary steps to proactively address them to ensure program success:

- Graphics – This element is needed for the system map and individual intersections making up the system. All too often, there is a desire to use existing plan sheets or scaled drawings as the basis for the intersection graphic. Unfortunately, this does not work well in practice because the scale required for advance detector locations make the width of the travel lanes too narrow for practical use. Therefore, it is recommended that a non-scaleable graphical rendering of the intersection be produced so that detectors, signal indications, and other pertinent information can be placed on the graphic in a useful manner. These graphical renderings can be as simple or as elaborate as desired. The point is that the graphics should correctly depict the number of travel lanes and provide the operator a general idea of intersection configuration. The system map, on the other hand, should be a scaled drawing so that the operator can easily locate intersections and infer distances between and along various links of the transportation network. Graphics development is often used as a training tool so that operators can become familiar with use of the graphics development software and how the resulting images are loaded into the system. The system map, however, is typically generated by the central system software provider and is usually based on Graphical Information System data provided by a local agency – either Pinellas County or another agency responsible for generating local maps. Intersection graphics will need to be a budgeted item in the project, whether the work is outsourced or completed in-house. Intersection graphics should also be developed based upon previously mentioned incremental approach, and graphics for all of the intersections along a given communications channel or priority corridor should be completed prior to the 'cut-over' of that communications channel or corridor.
- Databases – this element is needed to populate the system and local controller information used for operations. For the system to properly operate, both the central system database and local controller database need to be properly configured. For the central system, this entails assignment of identification numbers or IP addresses to device locations, assignment of dynamic data to features within the graphics, and the like. For local intersection controllers, the database information, which governs signal timing and control parameters, is far more critical, because this information assigns right-of-way to vehicles and pedestrians traversing intersections and ensures orderly progression of traffic along operational corridors and grid networks. The databases for the traffic signal controllers should be populated and tested prior to any controller leaving the test facilities. It is typically convenient for operators to load the controller database during final testing phases so that any potential problems can be encountered and resolved in the test facility prior to field deployment. Care must be exercised to ensure that the database was properly loaded into the controller and successfully tested so that intersection down time is kept to a minimum. Migration of the existing database to a new control system is typically achieved in an automated fashion. It should be noted, however, that modern systems usually require more, or different, parameters than older systems, especially in the case of adaptive traffic control systems. Efforts should be made to verify the integrity of data transfer and addition of new information needed for proper system

functionality. To aid in the configuration of central and local databases, the county has established standardized numbering schemes for phase orientation and detectors. Such standardized numbering schemes will enable operators and technicians to become more efficient in their activities over time.

- Communication – this element is needed to establish information transfer links between central management system and local device controller. Most systems require the configuration of a communications server to facilitate the center-to-field transfer of data. These configuration parameters generally include the communications channel assignments, device addresses for equipment in the field, and communications timing parameters. The exact configuration of the communications server will depend on the needs of the system, the communications architecture, and communications protocols employed.
- Sensors – this element is needed for the collection of traffic data, measures of effectiveness, and local and strategic control detection and incident detection and management. The assignment of system detectors or adaptive detectors (strategic) is a local controller function in most cases. With sufficient planning, system or adaptive detector assignments can be documented and entered into the local controller database before the device is deployed. A system or adaptive detector plan should be developed showing the location of all proposed advanced detectors in locations ideally suited for the purpose of collecting strategic as well as incident management data. The proposed locations should be adjusted in the advanced detector plan to make the most efficient use of detector locations that can serve as system or adaptive detection as well as incident management detection. Once detectors are installed, the local controller database can be configured as appropriate. This configuration requirement and associated programming is essential regardless of the choice of detection technology.

4.3.6 System Testing

Thorough and comprehensive system testing is a key component for successful deployment of the Pinellas County ATMS program. System testing ensures that the deployed system, subsystems, and associated components perform as originally intended. Three types of testing are typically encountered in the transportation community, which collectively define the life-cycle phases of an overall testing program:

- Unit Testing – this testing phase involves bench testing of a device or subsystem component to determine whether or not it is compliant with applicable specifications or conformant with applicable standards. Failures during this phase of testing provide a clear indication that there are problems with the implementation. A device failing such a test would almost certainly not perform as intended. A subsystem component that passes such a test has less risk and a reasonable probability for performing as intended in the overall system.
- Integration Testing – this testing phase consists of connecting two or more devices, or subsystem components, together to ensure they successfully exchange data or perform as intended when combined with other components of the system. Problems typically arising in this phase of testing include different interpretations of a requirement, system incompatibility issues between two

manufacturers, and implementation of unique interfaces. The testing intent is to ensure the devices and subsystem components work well together.

- System Testing – this testing phase ensures that all devices and end communications equipment within the system are integrated together to form a complete and operational system. The focus in this testing phase is on a fully operational system performing under actual field conditions. Theoretically, once system components have successfully passed the two previous testing phases, there should be no problems during this phase. Practically speaking, however, this phase of testing can identify problems in communications infrastructure, quality of service, and a variety of other concerns that might only become apparent on-site.

An effective testing program will include all three phases of testing. To this end, a series of written test plans needs to be developed and applied to ensure devices and subsystem components meet all applicable standards and specifications and perform as desired in accordance with the county's requirements. It is essential that sufficient space and staff resources be allocated so that testing and equipment evaluations can be performed without disturbing ongoing operations and maintenance activities.

All devices or subsystem components should be subjected to unit testing upon delivery. Successful completion of unit testing will allow the device or subsystem component to migrate to the next level of testing – integration. Failures at the unit testing level should be well documented as to the cause for rejection. This process is repeated for integration testing and system testing. It is also important to note that any failure at the integration or system testing levels that requires a hardware redesign or software modification should be considered as sufficient cause for repeating all tests on that device or subsystem component.

Another testing opportunity that could pay dividends includes allocating a small deployment area for 'proof of technology' testing. In this area, the relevant technologies for the system are installed and monitored to ensure proper function. Information from this proof of technology test can also be used to quantify integration complexity and system implementation timeframe in other areas. All new technologies being considered can be installed in the test area and evaluated for use throughout the entire system. This approach will serve to further test and evaluate devices and subsystem components at the integration and systems testing levels. A successful testing program will serve to minimize risks associated with systems implementation.

4.3.7 System Start-up

System start-up is the successful end to a logical progression of work that includes the deployment of the control center facilities, communications infrastructure, local devices, software systems, along with the integration and configuration of pertinent aspects of the system. System start-up does not occur all at once. Instead, it is a gradual process of bringing various pieces of the new system online over what might be a lengthy migration period. However, for system start-up to occur, all pieces of the system need to be in place, and operational, so that end-to-end connectivity is provided for a given corridor. This signifies a successfully deployed, tested, and integrated system – involving local controllers, central management system, and all interconnecting communications components. These elements must be in place and properly functioning before system start-up can occur on that portion of the system.

The most critical part of system start-up is the development of a sound migration plan for the system. The migration plan should focus on an incremental approach to bringing individual, well defined corridors online under the new communications infrastructure. The plan should prioritize the flow of work, and should continually be modified based upon feedback from the contractors and system manager. The migration plan essentially becomes the roadmap for system start-up. Adherence to these requirements is essential as more and more operational corridors within Pinellas County are instrumented and as new technologies (e.g., adaptive control systems) are considered for deployment along operational corridors.

4.4 PROGRAM DEPLOYMENT

This section presents the county's deployment plan for the ATMS elements comprised of priority corridors, deployment strategy, deployment staging and sequence, deployment schedule, and deployment costs.

4.4.1 Priority Corridors

Disparate service areas within the county have played a significant role in differentiating the county's traffic management needs, priorities, and associated remedies. The operational needs and solutions of the county within the urbanized services areas are distinctly unique and representative of such factors as population density, development density, roadway characteristics, and land-use characteristics. The ATMS program's technologies and operational strategies are for countywide deployment to enhance control functionality and features, improve traffic operations and safety, and ensure more reliable system performance for all traffic signals countywide. Since current funding for the ATMS program is not sufficient to support deployment of a full-build scenario, a ranking process needs to be developed to geographically distribute deployment of field devices and communications network along priority corridors within the county for staged implementation.

The county's program stakeholders; through in-house considerations and validation by other studies (IDAS), have identified three deployment phases each of which are populated with ranked operational corridors that will be instrumented with ATMS elements and interconnected to Primary Control Center. This prioritization leveraged the stakeholders' intuitive understanding of the county's surface street system and synergistic operational interdependence, short-term needs and requirements, regional considerations, and relative benefits/cost ratios. These factors were considered to systematically allocate operational corridors within three deployment phases. As part of the ATMS master plan development, the prioritized operational corridors and associated deployment stages were compared with a new corridor ranking strategy. The ranking criteria allocated higher priority to corridors that suffer from high levels of traffic congestion and crashes and are currently equipped with communications infrastructure. These corridors were typically urbanized in character with frequent and closely spaced traffic signals as well as fluctuating traffic flow. In addition, the criteria reflected committed ATMS funding and availability of favorable communications infrastructure (legacy fiber cable, underground conduit systems, and twisted pair communications cabling for remote devices) to maximize return on investments. To this end, the ranking criteria for prioritizing operational corridors within the county encompassed several corridor-based variables, deemed important because they reflected the relative road user cost and ATMS program deployment cost:

- Traffic safety
- Level of congestion

- ❑ Legacy communications infrastructure available for center-to-field devices communications.

The ranking formula assigned a score and a weight to each of the three variables, which were subsequently multiplied and summed across all variables, as presented in Figure 4-1**,** to arrive at a final ranking score for each corridor. The scores and weights used in the ranking criteria are presented in Table 4-6**.**

Figure 4-1: Ranking Criteria Formula

$$OverallRanking = \sum_{p=1}^{3} S_i * W_i$$

Table 4-6: Ranking Criteria Variables and Associated Scores and Weights

Parameters (P_i)	Assigned Score (S_i)						Weights (W_i)
	1	2	3	4	5	6	
Traffic Safety (Crash Rate)	<=1	<=2	<=3	<=4	<=5	>5	0.333
Level of Congestion	A	B	C	D	E	F	0.333
ATMS Infrastructure (N=None, AC=Aerial Copper, UC=Underground Copper, C=Conduit Only, AF=Aerial Fiber, UF=Underground Fiber)	=N	=AC	=UC	=C	=AF	=UF	0.333

The list of corridors was subsequently sorted based on the final ranking score to arrive at prioritized corridors and compared with ranked operational corridors defined by program stakeholders and further refined by the IDAS study. The comparison considered relative IDAS corridor ranking by deployment phase, overall ATMS program, and composite scope computed for this study, as presented in Table 4-7. The findings indicated close proximity in operational corridors ranking among all three perspectives for corridors included in deployment phase I (shown in pale peach color. Tables 4-8 thru 4-10 present the priority operational corridors associated with each deployment phase.

Table 4-7: Priority Corridors Ranking for Deployment Phase I

Phase I Corridors

Phase	Jurisdiction	Rank 1 Per Phase	Rank 2 (B/C) Program	Rank 3 (Composite) see Factors	Roadway	Limits	
						From	To
1	CW	1-1	123-1	C-1	US 19/SR 55	Beckett Way	54th Avenue N.
1	CW	1-2	123-2	C-2	McMullen Booth/East Lake Rd.	Trinity	Gulf to Bay/SR 60
1	SP	1-3	123-3	C-3	I-275	Howard Frankland Bridge	Skyway Bridge
1	CW	1-4	123-4	C-4	Gulf to Bay/SR 60	Hillcrest Ave.	Damascus Drive
1	PC	1-5	123-5	C-9	Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line
1	PC	1-6	123-6	C-16	SR 686†	49th St.	Bryan Dairy
1	SP	1-7	123-7	C-18	Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686
1	PC	1-8	123-8	C-12	Main St./ SR 580	McMullen Booth	SR 584/Tampa Rd.
1	SP	1-9	123-9	C-14	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR 694
1	PC	1-10	123-10	C-6	Tampa Rd*	Belcher Rd.	McMullen Booth
1	PC	1-11	123-11	C-10	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd.
1	CW	1-12	123-14	C-11	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60
1	PC	1-13	123-15	C-20	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd.
1	PC	1-14	123-17	C-23	East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge
1	CW	1-15	123-18	C-8	Curlew Rd./SR 586*	Belcher Rd.	McMullen Booth
1	CW	1-16	123-19	C-17	Main St./ SR 580*	Belcher Rd.	McMullen Booth
1	PC	1-17	123-21	C-7	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.
1	PC	1-18	123-26	C-19	Countryside Blvd	Belcher Rd.	Main St.
1	SP	1-19	123-30	C-5	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275
1	PC	1-20	123-32	C-32	66th St. N./SR 693	US 19/SR 55	46th Avenue N.
1	CW	1-21	123-33	C-39	Belcher Rd.	Klosterman Rd.	Druid Rd
1	CW	1-22	123-34	C-24	Drew St.	Belcher Rd.	McMullen Booth
1	CW	1-23	123-50	C-38	Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688

Table 4-8: ATMS Deployment Phase I Corridors

Dist.	Rank	Main Corridor	Begin	End	B/C Ratio
1	1-1	US 19/SR 55	Beckett Way	54th Avenue N.	11.74
1	1-2	McMullen Booth/East Lake Rd	Trinity	Gulf to Bay/SR 60	11.74
1	1-3	I-275	Howard Frankland Bridge	Skyway Bridge	11.74
1	1-4	Gulf to Bay/SR 60	Hillcrest Ave	Damascus Drive	11.74
22	1-5	Tampa Rd/SR 584/SR 580	East Lake Rd	County Line	23.02
19	1-6	SR 686	49th St	Bryan Dairy	22.90
30	1-7	Bryan Dairy	Seminole Blvd/Alt US 19	Roosevelt/SR 686	21.33
26	1-8	Main St/ SR 580	McMullen Booth	SR 584/Tampa Rd	19.37
32	1-9	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St N/ SR 694	17.85
8	1-10	Tampa Rd	Belcher Rd	McMullen Booth	16.39
24	1-11	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd	16.18
6	1-12	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	14.65
7	1-13	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd	13.73
13	1-14	East Bay/Roosevelt/SR 686	Belcher Rd	49th St N/Bayside Bridge	11.89
9	1-15	Curlew Rd./SR 586	Belcher Rd	McMullen Booth	11.62
10	1-16	Main St./ SR 580	Belcher Rd	McMullen Booth	11.58
14	1-17	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St N	10.56
40	1-18	Countryside Blvd	Belcher Rd	Main St	10.36
15	1-19	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St N	I-275	9.52
4	1-20	66th St. N./SR 693	US 19/SR 55	54th Street	9.03
2	1-21	Belcher Rd	Klosterman Rd	Druid Rd	8.97
12	1-22	Drew St	Belcher Rd	McMullen Booth	8.93
3	1-23	Belcher Rd	Druid Rd	Ulmerton Rd/SR 688	5.92

Table 4-9: ATMS Deployment Phase II Corridors

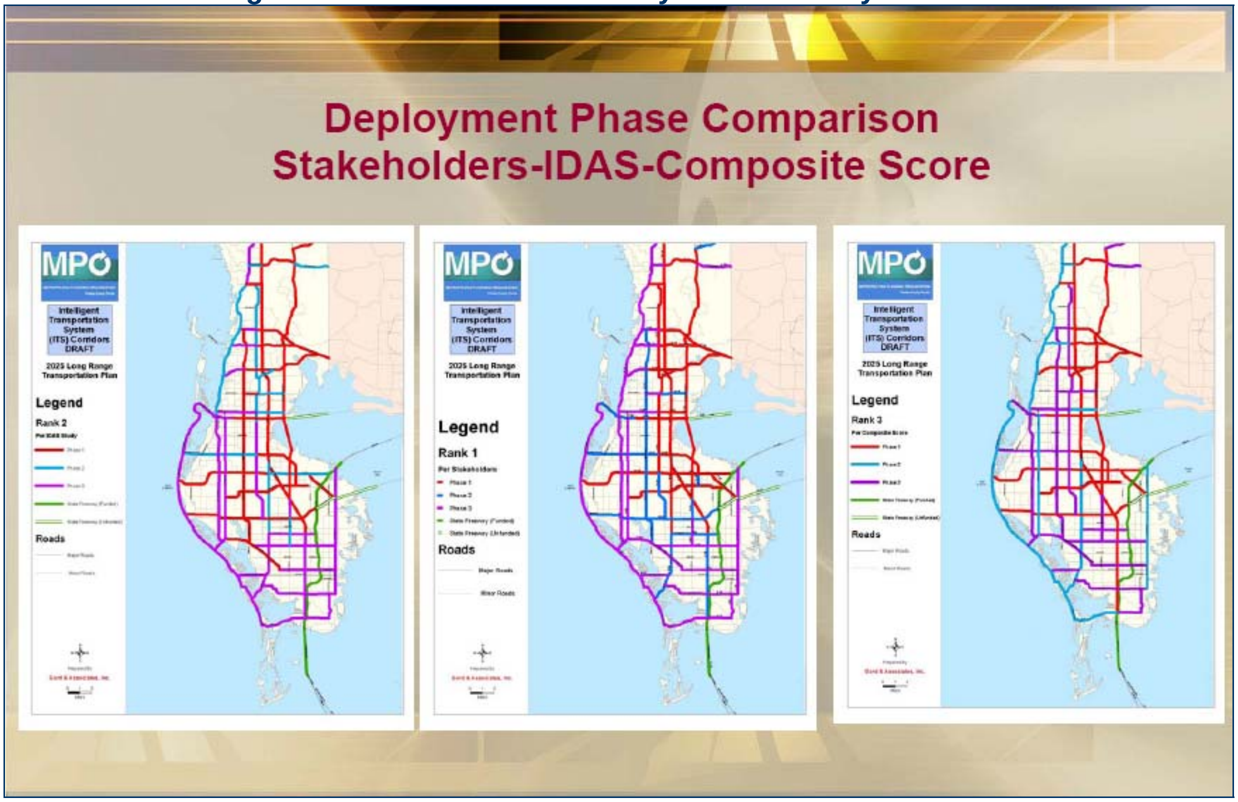
Dist.	Rank	Main Corridor	Begin	End	B/C Ratio
39	2-1	Starkey Rd/Keene Rd Park St	Tyrone Blvd/ Alt US 19/SR 595	Tampa Rd	15.35
33	2-2	Trinity	East Lake Rd	County Line	11.99
31	2-3	Park Blvd/Gandy Blvd/SR 694	Gulf Blvd	I-275	10.52
18	2-4	49th St	Park Blvd N	US 19/SR 55	10.45
11	2-5	Sunset Point Rd	Belcher Rd	McMullen Booth	9.70
29	2-6	Belleair CSWY/ (West/East) Bay Dr/ SR 686	Gulf Blvd	Belcher Rd	9.21
20	2-7	US 19/SR 55	54th Avenue S	54th Ave N	8.73
41	2-8	Belcher Rd	Ulmerton Rd/SR 688	Park Blvd	8.29
16	2-9	54th Ave N	66th St N	I-275	7.65
5	2-10	66th St N/SR 693	54th Street	Gulf Blvd	6.68
28	2-11	Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	6.39

Table 4-10: ATMS Deployment Phased III Corridors

Dist.	Rank	Main Corridor	Begin	End	B/C Ratio
54	3-1	Gandy Blvd	I-275	Hillsborough County	15.47
47	3-2	Sunset Point Rd	Keene Rd	Belcher Rd	11.28
50	3-3	Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd	5th Ave N/ SR 595	10.49
45	3-4	Tarpon Ave	Alt. US 19/ SR 595	US 19	10.42
46	3-5	Keystone Rd.	East Lake Rd	County Line	10.36
35	3-6	Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore Blvd./Broadway /Edgewater Dr./ Myrtle Avenue	Klosterman Rd	Gulf to Bay/SR 60	10.22
42	3-7	49th St. N.	Park Blvd/ SR 694	38th Ave N	8.93
38	3-8	Missouri Ave/ Séminole Blvd/SR 595/SR 651	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	8.50
52	3-9	Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.	8.47
48	3-10	38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	8.06
34	3-11	Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	8.01
37	3-12	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	Gulf Blvd	Seminole Blvd/Alt. US 19/ Bay Pine Blvd.	7.75
55	3-13	Courtney Campbell	Damascus Rd	Hillsborough County	7.4
23	3-14	Curlew Rd./SR 586	Alt US 19/SR 595/ Bayshore Blvd	Belcher Rd.	7.29
44	3-15	4th St. N.	22nd Ave S	I-275	7.20
51	3-16	22nd Ave S/Gulfport Blvd	Pasadena Ave	4th St N	6.15
17	2-13	Alt US 19/SR 595/ Pinellas Ave	Klosterman Rd	Pasco County Line	5.62
43	3-17	9th St S	54th Ave S	22nd Ave S	5.63
49	3-18	5th Ave N/ SR 595/Bay Pines Blvd	Tyrone Blvd/ SR 595	4th St N	5.63
36	3-19	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
27	3-20	Drew St/ SR 590	Alt US 19/SR 595/ Ft Harrison Ave	Belcher Rd	5.00
25	3-21	Main St/ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd	3.27
53	3-22	54th Ave S	I-275	9th St S	3.27
21	3-23	Tampa Rd	Alt US 19/SR 595/ Palm Harbor	Belcher Rd	1.65

The deployment priority for each corridor considered such factors as traffic safety, traffic congestion, availability of communications infrastructure, and funding commitment for each corridor. The inclusion of existing communications infrastructure (fiber optic cabling, underground conduit system, and/or twisted pair copper cabling) in ranking criteria maximizes return on investment by reducing deployment cost. The ranked operational corridors, derived as part of this study, were compared with rankings developed by the ATMS program stakeholders and IDAS study, as presented in Figure 4-2. The corridors included in deployment phase I, II, and III are represented in red, blue, and purple colors, respectively.

Figure 4-2: Final Pinellas County ATMS Priority Corridors



FDOT has historically works closely with local public agencies to develop its five-year work program for roadway improvements and has included many ATMS elements as part of roadway improvement projects. Roadway reconstruction projects (e.g., Ulmerton Road) and at times even resurfacing projects (Alternate US 19 in St. Petersburg) have included installation of communications infrastructure (e.g., underground conduit system, pull boxes, fiber optic cabling, traffic controllers and associated cabinets, end communications equipment, VIDS, etc.). Roadway reconstruction projects have typically included ATMS foundations and structures and sometimes even devices and device cabinets.

FDOT funded projects provide a complementary source of funding for deployment of ATMS elements, especially ATMS infrastructure, structures, communications, devices, and/or end communications equipment along the State highways within the county, which are a subset of the county's priority corridors. Coordination needs to be maintained with FDOT regarding specific ATMS elements that will be included in the scope of planned roadway improvements projects. For example, FDOT's deployment of ATMS infrastructure as part of a roadway improvement project (reconstruction or even resurfacing) provides the county the opportunity to add field devices and operational strategies as part of the county's ATMS program. This approach maximizes the reach of the county's available funds (ninth-cent fuel tax) in instrumenting priority corridors within the county. The specific deployment elements for inclusion in scope of work for each priority corridor should consider scope of ATMS elements of historical and future projects. Pertinent roadway improvement projects completed or scheduled for implementation in Pinellas County (reference FDOT's previous and current 5-Year Work Programs) during fiscal years 2004–2008 and 2009–2013 are presented in Tables 4-11 and 4-12, respectively, and depicted in Figure 4-3. This information is presented to establish a context for programming future ITS / ATMS projects.

Table 4-11: TIP-CIP Roadway Improvement Projects (2004-2008)

ATMS Program Priority Corridor Ranking	Work Program	Roadway	Limits		TIP OR CIP IMPROVEMENT PROJECTS	
			From	To	FPN	Purpose
1-1	2004 – 2008	SR 55 (US-19)	Haines/Bayshore	54th Ave N	4062552	Upgrade signal controllers, add CCTV-DMS
1-1	2004 – 2008	SR 55 (US-19)	Haines/Bayshore	54th Ave N	4062552	Upgrade signal controllers, add CCTV-DMS
1-1	2004 – 2008	SR 55 (US-19)	SR 60	SR 580	4062553	Upgrade signal controllers, add CCTV-DMS
1-1	2004 – 2008	SR 55 (US-19)	SR 60	SR 580	4062553	Upgrade signal controllers, add CCTV-DMS
3-48	2004 – 2008	SR 586 (Curlew Rd)	Alt. US-19	CR 1/Omaha St.	2567822	Add Lanes & Reconstruct
3-48	2004 – 2008	SR 586 (Curlew Rd)	W of CR 1	E of Fisher Rd.	2568151	Add Lanes & Reconstruct
3-48	2004 – 2008	SR 586 (Curlew Rd)	Alt. US-19 (SR 595)	W of CR 1	2571381	Widen/Resurface Existing Lanes
1-11	2004 – 2008	SR 586 (Curlew Rd)	At Gull Aire Blvd		4150191	Traffic Signals
1-4	2004 – 2008	SR 60	Gulf View Blvd	US 19	4084192	Upgrade signal controllers
2-26	2004 – 2008	SR 600 (Gandy Blvd)	I-275	W End of Gandy Blvd	4109702	ITS Freeway Management
1-19	2004 – 2008	SR 686 (Ulmerton)	E of US-19	W of 29th St.	2571391	Add Lanes & Reconstruct
1-17	2004 – 2008	SR 686 (Ulmerton)	El Centro/Ranchero	W of US-19	2571541	Add Lanes & Reconstruct
1-17	2004 – 2008	SR 686 (Ulmerton)	E of 119th St.	W of Lk. Seminole Bypass Canal	2571551	Add Lanes & Reconstruct
1-17	2004 – 2008	SR 688 (Ulmerton Rd)	Oakhurst Ave	119th Ave	2570502	Install CCTV Cameras
1-19	2004 – 2008	SR 688 (Ulmerton Rd)	W of 38th ST	W of I-275	2571471	Add Lanes & Reconstruct
1-17	2004 – 2008	SR 688 (Ulmerton Rd)	Wild Acres Rd.	El Centro/Ranchero Blvd	4091541	Add Lanes & Reconstruct
1-17	2004 – 2008	SR 688 (Ulmerton Rd)	W of Lk. Seminole Bypass Canal	E of Wild Acres Rd.	4091551	Add Lanes & Reconstruct
2-26	2004 – 2008	SR 694 (Gandy Blvd)	I-275	E of 4th St.	2569312	Add Lanes & Reconstruct
2-26	2004 – 2008	SR 694 (Gandy Blvd)	W of 9th St.	E of 4th St.	2569313	Add Lanes & Reconstruct

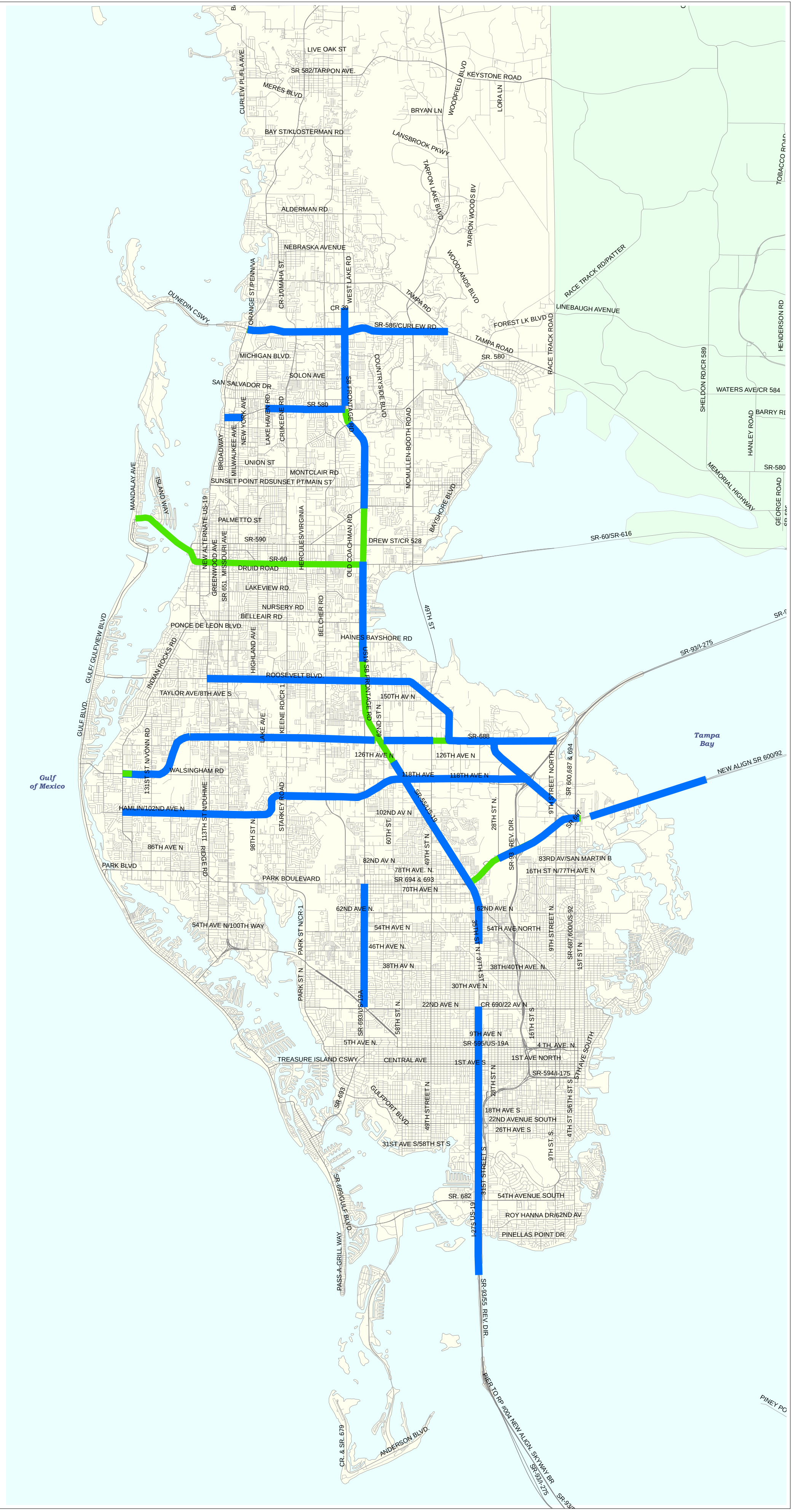
Table 4-12: TIP-CIP Planned Roadway Improvement Projects (2008-2013)

ATMS Program Priority Corridor Ranking	Work Program	Roadway	Limits		TIP OR CIP IMPROVEMENT PROJECTS			
			From	To	FPN	Purpose	Budgeted Funds	Years
1-7	2008 – 2013	Bryan Dairy Rd.	Starkey Rd.	72nd St.	4206291	Add Lanes & Reconstruct (4-6 Lanes, Safetea-lu Earmark)	24,279,600	2008-2009
1-7	2008 – 2013	Bryan Dairy Rd.	28th St.	Alt US-19	4230861	ITS Communication System	4,000,000	2010-2011
1-7	2008 – 2013	CR 296 (Future SR 690)	US-19	E of Roosevelt Blvd/CR 296	4136222	Add Lanes & Reconstruct (118th Ave Connector)	26715000	2009-2013
n/a	2008 – 2013	CR 298 (102nd Ave)	125th St.	Ridge Rd.	4217601	Add Lanes and Reconstruct	1,016,828	2008-2009
n/a	2008 – 2013	Pinellas County			4206281	ITS Communication System - Phase II, Stage I, Safetea-lu Earmark	4,401,949	2008-2009
3-56	2008 – 2013	SR 580	E Overcash Dr.	K-Mart Entrance	4113271	Resurfacing (6 Lanes)	2,851,509	2009-2010
3-56	2008 – 2013	SR 580 (Main St.)	Pinehurst/Crosley	Overcash Dr.	4168471	Resurfacing (7 Lanes)	4,168,647	2009-2010
3-56	2008 – 2013	SR 580 (Skinner Blvd)	SR 595	Main St.	4065481	Resurfacing (4 Lanes)	1788694	2008-2011
1-11	2008 – 2013	SR 586 (Curlew Rd)	Alt US-19	SR 584 (Tampa Rd)	4230851	ITS Communication System - SR 580: Racetrack to Alt US-19 SR 586: SR580 to Alt US-19	5,773,688	2008-2009
1-19	2008 – 2013	SR 686	E of 40th St.	W of 28th St.	2569941	New Road Construction (0-4 Lanes, Stage 2 of 6)	52,008,491	2008-2009
1-19	2008 – 2013	SR 686	NB I-275 (Ramp P)	WB SR 686	2569942	New Road Construction (Ramp Only: 2-lanes PE/Right-of-Way on Segment 1)	28,740,284	2009-2012
1-14	2008 – 2013	SR 686	N of Ulmerton Rd.	E of 40th St.	2569951	New Road Construction (0-8 Lanes, Stage 4 of 6)	13407896	2008-2011
1-14	2008 – 2013	SR 686	At 49th St.		2599961	New Road Construction (0-2 Lanes, Stage 6 of 6)	4466214	2008-2012
1-9	2008 – 2013	SR 686	W of I-275	W of 9th St.	2569981	New Road Construction (2-4 Lanes, Stage 3 of 6)	1,177,712	2008-2009
1-14	2008 – 2013	SR 686	SR 688	Alt US-19	4230841	ITS Communication System-Connect ITS to Existing ITS on McMullen Booth and US-19	5,000,000	2009-2010
1-17	2008 – 2013	SR 688 (Ulmerton Rd.)	Oakhurst Ave.	119th Ave.	2570502	Traffic Control Devices/System	256,000	2009-2011
1-19	2008 – 2013	SR 688 (Ulmerton Rd.)	E of US-19	E of 49th St.	2571391	Add Lanes and Reconstruct (4 to 6 Lanes, Stage 2 of 6)	489,712	2008-2009
1-19	2008 – 2013	SR 688 (Ulmerton Rd.)	W of 38th St.	W of I-275	2571471	Add Lanes and Reconstruct (4 to 6 Lanes, Stage 6 of 6)	37307552	2008-2011
1-17	2008 – 2013	SR 688 (Ulmerton Rd.)	El Centro/Ranchero	W of US-19	2571541	Add Lanes and Reconstruct (4 to 6 Lanes, Stage 3 of 6)	1,000,000	2008-2009
1-17	2008 – 2013	SR 688 (Ulmerton Rd.)	E of 119th St.	W of Seminole Bypass	2571551	Add Lanes and Reconstruct (4 to 6 Lanes, Stage 1 of 6)	29809535	2008-2010
1-17	2008 – 2013	SR 688 (Ulmerton Rd.)	E of Wild Acres Rd.	El Centro/Ranchero	4091541	Add Lanes and Rehabilitate Pavement (4 to 6 Lanes, Stage 4 of 6)	13442978	2008-2012
1-17	2008 – 2013	SR 688 (Ulmerton Rd.)	Lake Seminole Bypass	E of wild Acres Rd.	4091551	Add Lanes and Rehabilitate Pavement (4 to 6 Lanes, Stage 5 of 6)	9355176	2008-2012
2-33	2008 – 2013	SR 693 (66th ST)	Tyrone Blvd	Park Blvd	4113301	Resurfacing (6 Lanes)	9846621	2008-2011
2-26	2008 – 2013	SR 694 (Gandy Blvd)	W of 9th N	E of 4th St N	2569312	Add Lanes and Reconstruct (4 to 8 Lanes, Advanced Row Acquisition)	15,000,500	2012-2013
2-26	2008 – 2013	SR 694 (Gandy Blvd)	MLK Jr St. (9th St.)	28th St.	4188691	Add Lanes and Reconstruct (4 to 6 Lanes, 2005 Earmark, City of St. Petersburg)	12,320,000	2008-2009
1-1	2008 – 2013	US-19 (SR 55)	N of SR 580	N of CR 95	2567742	Add Lanes and Reconstruct (Reconstruct US 19 with Frontage Roads)	7,399,000	2010-2012
1-1	2008 – 2013	US-19 (SR 55)	N of Whitney Rd.	S of Seville Blvd	2568811	Interchange (NEW)-(Reconstruct Us 19W/Frontage Rd, Belleair Interchange	84303221	2008-2011
1-1	2008 – 2013	US-19 (SR 55)	S of Seville Blvd	N of SR 60	2568812	Interchange (NEW)-(Reconstruct US-19 W/Frontage Rd., Seville Interchange	119,972,800	2008-2013
1-1	2008 – 2013	US-19 (SR 55)	S of NE Coachman Rd	N of Sunset Point Rd	2568881	Add Lanes and Reconstruct (6 to 10 Lanes, NE Coachman Rd and Sunset Pt Interchanges)	23,527,259	2008-2009
1-1	2008 – 2013	US-19 (SR 55)	N of Sunset Point Rd	S of Countryside Blvd	2568901	Add Lanes and Reconstruct (Reconstruct US-19 W/Frontage Rd., Enterprise Interchange)	2,87,883	2008-2013
1-1	2008 – 2013	US-19 (SR 55)	N of 49th St.	S of 126th Ave N.	2570701	Add Lanes and Reconstruct (Reconstruct US-19 W/Frontage Rd., 118th and 110th Interchanges)	3,000,000	2008-2009
2-30	2008 – 2013	US-19 (SR 55)	N of 22nd Ave N	S End of Bridge #061	4037311	Resurfacing-(6 Lanes)	4,801,646	2008-2011
2-26	2008 – 2013	US-92 (SR 600/Gandy)	Pelican Sound	Gandy Bridge	4168381	Resurfacing (4 Lanes)	8,563,806	2009-2010

METROPOLITAN PLANNING ORGANIZATION
Pinellas County, Florida

Pinellas County Planned Roadway Improvement Projects under TIP and CIP

Figure 4-3
Planned Roadway Improvements



Legend

Work Program

- 2004 - 2008
- 2008 - 2013

Roads

- Major Roads
- Minor Roads
- Local Roads

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Several corridors within Pinellas County were or are being instrumented, in some cases partially, with ATMS devices, support infrastructure, communications infrastructure, and operational strategies consistent with the ATMS master plan as presented in Table 4-13. These corridors are included in deployment phase I to reflect their completed or ongoing status.

Table 4-13: Corridors Previously Funded for Instrumentation

Corridor	From	To
US 19/SR 55	Beckett Way	54th Avenue N.
McMullen Booth/East Lake Rd.	Trinity	Gulf to Bay/SR 60
Gulf to Bay/SR 60	Hillcrest Ave	Damascus Drive
Tampa Rd	Belcher Rd	McMullen Booth
Curlew Rd/SR 586	McMullen Booth	SR 584/Tampa Rd.
49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60
Curlew Rd./SR 586*	Belcher Rd	McMullen Booth
Main St./ SR 580*	Belcher Rd	McMullen Booth
Walsingham Rd./ Ulmerton Rd/SR 688	Gulf Blvd	66th St. N
Walsingham Rd./ Ulmerton Rd/SR 689	66th St. N	I-275
Drew St.	Belcher Rd.	McMullen Booth
Belleair CSWY/ (West/East) Bay Drive/ SR 686	Gulf Blvd	Belcher Rd
US 19/SR 55	54th Avenue S	54th Avenue N
Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest

4.4.2 Deployment Stages and Strategy

Figure 4-4 presents the county's final deployment phases and associated operational corridors. An incremental implementation plan must be followed, not only because of limited funding, but also to ensure newly installed ATMS devices are augmented by additional staff, resources, and training for effective operations and management. This requirement must be supported not only at the onset of program deployment but also sustained over time as the size and complexity of deployed solutions increase to encompass a multitude of priority corridors and technologies. Given the complexity of ATMS solutions and ongoing challenge for hiring and retaining experienced technicians and engineers to sustain system operations and management, the county should also explore outsourcing some of the operations, management, and maintenance functions, particularly those related to electronic devices in the Primary Control Center, ATMS field devices, and fiber-based communications network.

The new ATMS devices and intelligent strategies should be introduced logically and incrementally, having incorporated lessons learned from previous deployments. This approach will help minimize deployment risks associated with advanced technologies and avoid overwhelming the county's maintenance and management staff. The strategy for migrating from the county's legacy system to the envisioned intelligent standards-based, open-architecture system would involve three deployment phases each encompassing many deployment stages. The pace and geographic distribution of recommended improvements as well as number of priority corridors for instrumentation with ATMS, on an annual basis, will depend on the level of funding stream over time. Currently, it is anticipated that the ninth-cent fuel tax will generate an annual funding stream of about $3.8 million. This funding will be sufficient to support the deployment of phase I corridors partially within the 10-year focus of this master plan. Additional funding, such as Federal grants and FDOT ATMS investments along state routes, will be needed to instrument all phase I corridors with ATMS solutions. A series of overlapping deployment stages are needed for design, procurement, construction, and integration of these operational corridors.

METROPOLITAN PLANNING ORGANIZATION
Pinellas County, Florida

Intelligent Transportation System (ITS) Corridors

Figure 4-4
Proposed Staged Implementation Plan

Legend

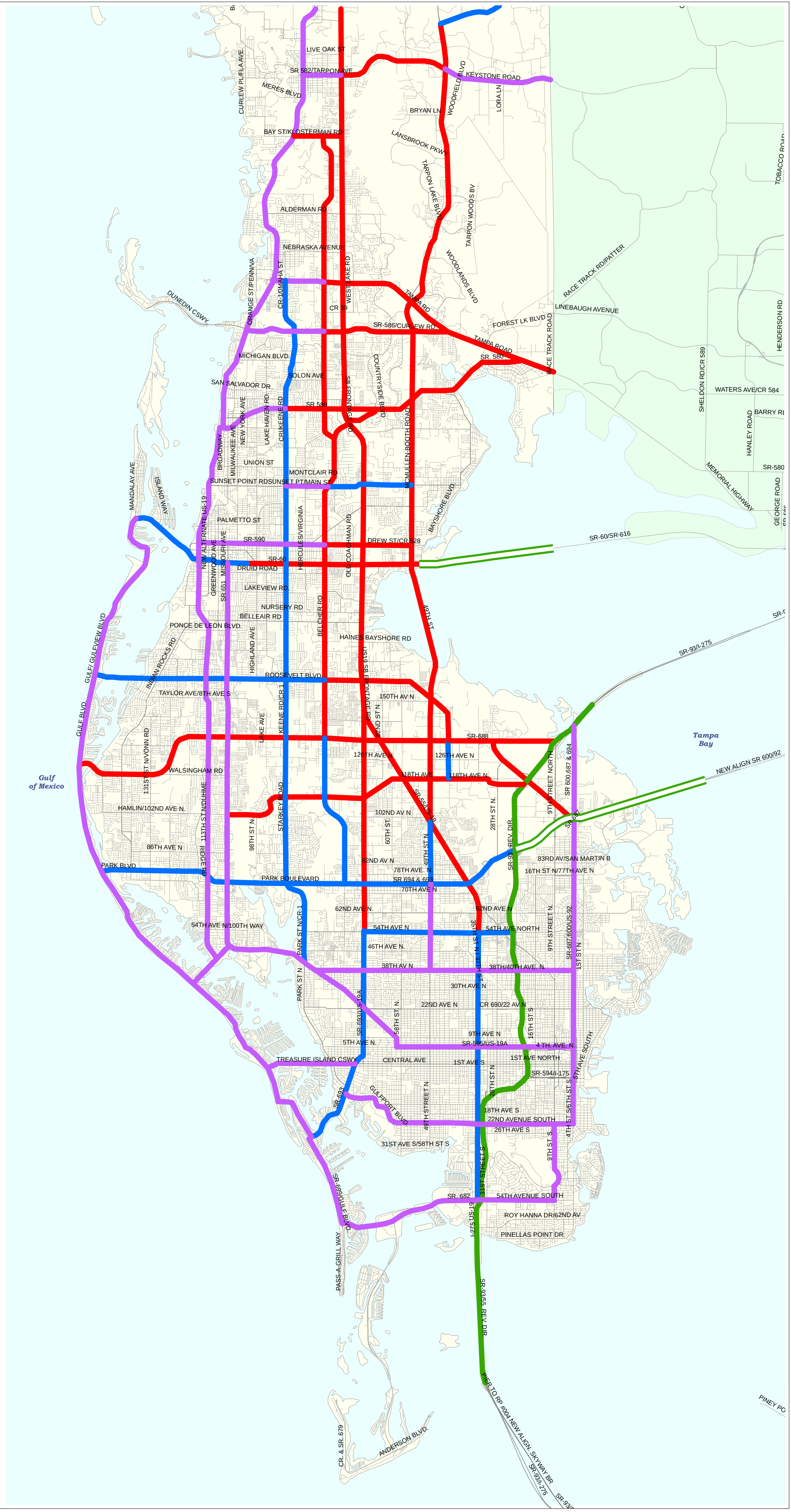
Rank 1

Per Stakeholders

- Phase 1
- Phase 2
- Phase 3
- State Freeway (Funded)
- State Freeway (Unfunded)

Roads

- Major Roads
- Minor Roads
- Local Roads



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For example, each deployment stage could leverage one year for design and two years for procurement, construction, and integration with $3.8 million annual funding. The design years could encompass the first, fourth, and seventh years of a 10-year implementation plan each following a 2-year period for procurement, construction, and integration. This approach will help streamline design and deployment activities by bundling several corridors within each deployment stage as feasible as supported by annual revenue stream. In addition, this approach will allow the county to leverage enhancements in advanced technologies and operational strategies as well as handle contract management and administration. The staged deployment approach would be repeated for subsequent set of operational corridors until all priority corridors have been instrumented. This strategy will enable the county to instrument most priority corridors of deployment phase I within a 10-year period. It is important to emphasize that care must be exercised; however, to ensure each deployment stage is constructible and manageable from the work programming, construction management, and execution standpoint.

Table 4-14 presents the overlapping three-year deployment stages and associated priority corridors to be instrumented with ATMS devices, support infrastructure, communications infrastructure, and operational strategies consistent with the ATMS master plan. The projects included in the first deployment stage reflect corridors previously funded for ATMS improvements under various funding mechanisms, corridors' ranking score, and corridors that facilitate center-to-center connectivity to enable sharing of traffic video and data and automated collaborations across centers.

Table 4-14: Deployment Stages and Priority Corridors (Phase I Corridors)

Staging	Rank	Priority Corridors			
		Roadway	From	To	Length (Miles)
Stage 1	1-1 F	US 19/SR 55	Beckett Way	54th Avenue N.	25.25
	1-2 F	McMullen Booth/East Lake Rd	Trinity	Gulf to Bay/SR 60	15.17
	1-3 F	I-275	Howard Frankland Bridge	Skyway Bridge	11.43
	1-4 F	Gulf to Bay/SR 60	Hillcrest Ave.	Damascus Drive	4.54
	1-5 F	Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	7.42
	1-10 F	Tampa Rd	Belcher Rd.	McMullen Booth	2.34
	1-23 F	Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	4.31
Stage 2	1-6	SR 686	49th St.	Bryan Dairy	1.25
	1-7	Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	8.32
	1-8	Main St./ SR 580	McMullen Booth	SR 584/Tampa Rd.	3.28
	1-9	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR 694	3.10
Stage 3	1-11	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd.	0.93
	1-12	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	6.78
	1-13	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd.	2.99
	1-14	East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	2.83
Stage 4	1-15	Curlew Rd./SR 586	Belcher Rd.	McMullen Booth	2.34
	1-16	Main St./ SR 580	Belcher Rd.	McMullen Booth	2.41
	1-17	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	8.10
	1-18	Countryside Blvd	Belcher Rd.	Main St.	1.13
Stage 5	1-19	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	5.01
	1-20	66th St. N./SR 693	US 19/SR 55	46th Avenue N.	6.00
	1-21	Belcher Rd.	Klosterman Rd.	Druid Rd	8.89
	1-22	Drew St.	Belcher Rd.	McMullen Booth	2.28

4.4.3 Deployment Costs

The overall cost for modernizing and expanding the Pinellas County's ATMS program based on advanced technologies and strategies for each deployment phase are presented in Tables 4-15, 4-16, and 4-17.

Table 4-15: ATMS Program Cost Summary – Deployment Phase I

Item	Total Cost
ATMS Field Devices	$13,520,528
Field Communications	$6,687,644
Mobilizations	$1,010,409
Maintenance of Traffic	$1,010,409
Engineering Design	$3,334,348
System Testing, Integration, and Configuration	$2,424,981
Construction Engineering and Inspection	$1,333,739
Contingency	$2,020,817
Total Cost	$31,342,874
Annual Operations and Maintenance Cost	$3,134,287

Table 4-16: ATMS Program Cost Summary – Deployment Phase II

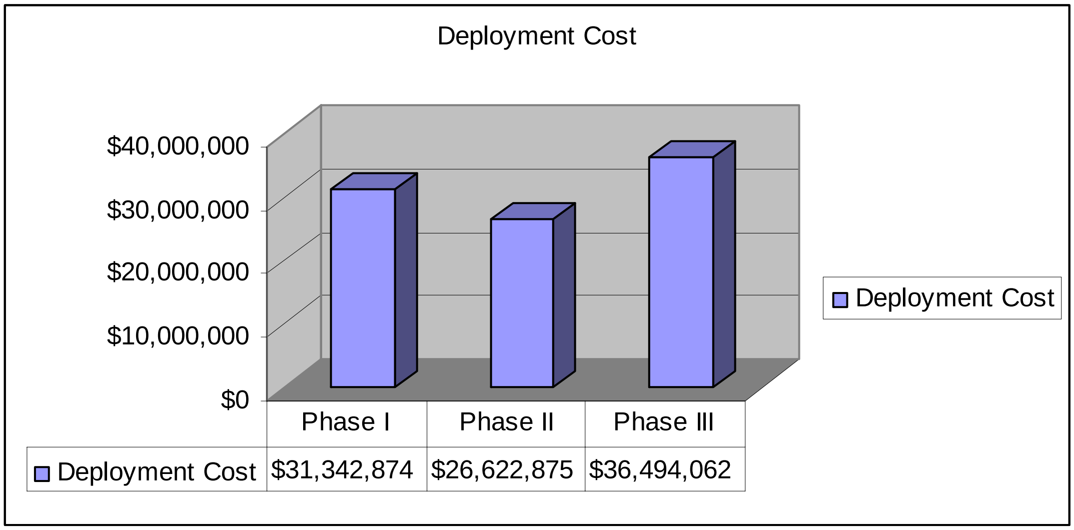
Item	Total Cost
ATMS Field Devices	$9,885,743
Field Communications	$7,279,231
Mobilizations	$858,249
Maintenance of Traffic	$858,249
Engineering Design	$2,832,221
System Testing, Integration, and Configuration	$2,059,797
Construction Engineering and Inspection	$1,132,888
Contingency	$1,716,497
Total Cost	$26,622,875
Annual Operations and Maintenance Cost	$2,662,287

Table 4-17: ATMS Program Cost Summary – Deployment Phase III

Item	Total Cost
ATMS Field Devices	$12,643,568
Field Communications	$10,885,808
Mobilizations	$1,176,469
Maintenance of Traffic	$1,176,469
Engineering Design	$3,882,347
System Testing, Integration, and Configuration	$2,823,525
Construction Engineering and Inspection	$1,552,939
Contingency	$2,352,938
Total Cost	$36,494,062
Annual Operations and Maintenance Cost	$3,649,406

Figure 4-5 presents the Pinellas Countywide ATMS deployment phases and associated costs. This estimated cost assumes deployment of ATMS elements, advanced controllers and cabinets, and adaptive traffic control technology along all operational corridors countywide excepting that traffic signals along operational corridors, located within the City of St. Petersburg, will not operate under adaptive traffic control operations at this time.

Figure 4-5: Pinellas County ATMS Deployment Cost by Phase



As previously stated, the county must invest in the needed staffing, resources, training, and operational improvements during incremental deployment stages. This is essential to proactively support and sustain the critical functions such as system operations, maintenance, management, and training. The county should leverage lessons learned and best practices from real-world deployment of ATMS solutions to assess need, opportunity, and viability of outsourcing some of these functions where appropriate. Typically, the annual cost for these functions is about 10 percent of deployed ATMS cost. This translates into the need for approximately $3,134,287 of additional funding upon completion of all phase 1 corridors. Table 4-18 presents estimated stage-based cost for operational corridors included in deployment phase I assuming full-built ATMS scenario. Care needs to be exercised to provide the needed funding to ensure program success by sustaining ATMS system support functions.

Table 4-18: Operations and Management Costs

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total
$974,682	$567,751	$322,232	$432,277	$837,346	$3,134,287

Table 4-19 presents the deployment cost for establishing interim center-to-center connectivity between the Primary Control Center and the county's ATMS program stakeholders for sharing streaming video, data, and operations plans as well as cooperation and coordination for regional transportation management. The interim connectivity leverages wireless communications media until fiber optic cabling is deployed along priority corridors that will facilitate permanent connectivity. The interim center-to-center connectivity is essential for optimizing transportation management regionally by sharing valuable traffic data and video for better decision making by the ATMS program stakeholders such as Clearwater, St. Petersburg, PSTA, Pinellas Emergency Management Center, Clearwater 911 Center, Clearwater Fire Department, Clearwater Police Department, St. Petersburg Police Department, Pinellas County Sheriff's Office, etc.

Table 4-20 thru 4-23 and Figure 4-6 thru 4-8 present the Pinellas Countywide ATMS investment representative of existing and programmed ATMS elements for operational corridors included in deployment phases I, II, and III. The tables itemize, by deployment phase, total quantities and costs associated with ATMS devices, equipment, structures, infrastructure, operational strategies, and communications network as well as development and deployment costs. Tables 4-24 thru 4-36 present the same elements by deployment phase, ranked operational corridors, and signalized intersections along the operational corridors. Tables 4-37 thru 4-39 provide a high-level summary of ATMS elements and costs by deployment phases I, II, and III and associated ranked operational corridors.

Figures 5-1 through 5-10 (in Appendix A) present project costs for each ranked operational corridor by field equipment, field communications, and development costs graphically. Tables 6-1 through 6-12 (in Appendix B) itemize, by deployment phase and operational corridors, total quantities and costs associated with ATMS devices, equipment, structures, infrastructure, operational strategies, and communications network as well as development and deployment costs. Together, these tables and *figures* present a detailed investment plan for each deployment phase, ranked priority corridor, and associated ATMS elements and serve Pinellas County as a summary representation of work scope and engineer's estimate for project budgeting and programming purposes since ATMS quantities and costs are segregated by:

- Field devices including ATC (ATC Type 2070s and ITS cabinets), CCTV cameras, VIDS, DMS signs, adaptive traffic control, and associated foundations and structures as applicable
- Field communications including MPEG-2 encoders, MPEG-4 encoders, terminal servers, edge switches, backbone switches, communications infrastructure, and communications media
- Maintenance of traffic (MOT), mobilization, engineering design, construction engineering and inspection (CEI), and contingency.

These elements represent the ATMS instrumentation needed to provide surface street control (adaptive traffic control countywide excepting St. Petersburg), network surveillance, traveler information system, and incident management.

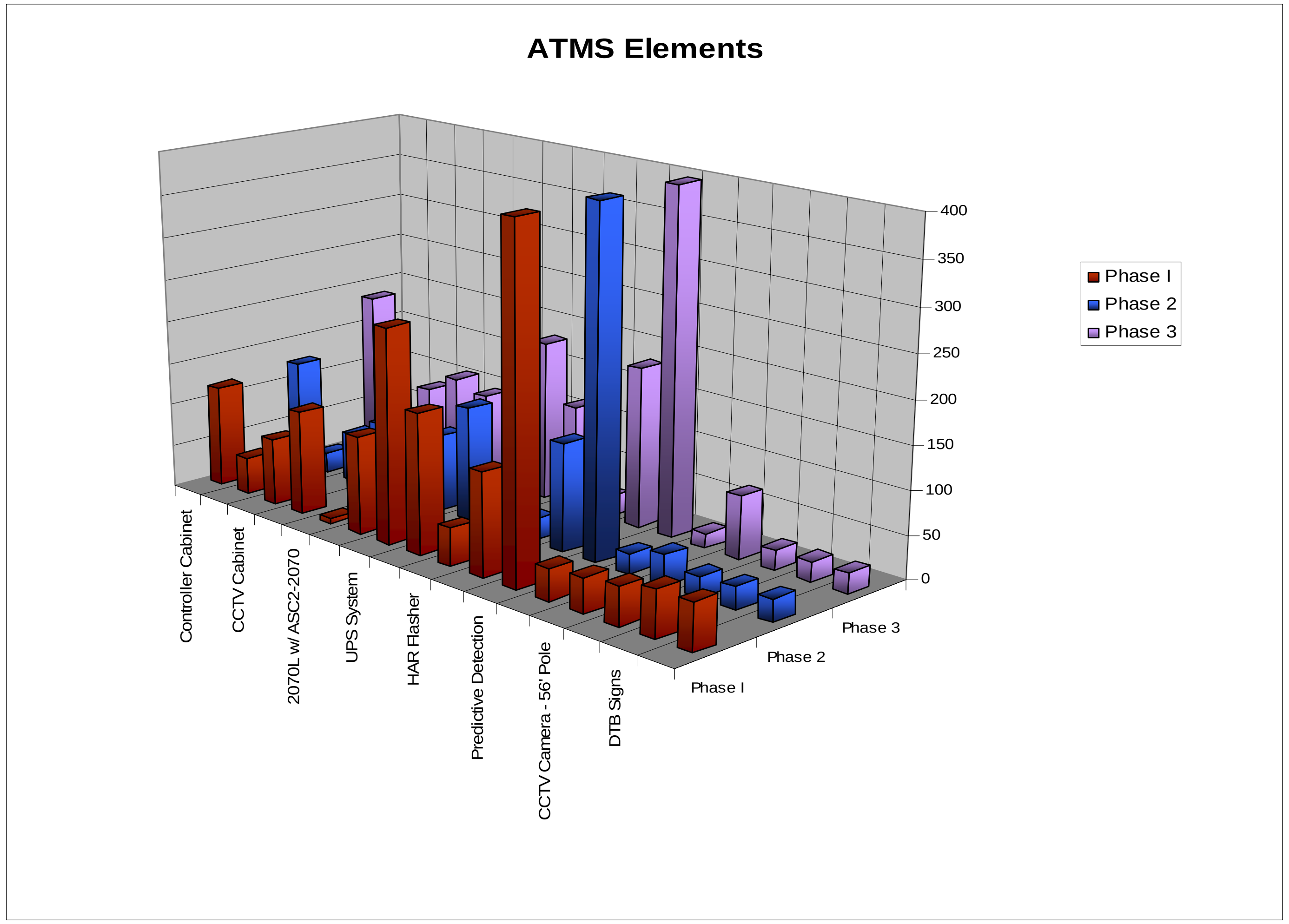
Table 4-19: Pinellas Countywide Center-to-Center Investment

From	Center	Comm. Media	Communications Path	Center Elements								Total Cost
				Communications equipment & termination (F&I)	Software-based video decoder client (F&I) and system training	Ethernet Hub Switch (F&I)	Support ITS Server (TOC, map, web, equipment polling, adaptive control, etc.)	ITS Operator Workstation (1/center)	Work Stations Monitors (2/ workstation)	TOC LCD Displays (2x 42" LCD displays)	UPS 5 KVA for 120/208VAC rack-mount (F&I)	
Primary Control Center	TOC-Clearwater	FO	Existing fiber link		$1,100		$7,200				$4,000	$12,300
Primary Control Center	TOC-St. Petersburg	FO-wireless	US19 S (FO), SR 688 E (FO), 49th St S (FO), US 19 S (FO), 54th St to I-275 (wireless), I-275 S (FO), 4th Ave to midpoint (wireless repeater), St. Pete TOC (wireless)	$35,680	$1,100	$16,000	$7,200			$8,000	$4,000	$71,980
Primary Control Center	PSTA	FO-wireless	US19 S (FO), SR 688 E up to 49th St (FO), SR 688 E (wireless), 34th St (wireless repeater point), PSTA TOC (wireless)	$23,120	$1,100	$16,000	$7,200	$3,000	$1,400	$8,000	$4,000	$63,820
Primary Control Center	Pinellas EOC	FO-wireless	US19 S (FO), SR 60 W up to Fort Harrison Ave. (FO), Fort Harrison Ave. S (wireless), EOC (wireless)	$12,560	$1,100	$16,000		$3,000	$1,400	$8,000	$4,000	$46,060
Primary Control Center	Clearwater 911 Center	FO-wireless	US19 S (FO), SR 60 W up to Fort Harrison Ave. (FO), existing Fort Harrison Ave. S (wireless), EOC (wireless repeater), 911 Center (wireless)	$11,560	$1,100	$16,000		$3,000	$1,400		$4,000	$37,060
Primary Control Center	Clearwater Fire Dept.	FO	Existing fiber link	$1,000	$1,100			$3,000	$1,400	$8,000	$4,000	$18,500
Primary Control Center	Clearwater PD	FO	Existing fiber link	$1,000	$1,100			$3,000	$1,400	$8,000	$4,000	$18,500
Primary Control Center	St. Pete PD	FO-ATM	Connection to RTMC by others		$1,100	$16,000		$3,000	$1,400	$8,000		$29,500
Primary Control Center	PCSO	FO-ATM	Connection to RTMC by others		$1,100			$3,000	$1,400	$8,000		$13,500
Subtotal (F&I)												$311,220
Mobilizations	5%											$15,561
Engineering Design	18%											$58,821
System Testing, Integration, and Configuration	18%											$58,821
Construction Engineering and Inspection	6%											$19,607
Contingency	10%											$32,678
TOTAL												$496,707

Table 4-20: Pinellas Countywide ATMS Investment

ITS Component	Item	Unit	Unit Cost	Total ATMS Program	Pinellas Countywide ATMS Investment: Existing Investment		Phase I		Phase 2		Phase 3		New ATMS Program		Existing and New ATMS Program	
					QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	430	72	$734,400	119	$1,213,800	125	$1,275,000	186	$1,897,200	430	$4,386,000	502	$5,120,400
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	91	10	$50,000	44	$220,000	24	$120,000	23	$115,000	91	$455,000	101	$505,000
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	225	55	$192,500	77	$269,500	58	$203,000	90	$315,000	225	$787,500	280	$980,000
	Device Cabinet Foundation	Each	$1,000	316	65	$65,000	121	$121,000	82	$82,000	113	$113,000	316	$316,000	381	$381,000
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	144	0	$0	6	$19,800	36	$118,800	102	$336,600	144	$475,200	144	$475,200
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	286	72	$444,960	113	$698,340	89	$550,020	84	$519,120	286	$1,767,480	358	$2,212,440
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	567	0	$0	248	$1,488,000	133	$798,000	186	$1,116,000	567	$3,402,000	567	$3,402,000
	TVSS Surge Protection (Data/Power)	Each	$600	337	137	$82,200	162	$97,200	55	$33,000	120	$72,000	337	$202,200	474	$284,400
	HAR Sign and Flashers (post-mount)	Each	$1,500	91	0	$0	44	$66,000	24	$36,000	23	$34,500	91	$136,500	91	$136,500
	VIDS at Traffic Signals	Each	$20,700	430	72	$1,490,400	119	$2,463,300	125	$2,587,500	186	$3,850,200	430	$8,901,000	502	$10,391,400
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	1556	416	$498,333	678	$812,188	469	$561,823	409	$489,948	1556	$1,863,958	1972	$2,362,292
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	77	55	$1,661,000	37	$1,117,400	23	$694,600	17	$513,400	77	$2,325,400	132	$3,986,400
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	148	0	$0	40	$608,000	35	$532,000	73	$1,109,600	148	$2,249,600	148	$2,249,600
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	91	10	$750,000	44	$3,300,000	24	$1,800,000	23	$1,725,000	91	$6,825,000	101	$7,575,000
	DTB Signs (post-mount)	Each	$16,000	103	0	$0	54	$864,000	26	$416,000	23	$368,000	103	$1,648,000	103	$1,648,000
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	103	0	$0	54	$162,000	26	$78,000	23	$69,000	103	$309,000	103	$309,000
					Total	$5,968,793	Total	$13,520,528	Total	$9,885,743	Total	$12,643,568	Total	$36,049,838	Total	$42,018,632
Communications Network	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	581513	0	$0	148236	$3,112,956	173633	$3,646,289	259644	$5,452,524	581513	$12,211,769	581513	$12,211,769
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	581513	0	$0	148236	$1,630,596	173633	$1,909,961	259644	$2,856,084	581513	$6,396,641	581513	$6,396,641
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	0	153437	$3,222,173	0	$0	0	$0	0	$0	0	$0	153437	$3,222,173
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	0	153437	$1,687,805	0	$0	0	$0	0	$0	0	$0	153437	$1,687,805
	Fiber Optic Splice Box and Grounding System	Each	$1,500	700	137	$205,500	240	$360,000	207	$310,500	253	$379,500	700	$1,050,000	837	$1,255,500
	Fiber Optic Pull Box with Grounding System	Each	$800	1454	384	$306,874	371	$296,472	434	$347,266	649	$519,288	1454	$1,163,026	1837	$1,469,899
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	225	55	$165,000	77	$231,000	58	$174,000	90	$270,000	225	$675,000	280	$840,000
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	430	72	$324,000	119	$535,500	125	$562,500	186	$837,000	430	$1,935,000	502	$2,259,000
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	700	137	$205,500	240	$360,000	207	$310,500	253	$379,500	700	$1,050,000	837	$1,255,500
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	5	1	$10,000	5	$50,000	0	$0	0	$0	5	$50,000	6	$60,000
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	46	0	$0	0	$0	0	$0	46	$165,600	46	$165,600	46	$165,600
	Fiber Splices	Each	$22	2984	548	$12,056	960	$21,120	828	$18,216	1196	$26,312	2984	$65,648	3532	$77,704
	Hub Cabinet	Each	$30,000	3	1	$30,000	3	$90,000	0	$0	0	$0	3	$90,000	4	$120,000
					Total	$6,168,907	Total	$6,687,644	Total	$7,279,231	Total	$10,885,808	Total	$24,852,683	Total	$31,021,590
Summary Cost	**Corridor Subtotal**			$60,902,522		$12,137,701		$20,208,172		$17,164,974		$23,529,376		$60,902,522		$73,040,222
	Mobilizations			$3,045,126		$606,885		$1,010,409		$858,249		$1,176,469		$3,045,126		$3,652,011
	MOT			$3,045,126		$606,885		$1,010,409		$858,249		$1,176,469		$3,045,126		$3,652,011
	Engineering Design and Survey			$10,048,916		$2,002,721		$3,334,348		$2,832,221		$3,882,347		$10,048,916		$12,051,637
	System Testing, Integration, and Configuration			$7,308,303		$1,456,524		$2,424,981		$2,059,797		$2,823,525		$7,308,303		$8,764,827
	Construction Engineering and Inspection			$4,019,566		$801,088		$1,333,739		$1,132,888		$1,552,939		$4,019,566		$4,820,655
	Contingency			$6,090,252		$1,213,770		$2,020,817		$1,716,497		$2,352,938		$6,090,252		$7,304,022
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$33,557,289		$6,687,873		$11,134,702		$9,457,901		$12,964,686		$33,557,289		$40,245,162
	Total Capital Costs			$94,459,811		$18,825,574		$31,342,874		$26,622,875		$36,494,062		$94,459,811		**$113,285,384**
	Annual Operations and Maintenance Cost			$9,445,981		$1,882,557		$3,134,287		$2,662,287		$3,649,406		$9,445,981		$11,328,538

Figure 4-6: ATMS Elements



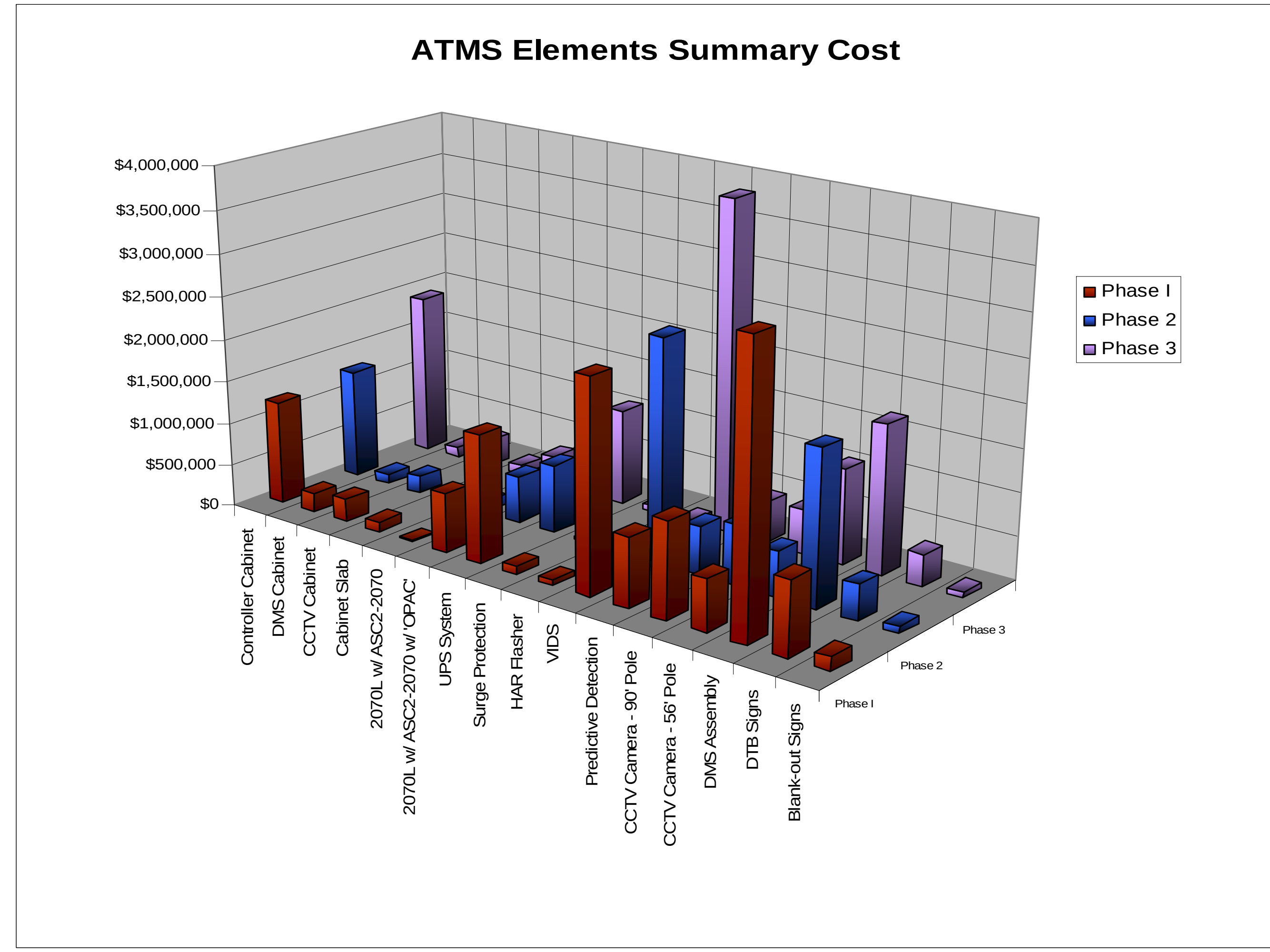
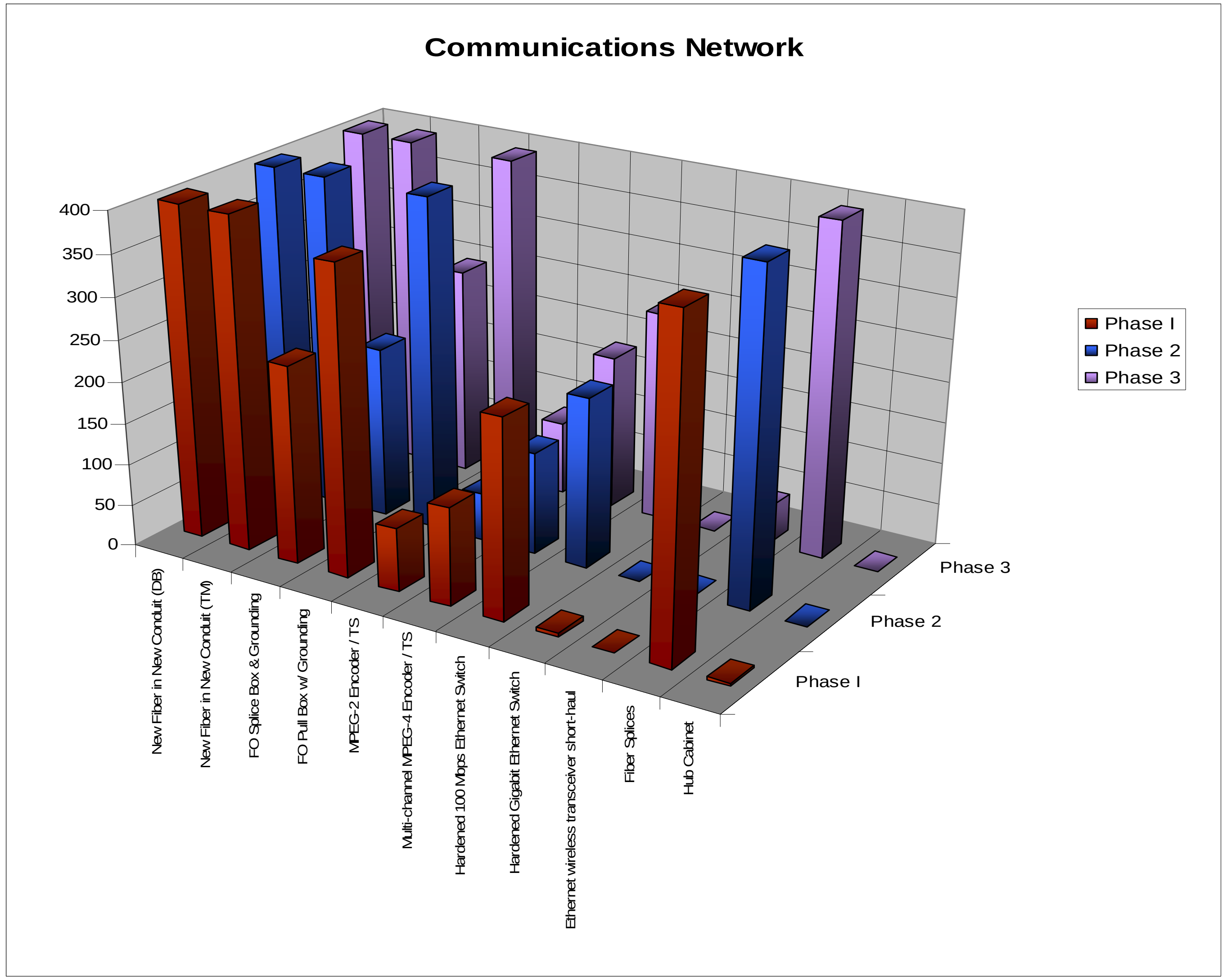


Table 4-21: ATMS Elements

Item	Unit	Unit Cost	Phase I		Phase 2		Phase 3		ATMS Program Future Projects	
			QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost
Controller Cabinet	Each	$10,200	119	$1,213,800	125	$1,275,000	186	$1,897,200	430	$4,386,000
DMS Cabinet	Each	$5,000	44	$220,000	24	$120,000	23	$115,000	91	$455,000
CCTV Cabinet	Each	$3,500	77	$269,500	58	$203,000	90	$315,000	225	$787,500
Cabinet Slab	Each	$1,000	121	$121,000	82	$82,000	113	$113,000	316	$316,000
2070L w/ ASC2-2070	Each	$3,300	6	$19,800	36	$118,800	102	$336,600	144	$475,200
2070L w/ ASC2-2070 w/ 'OPAC'	Each	$6,180	113	$698,340	89	$550,020	84	$519,120	286	$1,767,480
UPS System	Each	$6,000	248	$1,488,000	133	$798,000	186	$1,116,000	567	$3,402,000
Surge Protection	Each	$600	162	$97,200	55	$33,000	120	$72,000	337	$202,200
HAR Flasher	Each	$1,500	44	$66,000	24	$36,000	23	$34,500	91	$136,500
VIDS	Each	$20,700	119	$2,463,300	125	$2,587,500	186	$3,850,200	430	$8,901,000
Predictive Detection	Det	$1,198	678	$812,188	469	$561,823	409	$489,948	1556	$1,863,958
CCTV Camera - 90' Pole	Each	$30,200	37	$1,117,400	23	$694,600	17	$513,400	77	$2,325,400
CCTV Camera - 56' Pole	Each	$15,200	40	$608,000	35	$532,000	73	$1,109,600	148	$2,249,600
DMS Assembly	Each	$75,000	44	$3,300,000	24	$1,800,000	23	$1,725,000	91	$6,825,000
DTB Signs	Each	$16,000	54	$864,000	26	$416,000	23	$368,000	103	$1,648,000
Blank-out Signs	Each	$3,000	54	$162,000	26	$78,000	23	$69,000	103	$309,000

Figure 4-7: Communications Network



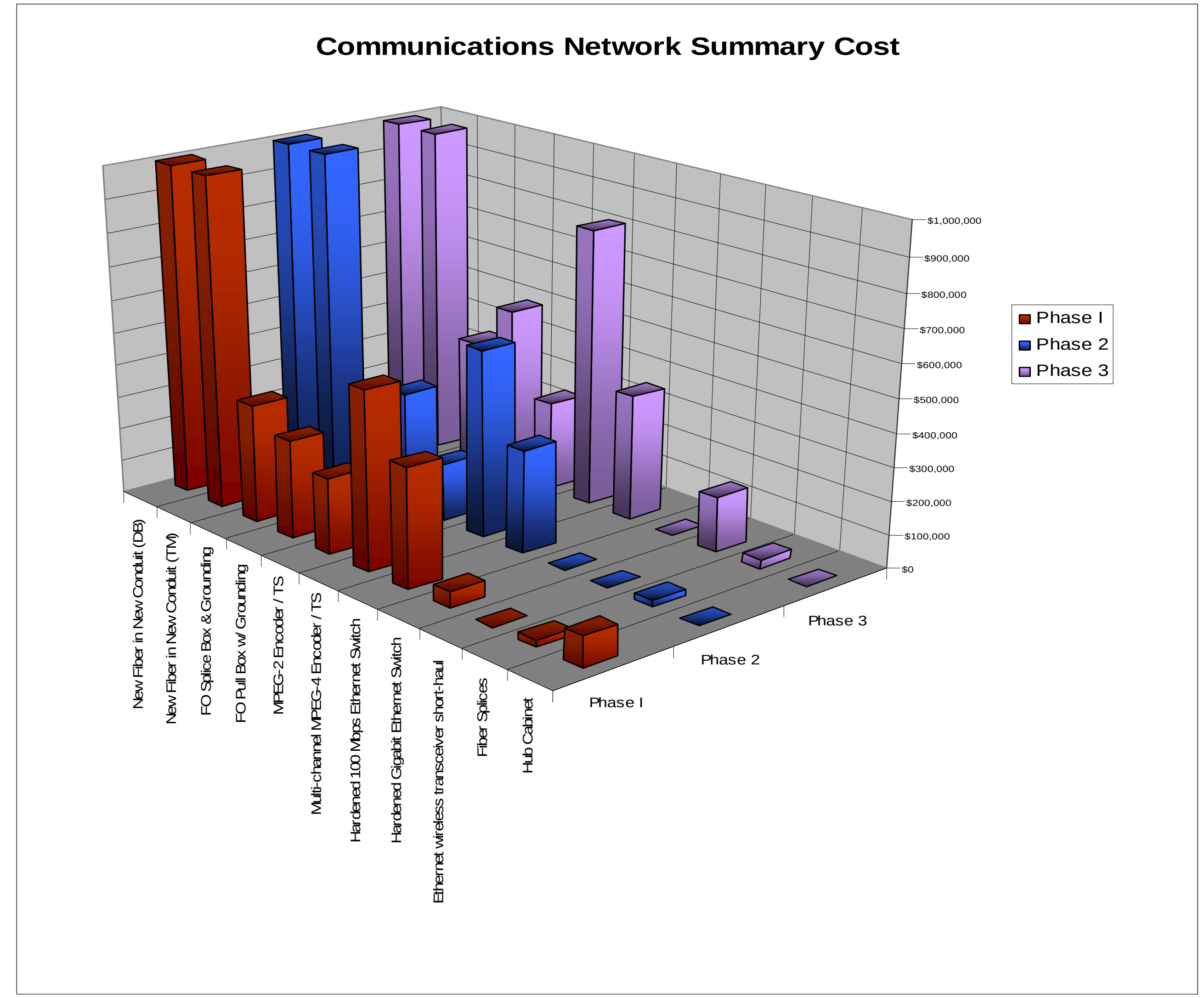


Table 4-22: Communications Network

Item	Unit	Unit Cost	Phase I		Phase 2		Phase 3		ATMS Program Future Projects	
			QTY	Total Cost	QTY	Total Cost	QTY	Total Cost	QTY	Total Cost
New Fiber in New Conduit (DB)	Ft	$21	148236	$3,112,956	173633	$3,646,289	259644	$5,452,524	581513	$12,211,769
New Fiber in New Conduit (TM)	Ft	$11	148236	$1,630,596	173633	$1,909,961	259644	$2,856,084	581513	$6,396,641
FO Splice Box & Grounding	Each	$1,500	240	$360,000	207	$310,500	253	$379,500	700	$1,050,000
FO Pull Box w/ Grounding	Each	$800	371	$296,472	434	$347,266	649	$519,288	1454	$1,163,026
MPEG-2 Encoder / TS	Each	$3,000	77	$231,000	58	$174,000	90	$270,000	225	$675,000
Multi-channel MPEG-4 Encoder / TS	Each	$4,500	119	$535,500	125	$562,500	186	$837,000	430	$1,935,000
Hardened 100 Mbps Ethernet Switch	Each	$1,500	240	$360,000	207	$310,500	253	$379,500	700	$1,050,000
Hardened Gigabit Ethernet Switch	Each	$10,000	5	$50,000	0	$0	0	$0	5	$50,000
Ethernet wireless transceiver short-haul	Each	$3,600	0	$0	0	$0	46	$165,600	46	$165,600
Fiber Splices	Each	$22	960	$21,120	828	$18,216	1196	$26,312	2984	$65,648
Hub Cabinet	Each	$30,000	3	$90,000	0	$0	0	$0	3	$90,000

Figure 4-8: Pinellas Countywide ATMS Investment

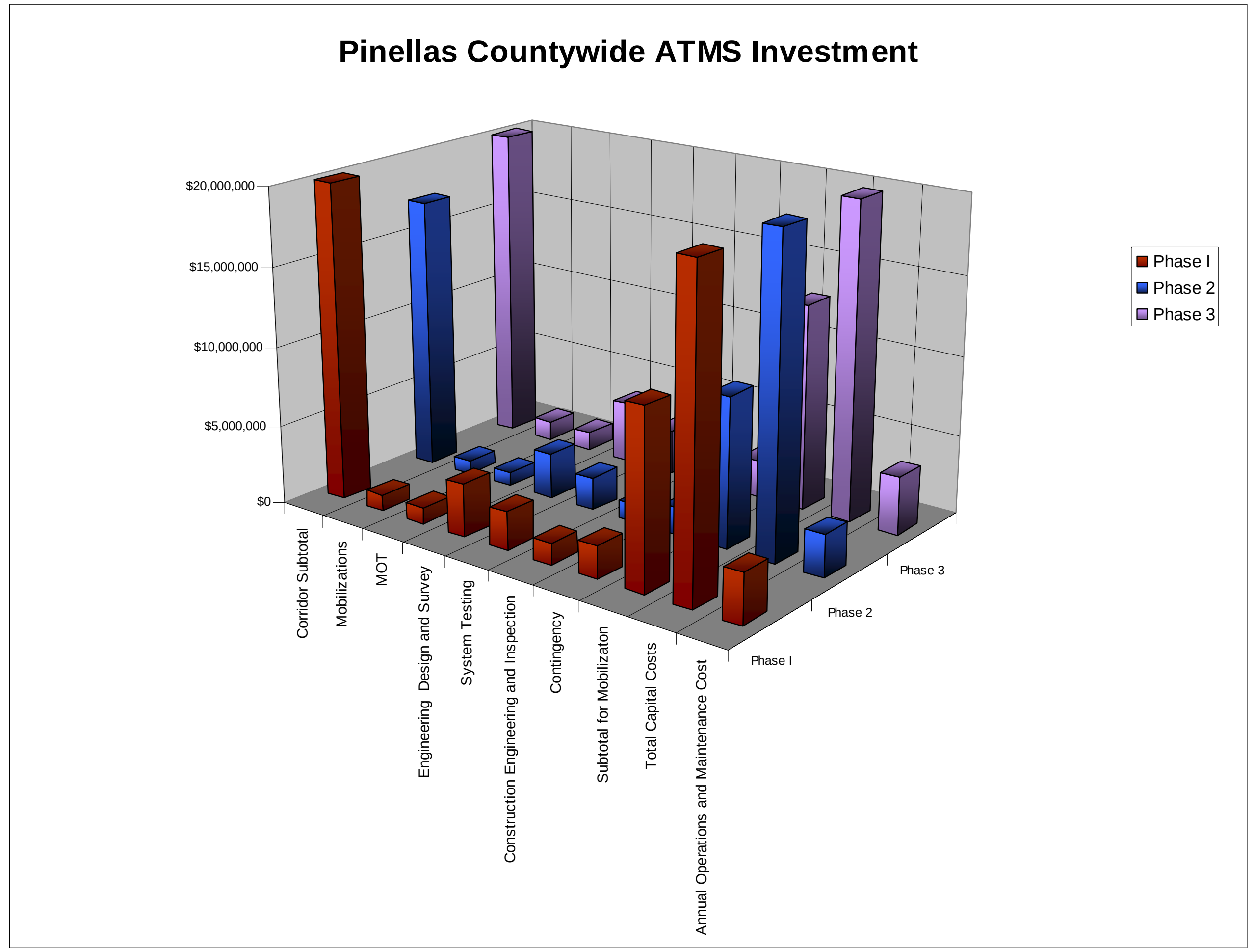


Table 4-23: Pinellas Countywide ATMS Investment

Pinellas Countywide ATMS Investment				
Item	Phase I	Phase 2	Phase 3	ATMS Program Future Projects
	Total Cost	Total Cost	Total Cost	Total Cost
Corridor Subtotal	$20,208,172	$17,164,974	$23,529,376	$60,902,522
Mobilizations	$1,010,409	$858,249	$1,176,469	$3,045,126
MOT	$1,010,409	$858,249	$1,176,469	$3,045,126
Engineering Design and Survey	$3,334,348	$2,832,221	$3,882,347	$10,048,916
System Testing, Integration, and Configuration	$2,424,981	$2,059,797	$2,823,525	$7,308,303
Construction Engineering and Inspection	$1,333,739	$1,132,888	$1,552,939	$4,019,566
Contingency	$2,020,817	$1,716,497	$2,352,938	$6,090,252
Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency	$11,134,702	$9,457,901	$12,964,686	$33,557,289
Total Capital Costs	$31,342,874	$26,622,875	$36,494,062	**$94,459,811**
Annual Operations and Maintenance Cost	$3,134,287	$2,662,287	$3,649,406	**$9,445,981**

Table 4-24: Pinellas County ATMS Master Plan

								Existing ATMS		Proposed ATMS Field Devices																					Implementation Cost by Component			
PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing UG Fiber	Existing Adaptive Signals	Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
1	1-1	11.74	US 19/SR 55	Beckett Way	54th Avenue N.	Keystone Blvd	25.26	21.88	1				1				204					1	2	2	1	1	1		3.03	1	$2,091,979	$534,701	$1,447,300	$4,073,980
			US 19/SR 55	Beckett Way	54th Avenue N.	Tampa Rd			1				1	1					1	1		1	2	2	2	2	1							
			US 19/SR 55	Beckett Way	54th Avenue N.	Main St					1	1			1	1					1		1	1	1	1		1						
			US 19/SR 55	Beckett Way	54th Avenue N.	Country Way					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			US 19/SR 55	Beckett Way	54th Avenue N.	Sunset Point Rd					1	1		1	1	1			1	1	1				2	2		1						
			US 19/SR 55	Beckett Way	54th Avenue N.	SR 60							1									1	1	1	1	1	1							
			US 19/SR 55	Beckett Way	54th Avenue N.	SR 590					1	1		1	1	1			1	1	1				2	2		1						
			US 19/SR 55	Beckett Way	54th Avenue N.	Drew St					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			US 19/SR 55	Beckett Way	54th Avenue N.	Whitney Rd					1	1		1	1	1			1	1	1				2	2		1						
			US 19/SR 55	Beckett Way	54th Avenue N.	East Bay Dr					1	1	2	1	1	1		1		1	1	2	2	2	4	4	2	1						
			US 19/SR 55	Beckett Way	54th Avenue N.	66th St					1	1			1	1					1				1	1		1						
			US 19/SR 55	Beckett Way	54th Avenue N.	Ulmerton Rd					1	1		1	1	1		1		1	1				2	2		1		1				
			US 19/SR 55	Beckett Way	54th Avenue N.	126th Ave					1	1			1	1					1				1	1		1						
			US 19/SR 55	Beckett Way	54th Avenue N.	118th Ave					1	1		1	1	1		1		1	1				2	2		1						
			US 19/SR 55	Beckett Way	54th Avenue N.	110th Ave					1	1			1	1					1				1	1		1						
			US 19/SR 55	Beckett Way	54th Avenue N.	62nd Ave								1					1	1					1	1								
			US 19/SR 55	Beckett Way	54th Avenue N.	54th St								1					1	1					1	1								
			US 19/SR 55	Beckett Way	54th Avenue N.	49th St							1									1	2	2	1	1	1							
1	1-1	11.74	US 19/SR 55	Beckett Way	54th Avenue N.		25.26	21.88	2		12	12	8	11	12	12	204	5	6	11	12	8	12	12	31	31	8	12	3.03	2	$2,091,979	$534,701	$1,447,300	$4,073,980
1	1-2	11.74	McMullen Booth/East Lake Rd.	Trinity	Gulf to Bay/SR 60	N/A	15.17	13.27					2	1			106	1		1		2	6	6	3	3	2		1.21		$579,500	$120,874	$385,906	$1,086,279
1	1-2	11.74	McMullen Booth/East Lake Rd.	Trinity	Gulf to Bay/SR 60		15.17	13.27					2	1			106	1		1		2	6	6	3	3	2		1.21		$579,500	$120,874	$385,906	$1,086,279
1	1-4	11.74	Gulf to Bay/SR 60	Hillcrest Ave.	Damascus Drive	N/A	4.54	4.23					2	4			78	1	3	4		2	3	3	6	6	2				$427,400	$50,528	$263,338	$741,266
1	1-4	11.74	Gulf to Bay/SR 60	Hillcrest Ave.	Damascus Drive		4.54	4.23					2	4			78	1	3	4		2	3	3	6	6	2				$427,400	$50,528	$263,338	$741,266
1	1-5	23.02	Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	East Lake PKWY	7.42				1	1			1	1	55				1				1	1		1	3.42		$631,705	$390,535	$563,255	$1,585,495
			Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	Curlew Rd					1	1		1	1	1		1		1	1				2	2		1						
			Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	Gray Bark Dr					1	1			1	1					1				1	1		1						
			Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	Forest LK BLVD					1	1			1	1					1				1	1		1						
			Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	Pine Ave					1	1			1	1					1				1	1		1						
			Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	S Bayview BLVD					1	1			1	1					1				1	1		1						
			Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	SR 580					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	St Pete Dr					1	1			1	1					1				1	1		1						
			Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	Lafayette BLVD					1	1			1	1					1				1	1		1						
1	1-5	23.02	Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line		7.42				9	9	1	2	9	9	55	2		2	9	1	1	1	12	12	1	9	3.42		$631,705	$390,535	$563,255	$1,585,495

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-25: Pinellas County ATMS Master Plan

PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing ATMS		Proposed ATMS Field Devices																					Implementation Cost by Component			
								Existing UG Fiber	Existing Adaptive Signals	Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
1	1-6	22.9	SR 686†	49th St.	Bryan Dairy	46th St N	1.25				1	1	1	3	1	1	9	2	1	3	1	1	1	1	5	5	1	1	1.25		$247,461	$141,140	$214,119	$602,721
1	1-6	22.9	SR 686†	49th St.	Bryan Dairy		1.25				1	1	1	3	1	1	9	2	1	3	1	1	1	1	5	5	1	1	1.25		$247,461	$141,140	$214,119	$602,721
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	Seminole Blvd					1	1		1	1	1		1		1	1				2	2		1						
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	98th St					1	1			1	1					1				1	1		1						
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	96th St					1	1		1	1	1			1	1	1				2	2		1						
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	Starkey Rd					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	Meadowbrook Dr					1	1			1	1					1				1	1		1						
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	Parking Lot					1	1			1	1					1				1	1		1						
1	1-7	21.33	Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	Parking Lot	8.32				1	1			1	1	47				1				1	1		1	8.32		$1,238,382	$898,915	$1,177,651	$3,314,948
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	Belcher Rd					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	66th St					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	49th St					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	Roosevelt Blvd								1				1		1					1	1								
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	31st Court					1	1			1	1					1				1	1		1						
			Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	28th St				1		1		1		1			1	1	1				2	2		1						
1	1-7	21.33	Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686		8.32			1	11	12	4	8	11	12	47	6	2	8	12	4	4	4	24	24	4	12	8.32		$1,238,382	$898,915	$1,177,651	$3,314,948
			Main St./ SR 580	McMullen Booth	SR 584/Tampa Rd.	SR 590					1	1			1	1					1				1	1		1						
1	1-8	19.37	Main St./ SR 580	McMullen Booth	SR 584/Tampa Rd.	St Pete Dr	3.28				1	1		1	1	1	12		1	1	1				2	2		1	3.28		$288,115	$332,441	$341,926	$962,482
			Main St./ SR 580	McMullen Booth	SR 584/Tampa Rd.	State St E					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
1	1-8	19.37	Main St./ SR 580	McMullen Booth	SR 584/Tampa Rd.		3.28				3	3	1	2	3	3	12		2	2	3	1	1	1	6	6	1	3	3.28		$288,115	$332,441	$341,926	$962,482
			Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR	28th St				1		1				1					1				1	1		1						
1	1-9	17.85	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR	16th St	3.11			1		1				1					1				1	1		1	3.11		$198,500	$315,594	$283,266	$797,359
			Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR	9th St				1		1		1		1		1		1	1				2	2		1						
			Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR	Gandy Blvd				1		1				1					1				1	1		1						
1	1-9	17.85	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR		3.11			4		4		1		4		1		1	4				5	5		4	3.11		$198,500	$315,594	$283,266	$797,359
1	1-10	16.39	Tampa Rd*	Belcher Rd.	McMullen Booth	Belcher Rd	2.34	1.73			1	1		2	1	1	22	1	1	2	1				3	3		1			$120,876	$19,764	$77,493	$218,132
1	1-10	16.39	Tampa Rd*	Belcher Rd.	McMullen Booth		2.34	1.73			1	1		2	1	1	22	1	1	2	1				3	3		1			$120,876	$19,764	$77,493	$218,132
1	1-11	16.18	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd.	East Lake Rd	0.94	0.84			1	1	1		1	1	12				1	1	1	1	2	2	1	1			$161,955	$10,676	$95,120	$267,751
1	1-11	16.18	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd.		0.94	0.84			1	1	1		1	1	12				1	1	1	1	2	2	1	1			$161,955	$10,676	$95,120	$267,751
			49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	Bayside Bridge							1	3					3	3		1	2	2	4	4	1							
			49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	144th Ave					1	1			1	1					1				1	1		1						
			49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	140th Ave					1	1			1	1					1				1	1		1						
1	1-12	14.65	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	Ulmerton Rd	6.78	3.43			1	1			1	1	51				1				1	1		1			$603,674	$69,968	$371,177	$1,044,818
			49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	126th Ave					1	1	1		1	1					1	1	1	1	2	2	1	1						
			49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	110th Ave					1	1			1	1					1				1	1		1						
			49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	Lake Blvd					1	1			1	1					1				1	1		1						
1	1-12	14.65	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60		6.78	3.43			6	6	2	3	6	6	51		3	3	6	2	3	3	11	11	2	6			$603,674	$69,968	$371,177	$1,044,818
1	1-13	13.73	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd.	N/A	3.00							2			4		2	2					2	2			3		$47,192	$281,456	$181,085	$509,733
1	1-13	13.73	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd.		3.00							2			4		2	2					2	2			3		$47,192	$281,456	$181,085	$509,733

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-26: Pinellas County ATMS Master Plan

PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing ATMS: Existing UG Fiber	Existing ATMS: Existing Adaptive Signals	Proposed ATMS Field Devices: Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Implementation Cost by Component: Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
			East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	Belcher Rd					1	1			1	1					1				1	1		1						
			East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	Bedford Cr					1	1			1	1					1				1	1		1						
			East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	69th St					1	1		1	1	1		1		1	1				2	2		1						
1	1-14	11.89	East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	Dodge St	2.83				1	1			1	1	100				1				1	1		1	2.83		$580,252	$322,401	$497,362	$1,400,014
			East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	62nd St					1	1	1		1	1					1	1	1	1	2	2	1	1						
			East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	58th St					1	1		1	1	1			1	1	1				2	2		1						
			East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	Bayside Bridge					1	1			1	1					1				1	1		1						
1	1-14	11.89	East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge		2.83				7	7	1	2	7	7	100	1	1	2	7	1	1	1	10	10	1	7	2.83		$580,252	$322,401	$497,362	$1,400,014
1	1-15	11.62	Curlew Rd./SR 586*	Belcher Rd.	McMullen Booth	Belcher Rd	2.34	1.77			1	1		1	1	1	22	1		1	1				2	2		1			$95,176	$13,676	$59,977	$168,829
1	1-15	11.62	Curlew Rd./SR 586*	Belcher Rd.	McMullen Booth		2.34	1.77			1	1		1	1	1	22	1		1	1				2	2		1			$95,176	$13,676	$59,977	$168,829
			Main St./ SR 580*	Belcher Rd.	McMullen Booth	Belcher Rd					1	1		1	1	1		1		1	1				2	2		1						
1	1-16	11.58	Main St./ SR 580*	Belcher Rd.	McMullen Booth	US 19	2.42	1.03						1			33	1		1					1	1			1.33		$317,591	$149,821	$257,544	$724,956
			Main St./ SR 580*	Belcher Rd.	McMullen Booth	Summerdale Dr					1	1	1		1	1					1	1	1	1	2	2	1	1						
1	1-16	11.58	Main St./ SR 580*	Belcher Rd.	McMullen Booth		2.42	1.03			2	2	1	2	2	2	33	2		2	2	1	1	1	5	5	1	2	1.33		$317,591	$149,821	$257,544	$724,956
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Gulf Blvd				1		1		1		1			1	1	1				2	2		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Hamlin Blvd					1	1		1	1	1			1	1	1				2	2		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Indian Rocks Rd					1	1		1	1	1			1	1	1				2	2		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	137th St					1	1		1	1	1			1	1	1				2	2		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Vonn Rd					1	1		1	1	1			1	1	1				2	2		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Walsingham Rd					1	1			1	1					1				1	1		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	119th St					1	1			1	1					1				1	1		1						
1	1-17	10.56	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	113th St	8.11	4.55			1	1	1	1	1	1	80	1		1	1	1	1	1	3	3	1	1	3.55	1	$1,454,853	$551,788	$1,105,659	$3,112,301
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Seminole Blvd					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Honeyvine					1	1		1	1	1		1		1	1				2	2		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	101st St					1	1			1	1					1				1	1		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Starkey Rd					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Belcher Rd					1	1		1	1	1		1		1	1				2	2		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	Village Blvd					1	1			1	1					1				1	1		1						
			Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	66th St					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
1	1-17	10.56	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.		8.11	4.55		1	14	15	4	11	14	15	80	6	5	11	15	4	4	4	30	30	4	15	3.55	1	$1,454,853	$551,788	$1,105,659	$3,112,301

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-27: Pinellas County ATMS Master Plan

PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing ATMS: Existing UG Fiber	Existing ATMS: Existing Adaptive Signals	Proposed ATMS Field Devices: Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Implementation Cost by Component: Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
1	1-18	10.36	Countryside Blvd	Belcher Rd.	Main St.	Belcher Rd	1.14				1	1			1	1	7				1				1	1		1			$175,325	$28,852	$112,502	$316,679
			Countryside Blvd	Belcher Rd.	Main St.	Enterprise Rd					1	1		1	1	1		1		1	1				2	2		1						
			Countryside Blvd	Belcher Rd.	Main St.	Village Dr					1	1			1	1					1				1	1		1						
1	1-18	10.36	Countryside Blvd	Belcher Rd.	Main St.		1.14				3	3		1	3	3	7	1		1	3				4	4		3			$175,325	$28,852	$112,502	$316,679
1	1-19	9.52	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	58th St	5.01	2.20			1	1	1		1	1	45				1	1	1	1	2	2	1	1	2.61		$666,586	$295,154	$529,919	$1,491,659
			Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	40th St					1	1		1	1	1		1		1	1				2	2		1						
			Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	38th St					1	1			1	1					1				1	1		1						
			Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	34th St					1	1	2		1	1					1	2	2	2	3	3	2	1						
			Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	Carillon Pkwy					1	1			1	1					1				1	1		1						
			Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	Feather Sound Dr					1	1			1	1					1				1	1		1						
1	1-19	9.52	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275		5.01	2.20			6	6	3	1	6	6	45	1		1	6	3	3	3	10	10	3	6	2.61		$666,586	$295,154	$529,919	$1,491,659
1	1-20	9.03	66th St. N./SR 693	US 19/SR 55	46th Avenue N.	142nd Ave	6.01				1	1		1	1	1	66	1		1	1				2	2		1	6.01		$1,090,443	$665,718	$967,644	$2,723,804
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	126th Ave					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	118th Ave					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	102nd Ave					1	1	1		1	1					1	1	1	1	2	2	1	1						
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	94th Ave					1	1		1	1	1			1	1	1				2	2		1						
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	82nd Ave					1	1	1		1	1					1	1	1	1	2	2	1	1						
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	78th Ave					1	1			1	1					1				1	1		1						
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	Park Blvd					1	1			1	1					1				1	1		1						
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	70th Ave					1	1			1	1					1				1	1		1						
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	62nd Ave					1	1			1	1					1				1	1		1						
			66th St. N./SR 693	US 19/SR 55	46th Avenue N.	54th Ave					1	1		1	1	1			1	1	1				2	2		1						
1	1-20	9.03	66th St. N./SR 693	US 19/SR 55	46th Avenue N.		6.01				11	11	4	5	11	11	66	2	3	5	11	4	4	4	20	20	4	11	6.01		$1,090,443	$665,718	$967,644	$2,723,804
1	1-21	8.97	Belcher Rd.	Klosterman Rd.	Druid Rd	Klosterman Rd	8.89				1	1		1	1	1	60	1		1	1				2	2		1	8.89		$1,548,355	$1,001,782	$1,405,126	$3,955,263
			Belcher Rd.	Klosterman Rd.	Druid Rd	School Entrance					1	1			1	1					1				1	1		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	County Rd					1	1		1	1	1			1	1	1				2	2		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Alderman Rd					1	1		1	1	1			1	1	1				2	2		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Nebraska Ave					1	1		1	1	1			1	1	1				2	2		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Tampa Rd							2	1					1	1		2	2	2	3	3	2							
			Belcher Rd.	Klosterman Rd.	Druid Rd	Solon Ave					1	1		1	1	1			1	1	1				2	2		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Greenbriar Blvd					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Country Side Blvd							1	1				1		1		1	1	1	2	2	1							
			Belcher Rd.	Klosterman Rd.	Druid Rd	Parkway Blvd					1	1			1	1					1				1	1		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Montclair Rd					1	1		1	1	1			1	1	1				2	2		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Sunset Point Rd					1	1		1	1	1		1		1	1				2	2		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Logan St					1	1			1	1					1				1	1		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	NE Coachman Rd					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Drew St					1	1		1	1	1		1		1	1				2	2		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Cleveland St					1	1			1	1					1				1	1		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Turner Blvd					1	1			1	1					1				1	1		1						
			Belcher Rd.	Klosterman Rd.	Druid Rd	Druid Rd					1	1			1	1					1				1	1		1						
1	1-21	8.97	Belcher Rd.	Klosterman Rd.	Druid Rd		8.89				16	16	5	11	16	16	60	4	7	11	16	5	5	5	32	32	5	16	8.89		$1,548,355	$1,001,782	$1,405,126	$3,955,263

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-28: Pinellas County ATMS Master Plan

PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing ATMS: Existing UG Fiber	Existing ATMS: Existing Adaptive Signals	Proposed ATMS Field Devices: Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Implementation Cost by Component: Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
1	1-22	8.93	Drew St.	Belcher Rd.	McMullen Booth	S Old Coachman Rd	2.28	1.32			1	1			1	1	18				1				1	1		1			$115,535	$15,176	$72,022	$202,733
			Drew St.	Belcher Rd.	McMullen Booth	Parking Lot					1	1			1	1					1				1	1		1						
1	1-22	8.93	Drew St.	Belcher Rd.	McMullen Booth		2.28	1.32			2	2			2	2	18				2				2	2		2			$115,535	$15,176	$72,022	$202,733
			Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	Harn Blvd					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
			Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	Curtis Dr					1	1			1	1					1				1	1		1						
			Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	Nursery Rd					1	1			1	1					1				1	1		1						
			Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	Bellair Rd					1	1		1	1	1			1	1	1				2	2		1						
1	1-23	5.92	Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	Lancaster Dr	4.31				1	1		1	1	1	42		1	1	1				2	2		1	4.31		$839,673	$476,686	$725,313	$2,041,671
			Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	Cromwell Dr					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
			Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	142nd Ave					1	1			1	1					1				1	1		1						
			Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	East Bay Dr							1									1	1	1	1	1	1							
			Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	Ulmerton Rd							1									1	1	1	1	1	1							
1	1-23	5.92	Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688		4.31				7	7	4	4	7	7	42		4	4	7	4	4	4	15	15	4	7	4.31		$839,673	$476,686	$725,313	$2,041,671
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Tampa Rd					1	1		1	1	1		1		1	1				2	2		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Curlew Rd					1	1		2	1	1		1	1	2	1				3	3		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Michigan Blvd					1	1		1	1	1			1	1	1				2	2		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Solon Ave					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	San Christopher Dr					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	SR 580					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Virginia St					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Beltrees St					1	1		1	1	1			1	1	1				2	2		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Union St					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Sunset Point Rd					1	1		1	1	1		1		1	1				2	2		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Palmetto St					1	1		1	1	1			1	1	1				2	2		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Drew St					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Cleveland St					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Druid Rd					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
2	2-24	15.35	Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Lakeview Rd	19.29				1	1		1	1	1	142		1	1	1				2	2		1	19.29		$2,890,124	$2,108,662	$2,754,331	$7,753,118
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Nursery Rd					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Belleair Rd					1	1		1	1	1			1	1	1				2	2		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Mcmullen Rd					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	East Bay Dr					1	1	1	2	1	1		1	1	2	1	1	1	1	4	4	1	1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	126th Ave					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Walsingham Rd					1	1		1	1	1			1	1	1				2	2		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Bryan Dairy Rd							1	1				1		1		1	1	1	2	2	1							
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Bardmoor Blvd					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	94th Ave					1	1		1	1	1			1	1	1				2	2		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	86th Ave					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Flamevine Rd					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Park Blvd					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Burning Tree Dr					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	54th Ave					1	1		1	1	1			1	1	1				2	2		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	48th Ave					1	1			1	1					1				1	1		1						
			Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.	Tyrone Blvd				1		1				1					1				1	1		1						
2	2-24	15.35	Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19	Tampa Rd.		19.29			1	29	30	9	20	29	30	142	8	12	20	30	9	9	9	59	59	9	30	19.29		$2,890,124	$2,108,662	$2,754,331	$7,753,118
2	2-25	11.99	Trinity	East Lake Rd.	County Line	N/A	1.71																						1.71		$3,000	$153,490	$86,226	$242,715
2	2-25	11.99	Trinity	East Lake Rd.	County Line		1.71																						1.71		$3,000	$153,490	$86,226	$242,715

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-29: Pinellas County ATMS Master Plan

PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing ATMS		Proposed ATMS Field Devices																					Implementation Cost by Component			
								Existing UG Fiber	Existing Adaptive Signals	Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	Gulf Blvd				1		1		1		1			1	1	1				2	2		1						
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	136th St					1	1		1	1	1			1	1	1				2	2		1						
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	131st St					1	1			1	1					1				1	1		1						
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	125th St					1	1		1	1	1			1	1	1				2	2		1						
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	Ridge Rd					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	113th St					1	1		1	1	1		1		1	1				2	2		1						
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	Johnson Blvd					1	1			1	1					1				1	1		1						
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	74th Ave					1	1			1	1					1				1	1		1						
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	Seminole Blvd					1	1		1	1	1		1		1	1				2	2		1						
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	104th Ln					1	1			1	1					1				1	1		1						
2	2-26	10.52	Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	Key Haven Entrance	11.97				1	1		1	1	1	86		1	1	1				2	2		1	11.97		$1,865,781	$1,299,595	$1,744,122	$4,909,498
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	Starkey Rd							2									2	2	2	2	2	2							
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	83rd St					1	1			1	1					1				1	1		1						
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	Belcher Rd					1	1		1	1	1		1		1	1				2	2		1						
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	66th St							1	1					1	1		1	1	1	2	2	1							
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	52nd St					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	49th St					1	1		1	1	1		1		1	1				2	2		1						
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	43rd St					1	1			1	1					1				1	1		1						
			Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	40th St					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	29th St					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
			Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275	9th St								1					1	1					1	1								
2	2-26	10.52	Park Blvd./Gandy Blvd./SR 695	Gulf Blvd	I-275		11.97			1	17	18	7	11	17	18	86	4	7	11	18	7	7	7	36	36	7	18	11.97		$1,865,781	$1,299,595	$1,744,122	$4,909,498
			49th St.	Park Blvd. N.	US 19/SR 55	94th Ave					1	1			1	1					1				1	1		1						
2	2-27	10.45	49th St.	Park Blvd. N.	US 19/SR 55	86th Ave	1.60				1	1	1		1	1	27				1	1	1	1	2	2	1	1	1.6		$309,164	$177,056	$267,907	$754,127
			49th St.	Park Blvd. N.	US 19/SR 55	82nd Ave					1	1			1	1					1				1	1		1						
			49th St.	Park Blvd. N.	US 19/SR 55	78th Ave					1	1			1	1					1				1	1		1						
2	2-27	10.45	49th St.	Park Blvd. N.	US 19/SR 55		1.60				4	4	1		4	4	27				4	1	1	1	5	5	1	4	1.6		$309,164	$177,056	$267,907	$754,127
2	2-28	9.7	Sunset Point Rd.	Belcher Rd.	McMullen Booth	N Old Coachman Rd	2.22				1	1			1	1	16				1				1	1		1	2.22		$151,407	$222,031	$205,764	$579,202
			Sunset Point Rd.	Belcher Rd.	McMullen Booth	World Pkwy Blvd					1	1			1	1					1				1	1		1						
			Sunset Point Rd.	Belcher Rd.	McMullen Booth	Lawson Rd					1	1			1	1					1				1	1		1						
2	2-28	9.7	Sunset Point Rd.	Belcher Rd.	McMullen Booth		2.22				3	3			3	3	16				3				3	3		3	2.22		$151,407	$222,031	$205,764	$579,202
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Gulf Blvd				1		1		2		1			2	2	1				3	3		1						
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Indian Rocks Rd					1	1		1	1	1			1	1	1				2	2		1						
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	20th St					1	1			1	1					1				1	1		1						
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	14th St					1	1			1	1					1				1	1		1						
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Parking Lot					1	1			1	1					1				1	1		1						
2	2-29	9.21	Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Clearwater Largo Rd	6.58	0.56			1	1	1		1	1	2				1	1	1	1	2	2	1	1	5.5		$952,476	$624,440	$868,881	$2,445,796
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	4th St					1	1			1	1					1				1	1		1						
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Seminole Blvd					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Central Park Dr					1	1			1	1					1				1	1		1						
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Highland Ave					1	1			1	1					1				1	1		1						
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Lake Ave					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Keene Rd												1		1					1									
			Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.	Fulton Dr					1	1			1	1					1				1	1		1						
2	2-29	9.21	Belleair CSWY/ E Bay Drive/ SR 686	Gulf Blvd	Belcher Rd.		6.58	0.56		1	11	12	3	4	11	12	2	2	3	5	12	3	3	3	20	19	3	12	5.5		$952,476	$624,440	$868,881	$2,445,796

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-30: Pinellas County ATMS Master Plan

								Existing ATMS		Proposed ATMS Field Devices																					Implementation Cost by Component			
PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing UG Fiber	Existing Adaptive Signals	Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
2	2-30	8.73	US 19/SR 55	54th Avenue S.	54th Avenue N.	54th St	7.40										102						1	1					7.4		$1,373,288	$842,012	$1,220,630	$3,435,930
			US 19/SR 55	54th Avenue S.	54th Avenue N.	38th Ave				1		1		1		1		1		1	1				2	2		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	30th Ave				1		1				1					1		1	1	1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	22nd Ave				1		1		1		1			1	1	1				2	2		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	13th Ave				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	9th Ave				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	4th Ave				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	1st Ave N				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	Central Ave				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	1st Ave S				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	5th Ave S				1		1	1			1					1	1	1	1	2	2	1	1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	11th Ave				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	15th Ave				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	18th Ave				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	22nd Ave S				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	26th Ave S				1		1				1					1				1	1		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	32nd Ave S				1		1	2			1					1	2	2	2	3	3	2	1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	34th Ave S				1		1		1		1			1	1	1				2	2		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	36th Ave S				1		1		1		1			1	1	1				2	2		1						
			US 19/SR 55	54th Avenue S.	54th Avenue N.	54th Ave S				1		1				1					1				1	1		1						
2	2-30	8.73	US 19/SR 55	54th Avenue S.	54th Avenue N.		7.40			19		19	3	4		19	102	1	3	4	19	3	5	5	26	26	3	19	7.4		$1,373,288	$842,012	$1,220,630	$3,435,930
2	2-31	8.29	Belcher Rd.	Ulmerton Rd./SR 688	Park Blvd	118th Ave	4.00				1	1		1	1	1	30		1	1	1				2	2		1	4		$328,778	$403,156	$403,295	$1,135,229
			Belcher Rd.	Ulmerton Rd./SR 688	Park Blvd	114th Ave					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
			Belcher Rd.	Ulmerton Rd./SR 688	Park Blvd	78th Ave					1	1		1	1	1			1	1	1				2	2		1						
2	2-31	8.29	Belcher Rd.	Ulmerton Rd./SR 688	Park Blvd		4.00				3	3	1	3	3	3	30		3	3	3	1	1	1	7	7	1	3	4		$328,778	$403,156	$403,295	$1,135,229
2	2-32	7.65	54th Avenue N.	66th St. N.	I-275	66th St N	5.06				1	1			1	1	28				1				1	1		1	5.06		$432,702	$527,066	$528,832	$1,488,599
			54th Avenue N.	66th St. N.	I-275	63rd Way N					1	1			1	1					1				1	1		1						
			54th Avenue N.	66th St. N.	I-275	62nd St					1	1			1	1					1				1	1		1						
			54th Avenue N.	66th St. N.	I-275	58th St					1	1			1	1					1				1	1		1						
			54th Avenue N.	66th St. N.	I-275	49th St N					1	1		1	1	1		1		1	1				2	2		1						
			54th Avenue N.	66th St. N.	I-275	40th St					1	1		1	1	1			1	1	1				2	2		1						
			54th Avenue N.	66th St. N.	I-275	28th St					1	1			1	1					1				1	1		1						
			54th Avenue N.	66th St. N.	I-275	Haines Rd				1		1				1					1				1	1		1						
2	2-32	7.65	54th Avenue N.	66th St. N.	I-275		5.06			1	7	8		2	7	8	28	1	1	2	8				10	10		8	5.06		$432,702	$527,066	$528,832	$1,488,599
2	2-33	6.68	66th St. N./SR 693	46th Avenue N.	Gulf Blvd	46th Ave N	5.35				1	1			1	1	26				1				1	1		1	5.35		$1,071,206	$674,592	$961,935	$2,707,732
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	38th Ave N				1		1		1		1		1		1	1				2	2		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	30th Ave N				1		1				1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Tyrone Blvd				1		1		1		1		1		1	1				2	2		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	22nd Ave				1		1				1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	18th Ave N				1		1				1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	13th Ave N				1		1				1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	9th Ave N				1		1				1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	5th Ave N				1		1				1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Passadena Ave				1		1				1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Central Ave				1		1				1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	1st Ave S				1		1				1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Park St				1		1		1		1		1		1	1				2	2		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Gulfport Blvd					1	1		1	1	1			1	1	1				2	2		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Majestic Way					1	1		1	1	1		1		1	1				2	2		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Huffman Way					1	1			1	1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Shore Dr					1	1			1	1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Sailboat Key Blvd					1	1			1	1					1				1	1		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Boca Ciega Dr					1	1		1	1	1			1	1	1				2	2		1						
			66th St. N./SR 693	46th Avenue N.	Gulf Blvd	Gulf Blvd				1		1		1		1		1		1	1				2	2		1						
2	2-33	6.68	66th St. N./SR 693	46th Avenue N.	Gulf Blvd		5.35			13	7	20		7	7	20	26	5	2	7	20				27	27		20	5.35		$1,071,206	$674,592	$961,935	$2,707,732

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-31: Pinellas County ATMS Master Plan

PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing ATMS: Existing UG Fiber	Existing ATMS: Existing Adaptive Signals	Proposed ATMS Field Devices: Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Implementation Cost by Component: Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
2	2-34	6.39	Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	Gulf Blvd	3.66	1.31			1	1		1	1	1	10		1	1	1				2	2		1	1.67		$507,819	$247,131	$415,978	$1,170,928
			Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	Island Way					1	1		1	1	1			1	1	1				2	2		1						
			Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	Court St					1	1		1	1	1			1	1	1				2	2		1						
			Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	Oak Ave					1	1			1	1					1				1	1		1						
			Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	Ft Harrison Ave					1	1		1	1	1		1		1	1				2	2		1						
			Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	Myrtle Ave					1	1			1	1					1				1	1		1						
			Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	S MLK Ave					1	1		1	1	1			1	1	1				2	2		1						
			Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	S Missouri Ave					1	1		1	1	1		1		1	1				2	2		1						
2	2-34	6.39	Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest		3.66	1.31			8	8		6	8	8	10	2	4	6	8				14	14		8	1.67		$507,819	$247,131	$415,978	$1,170,928
3	3-35	15.47	Gandy Blvd	I-275	Hillsborough County	N/A	5.01						1									1	1	1	1	1	1		3.28		$104,500	$297,501	$221,502	$623,503
3	3-35	15.47	Gandy Blvd	I-275	Hillsborough County		5.01						1									1	1	1	1	1	1		3.28		$104,500	$297,501	$221,502	$623,503
3	3-36	11.28	Sunset Point Rd.	Keene Rd.	Belcher Rd.	Hercules Ave	1.10				1	1			1	1	8				1				1	1		1	1.1		$55,663	$106,324	$89,255	$251,242
3	3-36	11.28	Sunset Point Rd.	Keene Rd.	Belcher Rd.		1.10				1	1			1	1	8				1				1	1		1	1.1		$55,663	$106,324	$89,255	$251,242
3	3-37	10.49	Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd.	5th Avenue N./ SR 595	100th Way N	5.59				1	1			1	1	12				1				1	1		1	5.59		$448,035	$585,314	$569,376	$1,602,725
			Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd.	5th Avenue N./ SR 595	Hoover Blvd					1	1		1	1	1			1	1	1				2	2		1						
			Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd.	5th Avenue N./ SR 595	38th Ave				1		1		1		1		1		1	1				2	2		1						
			Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd.	5th Avenue N./ SR 595	26th Ave				1		1		1		1			1	1	1				2	2		1						
			Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd.	5th Avenue N./ SR 595	22nd Ave				1		1		1		1		1		1	1				2	2		1						
			Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd.	5th Avenue N./ SR 595	9th Ave				1		1				1					1				1	1		1						
			Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd.	5th Avenue N./ SR 595	5th Ave				1		1		1		1		1		1	1				2	2		1						
3	3-37	10.49	Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Seminole Blvd.	5th Avenue N./ SR 595		5.59			5	2	7		5	2	7	12	3	2	5	7				12	12		7	5.59		$448,035	$585,314	$569,376	$1,602,725
3	3-38	10.42	Tarpon Ave	Alt. US 19/ SR 595	US 19/ SR	Alt 19	1.44				1	1		1	1	1	1	1		1	1				2	2		1	1.44		$125,058	$150,518	$151,843	$427,419
			Tarpon Ave	Alt. US 19/ SR 595	US 19/ SR	Parking Lot					1	1			1	1					1				1	1		1						
3	3-38	10.42	Tarpon Ave	Alt. US 19/ SR 595	US 19/ SR		1.44				2	2		1	2	2	1	1		1	2				3	3		2	1.44		$125,058	$150,518	$151,843	$427,419
3	3-39	10.36	Keystone Rd.	East Lake Rd.	County Line	N/A	2.84										1												2.84		$4,198	$254,918	$142,773	$401,889
3	3-39	10.36	Keystone Rd.	East Lake Rd.	County Line		2.84										1												2.84		$4,198	$254,918	$142,773	$401,889

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-32: Pinellas County ATMS Master Plan

PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing UG Fiber	Existing Adaptive Signals	Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
								Existing ATMS		Proposed ATMS Field Devices																					Implementation Cost by Component			
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Klosterman Rd					1	1		2	1	1		1	1	2	1				3	3		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Alderman Rd					1	1		1	1	1			1	1	1				2	2		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Tampa Rd					1	1		2	1	1		1	1	2	1				3	3		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Curlew Rd					1	1		2	1	1		1	1	2	1				3	3		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Palm Blvd					1	1			1	1					1				1	1		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Michigan Blvd					1	1		1	1	1			1	1	1				2	2		1						
3	3-40	10.22	Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Skinner Blvd	11.96				1	1			1	1	20				1				1	1		1	11.96		$972,238	$1,264,994	$1,232,715	$3,469,947
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Main St					1	1		2	1	1		1	1	2	1				3	3		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Sunset Point Rd					1	1		1	1	1			1	1	1				2	2		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Myrtle Ave				1		1				1					1				1	1		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Seminole St					1	1		1	1	1			1	1	1				2	2		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Drew St					1	1		1	1	1		1		1	1				2	2		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Cleveland St				1		1				1					1				1	1		1						
			Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60	Pierce St				1		1		1		1			1	1	1				2	2		1						
3	3-40	10.22	Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore	Klosterman Rd	Gulf to Bay/SR 60		11.96			3	11	14		14	11	14	20	5	9	14	14				28	28		14	11.96		$972,238	$1,264,994	$1,232,715	$3,469,947
			49th St. N.	Park Blvd./ SR 694	38th Avenue N.	70th Ave					1	1			1	1					1				1	1		1						
			49th St. N.	Park Blvd./ SR 694	38th Avenue N.	62nd Ave					1	1		1	1	1			1	1	1				2	2		1						
3	3-41	8.93	49th St. N.	Park Blvd./ SR 694	38th Avenue N.	54th Ave	2.26							1			30	1		1					1	1			2.26		$262,778	$245,386	$279,998	$788,161
			49th St. N.	Park Blvd./ SR 694	38th Avenue N.	46th Ave					1	1			1	1					1				1	1		1						
			49th St. N.	Park Blvd./ SR 694	38th Avenue N.	38th Ave				1		1				1					1				1	1		1						
3	3-41	8.93	49th St. N.	Park Blvd./ SR 694	38th Avenue N.		2.26			1	3	4		2	3	4	30	1	1	2	4				6	6		4	2.26		$262,778	$245,386	$279,998	$788,161
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Druid Rd					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Parking Lot					1	1			1	1					1				1	1		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Lakeview Rd					1	1		1	1	1			1	1	1				2	2		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Belleair Rd					1	1		1	1	1			1	1	1				2	2		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Wyatt St					1	1			1	1					1				1	1		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Greenwood Ave					1	1			1	1					1				1	1		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Rosery Rd					1	1		1	1	1			1	1	1				2	2		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	5th Ave					1	1	1		1	1					1	1	1	1	2	2	1	1						
3	3-42	8.5	Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	8th Ave	9.04				1	1		1	1	1	123		1	1	1				2	2		1	9.04		$1,469,684	$1,002,982	$1,362,439	$3,835,105
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	126th Ave					1	1			1	1					1				1	1		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Parking Lot					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Walsingham Rd					1	1		1	1	1			1	1	1				2	2		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	110th Ave					1	1			1	1					1				1	1		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	86th Ave N					1	1		1	1	1			1	1	1				2	2		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	Johnson Blvd					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	70th Ave					1	1			1	1					1				1	1		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	66th Ave					1	1		1	1	1			1	1	1				2	2		1						
			Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY	54th Ave					1	1			1	1					1				1	1		1						
3	3-42	8.5	Missouri Ave/ Seminole/SR 595	Gulf to Bay/SR 60	Tom Stuart CSWY		9.04				18	18	4	7	18	18	123		7	7	18	4	4	4	29	29	4	18	9.04		$1,469,684	$1,002,982	$1,362,439	$3,835,105

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-33: Pinellas County ATMS Master Plan

								Existing ATMS		Proposed ATMS Field Devices																					Implementation Cost by Component			
PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing UG Fiber	Existing Adaptive Signals	Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
			Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.	Gulf Blvd					1	1		1	1	1		1		1	1				2	2		1						
			Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.	Paradise Blvd				1		1		1		1			1	1	1				2	2		1						
3	3-43	8.47	Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.	79th St S	2.32			1		1				1	16				1				1	1		1	2.32		$401,647	$267,535	$368,719	$1,037,901
			Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.	Park St N				1		1		1		1			1	1	1				2	2		1						
			Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.	72nd St N				1		1	1			1					1	1	1	1	2	2	1	1						
3	3-43	8.47	Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.		2.32			4	1	5	1	3	1	5	16	1	2	3	5	1	1	1	9	9	1	5	2.32		$401,647	$267,535	$368,719	$1,037,901
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	71st St				1		1				1					1				1	1		1						
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	62nd St N				1		1				1					1				1	1		1						
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	58th St N				1		1		1		1			1	1	1				2	2		1						
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	43rd St N				1		1				1					1				1	1		1						
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	37th St N				1		1				1					1				1	1		1						
3	3-44	8.06	38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	28th St N	6.79			1		1				1					1				1	1		1	6.79		$539,000	$717,290	$692,216	$1,948,506
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	I-275				1		1		1		1			1	1	1				2	2		1						
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	18th St N				1		1				1					1				1	1		1						
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	Haines Rd				1		1				1					1				1	1		1						
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	9th St N				1		1		1		1			1	1	1				2	2		1						
			38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	4th St N				1		1		1		1		1		1	1				2	2		1						
3	3-44	8.06	38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.		6.79			11		11		4		11		1	3	4	11				15	15		11	6.79		$539,000	$717,290	$692,216	$1,948,506
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Coronado St				1		1		1		1			1	1	1				2	2		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	1st St				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	S Hamden Dr				1		1		1		1			1	1	1				2	2		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Beach Access				1		1		1		1			1	1	1				2	2		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Belleair CSWY							2	3					3	3		2	2	2	5	5	2							
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Ulmerton Rd								3					3	3					3	3								
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Park Blvd							2	3					3	3		2	2	2	5	5	2							
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	195th Ave				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	161st Ave				1		1		1		1			1	1	1				2	2		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Madiera Way				1		1		1		1		1		1	1				2	2		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	150th Ave				1		1		1		1			1	1	1				2	2		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	140th Ave				1		1		1		1			1	1	1				2	2		1						
3	3-45	8.01	Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	117th Ave	25.38			1		1				1					1				1	1		1			$1,722,900	$330,148	$1,131,229	$3,184,277
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	112th Ave				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	1st St E				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	75th Ave				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Gulf St				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Corey Ave				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Blind Pass Rd				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Gulf Winds Rd				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	55th Ave				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Beach Access				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	44th Ave				1		1				1					1				1	1		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	35th Ave				1		1		1		1			1	1	1				2	2		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Sun Blvd W				1		1		2		1			2	2	1				3	3		1						
			Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	Leeland St				1		1				1					1				1	1		1						
3	3-45	8.01	Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275		25.38			23		23	4	19		23		1	18	19	23	4	4	4	46	46	4	23			$1,722,900	$330,148	$1,131,229	$3,184,277
3	3-46	7.75	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	Gulf Blvd	Seminole Blvd/Alt. US 19/ Bay Pine Blvd.	Maderia Way	1.51			1		1				1					1				1	1		1	1.51		$222,480	$159,890	$210,686	$593,055
			Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	Gulf Blvd	Seminole Blvd/Alt. US 19/ Bay Pine Blvd.	Alt 19					1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1						
3	3-46	7.75	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	Gulf Blvd	Seminole Blvd/Alt. US 19/ Bay Pine Blvd.		1.51			1	1	2	1	1	1	2		1		1	2	1	1	1	4	4	1	2	1.51		$222,480	$159,890	$210,686	$593,055
3	3-47	7.4	Courtney Campbell	Damascus Rd.	Hillsborough County	N/A	3.51						1				2					1	1	1	1	1	1				$106,896	$3,088	$60,601	$170,585
3	3-47	7.4	Courtney Campbell	Damascus Rd.	Hillsborough County		3.51						1				2					1	1	1	1	1	1				$106,896	$3,088	$60,601	$170,585
3	3-48	7.29	Curlew Rd./SR 586	Alt US 19/SR 595/ Bayshore Blvd	Belcher Rd.	N/A	2.06						1				12					1	1	1	1	1	1		2.06		$118,875	$187,994	$169,085	$475,953
3	3-48	7.29	Curlew Rd./SR 586	Alt US 19/SR 595/ Bayshore Blvd	Belcher Rd.		2.06						1				12					1	1	1	1	1	1		2.06		$118,875	$187,994	$169,085	$475,953

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-34: Pinellas County ATMS Master Plan

								Existing ATMS		Proposed ATMS Field Devices																					Implementation Cost by Component			
PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing UG Fiber	Existing Adaptive Signals	Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
3	3-49	7.2	4th St. N.	22nd Avenue S.	I-275	SR 687	7.71			1		1		1		1		1		1	1				2	2		1	7.71		$1,342,800	$942,630	$1,259,272	$3,544,701
			4th St. N.	22nd Avenue S.	I-275	Koger Blvd				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	94th Ave N				1		1	1			1					1	1	1	1	2	2	1	1						
			4th St. N.	22nd Avenue S.	I-275	83rd Ave NE				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	77th Ave N				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	71st Ave N				1		1		1		1			1	1	1				2	2		1						
			4th St. N.	22nd Avenue S.	I-275	62nd Ave N				1		1		1		1			1	1	1				2	2		1						
			4th St. N.	22nd Avenue S.	I-275	54th Ave N				1		1		1		1			1	1	1				2	2		1						
			4th St. N.	22nd Avenue S.	I-275	34th Ave N				1		1		1		1			1	1	1				2	2		1						
			4th St. N.	22nd Avenue S.	I-275	30th Ave N				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	25th Ave N				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	22nd Ave N				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	9th Ave N				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	5th Ave N				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	4th Ave N				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	3rd Ave N				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	2nd Ave N				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	1st Ave N				1		1		1		1			1	1	1				2	2		1						
			4th St. N.	22nd Avenue S.	I-275	Central Ave				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	1st Ave S				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	2nd Ave S				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	3rd Ave S				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	4th Ave S				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	5th Ave S				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	6th Ave S				1		1				1					1				1	1		1						
			4th St. N.	22nd Avenue S.	I-275	9th Ave S				1		1		1		1			1	1	1				2	2		1						
			4th St. N.	22nd Avenue S.	I-275	22nd Ave S				1		1				1					1				1	1		1						
3	3-49	7.2	4th St. N.	22nd Avenue S.	I-275		7.71			27		27	1	7		27		1	6	7	27	1	1	1	35	35	1	27	7.71		$1,342,800	$942,630	$1,259,272	$3,544,701
3	3-50	6.15	22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	Oleander Way	7.56				1	1			1	1	16				1				1	1		1	7.56		$832,587	$806,258	$903,003	$2,541,847
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	64th St S					1	1		1	1	1			1	1	1				2	2		1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	58th St S					1	1		1	1	1			1	1	1				2	2		1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	52nd St					1	1			1	1					1				1	1		1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	49th St N				1		1		1		1			1	1	1				2	2		1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	43rd St S				1		1				1					1				1	1		1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	38th St S				1		1				1					1				1	1		1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	I-275				1		1	2			1					1	2	2	2	3	3	2	1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	31st St				1		1				1					1				1	1		1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	22nd St S				1		1		1		1			1	1	1				2	2		1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	16th St S				1		1				1					1				1	1		1						
			22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	9th St S				1		1		1		1		1		1	1				2	2		1						
3	3-50	6.15	22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.		7.56			8	4	12	2	5	4	12	16	1	4	5	12	2	2	2	19	19	2	12	7.56		$832,587	$806,258	$903,003	$2,541,847
3	3-51	5.63	9th St. S.	54th Avenue S.	22nd Avenue S.	54th Ave S	3.42			1		1		1		1		1		1	1				2	2		1	3.42		$218,200	$349,507	$312,807	$880,514
			9th St. S.	54th Avenue S.	22nd Avenue S.	Country Club Way				1		1				1					1				1	1		1						
			9th St. S.	54th Avenue S.	22nd Avenue S.	45th Ave S				1		1		1		1			1	1	1				2	2		1						
			9th St. S.	54th Avenue S.	22nd Avenue S.	26th Ave				1		1				1					1				1	1		1						
3	3-51	5.63	9th St. S.	54th Avenue S.	22nd Avenue S.		3.42			4		4		2		4		1	1	2	4				6	6		4	3.42		$218,200	$349,507	$312,807	$880,514
3	3-52	5.63	5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	58th St N	4.63			1		1				1					1				1	1		1	4.63		$667,100	$515,909	$651,838	$1,834,847
			5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	49th St N				1		1		1		1			1	1	1				2	2		1						
			5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	37th St N				1		1	1			1					1	1	1	1	2	2	1	1						
			5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	31st St N				1		1				1					1				1	1		1						
			5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	28th St N				1		1				1					1				1	1		1						
			5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	I-275				1		1				1					1				1	1		1						
			5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	I-275 On Ramp				1		1	1	1		1			1	1	1	1	1	1	3	3	1	1						
			5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	16th St S				1		1				1					1				1	1		1						
			5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	Dr MLK Jr Blvd				1		1		1		1			1	1	1				2	2		1						
			5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.	Highland St				1		1				1					1				1	1		1						
3	3-52	5.63	5th Avenue N./ SR 595/Bay Pines	Tyrone Blvd/ SR 595	4th St. N.		4.63			10		10	2	3		10			3	3	10	2	2	2	15	15	2	10	4.63		$667,100	$515,909	$651,838	$1,834,847

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-35: Pinellas County ATMS Master Plan

PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing ATMS		Proposed ATMS Field Devices																					Implementation Cost by Component			
								Existing UG Fiber	Existing Adaptive Signals	Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
3	3-53	5.62	Alt. US 19/SR 595/ Pinellas Ave.	Klosterman Rd.	Pasco County Line	Meres Blvd	3.65				1	1		1	1	1	9		1	1	1				2	2		1	3.65		$288,281	$383,828	$370,332	$1,042,441
			Alt. US 19/SR 595/ Pinellas Ave.	Klosterman Rd.	Pasco County Line	Martin Luther King Jr Dr					1	1			1	1					1				1	1		1						
			Alt. US 19/SR 595/ Pinellas Ave.	Klosterman Rd.	Pasco County Line	Lemon St					1	1			1	1					1				1	1		1						
			Alt. US 19/SR 595/ Pinellas Ave.	Klosterman Rd.	Pasco County Line	W Orange St					1	1			1	1					1				1	1		1						
			Alt. US 19/SR 595/ Pinellas Ave.	Klosterman Rd.	Pasco County Line	Live Oak St					1	1		2	1	1			2	2	1				3	3		1						
3	3-53	5.62	Alt. US 19/SR 595/ Pinellas Ave.	Klosterman Rd.	Pasco County Line		3.65				5	5		3	5	5	9		3	3	5				8	8		5	3.65		$288,281	$383,828	$370,332	$1,042,441
3	3-54	5.17	Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Chestnut St	11.76				1	1			1	1	76				1				1	1		1	11.76		$1,495,862	$1,266,894	$1,522,278	$4,285,033
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Turner St					1	1			1	1					1				1	1		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Druid Rd					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Jeffords St					1	1			1	1					1				1	1		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Pinellas St					1	1			1	1					1				1	1		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Lakeview Rd					1	1		1	1	1			1	1	1				2	2		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Bellevue Blvd					1	1		1	1	1			1	1	1				2	2		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Wyatt St					1	1			1	1					1				1	1		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	12th Ave NW					1	1	1	1	1	1			1	1	1	1	1	1	3	3	1	1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	6th Ave					1	1			1	1					1				1	1		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Taylor Ave					1	1		1	1	1			1	1	1				2	2		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Ulmerton Rd							1									1	1	1	1	1	1							
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Walsingham Rd					1	1		1	1	1			1	1	1				2	2		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	102nd Ave N					1	1		1	1	1			1	1	1				2	2		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	Parking Lot					1	1			1	1					1				1	1		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	88th Ave					1	1		1	1	1			1	1	1				2	2		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	74th Ave					1	1	1		1	1					1	1	1	1	2	2	1	1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	66th Ave					1	1			1	1					1				1	1		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	54th Ave					1	1		1	1	1			1	1	1				2	2		1						
			Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY	American Legion Dr					1	1		1	1	1			1	1	1				2	2		1						
3	3-54	5.17	Alt US 19/SR 595/ Ft. Harrison Ave./Clwr/Largo Rd.	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666/Welch CSWY		11.76				19	19	4	9	19	19	76		9	9	19	4	4	4	32	32	4	19	11.76		$1,495,862	$1,266,894	$1,522,278	$4,285,033

1 2070L with ASC2-2070 local control software (non-adaptive)
2 2070L with ASC2-2070 with 'OPAC' adaptive software
3 TS-2 Type 1 Controller Cabinet (Type VI)
4 VIDS at Traffic Signals
5 Predictive Detection for Adaptive and Incicent Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).
6 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
7 CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrte Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)
8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-36: Pinellas County ATMS Master Plan

PHASE	CORRIDOR	B/C Ratio	ROADWAY	FROM	TO	SIGNAL / INTERSECTION	Length	Existing ATMS: Existing UG Fiber	Existing ATMS: Existing Adaptive Signals	Proposed ATMS Field Devices: Non-Adaptive Signals (1)	Adaptive Signals (2)	TS-2 Cabinet (3)	DMS Cabinet (2)	CCTV Cabinet (3)	Adaptive Control	VIDS (4)	Advanced Detection (5)	CCTV Primary (6)	CCTV Secondary & Tertiary (7)	MPEG-2 Encoder	MPEG-4 Encoder	DMS Signs (8)	DTB Signs (9)	Blank-out Signs (10)	Ethernet Switch	TVSS Surge Protection (11)	HAR Sign and Flashers (12)	UPS (13)	Proposed Fiber in new Conduit	Communications Hub	Implementation Cost by Component: Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor
							Miles	Miles	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Each	Miles	Each				
3	3-55	5	Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	Myrtle St	3.29				1	1			1	1	26				1				1	1		1	3.29		$418,186	$368,190	$433,293	$1,219,670
			Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	MLKJ Ave					1	1			1	1					1				1	1		1						
			Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	Laura St					1	1			1	1					1				1	1		1						
			Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	N Betty Ln					1	1		1	1	1			1	1	1				2	2		1						
			Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	Highland Ave					1	1			1	1					1				1	1		1						
			Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	Saturn Ave					1	1			1	1					1				1	1		1						
			Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	Hercules Ave					1	1			1	1					1				1	1		1						
			Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	NE Coachman Rd					1	1		1	1	1			1	1	1				2	2		1						
3	3-55	5	Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.		3.29				8	8		2	8	8	26		2	2	8				10	10		8	3.29		$418,186	$368,190	$433,293	$1,219,670
3	3-56	3.27	Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	Douglas Ave	2.80			1		1				1	41				1				1	1		1	2.8		$413,575	$318,120	$403,164	$1,134,858
			Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	Tilden St					1	1		1	1	1			1	1	1				2	2		1						
			Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	Patricia Ave					1	1			1	1					1				1	1		1						
			Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	Pinehurst Rd					1	1			1	1					1				1	1		1						
			Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	Lk Haven Rd					1	1			1	1					1				1	1		1						
			Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	Virginia St					1	1			1	1					1				1	1		1						
			Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	Overcash Dr					1	1			1	1					1				1	1		1						
			Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	Pinewood Dr					1	1			1	1					1				1	1		1						
3	3-56	3.27	Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.		2.80			1	7	8		1	7	8	41		1	1	8				9	9		8	2.8		$413,575	$318,120	$403,164	$1,134,858
3	3-57	3.27	54th Ave. S.	I-275	9th St. S.	31st St S	2.01			1		1	1			1					1	1	1	1	2	2	1	1	2.01		$304,700	$226,034	$292,434	$823,168
			54th Ave. S.	I-275	9th St. S.	22nd St S				1		1		1		1			1	1	1				2	2		1						
			54th Ave. S.	I-275	9th St. S.	16th St S				1		1				1					1				1	1		1						
			54th Ave. S.	I-275	9th St. S.	Dr MLK Jr St S				1		1		1		1			1	1	1				2	2		1						
3	3-57	3.27	54th Ave. S.	I-275	9th St. S.		2.01			4		4	1	2		4			2	2	4	1	1	1	7	7	1	4	2.01		$304,700	$226,034	$292,434	$823,168
3	3-58	1.65	Tampa Rd	Alt US 19/SR 595/ Palm Harbor Blvd	Belcher Rd.	15th St	1.33				1	1			1	1	16.00				1				1	1		1	1.33		$108,327	$134,557	$133,829	$376,712
			Tampa Rd	Alt US 19/SR 595/ Palm Harbor Blvd	Belcher Rd.	19th St					1	1			1	1					1				1	1		1						
3	3-58	1.65	Tampa Rd	Alt US 19/SR 595/ Palm Harbor Blvd	Belcher Rd.		1.33				2	2			2	2	16				2				2	2		2	1.33		108326.667	134556.8	133828.7901	376712.257

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8 DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Frankling Rods, Cantilever Structure, and Foundation)
9 DTB Signs (post-mount)
10 Blank-out Signs (mounted on Existing Signal Poles)
11 TVSS Surge Protection (Data/Power)
12 HAR Sign and Flashers (post-mount)
13 UPS, Batteries, Cabinet, and Slab

Table 4-37: ATMS Investment Plan for Implementation Phase I

Phase	Corridor Rank	Roadway	Limits		Miles	Proposed ATMS Field Devices																						Implementation Cost by Component			Total Implementation Cost	
			From	To		Non-Adaptive Signals	Adaptive Signals	TS-2 Cabinet	DMS Cabinet	CCTV Cabinet	Adaptive Control	VIDS	Detection	CCTV Level 1	CCTV Levels 2-3	MPEG-2 Encoder	MPEG-4 Encoder	DMS Assembly	DTB Signs	Blank-out Signs	Ethernet Switch	TVSS	HAR Sign and Flashers	UPS	Proposed Fiber in Conduit	Existing UG Fiber	COM HUB	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor	Phase
	1-1	US 19/SR 55	Beckett Way	54th Avenue N.	25.26		12	12	8	11	12	12	204	5	6	11	12	8	12	12	31	31	8	12	3.03	21.88	2	$2,091,979	$534,701	$1,447,300	$4,073,980	
	1-2	McMullen Booth/East Lake Rd.	Trinity	Gulf to Bay/SR 60	15.17				2	1			106	1		1		2	6	6	3	3	2		1.21	13.27		$579,500	$120,874	$385,906	$1,086,279	
	1-3	I-275	Howard Frankland Bridge	Skyway Bridge	11.44																											
	1-4	Gulf to Bay/SR 60	Hillcrest Ave.	Damascus Drive	4.54				2	4			78	1	3	4		2	3	3	6	6	2			4.23		$427,400	$50,528	$263,338	$741,266	
	1-5	Tampa Rd./SR 584/SR 580	East Lake Rd.	County Line	7.42		9	9	1	2	9	9	55	2		2	9	1	1	1	12	12	1	9	3.42			$631,705	$390,535	$563,255	$1,585,495	
	1-6	SR 686†	49th St.	Bryan Dairy	1.25		1	1	1	3	1	1	9	2	1	3	1	1	1	1	5	5	1	1	1.25			$247,461	$141,140	$214,119	$602,721	
	1-7	Bryan Dairy	Seminole Blvd/Alt. US 19	Roosevelt/SR 686	8.32	1	11	9	4	8	9	9	47	6	2	8	9	4	4	4	21	21	4	9	8.32			$1,238,382	$898,915	$1,177,651	$3,314,948	
	1-8	Main St./ SR 580	McMullen Booth	SR 584/Tampa Rd.	3.28		3	4	1	2	4	4	12		2	2	4	1	1	1	7	7	1	4	3.28			$288,115	$332,441	$341,926	$962,482	
	1-9	Roosevelt/SR 686	Ulmerton Rd./SR 688	Gandy Blvd./4th St. N./ SR 694	3.11	4		4		1		4		1		1	4				5	5		4	3.11			$198,500	$315,594	$283,266	$797,359	
	1-10	Tampa Rd*	Belcher Rd.	McMullen Booth	2.34		1	1		2	1	1	22	1	1	2	1				3	3		1		1.73		$120,876	$19,764	$77,493	$218,132	
	1-11	Curlew Rd./SR 586	McMullen Booth	SR 584/Tampa Rd.	0.94		1	1	1		1	1	12				1	1	1	1	2	2	1	1		0.84		$161,955	$10,676	$95,120	$267,751	
1	1-12	49th St. N./Bayside Bridge	US 19/SR 55	Gulf to Bay/SR 60	6.78		6	6	2	3	6	6	51		3	3	6	2	3	3	11	11	2	6		3.43		$603,674	$69,968	$371,177	$1,044,818	$31,342,874
	1-13	Tarpon Avenue/Keystone Rd.	US 19/SR 55	East Lake Rd.	3.00					2			4		2	2					2	2			3.00			$47,192	$281,456	$181,085	$509,733	
	1-14	East Bay/Roosevelt/SR 686	Belcher Rd.	49th St. N./Bayside Bridge	2.83		7	7	1	2	7	7	100	1	1	2	7	1	1	1	10	10	1	7	2.83			$580,252	$322,401	$497,362	$1,400,014	
	1-15	Curlew Rd./SR 586*	Belcher Rd.	McMullen Booth	2.34		1	1		1	1	1	22	1		1	1				2	2		1		1.77		$95,176	$13,676	$59,977	$168,829	
	1-16	Main St./ SR 580*	Belcher Rd.	McMullen Booth	2.42		2	2	1	2	2	2	33	2		2	2	1	1	1	5	5	1	2	1.33	1.03		$317,591	$149,821	$257,544	$724,956	
	1-17	Walsingham Rd./ Ulmerton Rd. / SR 688	Gulf Blvd	66th St. N.	8.11	1	14	12	4	11	12	12	80	6	5	11	12	4	4	4	27	27	4	12	3.55	4.55	1	$1,454,853	$551,788	$1,105,659	$3,112,301	
	1-18	Countryside Blvd	Belcher Rd.	Main St.	1.14		3	3		1	3	3	7	1		1	3				4	4		3				$175,325	$28,852	$112,502	$316,679	
	1-19	Walsingham Rd./ Ulmerton Rd. / SR 689	66th St. N.	I-275	5.01		6	6	3	1	6	6	45	1		1	6	3	3	3	10	10	3	6	2.61	2.20		$666,586	$295,154	$529,919	$1,491,659	
	1-20	66th St. N./SR 693	US 19/SR 55	46th Avenue N.	6.01		11	11	4	5	11	11	66	2	3	5	11	4	4	4	20	20	4	11	6.01			$1,090,443	$665,718	$967,644	$2,723,804	
	1-21	Belcher Rd.	Klosterman Rd.	Druid Rd	8.89		16	19	5	11	19	19	60	4	7	11	19	5	5	5	35	35	5	19	8.89			$1,548,355	$1,001,782	$1,405,126	$3,955,263	
	1-22	Drew St.	Belcher Rd.	McMullen Booth	2.28		2	2			2	2	18				2				2	2		2		1.32		$115,535	$15,176	$72,022	$202,733	
	1-23	Belcher Rd.	Druid Rd.	Ulmerton Rd./SR 688	4.31		7	8	4	4	8	8	42		4	4	8	4	4	4	16	16	4	8	4.31			$839,673	$476,686	$725,313	$2,041,671	
				Total	136.20	6	113	118	44	77	114	118	1073	37	40	77	118	44	54	54	239	239	44	118	56.15	56.25	3	$13,520,528	$6,687,644	$11,134,702	$31,342,874	

Table 4-38: ATMS Investment Plan for Implementation Phase II

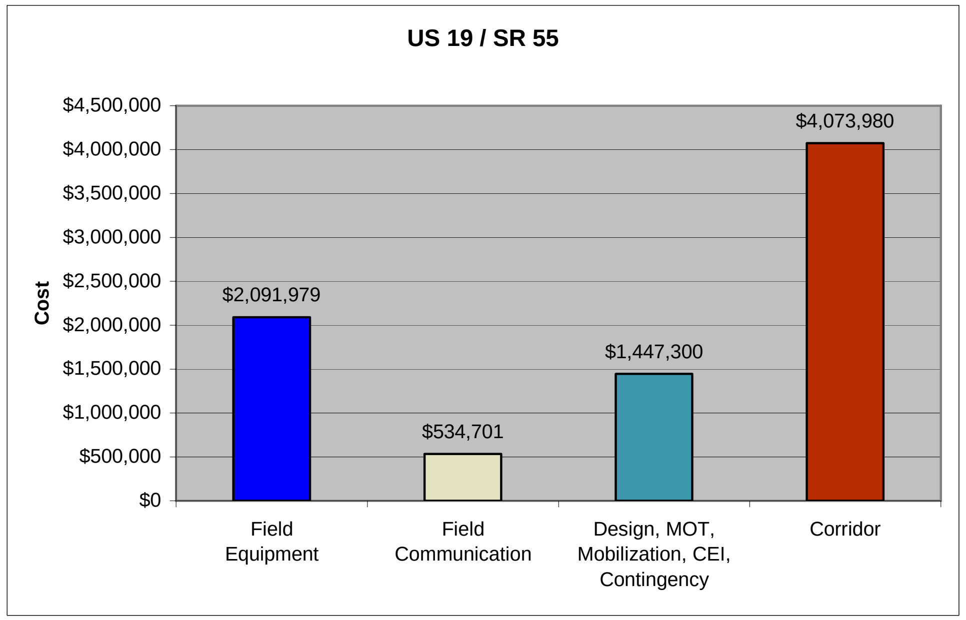
Phase	Corridor Rank	Roadway	Limits		Miles	Proposed ATMS Field Devices																						Implementation Cost by Component			Total Implementation	
			From	To		Non-Adaptive Signals	Adaptive Signals	TS-2 Cabinet	DMS Cabinet	CCTV Cabinet	Adaptive Control	VIDS	Detection	CCTV Level 1	CCTV Levels 2-3	MPEG-2 Encoder	MPEG-4 Encoder	DMS Assembly	DTB Signs	Blank-out Signs	Ethernet Switch	TVSS	HAR Sign and Flashers	UPS	Proposed Fiber in Conduit	Existing UG Fiber	COM HUB	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor	Phase
2	2-24	Starkey Rd./Keene Rd. Park St.	Tyrone Blvd/ Alt US 19/SR 595	Tampa Rd.	19.29	1	29	29	9	20	29	29	142	8	12	20	29	9	9	9	58	58	9	29	19.29			$2,890,124	$2,108,662	$2,754,331	$7,753,118	$26,622,875
	2-25	Trinity	East Lake Rd.	County Line	1.71																				1.71			$3,000	$153,490	$86,226	$242,715	
	2-26	Park Blvd./Gandy Blvd./SR 694	Gulf Blvd	I-275	11.97	1	17	18	7	11	17	18	86	4	7	11	18	7	7	7	36	36	7	18	11.97			$1,865,781	$1,299,595	$1,744,122	$4,909,498	
	2-27	49th St.	Park Blvd. N.	US 19/SR 55	1.60		4	4	1		4	4	27				4	1	1	1	5	5	1	4	1.60			$309,164	$177,056	$267,907	$754,127	
	2-28	Sunset Point Rd.	Belcher Rd.	McMullen Booth	2.22		3	3			3	3	16				3				3	3		3	2.22			$151,407	$222,031	$205,764	$579,202	
	2-29	Belleair CSWY/ (West/East) Bay Drive/ SR	Gulf Blvd	Belcher Rd.	6.58	1	11	11	3	5	11	11	2	2	3	5	11	3	3	3	19	19	3	11	5.50	0.56		$952,476	$624,440	$868,881	$2,445,796	
	2-30	US 19/SR 55	54th Avenue S.	54th Avenue N.	7.40	19		19	3	4		19	102	1	3	4	19	3	5	5	26	26	3	19	7.40			$1,373,288	$842,012	$1,220,630	$3,435,930	
	2-31	Belcher Rd.	Ulmerton Rd./SR 688	Park Blvd	4.00		3	4	1	3	4	4	30		3	3	4	1	1	1	8	8	1	4	4.00			$328,778	$403,156	$403,295	$1,135,229	
	2-32	54th Avenue N.	66th St. N.	I-275	5.06	1	7	8		2	7	8	28	1	1	2	8				10	10		8	5.06			$432,702	$527,066	$528,832	$1,488,599	
	2-33	66th St. N./SR 693	46th Avenue N.	Gulf Blvd	5.35	13	7	20		7	7	20	26	5	2	7	20				27	27		20	5.35			$1,071,206	$674,592	$961,935	$2,707,732	
	2-34	Clearwater CSWY/Gulf to Bay/ SR 60	Gulf Blvd	Hillcrest	3.66		8	6		6	6	6	10	2	4	6	6				12	12		6	1.67	1.31		$507,819	$247,131	$415,978	$1,170,928	
				Total	68.84	36	89	122	24	58	88	122	469	23	35	58	122	24	26	26	204	204	24	122	65.77	1.87		$9,885,743	$7,279,231	$9,457,901	$26,622,875	

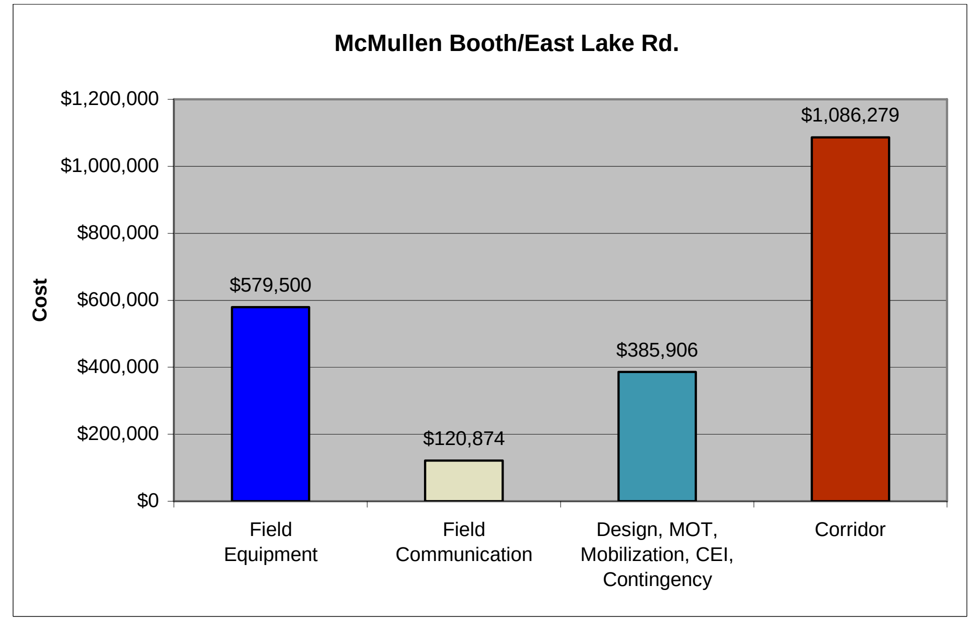
Table 4-39: ATMS Investment Plan for Implementation Phase III

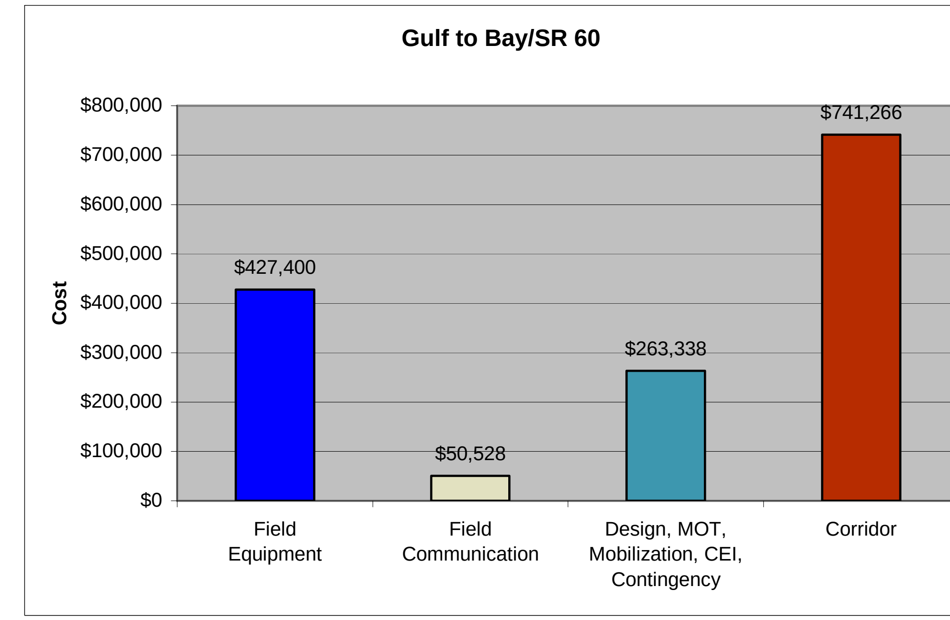
Phase	Corridor Rank	Roadway	Limits		Miles	Proposed ATMS Field Devices																						Implementation Cost by Component			Total Implementation Cost	
			From	To		Non-Adaptive Signals	Adaptive Signals	TS-2 Cabinet	DMS Cabinet	CCTV Cabinet	Adaptive Control	VIDS	Detection	CCTV Level 1	CCTV Levels 2-3	MPEG-2 Encoder	MPEG-4 Encoder	DMS Assembly	DTB Signs	Blank-out Signs	Ethernet Switch	TVSS	HAR Sign and Flashers	UPS	Proposed Fiber in Conduit	Existing UG Fiber	COM HUB	Field Equipment	Field Communication	Design, MOT, Mobilization, CEI, Contingency	Corridor	Phase
3	3-35	Gandy Blvd	I-275	Hillsborough County	5.01			1	1			1					1	1	1	1	2	2	1	1	3.28			$104,500.00	$297,500.80	$221,502	$623,503	$36,494,062
	3-36	Sunset Point Rd.	Keene Rd.	Belcher Rd.	1.10		1	1			1	1	8				1				1	1		1	1.10			$55,663.33	$106,324.00	$89,255	$251,242	
	3-37	Tyrone Blvd/SR 595	Alt. US 19/ SR 595/ Se	5th Avenue N./ SR 595	5.59	5	2	8		5	2	8	12	3	2	5	8				13	13		8	5.59			$448,035.00	$585,314.40	$569,376	$1,602,725	
	3-38	Tarpon Ave	Alt. US 19/ SR 595	US 19/ SR	1.44		2	2		1	2	2	1	1		1	2				3	3		2	1.44			$125,057.92	$150,518.40	$151,843	$427,419	
	3-39	Keystone Rd.	East Lake Rd.	County Line	2.84								1												2.84			$4,197.92	$254,918.40	$142,773	$401,889	
	3-40	Alt. US 19/ SR 595 Palm Harbor Blvd./ Bayshore Blvd./Broadway /Edgewater Dr./ Myrtle Avenue	Klosterman Rd	Gulf to Bay/SR 60	11.96	3	11	18		14	15	18	20	5	9	14	18				32	32		18	11.96			$972,238.33	$1,264,993.60	$1,232,715	$3,469,947	
	3-41	49th St. N.	Park Blvd./ SR 694	38th Avenue N.	2.26	1	3	4		2	3	4	30	1	1	2	4				6	6		4	2.26			$262,777.50	$245,385.60	$279,998	$788,161	
	3-42	Missouri Ave/ Seminole Blvd./SR 595/SR 6	Gulf to Bay/SR 60	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	9.04		18	18	4	7	18	18	123		7	7	18	4	4	4	29	29	4	18	9.04			$1,469,683.75	$1,002,982.40	$1,362,439	$3,835,105	
	3-43	Treasure Island Causeway	Gulf Blvd	Alt 19/ 66th St.	2.32	4	1	5	1	3	1	5	16	1	2	3	5	1	1	1	9	9	1	5	2.32			$401,646.67	$267,535.20	$368,719	$1,037,901	
	3-44	38th Avenue N.	Tyrone Blvd/SR 595	4th St. N.	6.79	11		11		4		11		1	3	4	11				15	15		11	6.79			$539,000.00	$717,290.40	$692,216	$1,948,506	
	3-45	Gulf Blvd./ Pinellas Bayway	Clearwater CSWY	I-275	25.38	23		26	4	19		26		1	18	19	26	4	4	4	49	49	4	26				$1,722,900.00	$330,148.00	$1,131,229	$3,184,277	
	3-46	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira CSWY	Gulf Blvd	Seminole Blvd/Alt. US 19/ Bay Pine Blvd.	1.51	1	1	1	1	1	1	1		1		1	1	1	1	1	3	3	1	1	1.51			$222,480.00	$159,889.60	$210,686	$593,055	
	3-47	Courtney Campbell	Damascus Rd.	Hillsborough County	3.51				1				2					1	1	1	1	1	1					$106,895.83	$3,088.00	$60,601	$170,585	
	3-48	Curlew Rd./SR 586	Alt US 19/SR 595/ Bayshore Blvd	Belcher Rd.	2.06				1				12					1	1	1	1	1	1		2.06			$118,875.00	$187,993.60	$169,085	$475,953	
	3-49	4th St. N.	22nd Avenue S.	I-275	7.71	27		27	1	7		27		1	6	7	27	1	1	1	35	35	1	27	7.71			$1,342,800.00	$942,629.60	$1,259,272	$3,544,701	
	3-50	22nd Avenue S./Gulfport Blvd.	Pasadena Ave	4th St. N.	7.56	8	4	12	2	5	4	12	16	1	4	5	12	2	2	2	19	19	2	12	7.56			$832,586.67	$806,257.60	$903,003	$2,541,847	
	3-51	9th St. S.	54th Avenue S.	22nd Avenue S.	3.42	4		4		2		4		1	1	2	4				6	6		4	3.42			$218,200.00	$349,507.20	$312,807	$880,514	
	3-52	5th Avenue N./ SR 595/Bay Pines Blvd.	Tyrone Blvd/ SR 595	4th St. N.	4.63	10		10	2	3		10			3	3	10	2	2	2	15	15	2	10	4.63			$667,100.00	$515,908.80	$651,838	$1,834,847	
	3-53	Alt. US 19/SR 595/ Pinellas Ave.	Klosterman Rd.	Pasco County Line	3.65		5	2		3	2	2	9		3	3	2				5	5		2	3.65			$288,281.25	$383,828.00	$370,332	$1,042,441	
	3-54	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	11.76		19	19	4	9	19	19	76		9	9	19	4	4	4	32	32	4	19	11.76			$1,495,861.67	$1,266,893.60	$1,522,278	$4,285,033	
	3-55	Drew St./ SR 590	Alt US 19/SR 595/ Ft. Harrison Ave.	Belcher Rd.	3.29		8	8		2	8	8	26		2	2	8				10	10		8	3.29			$418,185.83	$368,190.40	$433,293	$1,219,670	
	3-56	Main St./ SR 580	Alt US 19/SR 595/ Broadway	Belcher Rd.	2.80	1	7	8		1	7	8	41		1	1	8				9	9		8	2.80			$413,574.58	$318,120.00	$403,164	$1,134,858	
	3-57	54th Ave. S.	I-275	9th St. S.	2.01	4		6	1	2		6			2	2	6	1	1	1	9	9	1	6	2.01			$304,700.00	$226,033.60	$292,434	$823,168	
	3-58	Tampa Rd	Alt US 19/SR 595/ Palm Harbor Blvd	Belcher Rd.	1.33		2	2			2	2	16				2				2	2		2	1.33			$108,326.67	$134,556.80	$133,829	$376,712	
				Total	128.97	102	84	193	23	90	85	193	409	17	73	90	193	23	23	23	306	306	23	193	98.35			$12,643,568	$10,885,808	$12,964,686	$36,494,062	

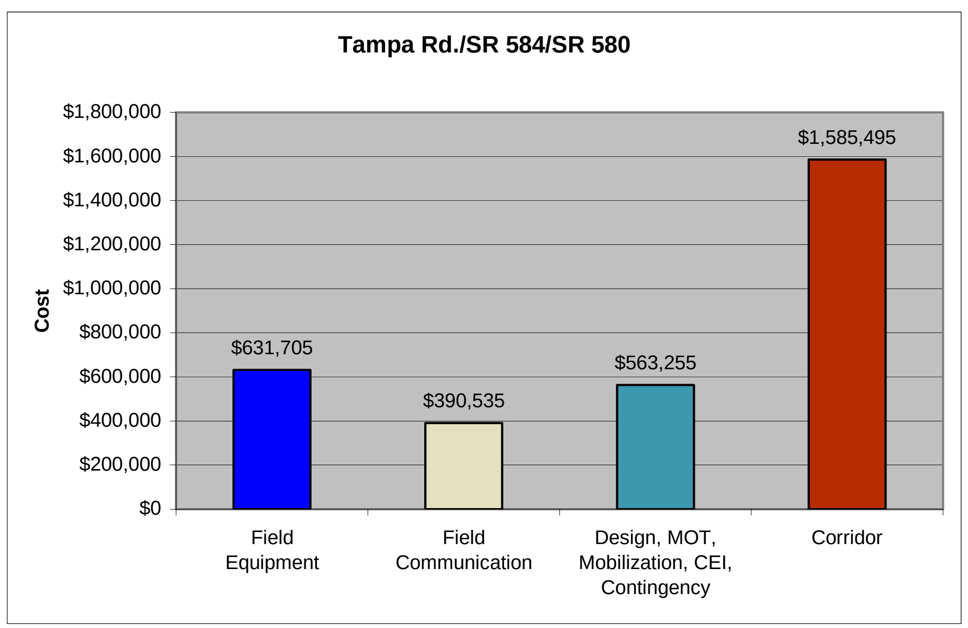
5.0 APPENDIX A - GRAPHS

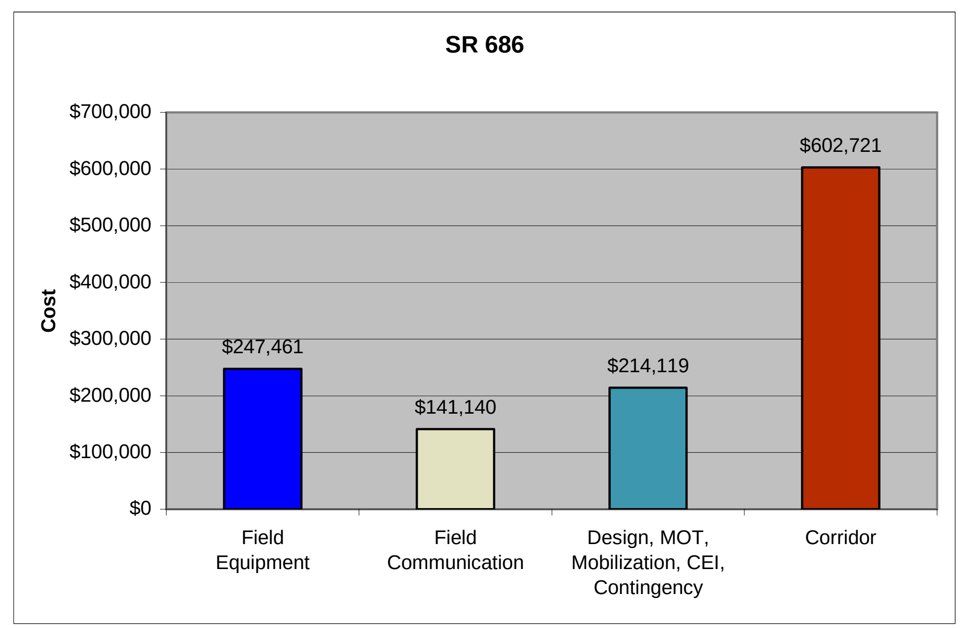
Figure 5-1: Project Development and Deployment Costs











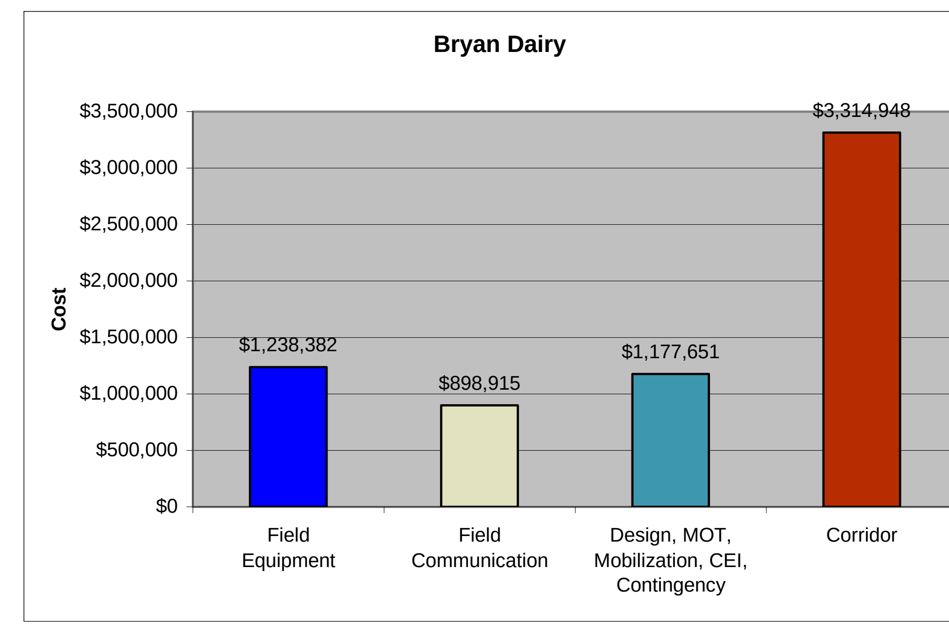


Figure 5-2: Project Development and Deployment Costs

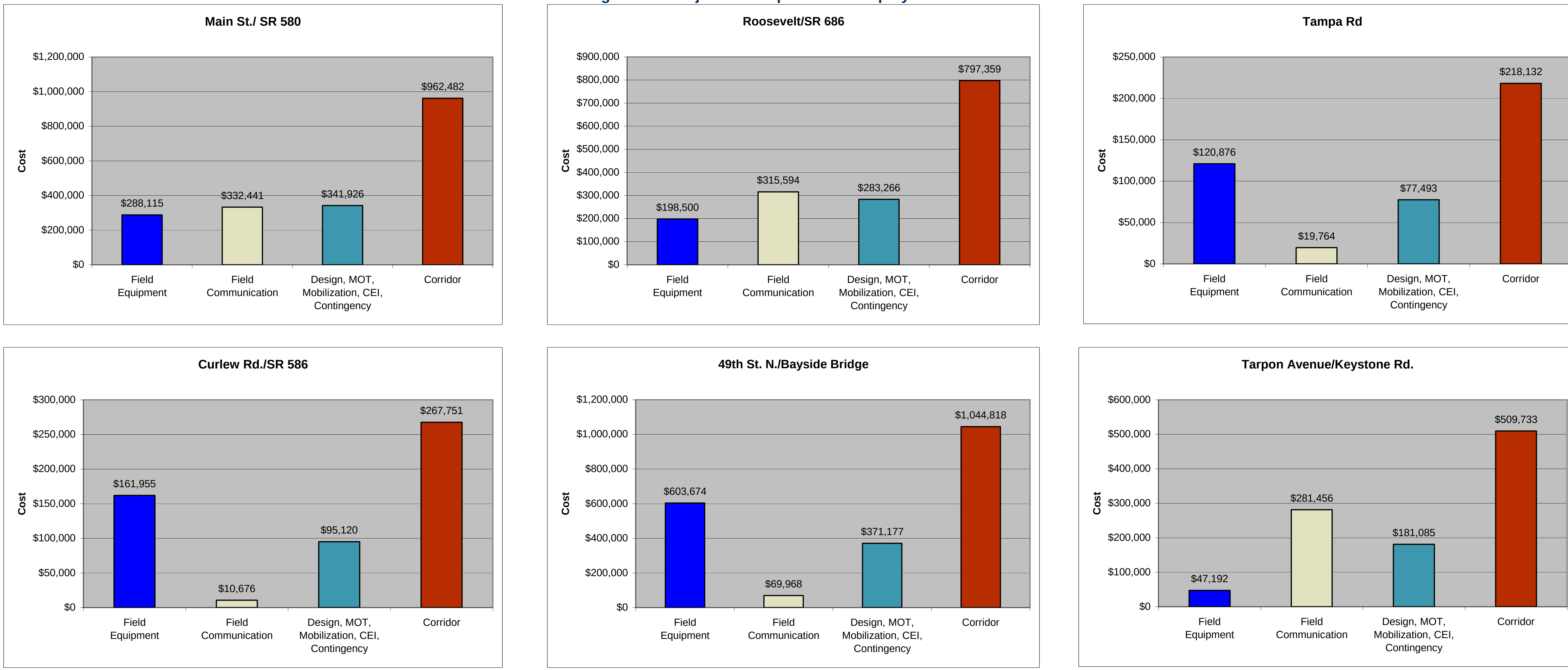
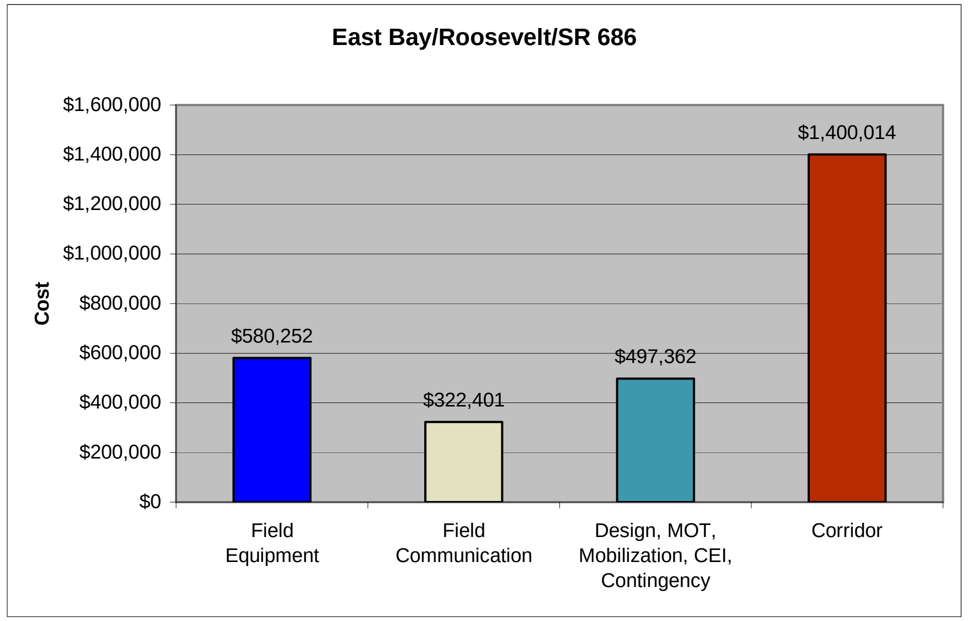
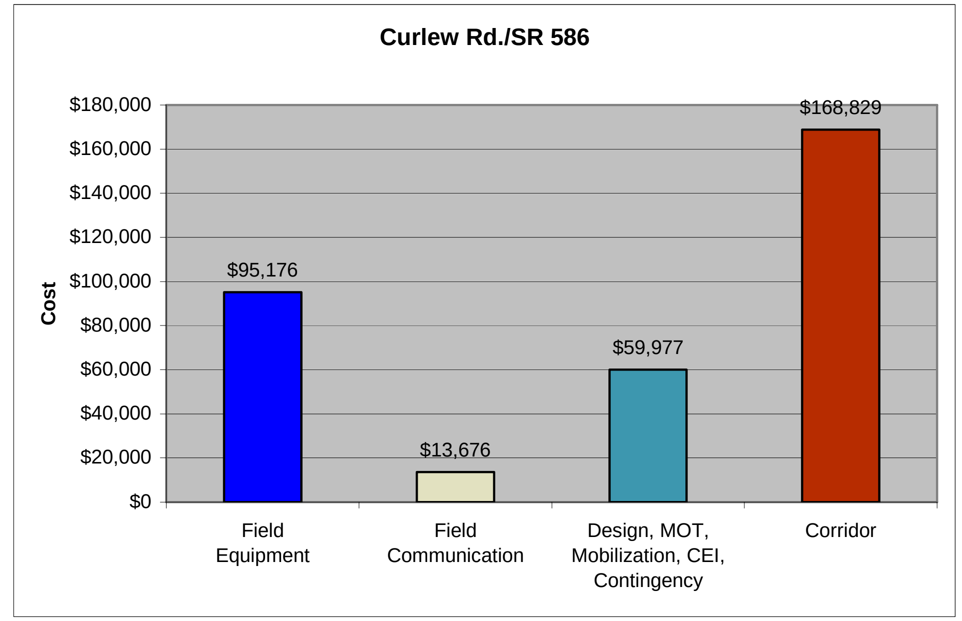
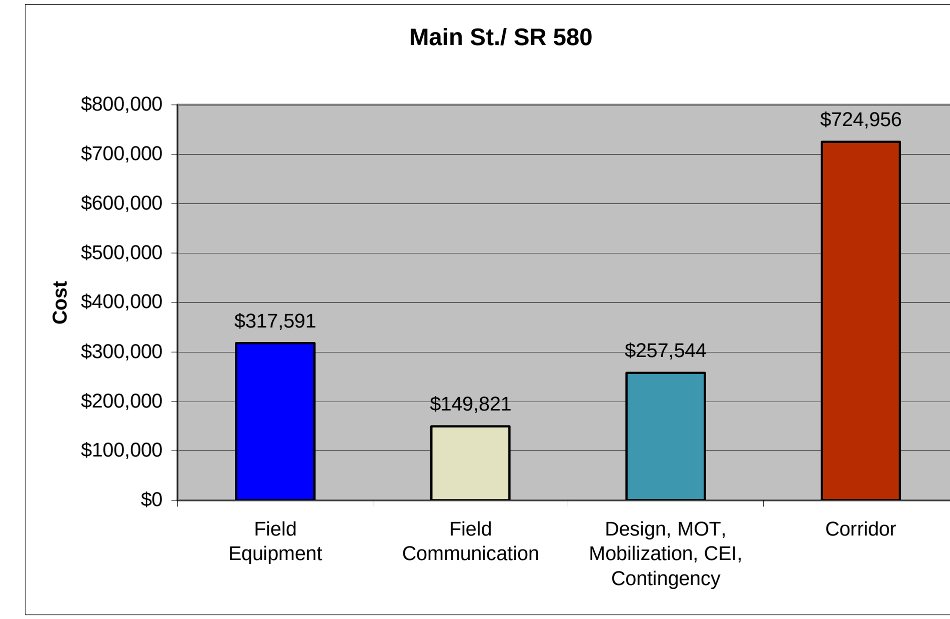
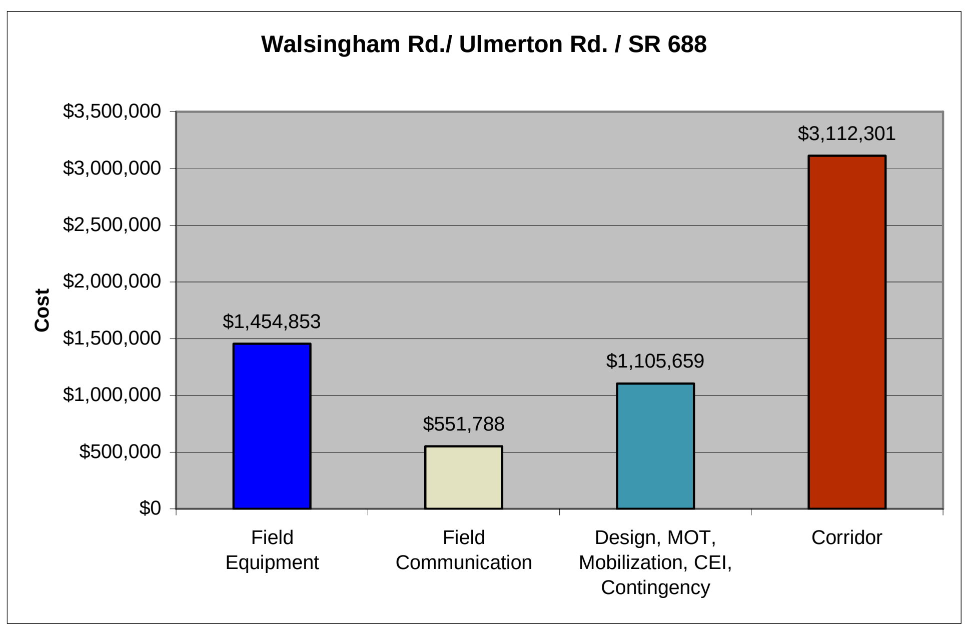


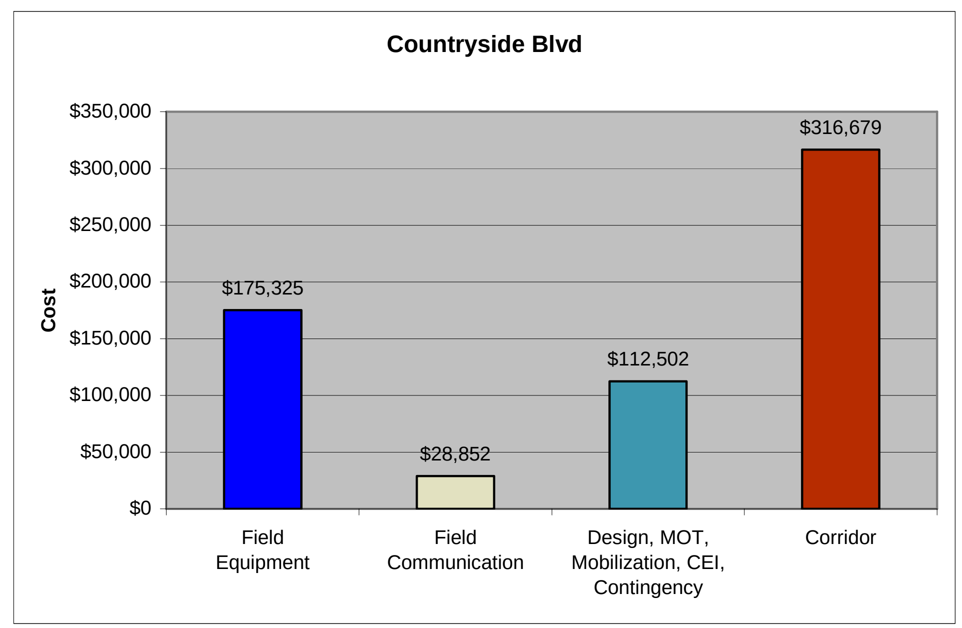
Figure 5-3: Project Development and Deployment Costs











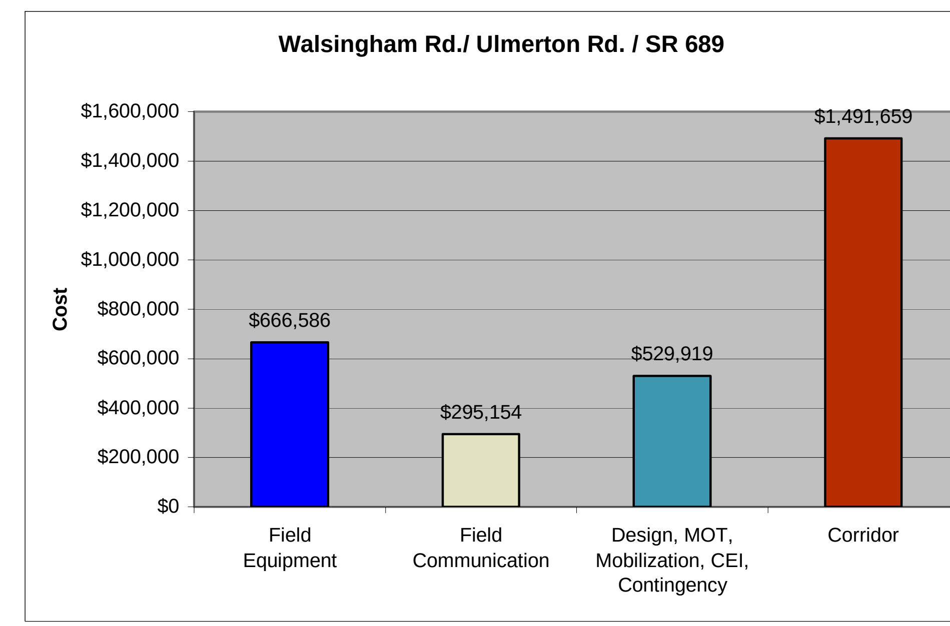
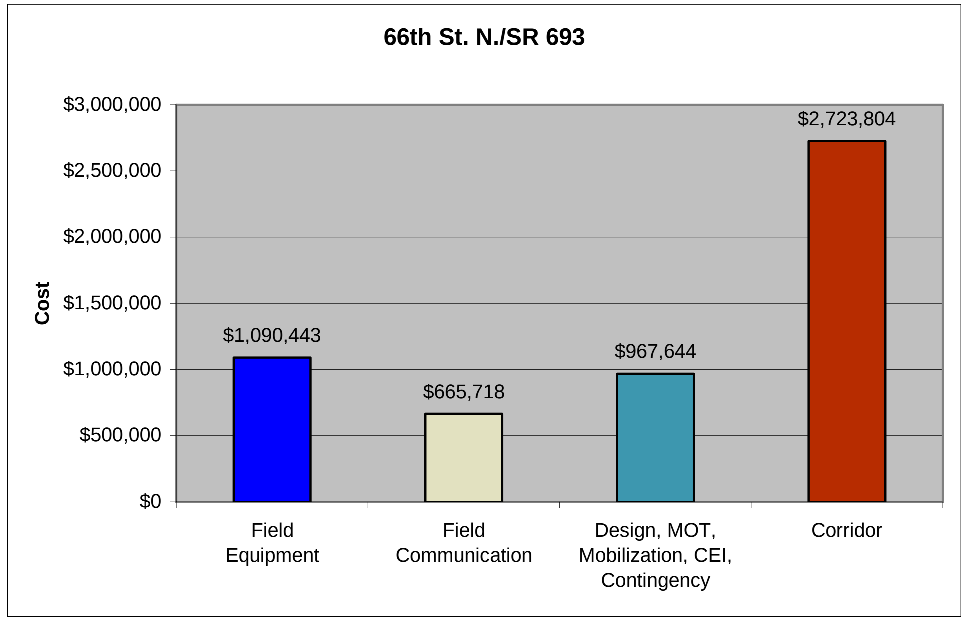
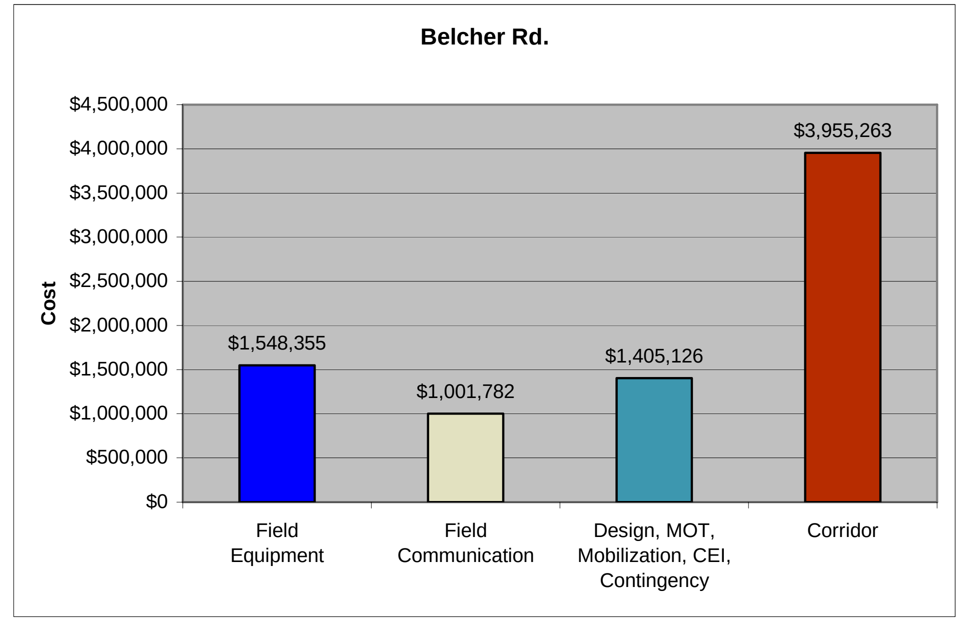
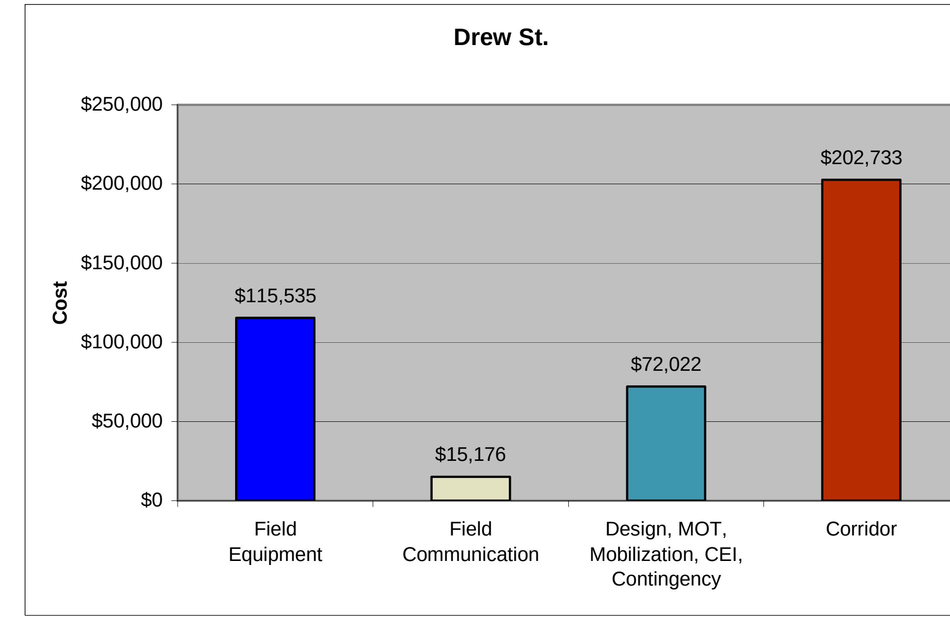
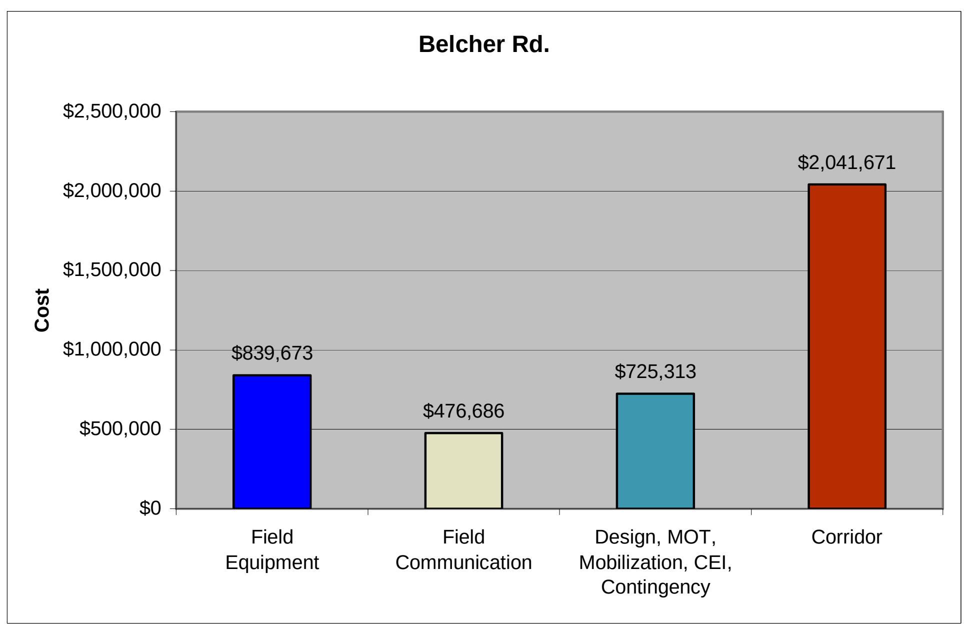


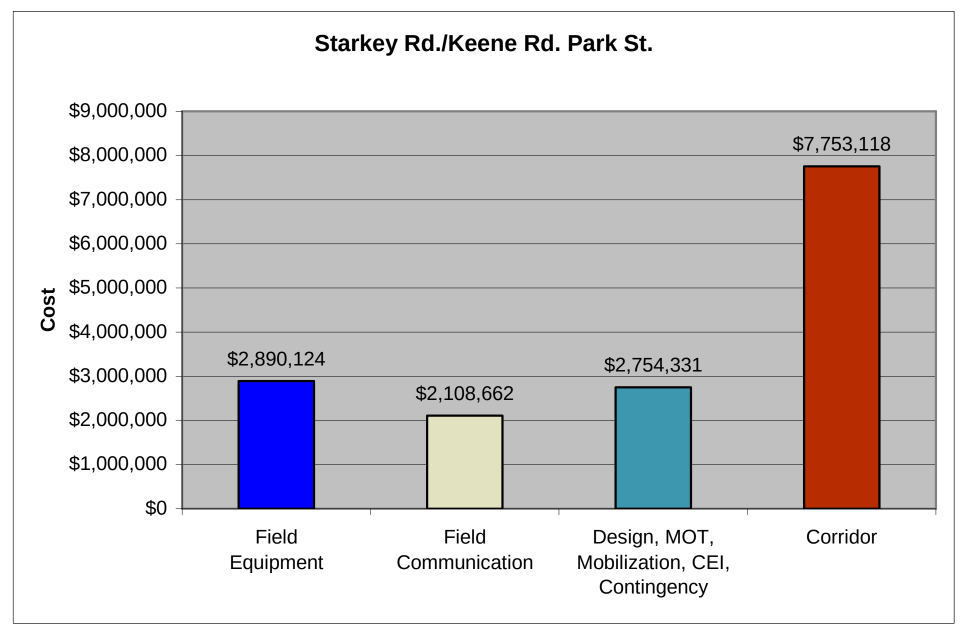
Figure 5-4: Project Development and Deployment Costs











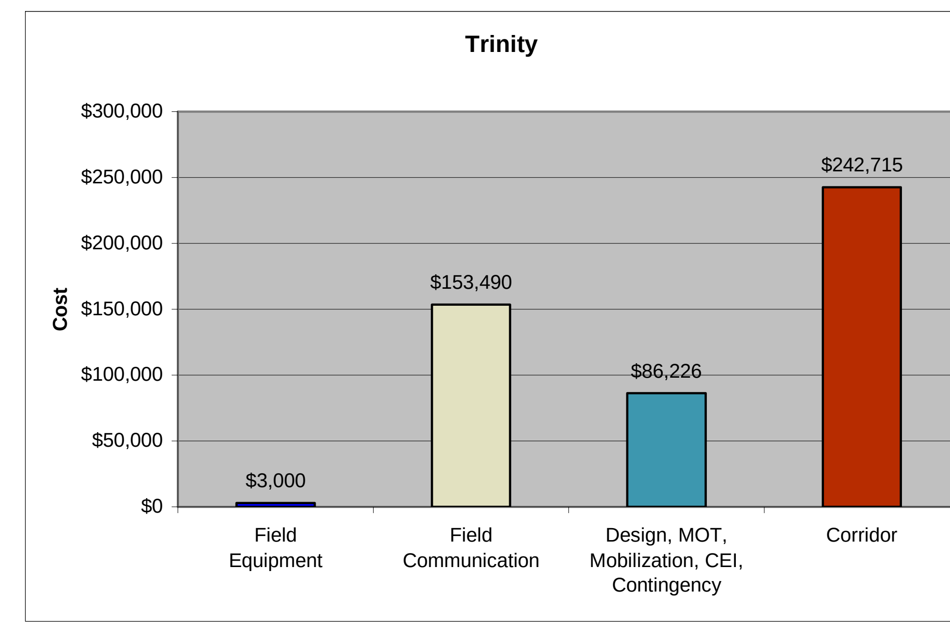
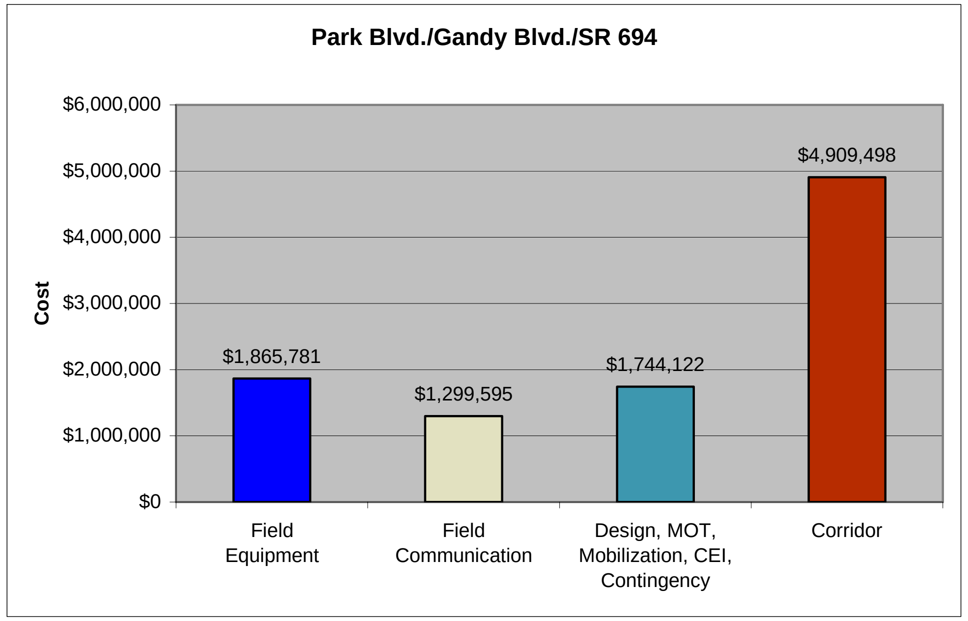
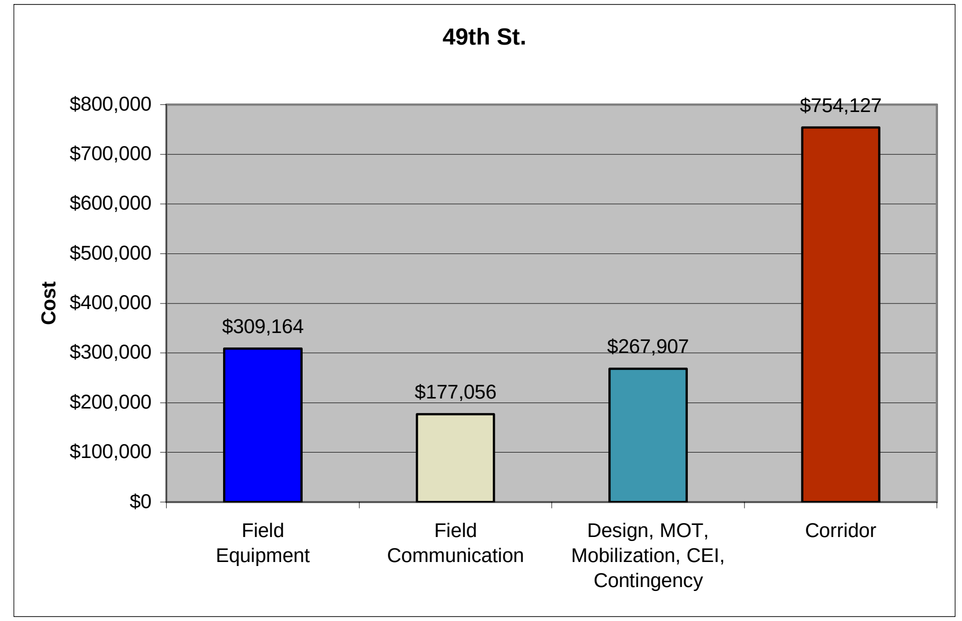
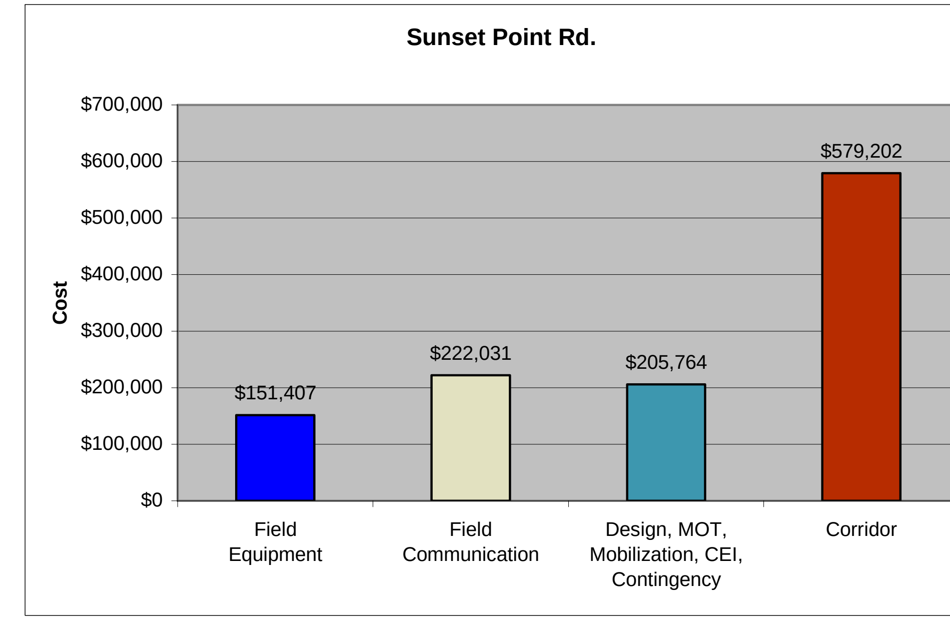
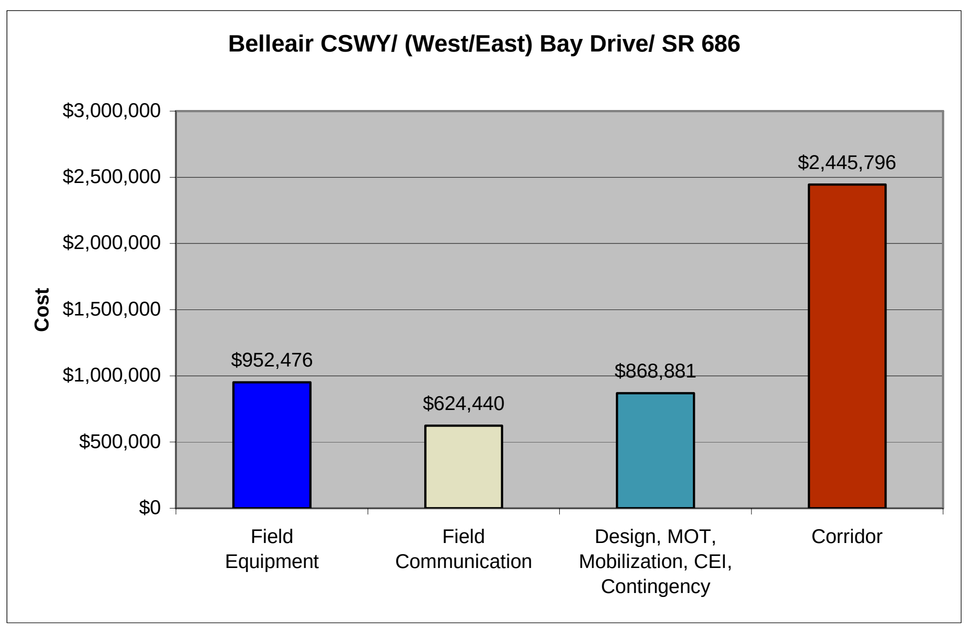


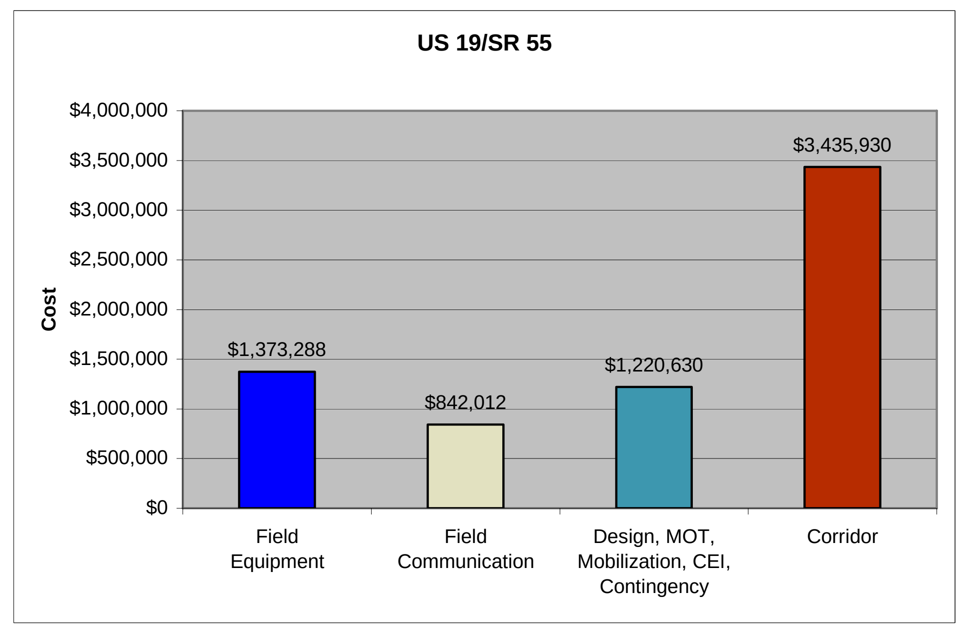
Figure 5-5: Project Development and Deployment Costs











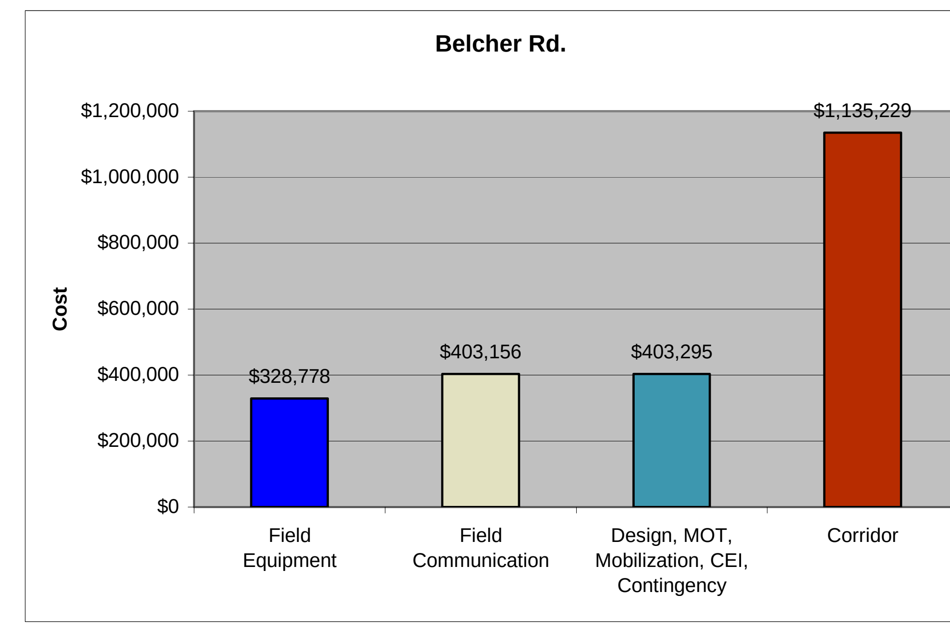
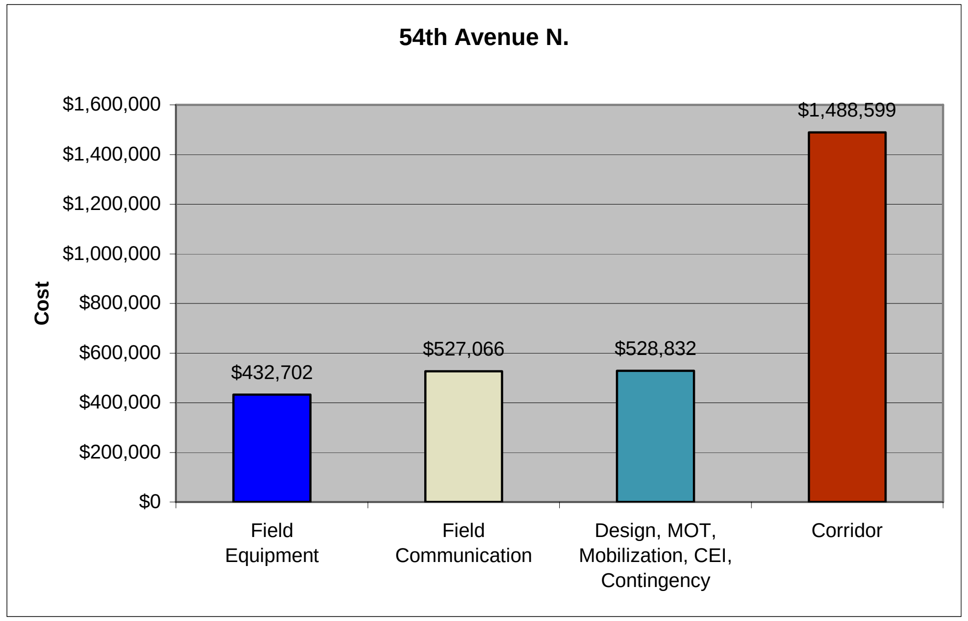
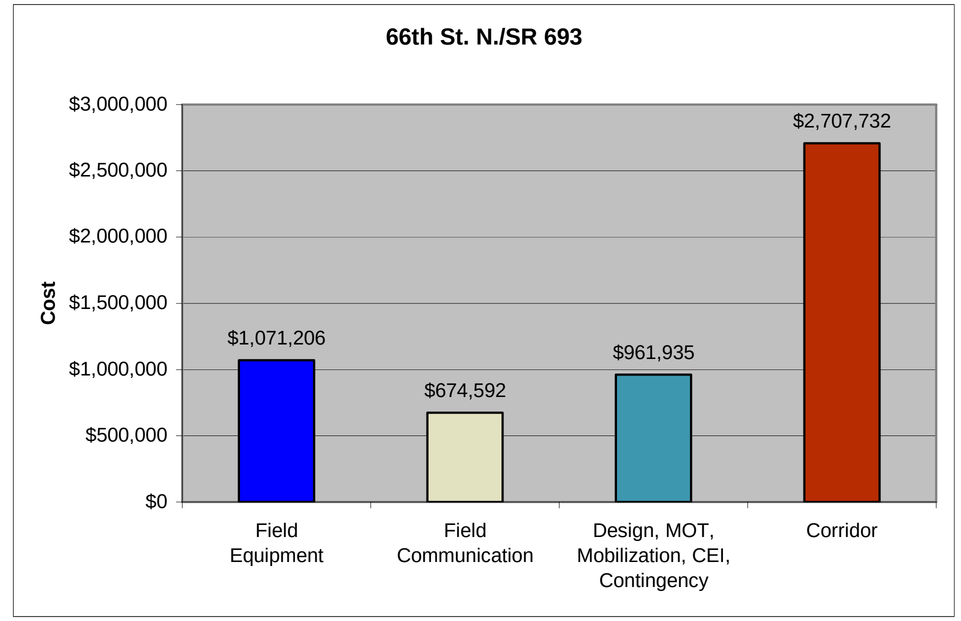
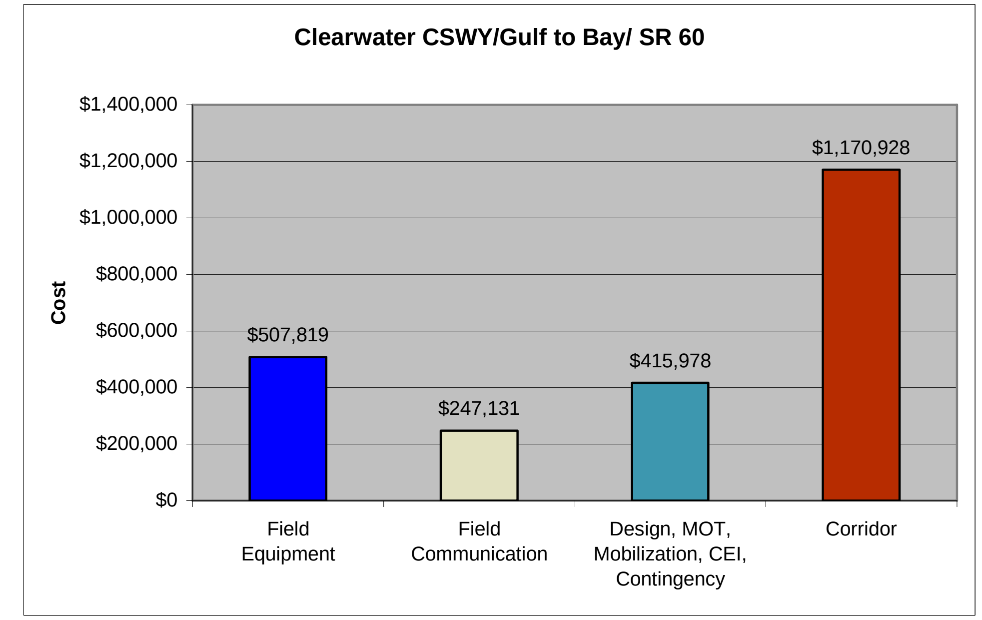
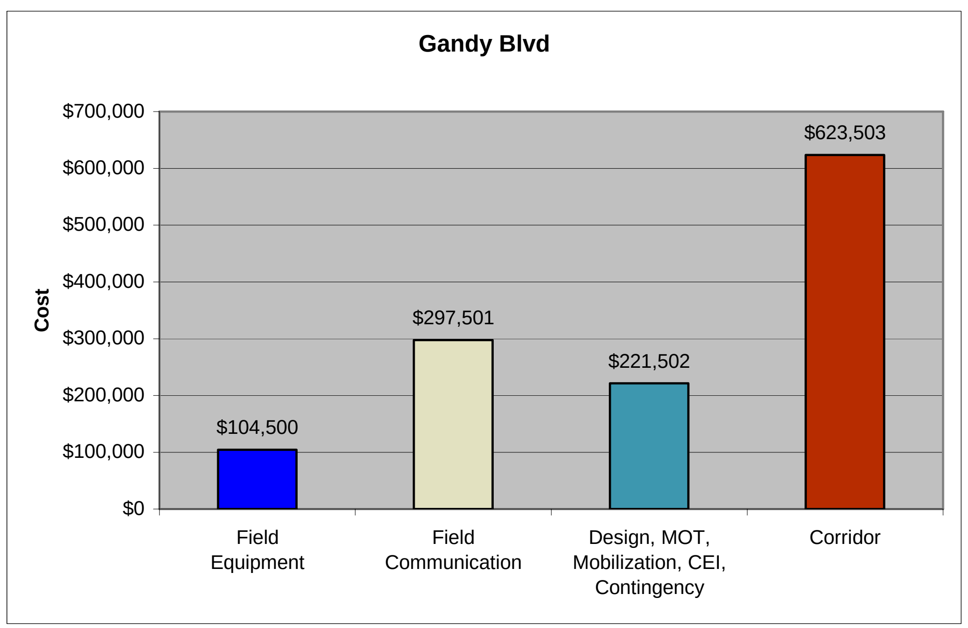


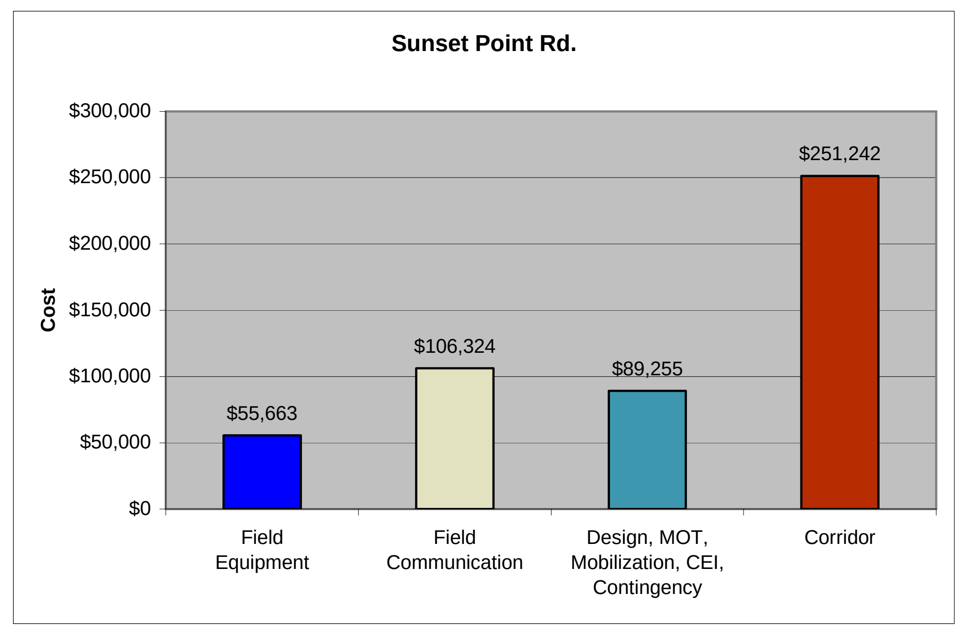
Figure 5-6: Project Development and Deployment Costs











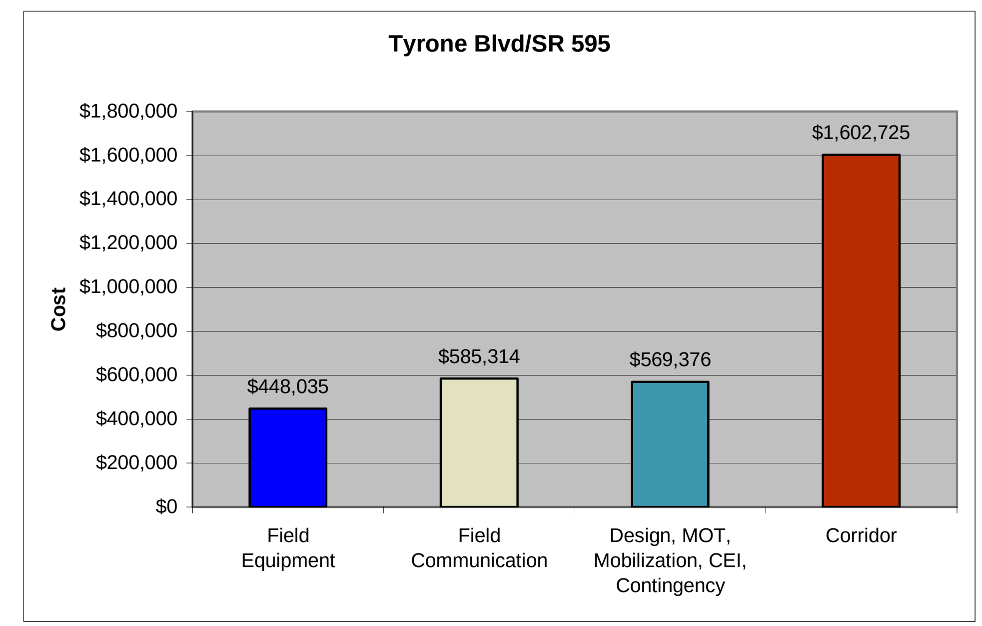
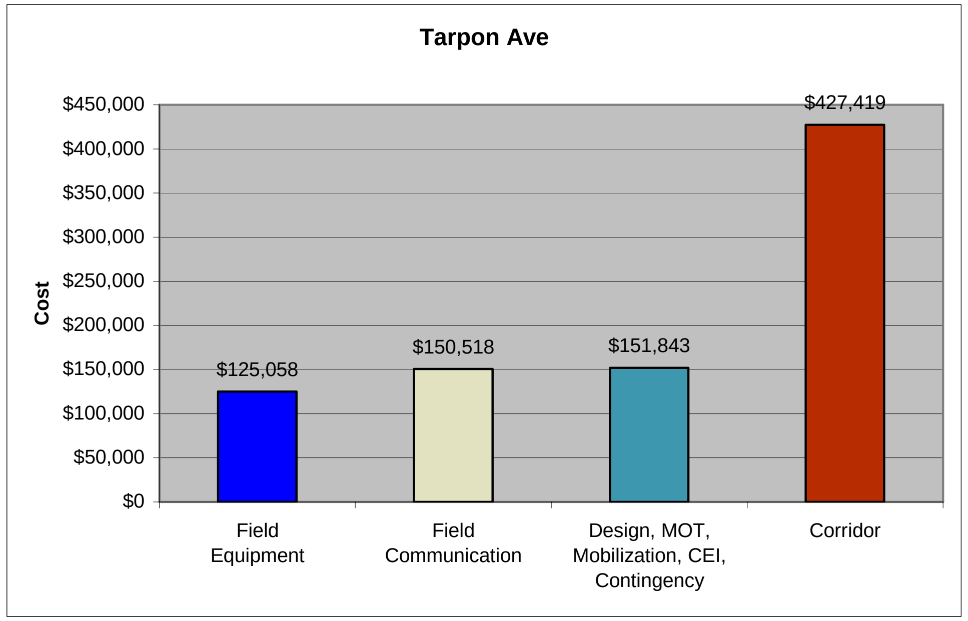
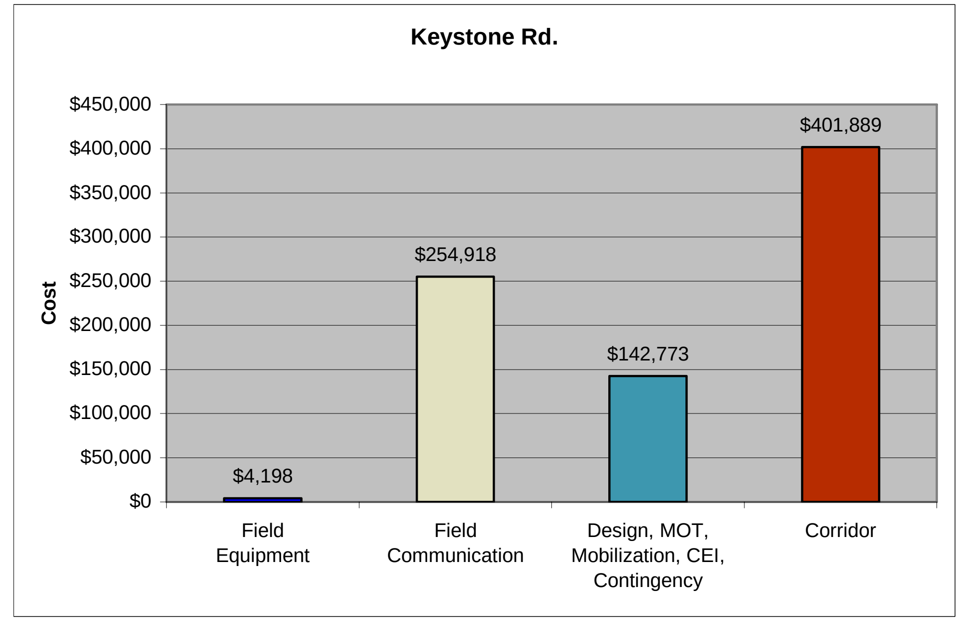
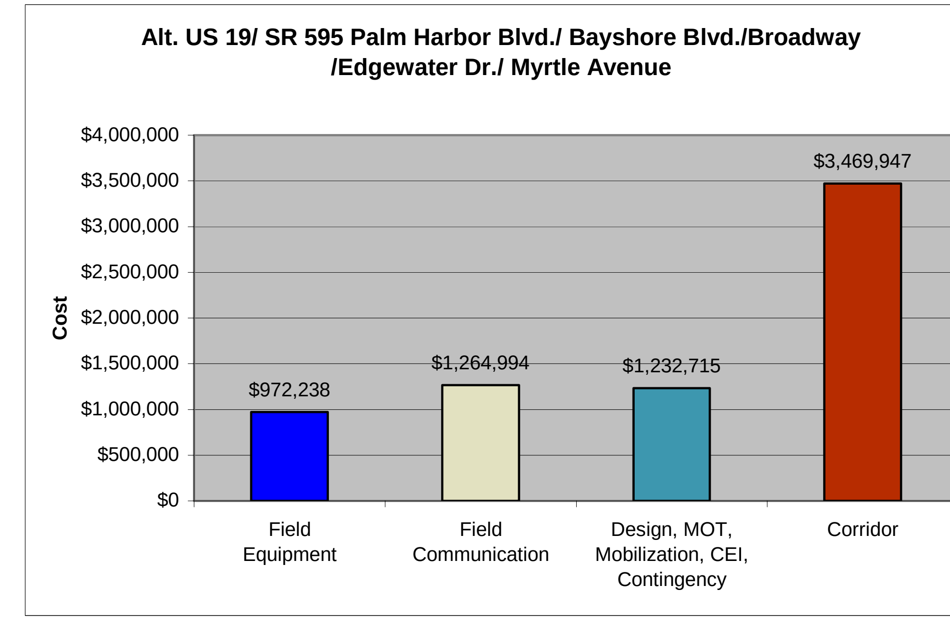
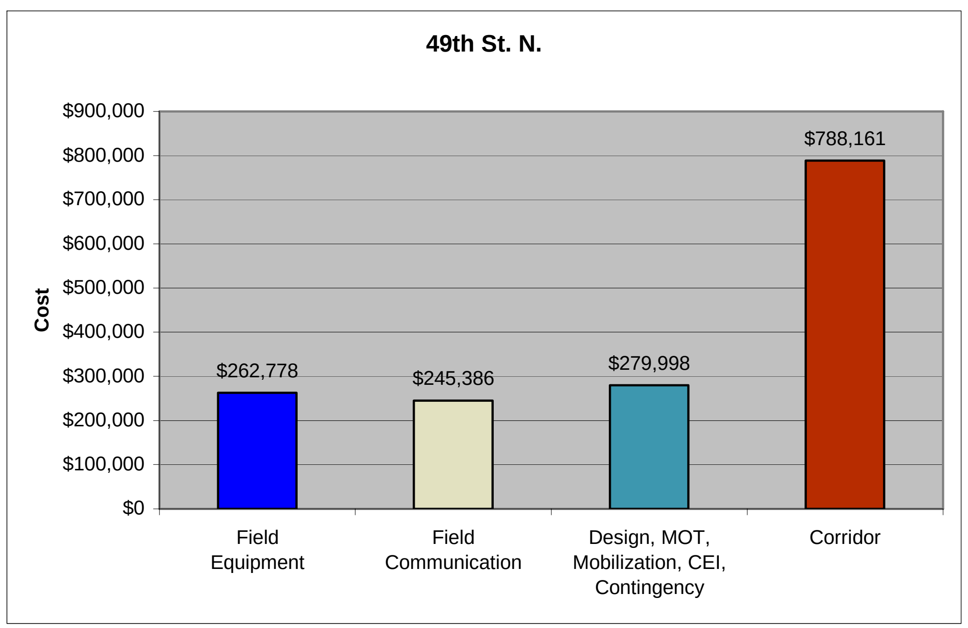


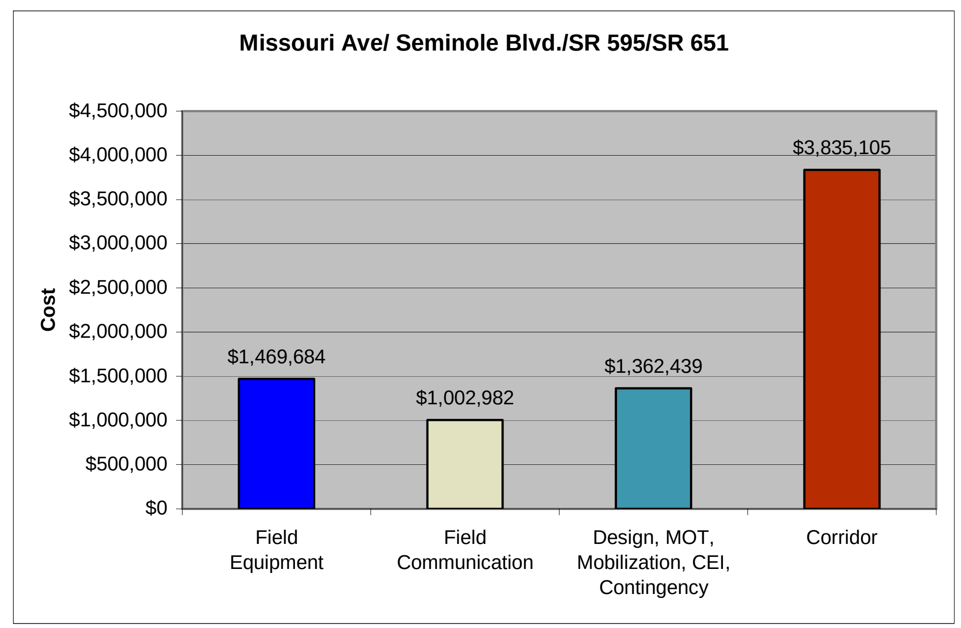
Figure 5-7: Project Development and Deployment Costs











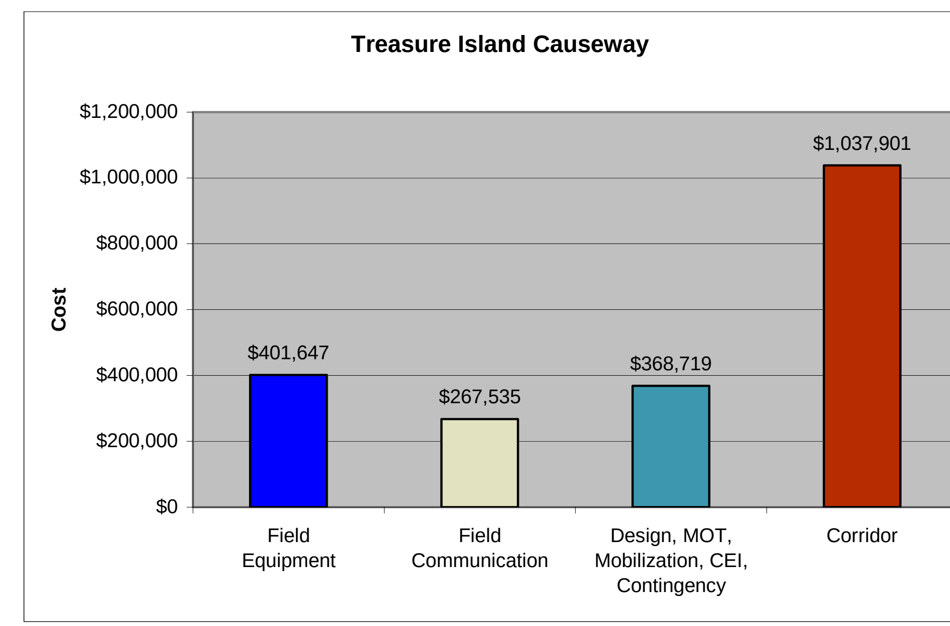
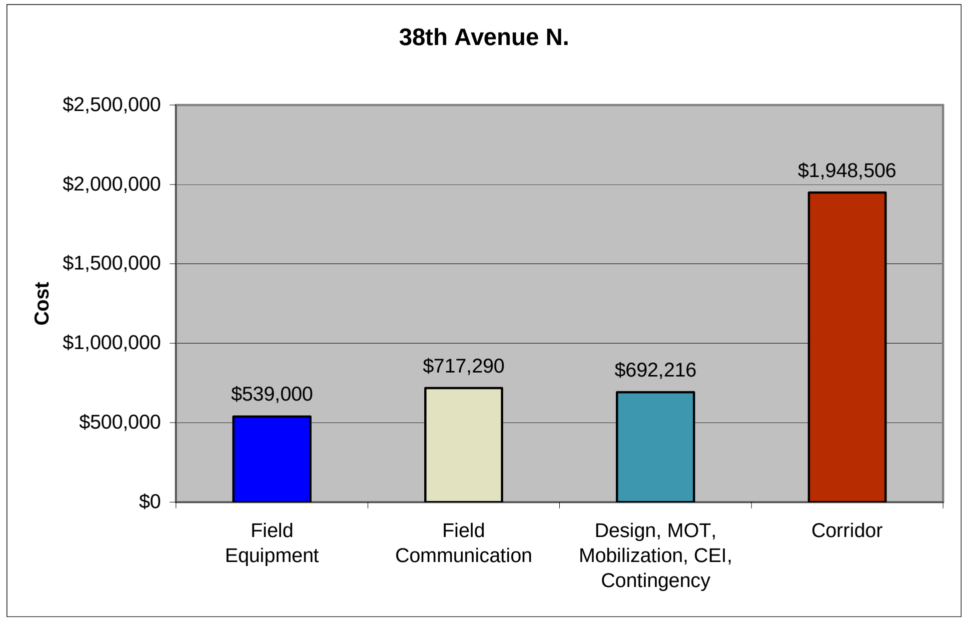
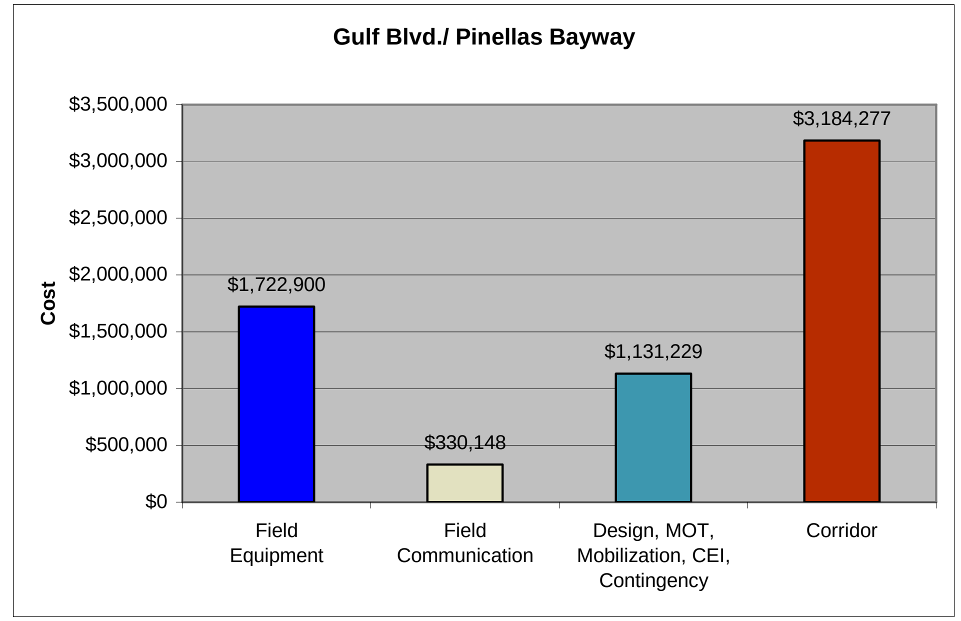
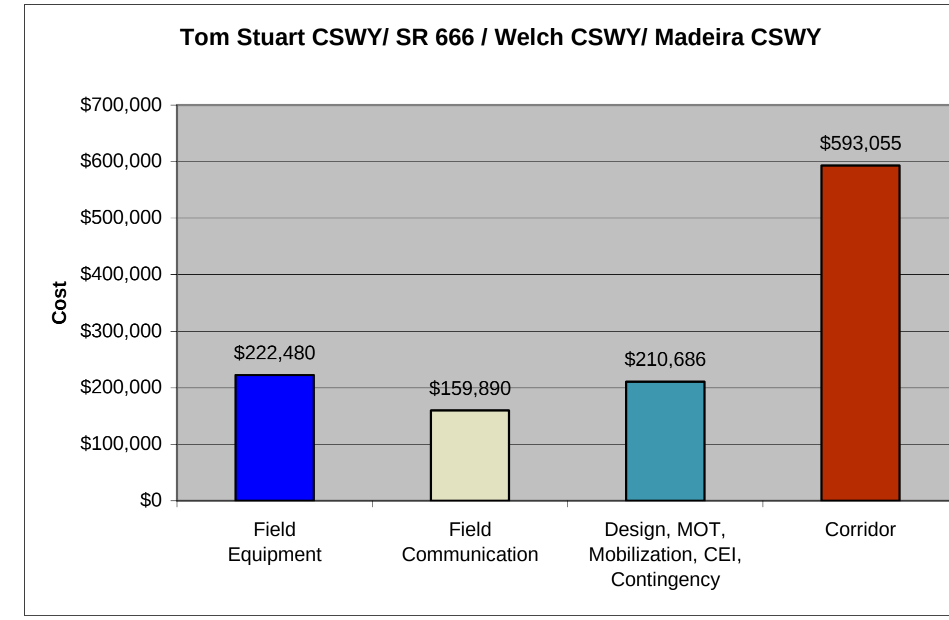
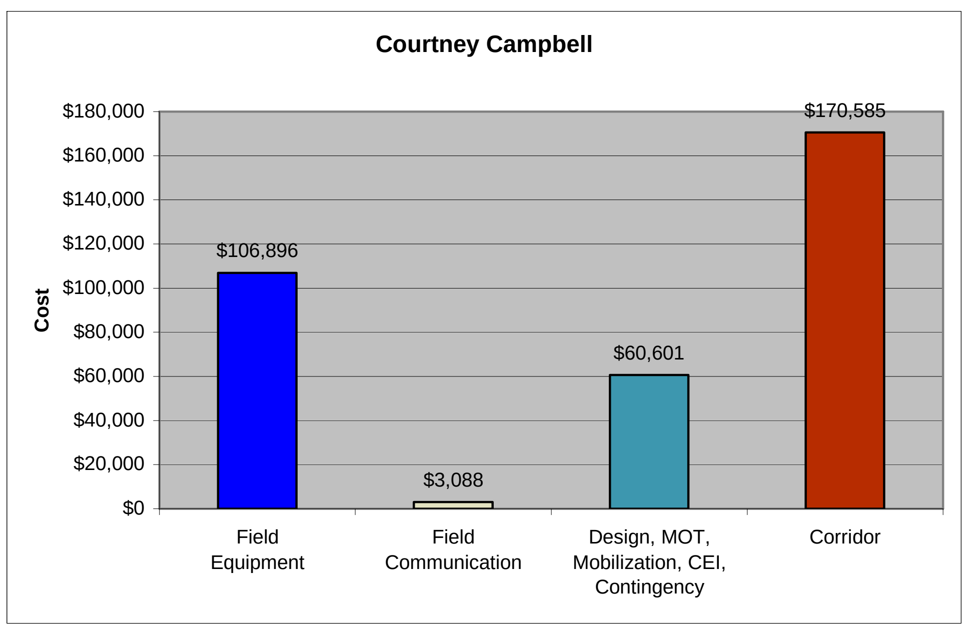


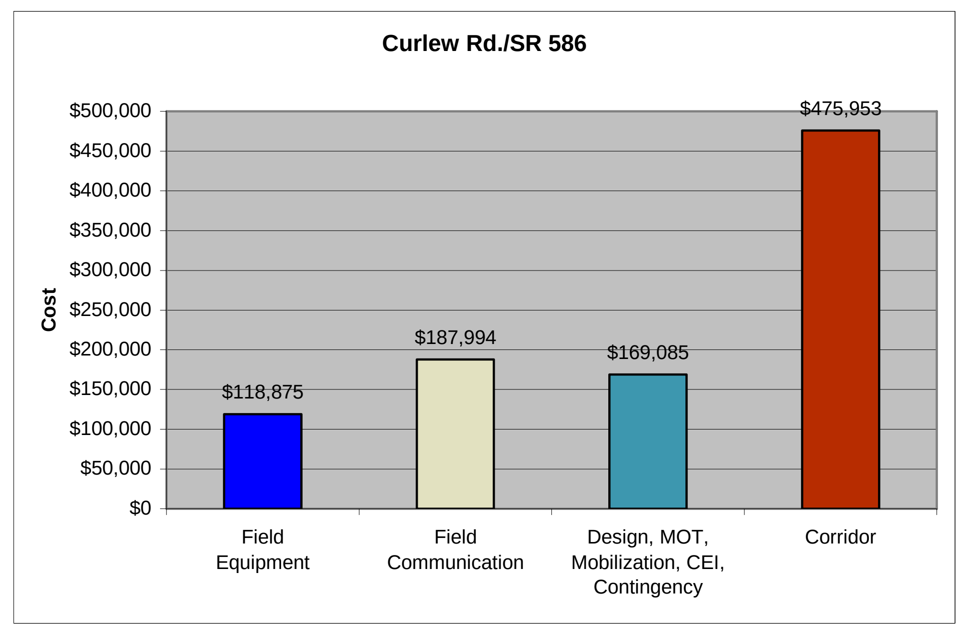
Figure 5-8: Project Development and Deployment Costs











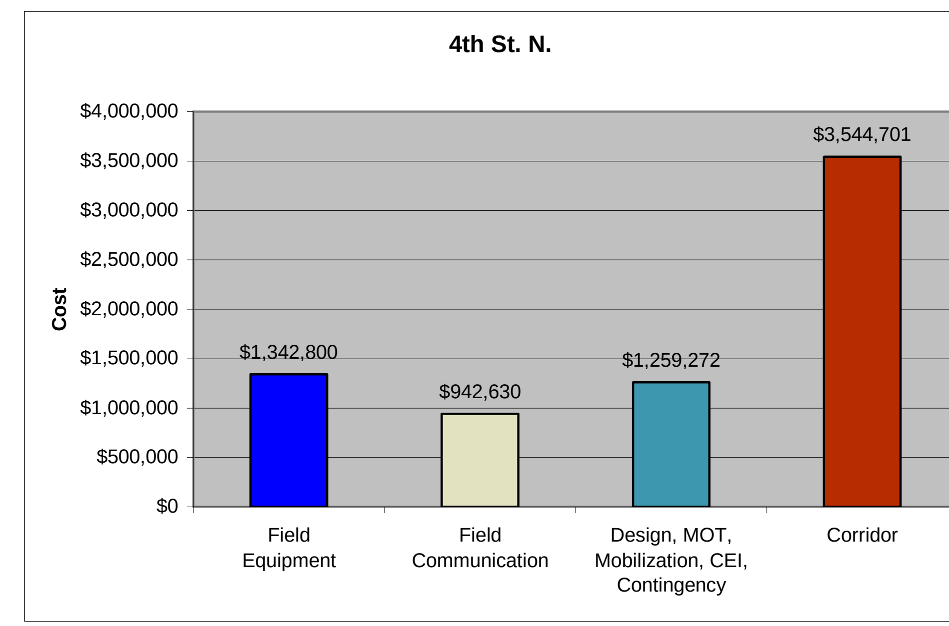
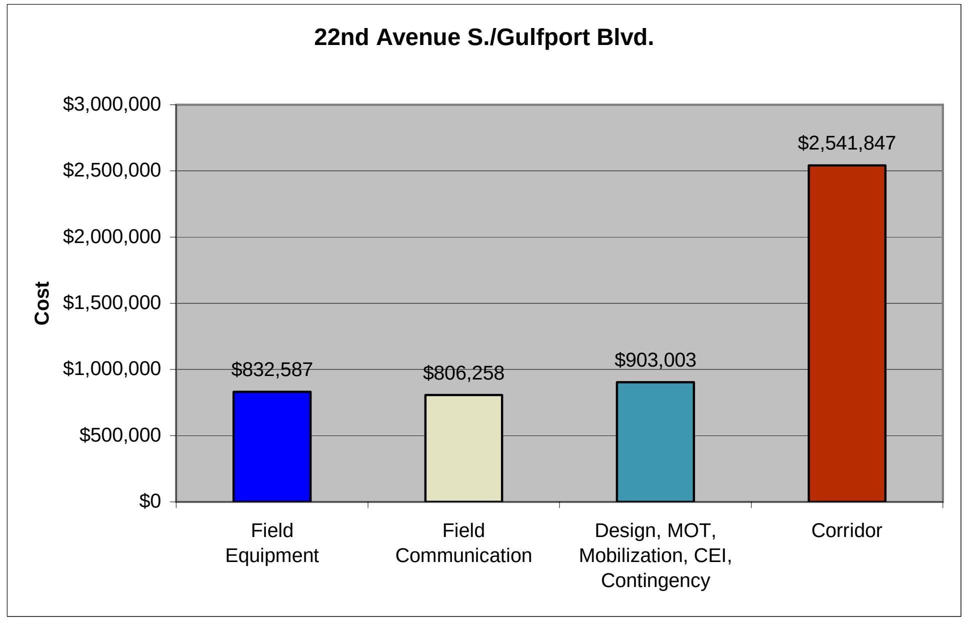
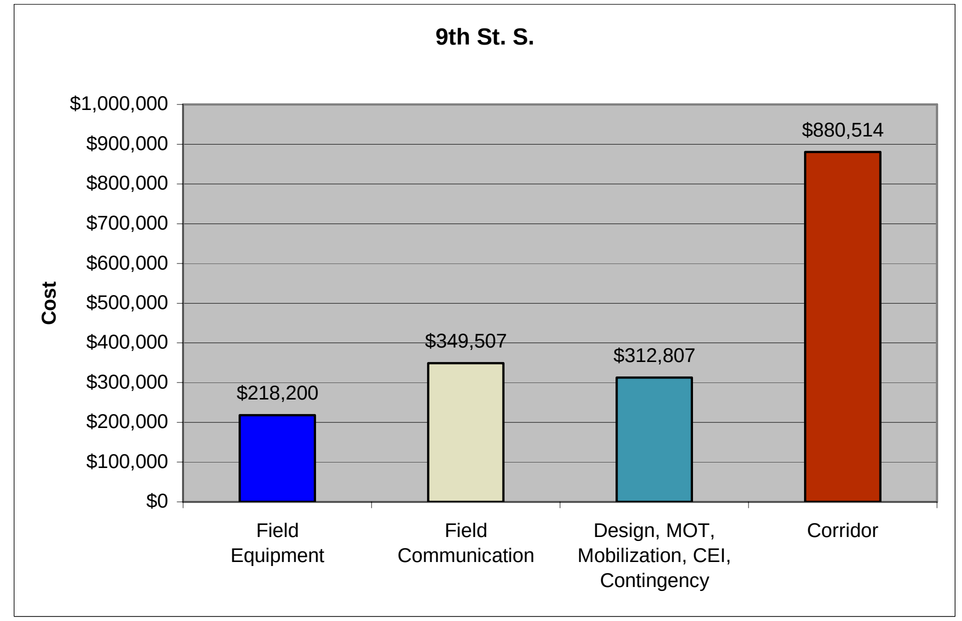
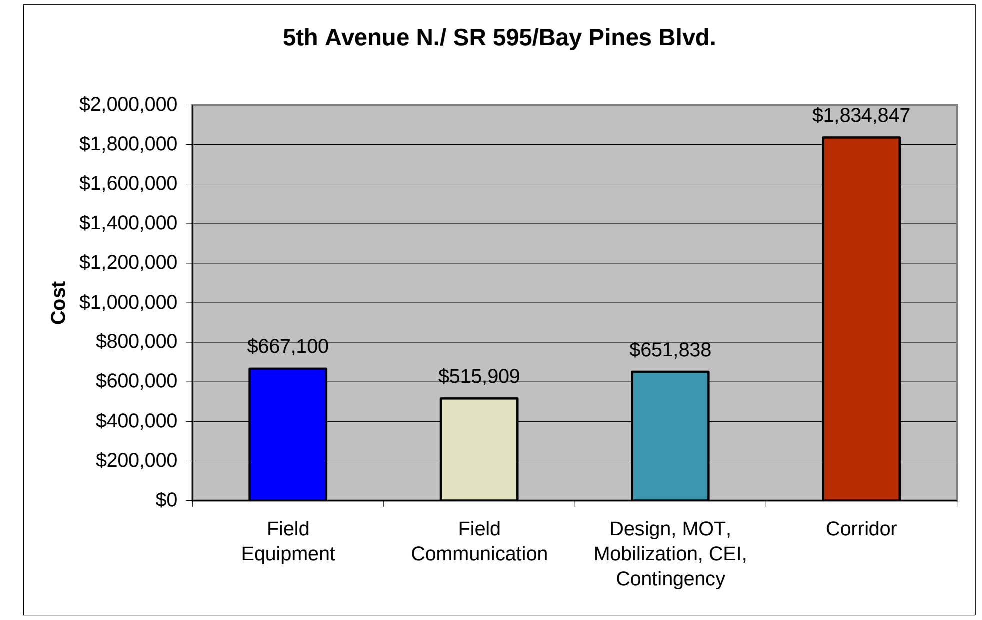
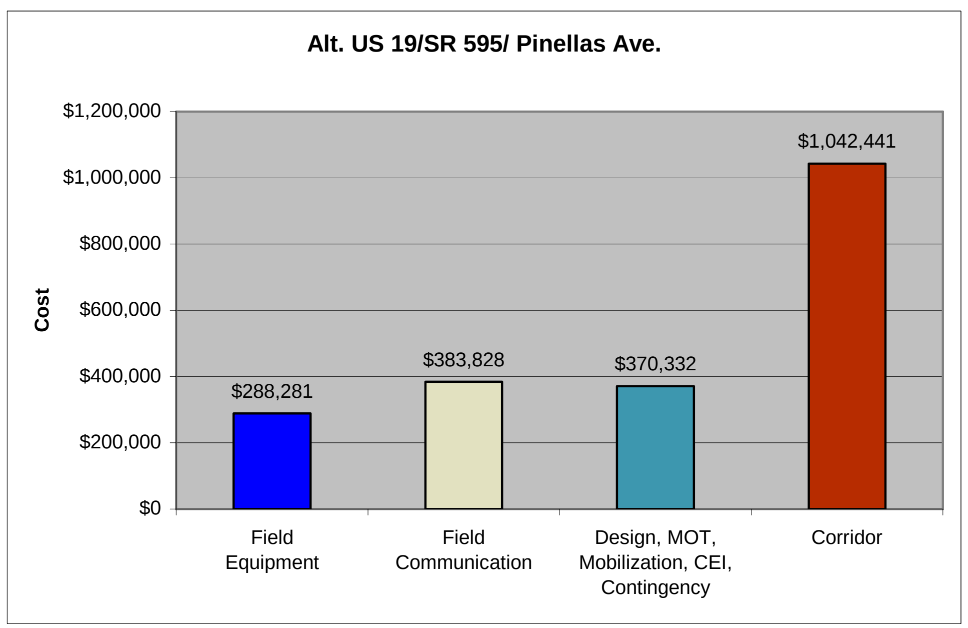


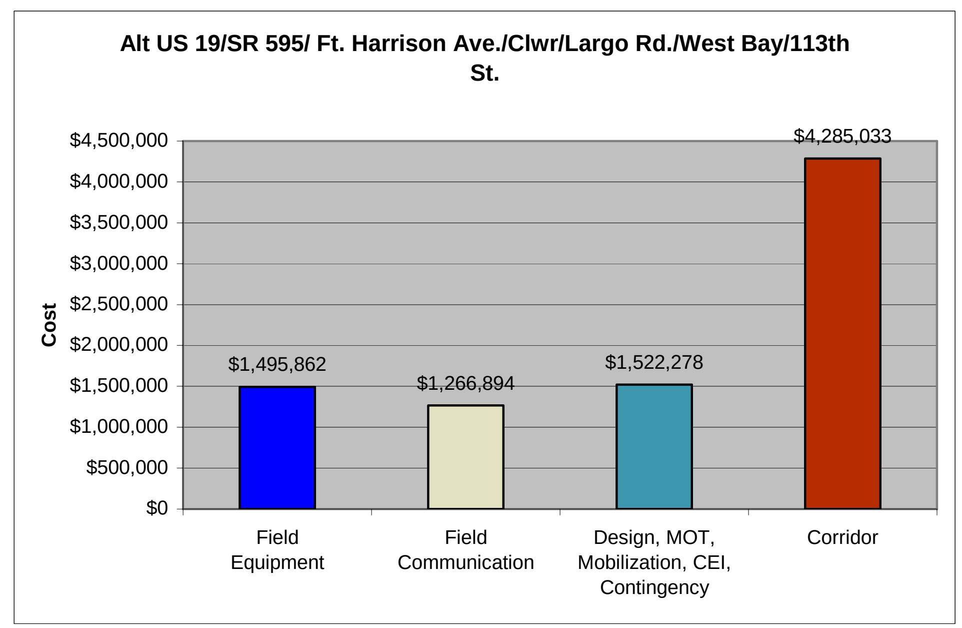
Figure 5-9: Project Development and Deployment Costs











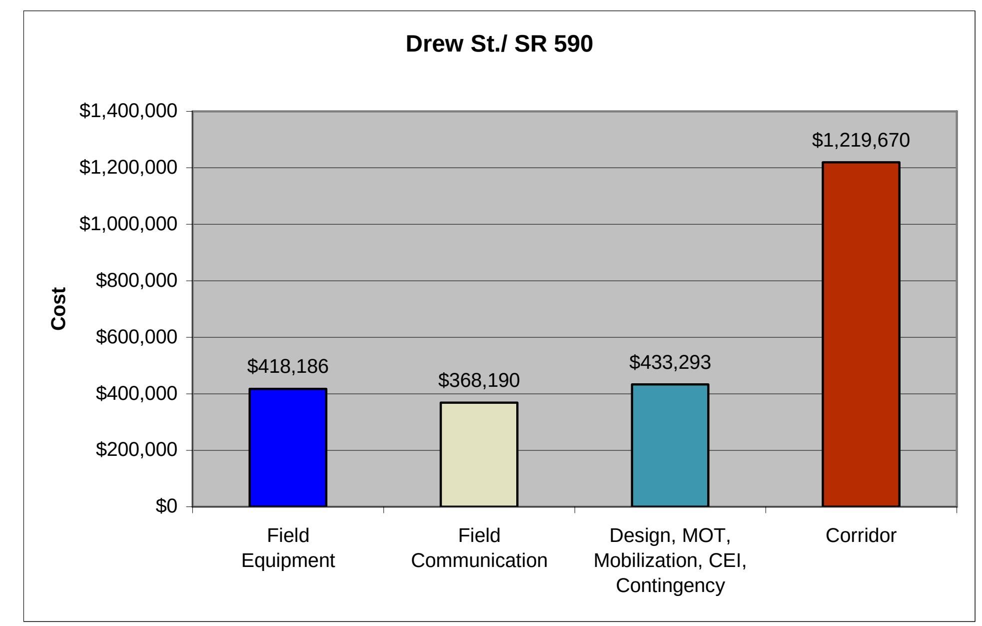
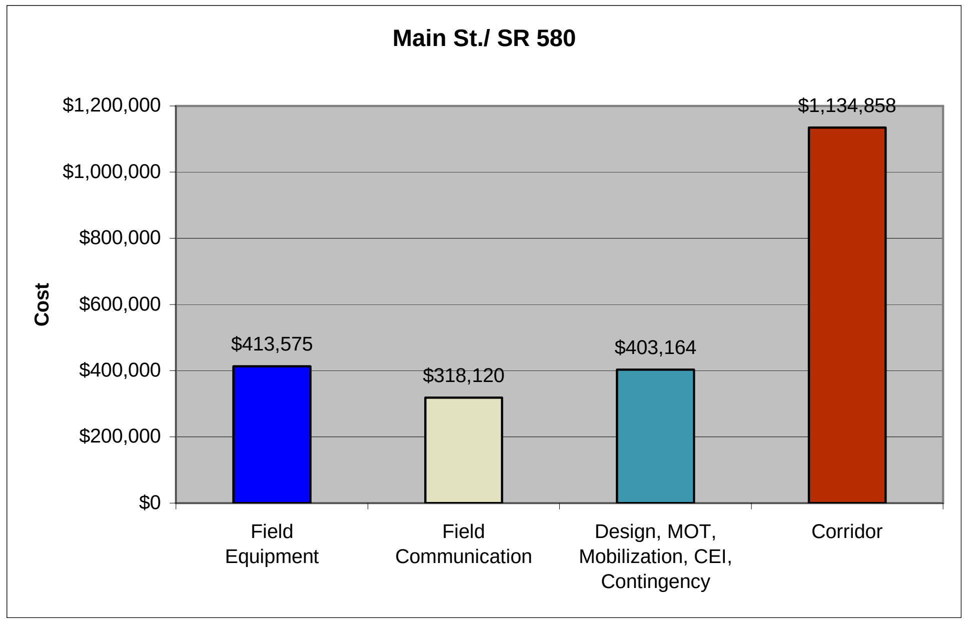
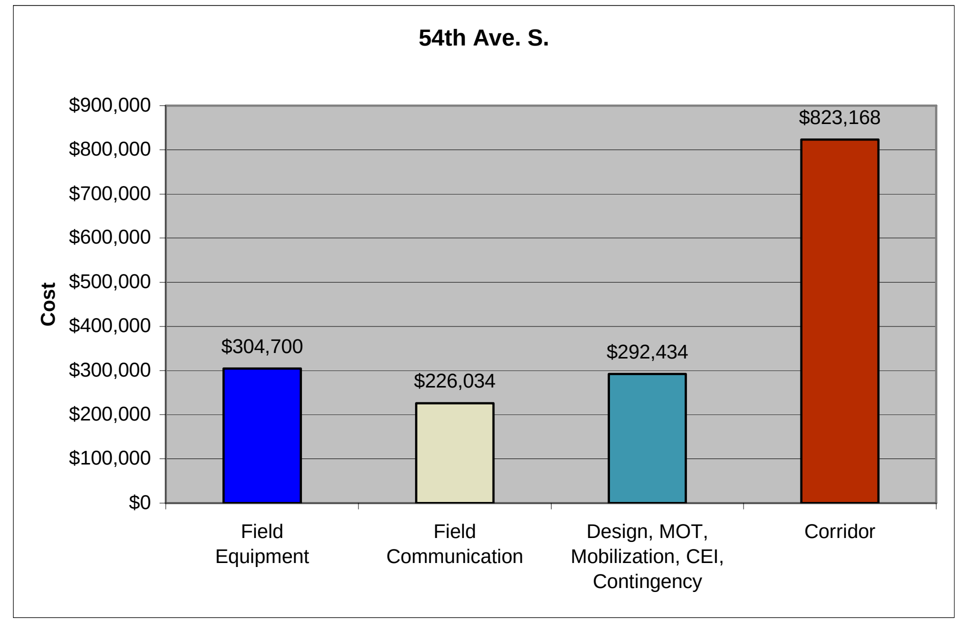
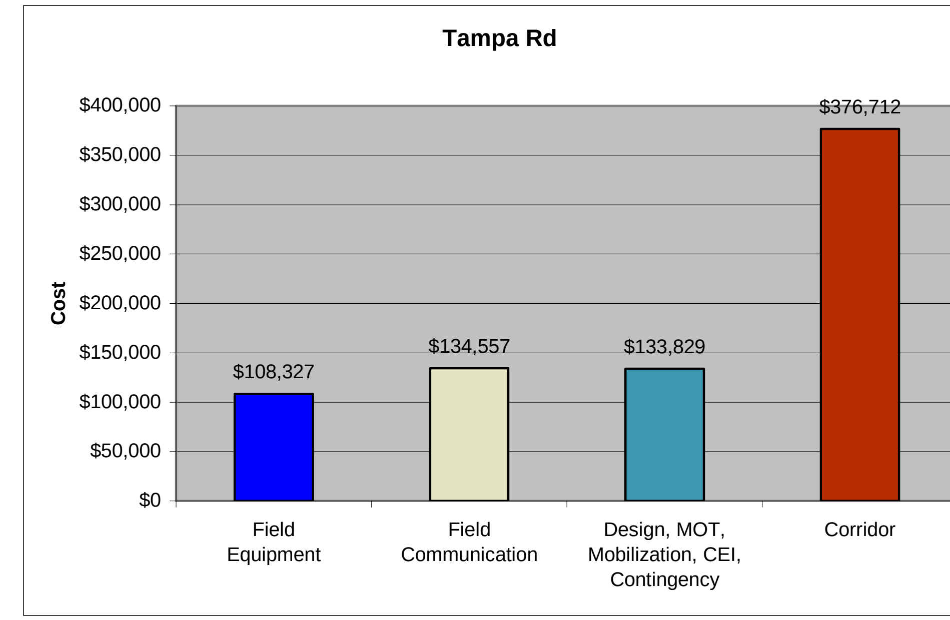


Figure 5-10: Project Development and Deployment Costs







6.0 Appendix B - Tables

Table 6-1: Existing ATMS

ITS Component	Item	Unit	Unit Cost	Existing ATMS													
				US 19/SR 55	McMullen Booth/East	Gulf to Bay/SR 60	Tampa Rd*	Curlew Rd./SR 586	49th St. N./Bayside	Curlew Rd./SR 586*	Main St./ SR 580*	Walsingham Rd./ Ulmerton	Walsingham Rd./ Ulmerton	Drew St.	Belleair CSWY/ (West/East)	US 19/SR 55	Clearwater CSWY/Gulf to
				Beckett Way	Trinity	Hillcrest Ave.	Belcher Rd.	McMullen Booth	US 19/SR 55	Belcher Rd.	Belcher Rd.	Gulf Blvd	66th St. N.	Belcher Rd.	Gulf Blvd	54th Avenue S.	Gulf Blvd
				54th Avenue N.	Gulf to Bay/SR 60	Damascus Drive	McMullen Booth	SR 584/Tampa Rd.	Gulf to Bay/SR 60	McMullen Booth	McMullen Booth	66th St. N.	I-275	McMullen Booth	Belcher Rd.	54th Avenue N.	Hillcrest
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	25	22	15	3	0	0	2	3	0	0	2	0	0	0
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	3	4	1	0	0	0	0	0	0	0	0	0	2	0
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	27	18	2	0	0	0	0	0	0	2	0	0	6	0
	Device Cabinet Foundation	Each	$1,000	30	22	3	0	0	0	0	0	0	2	0	0	8	0
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	25	22	15	3	0	0	2	3	0	0	2	0	0	0
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TVSS Surge Protection (Data/Power)	Each	$600	55	44	18	3	0	0	2	3	0	2	2	0	8	0
	HAR Sign and Flashers (post-mount)	Each	$1,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	VIDS at Traffic Signals	Each	$20,700	25	22	15	3	0	0	2	3	0	0	2	0	0	0
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	165	106	78	20	0	0	20	21	0	0	6	0	0	0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	27	18	2	0	0	0	0	0	0	2	0	0	6	0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	3	4	1	0	0	0	0	0	0	0	0	0	2	0
	DTB Signs (post-mount)	Each	$16,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Communications Network	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	57,763	35,033	11,167	4,567	2,218	9,055	4,673	2,719	12,012	5,808	3,485	1,478	0	3,458
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	57,763	35,033	11,167	4,567	2,218	9,055	4,673	2,719	12,012	5,808	3,485	1,478	0	3,458
	Fiber Optic Splice Box and Grounding System	Each	$1,500	55	44	18	3	0	0	2	3	0	2	2	0	8	0
	Fiber Optic Pull Box with Grounding System	Each	$800	144	88	28	11	6	23	12	7	30	15	9	4	0	9
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	27	18	2	0	0	0	0	0	0	2	0	0	6	0
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	25	22	15	3	0	0	2	3	0	0	2	0	0	0
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	55	44	18	3	0	0	2	3	0	2	2	0	8	0
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fiber Splices	Each	$22	220	176	72	12	0	0	8	12	0	8	8	0	32	0
	Hub Cabinet	Each	$30,000	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Summary Cost	**Corridor Subtotal**			$4,664,845	$3,437,726	$1,319,606	$315,047	$75,398	$307,877	$273,370	$253,413	$408,408	$280,248	$216,207	$50,266	$417,704	$117,586
	Mobilizations			$233,242	$171,886	$65,980	$15,752	$3,770	$15,394	$13,668	$12,671	$20,420	$14,012	$10,810	$2,513	$20,885	$5,879
	MOT			$233,242	$171,886	$65,980	$15,752	$3,770	$15,394	$13,668	$12,671	$20,420	$14,012	$10,810	$2,513	$20,885	$5,879
	Engineering Design and Survey			$769,699	$567,225	$217,735	$51,983	$12,441	$50,800	$45,106	$41,813	$67,387	$46,241	$35,674	$8,294	$68,921	$19,402
	System Testing, Integration, and Configuration			$559,781	$412,527	$158,353	$37,806	$9,048	$36,945	$32,804	$30,410	$49,009	$33,630	$25,945	$6,032	$50,124	$14,110
	Construction Engineering and Inspection			$307,880	$226,890	$87,094	$20,793	$4,976	$20,320	$18,042	$16,725	$26,955	$18,496	$14,270	$3,318	$27,568	$7,761
	Contingency			$466,485	$343,773	$131,961	$31,505	$7,540	$30,788	$27,337	$25,341	$40,841	$28,025	$21,621	$5,027	$41,770	$11,759
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$2,570,330	$1,894,187	$727,103	$173,591	$41,545	$169,640	$150,627	$139,631	$225,033	$154,417	$119,130	$27,696	$230,155	$64,790
	Total Capital Costs			$7,235,175	$5,331,914	$2,046,709	$488,638	$116,943	$477,517	$423,996	$393,044	$633,441	$434,665	$335,337	$77,962	$647,859	$182,375
	Annual Operations and Maintenance Cost			$723,517	$533,191	$204,671	$48,864	$11,694	$47,752	$42,400	$39,304	$63,344	$43,466	$33,534	$7,796	$64,786	$18,238

Table 6-2: Pinellas Countywide ATMS – Deployment Phase I

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase I											
				Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5	Corridor 6	Corridor 7	Corridor 8	Corridor 9	Corridor 10	Corridor 11	Corridor 12
				US 19/SR 55	McMullen Booth/East	I-275	Gulf to Bay/SR 60	Tampa Rd./SR 584/SR 580	SR 686†	Bryan Dairy	Main St./ SR 580	Roosevelt/SR 686	Tampa Rd*	Curlew Rd./SR 586	49th St. N./Bayside Bridge
				Beckett Way	Trinity	Howard Frankland	Hillcrest Ave.	East Lake Rd.	49th St.	Seminole Blvd/Alt. US 19	McMullen Booth	Ulmerton Rd./SR 688	Belcher Rd.	McMullen Booth	US 19/SR 55
				54th Avenue N.	Gulf to Bay/SR 60	Skyway Bridge	Damascus Drive	County Line	Bryan Dairy	Roosevelt/SR 686	SR 584/Tampa Rd.	Gandy Blvd./4th St. N./ SR 694	McMullen Booth	SR 584/Tampa Rd.	Gulf to Bay/SR 60
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	12	0	0	0	9	1	12	3	4	1	1	6
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	8	2	0	2	1	1	4	1	0	0	1	2
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	11	1	0	4	2	3	8	2	1	2	0	3
	Device Cabinet Foundation	Each	$1,000	19	3	0	6	3	4	12	3	1	2	1	5
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	0	0	0	0	0	0	1	0	4	0	0	0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	12	0	0	0	9	1	11	3	0	1	1	6
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	67	44	0	18	9	1	12	3	4	4	1	6
	TVSS Surge Protection (Data/Power)	Each	$600	31	3	0	6	12	5	24	6	5	5	5	5
	HAR Sign and Flashers (post-mount)	Each	$1,500	8	2	0	2	1	1	4	1	0	0	1	2
	VIDS at Traffic Signals	Each	$20,700	12	0	0	0	9	1	12	3	4	1	1	6
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	39	0	0	0	55	9	47	12	0	2	12	51
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	5	1	0	1	2	2	6	0	1	1	0	0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	6	0	0	3	0	1	2	2	0	1	0	3
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	8	2	0	2	1	1	4	1	0	0	1	2
	DTB Signs (post-mount)	Each	$16,000	12	6	0	3	1	1	4	1	0	0	1	3
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	12	6	0	3	1	1	4	1	0	0	1	3
Communications Network	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	7999	3194	0	0	9029	3300	21965	8659	8210	0	0	0
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	7999	3194	0	0	9029	3300	21965	8659	8210	0	0	0
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	0	0	0	0	0	0	0	0	0	0	0	0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	0	0	0	0	0	0	0	0	0	0	0	0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	31	3	0	6	12	5	24	6	5	3	2	11
	Fiber Optic Pull Box with Grounding System	Each	$800	20	8	0	0	23	8	55	22	21	0	0	0
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	11	1	0	4	2	3	8	2	1	2	0	3
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	12	0	0	0	9	1	12	3	4	1	1	6
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	31	3	0	6	12	5	24	6	5	3	2	11
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	2	0	0	2	0	0	0	0	0	0	0	0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	0	0	0	0	0	0	0	0	0	0	0	0
	Fiber Splices	Each	$22	124	12	0	24	48	20	96	24	20	12	8	44
	Hub Cabinet	Each	$30,000	2	0	0	0	0	0	0	0	0	0	0	0
Summary Cost	**Corridor Subtotal**			$2,626,680	$700,374	$0	$477,928	$1,022,241	$388,601	$2,137,297	$620,556	$514,094	$140,640	$172,631	$673,642
	Mobilizations			$131,334	$35,019	$0	$23,896	$51,112	$19,430	$106,865	$31,028	$25,705	$7,032	$8,632	$33,682
	MOT			$131,334	$35,019	$0	$23,896	$51,112	$19,430	$106,865	$31,028	$25,705	$7,032	$8,632	$33,682
	Engineering Design and Survey			$433,402	$115,562	$0	$78,858	$168,670	$64,119	$352,654	$102,392	$84,825	$23,206	$28,484	$111,151
	System Testing, Integration, and Configuration			$315,202	$84,045	$0	$57,351	$122,669	$46,632	$256,476	$74,467	$61,691	$16,877	$20,716	$80,837
	Construction Engineering and Inspection			$173,361	$46,225	$0	$31,543	$67,468	$25,648	$141,062	$40,957	$33,930	$9,282	$11,394	$44,460
	Contingency			$262,668	$70,037	$0	$47,793	$102,224	$38,860	$213,730	$62,056	$51,409	$14,064	$17,263	$67,364
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$1,447,300	$385,906	$0	$263,338	$563,255	$214,119	$1,177,651	$341,926	$283,266	$77,493	$95,120	$371,177
	Total Capital Costs			$4,073,980	$1,086,279	$0	$741,266	$1,585,495	$602,721	$3,314,948	$962,482	$797,359	$218,132	$267,751	$1,044,818
	Annual Operations and Maintenance Cost			$407,398	$108,628	$0	$74,127	$158,550	$60,272	$331,495	$96,248	$79,736	$21,813	$26,775	$104,482

Table 6-3: Pinellas Countywide ATMS – Deployment Phase I

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase I (Continued)										
				Corridor 13	Corridor 14	Corridor 15	Corridor 16	Corridor 17	Corridor 18	Corridor 19	Corridor 20	Corridor 21	Corridor 22	Corridor 23
				Tarpon Avenue/Keystone	East Bay/Roosevelt/SR	Curlew Rd./SR 586*	Main St./ SR 580*	Walsingham Rd./ Ulmerton Rd. / SR	Countryside Blvd	Walsingham Rd./ Ulmerton Rd. / SR	66th St. N./SR 693	Belcher Rd.	Drew St.	Belcher Rd.
				US 19/SR 55	Belcher Rd.	Belcher Rd.	Belcher Rd.	Gulf Blvd	Belcher Rd.	66th St. N.	US 19/SR 55	Klosterman Rd.	Belcher Rd.	Druid Rd.
				East Lake Rd.	49th St. N./Bayside Bridge	McMullen Booth	McMullen Booth	66th St. N.	Main St.	I-275	46th Avenue N.	Druid Rd	McMullen Booth	Ulmerton Rd./SR 688
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	0	7	1	2	15	3	6	11	16	2	7
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	0	1	0	1	4	0	3	4	5	0	4
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	2	2	1	2	11	1	1	5	11	0	4
	Device Cabinet Foundation	Each	$1,000	2	3	1	3	15	1	4	9	16	0	8
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	0	0	0	0	1	0	0	0	0	0	0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	0	7	1	2	14	3	6	11	16	2	7
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	0	7	3	5	15	3	8	11	16	4	7
	TVSS Surge Protection (Data/Power)	Each	$600	5	5	5	5	5	5	5	5	5	5	5
	HAR Sign and Flashers (post-mount)	Each	$1,500	0	1	0	1	4	0	3	4	5	0	4
	VIDS at Traffic Signals	Each	$20,700	0	7	1	2	15	3	6	11	16	2	7
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	4	100	2	33	80	7	45	66	60	12	42
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	0	1	1	2	6	1	1	2	4	0	0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	2	1	0	0	5	0	0	3	7	0	4
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	0	1	0	1	4	0	3	4	5	0	4
	DTB Signs (post-mount)	Each	$16,000	0	1	0	1	4	0	3	4	5	0	4
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	0	1	0	1	4	0	3	4	5	0	4
Communications Network	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	7920	7471	0	3511	9372	0	6890	15866	23470	0	11378
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	7920	7471	0	3511	9372	0	6890	15866	23470	0	11378
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	0	0	0	0	0	0	0	0	0	0	0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	0	0	0	0	0	0	0	0	0	0	0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	2	10	2	5	30	4	10	20	32	2	15
	Fiber Optic Pull Box with Grounding System	Each	$800	20	19	0	9	23	0	17	40	59	0	28
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	2	2	1	2	11	1	1	5	11	0	4
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	0	7	1	2	15	3	6	11	16	2	7
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	2	10	2	5	30	4	10	20	32	2	15
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	0	0	0	0	1	0	0	0	0	0	0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	0	0	0	0	0	0	0	0	0	0	0
	Fiber Splices	Each	$22	8	40	8	20	120	16	40	80	128	8	60
	Hub Cabinet	Each	$30,000	0	0	0	0	1	0	0	0	0	0	0
Summary Cost	**Corridor Subtotal**			$328,648	$902,652	$108,852	$467,412	$2,006,641	$204,177	$961,740	$1,756,160	$2,550,137	$130,711	$1,316,358
	Mobilizations			$16,432	$45,133	$5,443	$23,371	$100,332	$10,209	$48,087	$87,808	$127,507	$6,536	$65,818
	MOT			$16,432	$45,133	$5,443	$23,371	$100,332	$10,209	$48,087	$87,808	$127,507	$6,536	$65,818
	Engineering Design and Survey			$54,227	$148,938	$17,961	$77,123	$331,096	$33,689	$158,687	$289,766	$420,773	$21,567	$217,199
	System Testing, Integration, and Configuration			$39,438	$108,318	$13,062	$56,089	$240,797	$24,501	$115,409	$210,739	$306,016	$15,685	$157,963
	Construction Engineering and Inspection			$21,691	$59,575	$7,184	$30,849	$132,438	$13,476	$63,475	$115,907	$168,309	$8,627	$86,880
	Contingency			$32,865	$90,265	$10,885	$46,741	$200,664	$20,418	$96,174	$175,616	$255,014	$13,071	$131,636
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$181,085	$497,362	$59,977	$257,544	$1,105,659	$112,502	$529,919	$967,644	$1,405,126	$72,022	$725,313
	Total Capital Costs			$509,733	$1,400,014	$168,829	$724,956	$3,112,301	$316,679	$1,491,659	$2,723,804	$3,955,263	$202,733	$2,041,671
	Annual Operations and Maintenance Cost			$50,973	$140,001	$16,883	$72,496	$311,230	$31,668	$149,166	$272,380	$395,526	$20,273	$204,167

Table 6-4: Pinellas Countywide ATMS – Deployment Phase II

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase II										
				Corridor 24	Corridor 25	Corridor 26	Corridor 27	Corridor 28	Corridor 29	Corridor 30	Corridor 31	Corridor 32	Corridor 33	Corridor 34
				Starkey Rd./Keene Rd. Park St.	Trinity	Park Blvd./Gandy Blvd./SR 694	49th St.	Sunset Point Rd.	Belleair CSWY/ (West/East) Bay	US 19/SR 55	Belcher Rd.	54th Avenue N.	66th St. N./SR 693	Clearwater CSWY/Gulf to Bay/
				Tyrone Blvd/ Alt US 19/SR 595	East Lake Rd.	Gulf Blvd	Park Blvd. N.	Belcher Rd.	Gulf Blvd	54th Avenue S.	Ulmerton Rd./SR 688	66th St. N.	46th Avenue N.	Gulf Blvd
				Tampa Rd.	County Line	I-275	US 19/SR 55	McMullen Booth	Belcher Rd.	54th Avenue N.	Park Blvd	I-275	Gulf Blvd	Hillcrest
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	30	0	18	4	3	12	19	3	8	20	8
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	9	0	7	1	0	3	3	1	0	0	0
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	20	0	11	0	0	5	4	3	2	7	6
	Device Cabinet Foundation	Each	$1,000	29	0	18	1	0	8	7	4	2	7	6
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	1	0	1	0	0	1	19	0	1	13	0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	29	0	17	4	3	11	0	3	7	7	8
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	30	0	18	4	3	12	27	3	8	20	8
	TVSS Surge Protection (Data/Power)	Each	$600	5	5	5	5	5	5	5	5	5	5	5
	HAR Sign and Flashers (post-mount)	Each	$1,500	9	0	7	1	0	3	3	1	0	0	0
	VIDS at Traffic Signals	Each	$20,700	30	0	18	4	3	12	19	3	8	20	8
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	142	0	86	27	16	2	102	30	28	26	10
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	8	0	4	0	0	2	1	0	1	5	2
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	12	0	7	0	0	3	3	3	1	2	4
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	9	0	7	1	0	3	3	1	0	0	0
	DTB Signs (post-mount)	Each	$16,000	9	0	7	1	0	3	5	1	0	0	0
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	9	0	7	1	0	3	5	1	0	0	0
Communications Network	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	50926	4514	31601	4224	5861	14520	19536	10560	13358	14124	4409
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	50926	4514	31601	4224	5861	14520	19536	10560	13358	14124	4409
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	0	0	0	0	0	0	0	0	0	0	0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	0	0	0	0	0	0	0	0	0	0	0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	59	0	36	5	3	20	26	7	10	27	14
	Fiber Optic Pull Box with Grounding System	Each	$800	127	11	79	11	15	36	49	26	33	35	11
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	20	0	11	0	0	5	4	3	2	7	6
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	30	0	18	4	3	12	19	3	8	20	8
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	59	0	36	5	3	20	26	7	10	27	14
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	0	0	0	0	0	0	0	0	0	0	0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	0	0	0	0	0	0	0	0	0	0	0
	Fiber Splices	Each	$22	236	0	144	20	12	80	104	28	40	108	56
	Hub Cabinet	Each	$30,000	0	0	0	0	0	0	0	0	0	0	0
Summary Cost	**Corridor Subtotal**			$4,998,787	$156,490	$3,165,376	$486,220	$373,438	$1,576,916	$2,215,300	$731,934	$959,767	$1,745,798	$754,950
	Mobilizations			$249,939	$7,824	$158,269	$24,311	$18,672	$78,846	$110,765	$36,597	$47,988	$87,290	$37,748
	MOT			$249,939	$7,824	$158,269	$24,311	$18,672	$78,846	$110,765	$36,597	$47,988	$87,290	$37,748
	Engineering Design and Survey			$824,800	$25,821	$522,287	$80,226	$61,617	$260,191	$365,524	$120,769	$158,362	$288,057	$124,567
	System Testing, Integration, and Configuration			$599,854	$18,779	$379,845	$58,346	$44,813	$189,230	$265,836	$87,832	$115,172	$209,496	$90,594
	Construction Engineering and Inspection			$329,920	$10,328	$208,915	$32,091	$24,647	$104,076	$146,210	$48,308	$63,345	$115,223	$49,827
	Contingency			$499,879	$15,649	$316,538	$48,622	$37,344	$157,692	$221,530	$73,193	$95,977	$174,580	$75,495
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$2,754,331	$86,226	$1,744,122	$267,907	$205,764	$868,881	$1,220,630	$403,295	$528,832	$961,935	$415,978
	Total Capital Costs			$7,753,118	$242,715	$4,909,498	$754,127	$579,202	$2,445,796	$3,435,930	$1,135,229	$1,488,599	$2,707,732	$1,170,928
	Annual Operations and Maintenance Cost			$775,312	$24,272	$490,950	$75,413	$57,920	$244,580	$343,593	$113,523	$148,860	$270,773	$117,093

Table 6-5: Pinellas Countywide ATMS – Deployment Phase III

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase III											
				Corridor 35	Corridor 36	Corridor 37	Corridor 38	Corridor 39	Corridor 40	Corridor 41	Corridor 42	Corridor 43	Corridor 44	Corridor 45	Corridor 46
				Gandy Blvd	Sunset Point Rd.	Tyrone Blvd/SR 595	Tarpon Ave	Keystone Rd.	Alt. US 19/ SR 595 Palm Harbor Blvd./	49th St. N.	Missouri Ave/ Seminole Blvd./SR	Treasure Island Causeway	38th Avenue N.	Gulf Blvd./ Pinellas Bayway	Tom Stuart CSWY/ SR 666 / Welch
				I-275	Keene Rd.	Alt. US 19/ SR 595/ Seminole Blvd.	Alt. US 19/ SR 595	East Lake Rd.	Klosterman Rd	Park Blvd./ SR 694	Gulf to Bay/SR 60	Gulf Blvd	Tyrone Blvd/SR 595	Clearwater CSWY	Gulf Blvd
				Hillsborough County	Belcher Rd.	5th Avenue N./ SR 595	US 19/ SR	County Line	Gulf to Bay/SR 60	38th Avenue N.	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira	Alt 19/ 66th St.	4th St. N.	I-275	Seminole Blvd/Alt. US 19/ Bay Pine Blvd.
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	0	1	7	2	0	14	4	18	5	11	23	2
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	1	0	0	0	0	0	0	4	1	0	4	1
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	0	0	5	1	0	14	2	7	3	4	19	1
	Device Cabinet Foundation	Each	$1,000	1	0	5	1	0	14	2	11	4	4	23	2
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	0	0	5	0	0	3	1	0	4	11	23	1
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	0	1	2	2	0	11	3	18	1	0	0	1
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	0	1	7	2	0	14	4	18	5	11	23	2
	TVSS Surge Protection (Data/Power)	Each	$600	5	5	5	5	5	5	5	5	5	5	5	5
	HAR Sign and Flashers (post-mount)	Each	$1,500	1	0	0	0	0	0	0	4	1	0	4	1
	VIDS at Traffic Signals	Each	$20,700	0	1	7	2	0	14	4	18	5	11	23	2
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	0	8	12	1	1	20	30	123	16	0	0	0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	0	0	3	1	0	5	1	0	1	1	1	1
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	0	0	2	0	0	9	1	7	2	3	18	0
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	1	0	0	0	0	0	0	4	1	0	4	1
	DTB Signs (post-mount)	Each	$16,000	1	0	0	0	0	0	0	4	1	0	4	1
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	1	0	0	0	0	0	0	4	1	0	4	1
Communications Network	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	8659	2904	14758	3802	7498	31574	5966	23866	6125	17926	0	3986
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	8659	2904	14758	3802	7498	31574	5966	23866	6125	17926	0	3986
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	0	0	0	0	0	0	0	0	0	0	0	0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	0	0	0	0	0	0	0	0	0	0	0	0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	1	1	12	3	0	28	6	29	9	15	0	4
	Fiber Optic Pull Box with Grounding System	Each	$800	22	7	37	10	19	79	15	60	15	45	0	10
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	0	0	5	1	0	14	2	7	3	4	19	1
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	0	1	7	2	0	14	4	18	5	11	23	2
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	1	1	12	3	0	28	6	29	9	15	0	4
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	0	0	0	0	0	0	0	0	0	0	0	0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	0	0	0	0	0	0	0	0	0	0	46	0
	Fiber Splices	Each	$22	4	4	48	12	0	112	24	116	36	60	184	16
	Hub Cabinet	Each	$30,000	0	0	0	0	0	0	0	0	0	0	0	0
Summary Cost	**Corridor Subtotal**			$402,001	$161,987	$1,033,349	$275,576	$259,116	$2,237,232	$508,163	$2,472,666	$669,182	$1,256,290	$2,053,048	$382,370
	Mobilizations			$20,100	$8,099	$51,667	$13,779	$12,956	$111,862	$25,408	$123,633	$33,459	$62,815	$102,652	$19,118
	MOT			$20,100	$8,099	$51,667	$13,779	$12,956	$111,862	$25,408	$123,633	$33,459	$62,815	$102,652	$19,118
	Engineering Design and Survey			$66,330	$26,728	$170,503	$45,470	$42,754	$369,143	$83,847	$407,990	$110,415	$207,288	$338,753	$63,091
	System Testing, Integration, and Configuration			$48,240	$19,438	$124,002	$33,069	$31,094	$268,468	$60,980	$296,720	$80,302	$150,755	$246,366	$45,884
	Construction Engineering and Inspection			$26,532	$10,691	$68,201	$18,188	$17,102	$147,657	$33,539	$163,196	$44,166	$82,915	$135,501	$25,236
	Contingency			$40,200	$16,199	$103,335	$27,558	$25,912	$223,723	$50,816	$247,267	$66,918	$125,629	$205,305	$38,237
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$221,502	$89,255	$569,376	$151,843	$142,773	$1,232,715	$279,998	$1,362,439	$368,719	$692,216	$1,131,229	$210,686
	Total Capital Costs			$623,503	$251,242	$1,602,725	$427,419	$401,889	$3,469,947	$788,161	$3,835,105	$1,037,901	$1,948,506	$3,184,277	$593,055
	Annual Operations and Maintenance Cost			$62,350	$25,124	$160,272	$42,742	$40,189	$346,995	$78,816	$383,511	$103,790	$194,851	$318,428	$59,306

Table 6-6: Pinellas Countywide ATMS – Deployment Phase III

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase III (Continued)											
				Corridor 47	Corridor 48	Corridor 49	Corridor 50	Corridor 51	Corridor 52	Corridor 53	Corridor 54	Corridor 55	Corridor 56	Corridor 57	Corridor 58
				Courtney Campbell	Curlew Rd./SR 586	4th St. N.	22nd Avenue S./Gulfport Blvd.	9th St. S.	5th Avenue N./ SR 595/Bay Pines Blvd.	Alt. US 19/SR 595/ Pinellas Ave.	Alt US 19/SR 595/ Ft. Harrison	Drew St./ SR 590	Main St./ SR 580	54th Ave. S.	Tampa Rd
				Damascus Rd.	Alt US 19/SR 595/ Bayshore Blvd	22nd Avenue S.	Pasadena Ave	54th Avenue S.	Tyrone Blvd/ SR 595	Klosterman Rd.	Gulf to Bay/SR 60	Alt US 19/SR 595/ Ft. Harrison Ave.	Alt US 19/SR 595/ Broadway	I-275	Alt US 19/SR 595/ Palm Harbor Blvd
				Hillsborough County	Belcher Rd.	I-275	4th St. N.	22nd Avenue S.	4th St. N.	Pasco County Line	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira	Belcher Rd.	Belcher Rd.	9th St. S.	Belcher Rd.
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	0	0	27	12	4	10	5	19	8	8	4	2
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	1	1	1	2	0	2	0	4	0	0	1	0
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	0	0	7	5	2	3	3	9	2	1	2	0
	Device Cabinet Foundation	Each	$1,000	1	1	8	7	2	5	3	13	2	1	3	0
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	0	0	27	8	4	10	0	0	0	1	4	0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	0	0	0	4	0	0	5	19	8	7	0	2
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	0	0	27	12	4	10	5	19	8	8	4	2
	TVSS Surge Protection (Data/Power)	Each	$600	5	5	5	5	5	5	5	5	5	5	5	5
	HAR Sign and Flashers (post-mount)	Each	$1,500	1	1	1	2	0	2	0	4	0	0	1	0
	VIDS at Traffic Signals	Each	$20,700	0	0	27	12	4	10	5	19	8	8	4	2
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	2	12	0	16	0	0	9	76	26	41	0	16
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	0	0	1	1	1	0	0	0	0	0	0	0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	0	0	6	4	1	3	3	9	2	1	2	0
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	1	1	1	2	0	2	0	4	0	0	1	0
	DTB Signs (post-mount)	Each	$16,000	1	1	1	2	0	2	0	4	0	0	1	0
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	1	1	1	2	0	2	0	4	0	0	1	0
Communications Network	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	0	5438	20354	19958	9029	12223	9636	31046	8686	7392	5306	3511
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	0	5438	20354	19958	9029	12223	9636	31046	8686	7392	5306	3511
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	0	0	0	0	0	0	0	0	0	0	0	0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	0	0	0	0	0	0	0	0	0	0	0	0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	1	1	35	19	6	15	8	32	10	9	7	2
	Fiber Optic Pull Box with Grounding System	Each	$800	0	14	51	50	23	31	24	78	22	18	13	9
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	0	0	7	5	2	3	3	9	2	1	2	0
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	0	0	27	12	4	10	5	19	8	8	4	2
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	1	1	35	19	6	15	8	32	10	9	7	2
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	0	0	0	0	0	0	0	0	0	0	0	0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	0	0	0	0	0	0	0	0	0	0	0	0
	Fiber Splices	Each	$22	4	4	140	76	24	60	32	128	40	36	28	8
	Hub Cabinet	Each	$30,000	0	0	0	0	0	0	0	0	0	0	0	0
Summary Cost	**Corridor Subtotal**			$109,984	$306,869	$2,285,430	$1,638,844	$567,707	$1,183,009	$672,109	$2,762,755	$786,376	$731,695	$530,734	$242,883
	Mobilizations			$5,499	$15,343	$114,271	$81,942	$28,385	$59,150	$33,605	$138,138	$39,319	$36,585	$26,537	$12,144
	MOT			$5,499	$15,343	$114,271	$81,942	$28,385	$59,150	$33,605	$138,138	$39,319	$36,585	$26,537	$12,144
	Engineering Design and Survey			$18,147	$50,633	$377,096	$270,409	$93,672	$195,196	$110,898	$455,855	$129,752	$120,730	$87,571	$40,076
	System Testing, Integration, and Configuration			$13,198	$36,824	$274,252	$196,661	$68,125	$141,961	$80,653	$331,531	$94,365	$87,803	$63,688	$29,146
	Construction Engineering and Inspection			$7,259	$20,253	$150,838	$108,164	$37,469	$78,079	$44,359	$182,342	$51,901	$48,292	$35,028	$16,030
	Contingency			$10,998	$30,687	$228,543	$163,884	$56,771	$118,301	$67,211	$276,276	$78,638	$73,169	$53,073	$24,288
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$60,601	$169,085	$1,259,272	$903,003	$312,807	$651,838	$370,332	$1,522,278	$433,293	$403,164	$292,434	$133,829
	Total Capital Costs			$170,585	$475,953	$3,544,701	$2,541,847	$880,514	$1,834,847	$1,042,441	$4,285,033	$1,219,670	$1,134,858	$823,168	$376,712
	Annual Operations and Maintenance Cost			$17,058	$47,595	$354,470	$254,185	$88,051	$183,485	$104,244	$428,503	$121,967	$113,486	$82,317	$37,671

Table 6-7: Existing ATMS

ITS Component	Item	Unit	Unit Cost	Existing ATMS													
				US 19/SR 55	McMullen Booth/East	Gulf to Bay/SR 60	Tampa Rd*	Curlew Rd./SR 586	49th St. N./Bayside	Curlew Rd./SR 586*	Main St./ SR 580*	Walsingham Rd./ Ulmerton	Walsingham Rd./ Ulmerton	Drew St.	Belleair CSWY/ (West/East)	US 19/SR 55	Clearwater CSWY/Gulf to
				Beckett Way	Trinity	Hillcrest Ave.	Belcher Rd.	McMullen Booth	US 19/SR 55	Belcher Rd.	Belcher Rd.	Gulf Blvd	66th St. N.	Belcher Rd.	Gulf Blvd	54th Avenue S.	Gulf Blvd
				54th Avenue N.	Gulf to Bay/SR 60	Damascus Drive	McMullen Booth	SR 584/Tampa Rd.	Gulf to Bay/SR 60	McMullen Booth	McMullen Booth	66th St. N.	I-275	McMullen Booth	Belcher Rd.	54th Avenue N.	Hillcrest
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	$255,000	$224,400	$153,000	$30,600	$0	$0	$20,400	$30,600	$0	$0	$20,400	$0	$0	$0
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	$15,000	$20,000	$5,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$10,000	$0
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	$94,500	$63,000	$7,000	$0	$0	$0	$0	$0	$0	$7,000	$0	$0	$21,000	$0
	Device Cabinet Foundation	Each	$1,000	$30,000	$22,000	$3,000	$0	$0	$0	$0	$0	$0	$2,000	$0	$0	$8,000	$0
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	$154,500	$135,960	$92,700	$18,540	$0	$0	$12,360	$18,540	$0	$0	$12,360	$0	$0	$0
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	TVSS Surge Protection (Data/Power)	Each	$600	$33,000	$26,400	$10,800	$1,800	$0	$0	$1,200	$1,800	$0	$1,200	$1,200	$0	$4,800	$0
	HAR Sign and Flashers (post-mount)	Each	$1,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	VIDS at Traffic Signals	Each	$20,700	$517,500	$455,400	$310,500	$62,100	$0	$0	$41,400	$62,100	$0	$0	$41,400	$0	$0	$0
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	$197,656	$126,979	$93,438	$23,958	$0	$0	$23,958	$25,156	$0	$0	$7,188	$0	$0	$0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	$815,400	$543,600	$60,400	$0	$0	$0	$0	$0	$0	$60,400	$0	$0	$181,200	$0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	$225,000	$300,000	$75,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$150,000	$0
	DTB Signs (post-mount)	Each	$16,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	ITS Device Sub Total			**$2,337,556**	**$1,917,739**	**$810,838**	**$136,998**	**$0**	**$0**	**$99,318**	**$138,196**	**$0**	**$70,600**	**$82,548**	**$0**	**$375,000**	**$0**
Field Communications	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	$1,213,027	$735,689	$234,511	$95,911	$46,570	$190,159	$98,129	$57,103	$252,252	$121,968	$73,181	$31,046	$0	$72,626
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	$635,395	$385,361	$122,839	$50,239	$24,394	$99,607	$51,401	$29,911	$132,132	$63,888	$38,333	$16,262	$0	$38,042
	Fiber Optic Splice Box and Grounding System	Each	$1,500	$82,500	$66,000	$27,000	$4,500	$0	$0	$3,000	$4,500	$0	$3,000	$3,000	$0	$12,000	$0
	Fiber Optic Pull Box with Grounding System	Each	$800	$115,526	$70,066	$22,334	$9,134	$4,435	$18,110	$9,346	$5,438	$24,024	$11,616	$6,970	$2,957	$0	$6,917
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	$81,000	$54,000	$6,000	$0	$0	$0	$0	$0	$0	$6,000	$0	$0	$18,000	$0
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	$112,500	$99,000	$67,500	$13,500	$0	$0	$9,000	$13,500	$0	$0	$9,000	$0	$0	$0
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	$82,500	$66,000	$27,000	$4,500	$0	$0	$3,000	$4,500	$0	$3,000	$3,000	$0	$12,000	$0
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	$0	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Splices	Each	$22	$4,840	$3,872	$1,584	$264	$0	$0	$176	$264	$0	$176	$176	$0	$704	$0
	Hub Cabinet	Each	$30,000	$0	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Field Communications SubTotal			**$2,327,289**	**$1,519,987**	**$508,769**	**$178,049**	**$75,398**	**$307,877**	**$174,051**	**$115,217**	**$408,408**	**$209,648**	**$133,659**	**$50,266**	**$42,704**	**$117,586**
Summary Cost	**Corridor Subtotal**			$4,664,845	$3,437,726	$1,319,606	$315,047	$75,398	$307,877	$273,370	$253,413	$408,408	$280,248	$216,207	$50,266	$417,704	$117,586
	Mobilizations			$233,242	$171,886	$65,980	$15,752	$3,770	$15,394	$13,668	$12,671	$20,420	$14,012	$10,810	$2,513	$20,885	$5,879
	MOT			$233,242	$171,886	$65,980	$15,752	$3,770	$15,394	$13,668	$12,671	$20,420	$14,012	$10,810	$2,513	$20,885	$5,879
	Engineering Design and Survey			$769,699	$567,225	$217,735	$51,983	$12,441	$50,800	$45,106	$41,813	$67,387	$46,241	$35,674	$8,294	$68,921	$19,402
	System Testing, Integration, and Configuration			$559,781	$412,527	$158,353	$37,806	$9,048	$36,945	$32,804	$30,410	$49,009	$33,630	$25,945	$6,032	$50,124	$14,110
	Construction Engineering and Inspection			$307,880	$226,890	$87,094	$20,793	$4,976	$20,320	$18,042	$16,725	$26,955	$18,496	$14,270	$3,318	$27,568	$7,761
	Contingency			$466,485	$343,773	$131,961	$31,505	$7,540	$30,788	$27,337	$25,341	$40,841	$28,025	$21,621	$5,027	$41,770	$11,759
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$2,570,330	$1,894,187	$727,103	$173,591	$41,545	$169,640	$150,627	$139,631	$225,033	$154,417	$119,130	$27,696	$230,155	$64,790
	Total Capital Costs			$7,235,175	$5,331,914	$2,046,709	$488,638	$116,943	$477,517	$423,996	$393,044	$633,441	$434,665	$335,337	$77,962	$647,859	$182,375
	Annual Operations and Maintenance Cost			$723,517	$533,191	$204,671	$48,864	$11,694	$47,752	$42,400	$39,304	$63,344	$43,466	$33,534	$7,796	$64,786	$18,238

Table 6-8: Pinellas Countywide ATMS – Deployment Phase I

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase I											
				Corridor 1	Corridor 2	Corridor 3	Corridor 4	Corridor 5	Corridor 6	Corridor 7	Corridor 8	Corridor 9	Corridor 10	Corridor 11	Corridor 12
				US 19/SR 55	McMullen Booth/East	I-275	Gulf to Bay/SR 60	Tampa Rd./SR 584/SR 580	SR 686†	Bryan Dairy	Main St./ SR 580	Roosevelt/SR 686	Tampa Rd*	Curlew Rd./SR 586	49th St. N./Bayside Bridge
				Beckett Way	Trinity	Howard Frankland	Hillcrest Ave.	East Lake Rd.	49th St.	Seminole Blvd/Alt. US 19	McMullen Booth	Ulmerton Rd./SR 688	Belcher Rd.	McMullen Booth	US 19/SR 55
				54th Avenue N.	Gulf to Bay/SR 60	Skyway Bridge	Damascus Drive	County Line	Bryan Dairy	Roosevelt/SR 686	SR 584/Tampa Rd.	Gandy Blvd./4th St. N./ SR 694	McMullen Booth	SR 584/Tampa Rd.	Gulf to Bay/SR 60
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	$122,400	$0	$0	$0	$91,800	$10,200	$122,400	$30,600	$40,800	$10,200	$10,200	$61,200
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	$40,000	$10,000	$0	$10,000	$5,000	$5,000	$20,000	$5,000	$0	$0	$5,000	$10,000
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	$38,500	$3,500	$0	$14,000	$7,000	$10,500	$28,000	$7,000	$3,500	$7,000	$0	$10,500
	Device Cabinet Foundation	Each	$1,000	$19,000	$3,000	$0	$6,000	$3,000	$4,000	$12,000	$3,000	$1,000	$2,000	$1,000	$5,000
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	$0	$0	$0	$0	$0	$0	$3,300	$0	$13,200	$0	$0	$0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	$74,160	$0	$0	$0	$55,620	$6,180	$67,980	$18,540	$0	$6,180	$6,180	$37,080
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	$402,000	$264,000	$0	$108,000	$54,000	$6,000	$72,000	$18,000	$24,000	$24,000	$6,000	$36,000
	TVSS Surge Protection (Data/Power)	Each	$600	$18,600	$1,800	$0	$3,600	$7,200	$3,000	$14,400	$3,600	$3,000	$3,000	$3,000	$3,000
	HAR Sign and Flashers (post-mount)	Each	$1,500	$12,000	$3,000	$0	$3,000	$1,500	$1,500	$6,000	$1,500	$0	$0	$1,500	$3,000
	VIDS at Traffic Signals	Each	$20,700	$248,400	$0	$0	$0	$186,300	$20,700	$248,400	$62,100	$82,800	$20,700	$20,700	$124,200
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	$46,719	$0	$0	$0	$65,885	$10,781	$56,302	$14,375	$0	$2,396	$14,375	$61,094
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	$151,000	$30,200	$0	$30,200	$60,400	$60,400	$181,200	$0	$30,200	$30,200	$0	$0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	$91,200	$0	$0	$45,600	$0	$15,200	$30,400	$30,400	$0	$15,200	$0	$45,600
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	$600,000	$150,000	$0	$150,000	$75,000	$75,000	$300,000	$75,000	$0	$0	$75,000	$150,000
	DTB Signs (post-mount)	Each	$16,000	$192,000	$96,000	$0	$48,000	$16,000	$16,000	$64,000	$16,000	$0	$0	$16,000	$48,000
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	$36,000	$18,000	$0	$9,000	$3,000	$3,000	$12,000	$3,000	$0	$0	$3,000	$9,000
	ITS Device Sub Total			**$2,091,979**	**$579,500**	**$0**	**$427,400**	**$631,705**	**$247,461**	**$1,238,382**	**$288,115**	**$198,500**	**$120,876**	**$161,955**	**$603,674**
Field Communications	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	$167,983	$67,082	$0	$0	$189,605	$69,300	$461,261	$181,843	$172,418	$0	$0	$0
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	$87,991	$35,138	$0	$0	$99,317	$36,300	$241,613	$95,251	$90,314	$0	$0	$0
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	$46,500	$4,500	$0	$9,000	$18,000	$7,500	$36,000	$9,000	$7,500	$4,500	$3,000	$16,500
	Fiber Optic Pull Box with Grounding System	Each	$800	$15,998	$6,389	$0	$0	$18,058	$6,600	$43,930	$17,318	$16,421	$0	$0	$0
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	$33,000	$3,000	$0	$12,000	$6,000	$9,000	$24,000	$6,000	$3,000	$6,000	$0	$9,000
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	$54,000	$0	$0	$0	$40,500	$4,500	$54,000	$13,500	$18,000	$4,500	$4,500	$27,000
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	$46,500	$4,500	$0	$9,000	$18,000	$7,500	$36,000	$9,000	$7,500	$4,500	$3,000	$16,500
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	$20,000	$0	$0	$20,000	$0	$0	$0	$0	$0	$0	$0	$0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Splices	Each	$22	$2,728	$264	$0	$528	$1,056	$440	$2,112	$528	$440	$264	$176	$968
	Hub Cabinet	Each	$30,000	$60,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Field Communications SubTotal			**$534,701**	**$120,874**	**$0**	**$50,528**	**$390,535**	**$141,140**	**$898,915**	**$332,441**	**$315,594**	**$19,764**	**$10,676**	**$69,968**
Summary Cost	**Corridor Subtotal**			$2,626,680	$700,374	$0	$477,928	$1,022,241	$388,601	$2,137,297	$620,556	$514,094	$140,640	$172,631	$673,642
	Mobilizations			$131,334	$35,019	$0	$23,896	$51,112	$19,430	$106,865	$31,028	$25,705	$7,032	$8,632	$33,682
	MOT			$131,334	$35,019	$0	$23,896	$51,112	$19,430	$106,865	$31,028	$25,705	$7,032	$8,632	$33,682
	Engineering Design and Survey			$433,402	$115,562	$0	$78,858	$168,670	$64,119	$352,654	$102,392	$84,825	$23,206	$28,484	$111,151
	System Testing, Integration, and Configuration			$315,202	$84,045	$0	$57,351	$122,669	$46,632	$256,476	$74,467	$61,691	$16,877	$20,716	$80,837
	Construction Engineering and Inspection			$173,361	$46,225	$0	$31,543	$67,468	$25,648	$141,062	$40,957	$33,930	$9,282	$11,394	$44,460
	Contingency			$262,668	$70,037	$0	$47,793	$102,224	$38,860	$213,730	$62,056	$51,409	$14,064	$17,263	$67,364
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$1,447,300	$385,906	$0	$263,338	$563,255	$214,119	$1,177,651	$341,926	$283,266	$77,493	$95,120	$371,177
	Total Capital Costs			$4,073,980	$1,086,279	$0	$741,266	$1,585,495	$602,721	$3,314,948	$962,482	$797,359	$218,132	$267,751	$1,044,818
	Annual Operations and Maintenance Cost			$407,398	$108,628	$0	$74,127	$158,550	$60,272	$331,495	$96,248	$79,736	$21,813	$26,775	$104,482

Table 6-9: Pinellas Countywide ATMS – Deployment Phase I

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase I (Continued)										
				Corridor 13	Corridor 14	Corridor 15	Corridor 16	Corridor 17	Corridor 18	Corridor 19	Corridor 20	Corridor 21	Corridor 22	Corridor 23
				Tarpon Avenue/Keystone	East Bay/Roosevelt/SR	Curlew Rd./SR 586*	Main St./ SR 580*	Walsingham Rd./ Ulmerton Rd. / SR	Countryside Blvd	Walsingham Rd./ Ulmerton Rd. / SR	66th St. N./SR 693	Belcher Rd.	Drew St.	Belcher Rd.
				US 19/SR 55	Belcher Rd.	Belcher Rd.	Belcher Rd.	Gulf Blvd	Belcher Rd.	66th St. N.	US 19/SR 55	Klosterman Rd.	Belcher Rd.	Druid Rd.
				East Lake Rd.	49th St. N./Bayside Bridge	McMullen Booth	McMullen Booth	66th St. N.	Main St.	I-275	46th Avenue N.	Druid Rd	McMullen Booth	Ulmerton Rd./SR 688
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	$0	$71,400	$10,200	$20,400	$153,000	$30,600	$61,200	$112,200	$163,200	$20,400	$71,400
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	$0	$5,000	$0	$5,000	$20,000	$0	$15,000	$20,000	$25,000	$0	$20,000
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	$7,000	$7,000	$3,500	$7,000	$38,500	$3,500	$3,500	$17,500	$38,500	$0	$14,000
	Device Cabinet Foundation	Each	$1,000	$2,000	$3,000	$1,000	$3,000	$15,000	$1,000	$4,000	$9,000	$16,000	$0	$8,000
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	$0	$0	$0	$0	$3,300	$0	$0	$0	$0	$0	$0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	$0	$43,260	$6,180	$12,360	$86,520	$18,540	$37,080	$67,980	$98,880	$12,360	$43,260
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	$0	$42,000	$18,000	$30,000	$90,000	$18,000	$48,000	$66,000	$96,000	$24,000	$42,000
	TVSS Surge Protection (Data/Power)	Each	$600	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
	HAR Sign and Flashers (post-mount)	Each	$1,500	$0	$1,500	$0	$1,500	$6,000	$0	$4,500	$6,000	$7,500	$0	$6,000
	VIDS at Traffic Signals	Each	$20,700	$0	$144,900	$20,700	$41,400	$310,500	$62,100	$124,200	$227,700	$331,200	$41,400	$144,900
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	$4,792	$119,792	$2,396	$39,531	$95,833	$8,385	$53,906	$79,063	$71,875	$14,375	$50,313
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	$0	$30,200	$30,200	$60,400	$181,200	$30,200	$30,200	$60,400	$120,800	$0	$0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	$30,400	$15,200	$0	$0	$76,000	$0	$0	$45,600	$106,400	$0	$60,800
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	$0	$75,000	$0	$75,000	$300,000	$0	$225,000	$300,000	$375,000	$0	$300,000
	DTB Signs (post-mount)	Each	$16,000	$0	$16,000	$0	$16,000	$64,000	$0	$48,000	$64,000	$80,000	$0	$64,000
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	$0	$3,000	$0	$3,000	$12,000	$0	$9,000	$12,000	$15,000	$0	$12,000
	ITS Device Sub Total			**$47,192**	**$580,252**	**$95,176**	**$317,591**	**$1,454,853**	**$175,325**	**$666,586**	**$1,090,443**	**$1,548,355**	**$115,535**	**$839,673**
Field Communications	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	$166,320	$156,895	$0	$73,735	$196,812	$0	$144,698	$333,194	$492,862	$0	$238,946
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	$87,120	$82,183	$0	$38,623	$103,092	$0	$75,794	$174,530	$258,166	$0	$125,162
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	$3,000	$15,000	$3,000	$7,500	$45,000	$6,000	$15,000	$30,000	$48,000	$3,000	$22,500
	Fiber Optic Pull Box with Grounding System	Each	$800	$15,840	$14,942	$0	$7,022	$18,744	$0	$13,781	$31,733	$46,939	$0	$22,757
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	$6,000	$6,000	$3,000	$6,000	$33,000	$3,000	$3,000	$15,000	$33,000	$0	$12,000
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	$0	$31,500	$4,500	$9,000	$67,500	$13,500	$27,000	$49,500	$72,000	$9,000	$31,500
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	$3,000	$15,000	$3,000	$7,500	$45,000	$6,000	$15,000	$30,000	$48,000	$3,000	$22,500
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	$0	$0	$0	$0	$10,000	$0	$0	$0	$0	$0	$0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Splices	Each	$22	$176	$880	$176	$440	$2,640	$352	$880	$1,760	$2,816	$176	$1,320
	Hub Cabinet	Each	$30,000	$0	$0	$0	$0	$30,000	$0	$0	$0	$0	$0	$0
	Field Communications SubTotal			**$281,456**	**$322,401**	**$13,676**	**$149,821**	**$551,788**	**$28,852**	**$295,154**	**$665,718**	**$1,001,782**	**$15,176**	**$476,686**
Summary Cost	**Corridor Subtotal**			$328,648	$902,652	$108,852	$467,412	$2,006,641	$204,177	$961,740	$1,756,160	$2,550,137	$130,711	$1,316,358
	Mobilizations			$16,432	$45,133	$5,443	$23,371	$100,332	$10,209	$48,087	$87,808	$127,507	$6,536	$65,818
	MOT			$16,432	$45,133	$5,443	$23,371	$100,332	$10,209	$48,087	$87,808	$127,507	$6,536	$65,818
	Engineering Design and Survey			$54,227	$148,938	$17,961	$77,123	$331,096	$33,689	$158,687	$289,766	$420,773	$21,567	$217,199
	System Testing, Integration, and Configuration			$39,438	$108,318	$13,062	$56,089	$240,797	$24,501	$115,409	$210,739	$306,016	$15,685	$157,963
	Construction Engineering and Inspection			$21,691	$59,575	$7,184	$30,849	$132,438	$13,476	$63,475	$115,907	$168,309	$8,627	$86,880
	Contingency			$32,865	$90,265	$10,885	$46,741	$200,664	$20,418	$96,174	$175,616	$255,014	$13,071	$131,636
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$181,085	$497,362	$59,977	$257,544	$1,105,659	$112,502	$529,919	$967,644	$1,405,126	$72,022	$725,313
	Total Capital Costs			$509,733	$1,400,014	$168,829	$724,956	$3,112,301	$316,679	$1,491,659	$2,723,804	$3,955,263	$202,733	$2,041,671
	Annual Operations and Maintenance Cost			$50,973	$140,001	$16,883	$72,496	$311,230	$31,668	$149,166	$272,380	$395,526	$20,273	$204,167

Table 6-10: Pinellas Countywide ATMS – Deployment Phase II

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase II										
				Corridor 24	Corridor 25	Corridor 26	Corridor 27	Corridor 28	Corridor 29	Corridor 30	Corridor 31	Corridor 32	Corridor 33	Corridor 34
				Starkey Rd./Keene Rd. Park St.	Trinity	Park Blvd./Gandy Blvd./SR 694	49th St.	Sunset Point Rd.	Belleair CSWY/ (West/East) Bay	US 19/SR 55	Belcher Rd.	54th Avenue N.	66th St. N./SR 693	Clearwater CSWY/Gulf to Bay/
				Tyrone Blvd/ Alt US 19/SR 595	East Lake Rd.	Gulf Blvd	Park Blvd. N.	Belcher Rd.	Gulf Blvd	54th Avenue S.	Ulmerton Rd./SR 688	66th St. N.	46th Avenue N.	Gulf Blvd
				Tampa Rd.	County Line	I-275	US 19/SR 55	McMullen Booth	Belcher Rd.	54th Avenue N.	Park Blvd	I-275	Gulf Blvd	Hillcrest
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	$306,000	$0	$183,600	$40,800	$30,600	$122,400	$193,800	$30,600	$81,600	$204,000	$81,600
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	$45,000	$0	$35,000	$5,000	$0	$15,000	$15,000	$5,000	$0	$0	$0
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	$70,000	$0	$38,500	$0	$0	$17,500	$14,000	$10,500	$7,000	$24,500	$21,000
	Device Cabinet Foundation	Each	$1,000	$29,000	$0	$18,000	$1,000	$0	$8,000	$7,000	$4,000	$2,000	$7,000	$6,000
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	$3,300	$0	$3,300	$0	$0	$3,300	$62,700	$0	$3,300	$42,900	$0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	$179,220	$0	$105,060	$24,720	$18,540	$67,980	$0	$18,540	$43,260	$43,260	$49,440
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	$180,000	$0	$108,000	$24,000	$18,000	$72,000	$162,000	$18,000	$48,000	$120,000	$48,000
	TVSS Surge Protection (Data/Power)	Each	$600	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
	HAR Sign and Flashers (post-mount)	Each	$1,500	$13,500	$0	$10,500	$1,500	$0	$4,500	$4,500	$1,500	$0	$0	$0
	VIDS at Traffic Signals	Each	$20,700	$621,000	$0	$372,600	$82,800	$62,100	$248,400	$393,300	$62,100	$165,600	$414,000	$165,600
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	$170,104	$0	$103,021	$32,344	$19,167	$2,396	$122,188	$35,938	$33,542	$31,146	$11,979
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	$241,600	$0	$120,800	$0	$0	$60,400	$30,200	$0	$30,200	$151,000	$60,400
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	$182,400	$0	$106,400	$0	$0	$45,600	$45,600	$45,600	$15,200	$30,400	$60,800
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	$675,000	$0	$525,000	$75,000	$0	$225,000	$225,000	$75,000	$0	$0	$0
	DTB Signs (post-mount)	Each	$16,000	$144,000	$0	$112,000	$16,000	$0	$48,000	$80,000	$16,000	$0	$0	$0
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	$27,000	$0	$21,000	$3,000	$0	$9,000	$15,000	$3,000	$0	$0	$0
	ITS Device Sub Total			**$2,890,124**	**$3,000**	**$1,865,781**	**$309,164**	**$151,407**	**$952,476**	**$1,373,288**	**$328,778**	**$432,702**	**$1,071,206**	**$507,819**
Field Communications	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	$1,069,438	$94,802	$663,617	$88,704	$123,077	$304,920	$410,256	$221,760	$280,526	$296,604	$92,585
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	$560,182	$49,658	$347,609	$46,464	$64,469	$159,720	$214,896	$116,160	$146,942	$155,364	$48,497
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	$88,500	$0	$54,000	$7,500	$4,500	$30,000	$39,000	$10,500	$15,000	$40,500	$21,000
	Fiber Optic Pull Box with Grounding System	Each	$800	$101,851	$9,029	$63,202	$8,448	$11,722	$29,040	$39,072	$21,120	$26,717	$28,248	$8,818
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	$60,000	$0	$33,000	$0	$0	$15,000	$12,000	$9,000	$6,000	$21,000	$18,000
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	$135,000	$0	$81,000	$18,000	$13,500	$54,000	$85,500	$13,500	$36,000	$90,000	$36,000
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	$88,500	$0	$54,000	$7,500	$4,500	$30,000	$39,000	$10,500	$15,000	$40,500	$21,000
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Splices	Each	$22	$5,192	$0	$3,168	$440	$264	$1,760	$2,288	$616	$880	$2,376	$1,232
	Hub Cabinet	Each	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Field Communications SubTotal			**$2,108,662**	**$153,490**	**$1,299,595**	**$177,056**	**$222,031**	**$624,440**	**$842,012**	**$403,156**	**$527,066**	**$674,592**	**$247,131**
Summary Cost	**Corridor Subtotal**			$4,998,787	$156,490	$3,165,376	$486,220	$373,438	$1,576,916	$2,215,300	$731,934	$959,767	$1,745,798	$754,950
	Mobilizations			$249,939	$7,824	$158,269	$24,311	$18,672	$78,846	$110,765	$36,597	$47,988	$87,290	$37,748
	MOT			$249,939	$7,824	$158,269	$24,311	$18,672	$78,846	$110,765	$36,597	$47,988	$87,290	$37,748
	Engineering Design and Survey			$824,800	$25,821	$522,287	$80,226	$61,617	$260,191	$365,524	$120,769	$158,362	$288,057	$124,567
	System Testing, Integration, and Configuration			$599,854	$18,779	$379,845	$58,346	$44,813	$189,230	$265,836	$87,832	$115,172	$209,496	$90,594
	Construction Engineering and Inspection			$329,920	$10,328	$208,915	$32,091	$24,647	$104,076	$146,210	$48,308	$63,345	$115,223	$49,827
	Contingency			$499,879	$15,649	$316,538	$48,622	$37,344	$157,692	$221,530	$73,193	$95,977	$174,580	$75,495
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$2,754,331	$86,226	$1,744,122	$267,907	$205,764	$868,881	$1,220,630	$403,295	$528,832	$961,935	$415,978
	Total Capital Costs			$7,753,118	$242,715	$4,909,498	$754,127	$579,202	$2,445,796	$3,435,930	$1,135,229	$1,488,599	$2,707,732	$1,170,928
	Annual Operations and Maintenance Cost			$775,312	$24,272	$490,950	$75,413	$57,920	$244,580	$343,593	$113,523	$148,860	$270,773	$117,093

Table 6-11: Pinellas Countywide ATMS – Deployment Phase III

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase III											
				Corridor 35	Corridor 36	Corridor 37	Corridor 38	Corridor 39	Corridor 40	Corridor 41	Corridor 42	Corridor 43	Corridor 44	Corridor 45	Corridor 46
				Gandy Blvd	Sunset Point Rd.	Tyrone Blvd/SR 595	Tarpon Ave	Keystone Rd.	Alt. US 19/ SR 595 Palm Harbor Blvd./	49th St. N.	Missouri Ave/ Seminole Blvd./SR	Treasure Island Causeway	38th Avenue N.	Gulf Blvd./ Pinellas Bayway	Tom Stuart CSWY/ SR 666 / Welch
				I-275	Keene Rd.	Alt. US 19/ SR 595/ Seminole Blvd.	Alt. US 19/ SR 595	East Lake Rd.	Klosterman Rd	Park Blvd./ SR 694	Gulf to Bay/SR 60	Gulf Blvd	Tyrone Blvd/SR 595	Clearwater CSWY	Gulf Blvd
				Hillsborough County	Belcher Rd.	5th Avenue N./ SR 595	US 19/ SR	County Line	Gulf to Bay/SR 60	38th Avenue N.	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira	Alt 19/ 66th St.	4th St. N.	I-275	Seminole Blvd/Alt. US 19/ Bay Pine Blvd.
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	$0	$10,200	$71,400	$20,400	$0	$142,800	$40,800	$183,600	$51,000	$112,200	$234,600	$20,400
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	$5,000	$0	$0	$0	$0	$0	$0	$20,000	$5,000	$0	$20,000	$5,000
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	$0	$0	$17,500	$3,500	$0	$49,000	$7,000	$24,500	$10,500	$14,000	$66,500	$3,500
	Device Cabinet Foundation	Each	$1,000	$1,000	$0	$5,000	$1,000	$0	$14,000	$2,000	$11,000	$4,000	$4,000	$23,000	$2,000
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	$0	$0	$16,500	$0	$0	$9,900	$3,300	$0	$13,200	$36,300	$75,900	$3,300
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	$0	$6,180	$12,360	$12,360	$0	$67,980	$18,540	$111,240	$6,180	$0	$0	$6,180
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	$0	$6,000	$42,000	$12,000	$0	$84,000	$24,000	$108,000	$30,000	$66,000	$138,000	$12,000
	TVSS Surge Protection (Data/Power)	Each	$600	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
	HAR Sign and Flashers (post-mount)	Each	$1,500	$1,500	$0	$0	$0	$0	$0	$0	$6,000	$1,500	$0	$6,000	$1,500
	VIDS at Traffic Signals	Each	$20,700	$0	$20,700	$144,900	$41,400	$0	$289,800	$82,800	$372,600	$103,500	$227,700	$476,100	$41,400
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	$0	$9,583	$14,375	$1,198	$1,198	$23,958	$35,938	$147,344	$19,167	$0	$0	$0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	$0	$0	$90,600	$30,200	$0	$151,000	$30,200	$0	$30,200	$30,200	$30,200	$30,200
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	$0	$0	$30,400	$0	$0	$136,800	$15,200	$106,400	$30,400	$45,600	$273,600	$0
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	$75,000	$0	$0	$0	$0	$0	$0	$300,000	$75,000	$0	$300,000	$75,000
	DTB Signs (post-mount)	Each	$16,000	$16,000	$0	$0	$0	$0	$0	$0	$64,000	$16,000	$0	$64,000	$16,000
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	$3,000	$0	$0	$0	$0	$0	$0	$12,000	$3,000	$0	$12,000	$3,000
	ITS Device Sub Total			**$104,500**	**$55,663**	**$448,035**	**$125,058**	**$4,198**	**$972,238**	**$262,778**	**$1,469,684**	**$401,647**	**$539,000**	**$1,722,900**	**$222,480**
Field Communications	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	$181,843	$60,984	$309,910	$79,834	$157,450	$663,062	$125,294	$501,178	$128,621	$376,438	$0	$83,714
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	$95,251	$31,944	$162,334	$41,818	$82,474	$347,318	$65,630	$262,522	$67,373	$197,182	$0	$43,850
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	$1,500	$1,500	$18,000	$4,500	$0	$42,000	$9,000	$43,500	$13,500	$22,500	$0	$6,000
	Fiber Optic Pull Box with Grounding System	Each	$800	$17,318	$5,808	$29,515	$7,603	$14,995	$63,149	$11,933	$47,731	$12,250	$35,851	$0	$7,973
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	$0	$0	$15,000	$3,000	$0	$42,000	$6,000	$21,000	$9,000	$12,000	$57,000	$3,000
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	$0	$4,500	$31,500	$9,000	$0	$63,000	$18,000	$81,000	$22,500	$49,500	$103,500	$9,000
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	$1,500	$1,500	$18,000	$4,500	$0	$42,000	$9,000	$43,500	$13,500	$22,500	$0	$6,000
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$165,600	$0
	Fiber Splices	Each	$22	$88	$88	$1,056	$264	$0	$2,464	$528	$2,552	$792	$1,320	$4,048	$352
	Hub Cabinet	Each	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Field Communications SubTotal			**$297,501**	**$106,324**	**$585,314**	**$150,518**	**$254,918**	**$1,264,994**	**$245,386**	**$1,002,982**	**$267,535**	**$717,290**	**$330,148**	**$159,890**
Summary Cost	**Corridor Subtotal**			$402,001	$161,987	$1,033,349	$275,576	$259,116	$2,237,232	$508,163	$2,472,666	$669,182	$1,256,290	$2,053,048	$382,370
	Mobilizations			$20,100	$8,099	$51,667	$13,779	$12,956	$111,862	$25,408	$123,633	$33,459	$62,815	$102,652	$19,118
	MOT			$20,100	$8,099	$51,667	$13,779	$12,956	$111,862	$25,408	$123,633	$33,459	$62,815	$102,652	$19,118
	Engineering Design and Survey			$66,330	$26,728	$170,503	$45,470	$42,754	$369,143	$83,847	$407,990	$110,415	$207,288	$338,753	$63,091
	System Testing, Integration, and Configuration			$48,240	$19,438	$124,002	$33,069	$31,094	$268,468	$60,980	$296,720	$80,302	$150,755	$246,366	$45,884
	Construction Engineering and Inspection			$26,532	$10,691	$68,201	$18,188	$17,102	$147,657	$33,539	$163,196	$44,166	$82,915	$135,501	$25,236
	Contingency			$40,200	$16,199	$103,335	$27,558	$25,912	$223,723	$50,816	$247,267	$66,918	$125,629	$205,305	$38,237
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$221,502	$89,255	$569,376	$151,843	$142,773	$1,232,715	$279,998	$1,362,439	$368,719	$692,216	$1,131,229	$210,686
	Total Capital Costs			$623,503	$251,242	$1,602,725	$427,419	$401,889	$3,469,947	$788,161	$3,835,105	$1,037,901	$1,948,506	$3,184,277	$593,055
	Annual Operations and Maintenance Cost			$62,350	$25,124	$160,272	$42,742	$40,189	$346,995	$78,816	$383,511	$103,790	$194,851	$318,428	$59,306

Table 6-12: Pinellas Countywide ATMS – Deployment Phase III

ITS Component	Item	Unit	Unit Cost	Pinellas Countywide ATMS - Deployment Phase III (Continued)											
				Corridor 47	Corridor 48	Corridor 49	Corridor 50	Corridor 51	Corridor 52	Corridor 53	Corridor 54	Corridor 55	Corridor 56	Corridor 57	Corridor 58
				Courtney Campbell	Curlew Rd./SR 586	4th St. N.	22nd Avenue S./Gulfport Blvd.	9th St. S.	5th Avenue N./ SR 595/Bay Pines Blvd.	Alt. US 19/SR 595/ Pinellas Ave.	Alt US 19/SR 595/ Ft. Harrison	Drew St./ SR 590	Main St./ SR 580	54th Ave. S.	Tampa Rd
				Damascus Rd.	Alt US 19/SR 595/ Bayshore Blvd	22nd Avenue S.	Pasadena Ave	54th Avenue S.	Tyrone Blvd/ SR 595	Klosterman Rd.	Gulf to Bay/SR 60	Alt US 19/SR 595/ Ft. Harrison Ave.	Alt US 19/SR 595/ Broadway	I-275	Alt US 19/SR 595/ Palm Harbor Blvd
				Hillsborough County	Belcher Rd.	I-275	4th St. N.	22nd Avenue S.	4th St. N.	Pasco County Line	Tom Stuart CSWY/ SR 666 / Welch CSWY/ Madeira	Belcher Rd.	Belcher Rd.	9th St. S.	Belcher Rd.
ATMS Elements	TS-2 Type 1 Controller Cabinet (Type VI) (F&I)	Each	$10,200	$0	$0	$275,400	$122,400	$40,800	$102,000	$51,000	$193,800	$81,600	$81,600	$40,800	$20,400
	Device Cabinet (Type V) (DMS) (F&I)	Each	$5,000	$5,000	$5,000	$5,000	$10,000	$0	$10,000	$0	$20,000	$0	$0	$5,000	$0
	Device Cabinet (Type IV) (CCTV) (F&I)	Each	$3,500	$0	$0	$24,500	$17,500	$7,000	$10,500	$10,500	$31,500	$7,000	$3,500	$7,000	$0
	Device Cabinet Foundation	Each	$1,000	$1,000	$1,000	$8,000	$7,000	$2,000	$5,000	$3,000	$13,000	$2,000	$1,000	$3,000	$0
	2070L with ASC2-2070 local control software (non-adaptive) (F&I)	Each	$3,300	$0	$0	$89,100	$26,400	$13,200	$33,000	$0	$0	$0	$3,300	$13,200	$0
	2070L with ASC2-2070 with 'OPAC' adaptive software (F&I)	Each	$6,180	$0	$0	$0	$24,720	$0	$0	$30,900	$117,420	$49,440	$43,260	$0	$12,360
	UPS, Batteries, Cabinet, and Slab (F&I)	Each	$6,000	$0	$0	$162,000	$72,000	$24,000	$60,000	$30,000	$114,000	$48,000	$48,000	$24,000	$12,000
	TVSS Surge Protection (Data/Power)	Each	$600	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
	HAR Sign and Flashers (post-mount)	Each	$1,500	$1,500	$1,500	$1,500	$3,000	$0	$3,000	$0	$6,000	$0	$0	$1,500	$0
	VIDS at Traffic Signals	Each	$20,700	$0	$0	$558,900	$248,400	$82,800	$207,000	$103,500	$393,300	$165,600	$165,600	$82,800	$41,400
	Predictive Detection for Adaptive and Incident Management (Wireless Sensor, Repeater, Access Point) (Mounted on Existing Poles) (POE Connectivity to Controller Cabinet).	Det	$1,198	$2,396	$14,375	$0	$19,167	$0	$0	$10,781	$91,042	$31,146	$49,115	$0	$19,167
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 90-foot Steel Pole with Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$30,200	$0	$0	$30,200	$30,200	$30,200	$0	$0	$0	$0	$0	$0	$0
	CCTV Camera Assembly (Device Cabinet and Foundation, Grounding and Bonding, Franklin Rods, PTZ, 56' Concrete Pole w/o Lowering Device, Pole Foundation, Stub-outs, Grounding, and Composite Cable)	Each	$15,200	$0	$0	$91,200	$60,800	$15,200	$45,600	$45,600	$136,800	$30,400	$15,200	$30,400	$0
	DMS Assembly (includes Sign, Device Cabinet, Grounding and Bonding, Franklin Rods, Cantilever Structure, and Foundation)	Each	$75,000	$75,000	$75,000	$75,000	$150,000	$0	$150,000	$0	$300,000	$0	$0	$75,000	$0
	DTB Signs (post-mount)	Each	$16,000	$16,000	$16,000	$16,000	$32,000	$0	$32,000	$0	$64,000	$0	$0	$16,000	$0
	Blank-out Signs (mounted on Existing Signal Poles)	Each	$3,000	$3,000	$3,000	$3,000	$6,000	$0	$6,000	$0	$12,000	$0	$0	$3,000	$0
	ITS Device Sub Total			**$106,896**	**$118,875**	**$1,342,800**	**$832,587**	**$218,200**	**$667,100**	**$288,281**	**$1,495,862**	**$418,186**	**$413,575**	**$304,700**	**$108,327**
Field Communications	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Directional Bore) (F&I) (50% Split)	Ft	$21	$0	$114,206	$427,442	$419,126	$189,605	$256,687	$202,356	$651,974	$182,398	$155,232	$111,434	$73,735
	New Fiber in New Conduit (4" HDPE Outerduct w/ 3-1" HDPE Innerduct) (Trench Method) (F&I) (50% Split)	Ft	$11	$0	$59,822	$223,898	$219,542	$99,317	$134,455	$105,996	$341,510	$95,542	$81,312	$58,370	$38,623
	Existing Fiber in Existing Conduit (Direction Bore) (50% Split)	Ft	$21	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Existing Fiber in Existing Conduit (Trench Method) (50% Split)	Ft	$11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Optic Splice Box and Grounding System	Each	$1,500	$1,500	$1,500	$52,500	$28,500	$9,000	$22,500	$12,000	$48,000	$15,000	$13,500	$10,500	$3,000
	Fiber Optic Pull Box with Grounding System	Each	$800	$0	$10,877	$40,709	$39,917	$18,058	$24,446	$19,272	$62,093	$17,371	$14,784	$10,613	$7,022
	MPEG-2 Encoder and Terminal server (F&I)	Each	$3,000	$0	$0	$21,000	$15,000	$6,000	$9,000	$9,000	$27,000	$6,000	$3,000	$6,000	$0
	Multi-channel MPEG-4 Encoder and Terminal server (F&I)	Each	$4,500	$0	$0	$121,500	$54,000	$18,000	$45,000	$22,500	$85,500	$36,000	$36,000	$18,000	$9,000
	Hardened 100 Mbps Ethernet Switch (F&I) (Fiber, Twisted Pair, Wireless)	Each	$1,500	$1,500	$1,500	$52,500	$28,500	$9,000	$22,500	$12,000	$48,000	$15,000	$13,500	$10,500	$3,000
	Hardened Gigabit Ethernet Switch (F&I)	Each	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	IP/Ethernet/ serial wireless transceiver short-haul (4.9 Ghz Public safety) Antenna (short haul with cabling) (F&I)	Each	$3,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Fiber Splices	Each	$22	$88	$88	$3,080	$1,672	$528	$1,320	$704	$2,816	$880	$792	$616	$176
	Hub Cabinet	Each	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Field Communications SubTotal			**$3,088**	**$187,994**	**$942,630**	**$806,258**	**$349,507**	**$515,909**	**$383,828**	**$1,266,894**	**$368,190**	**$318,120**	**$226,034**	**$134,557**
Summary Cost	**Corridor Subtotal**			$109,984	$306,869	$2,285,430	$1,638,844	$567,707	$1,183,009	$672,109	$2,762,755	$786,376	$731,695	$530,734	$242,883
	Mobilizations			$5,499	$15,343	$114,271	$81,942	$28,385	$59,150	$33,605	$138,138	$39,319	$36,585	$26,537	$12,144
	MOT			$5,499	$15,343	$114,271	$81,942	$28,385	$59,150	$33,605	$138,138	$39,319	$36,585	$26,537	$12,144
	Engineering Design and Survey			$18,147	$50,633	$377,096	$270,409	$93,672	$195,196	$110,898	$455,855	$129,752	$120,730	$87,571	$40,076
	System Testing, Integration, and Configuration			$13,198	$36,824	$274,252	$196,661	$68,125	$141,961	$80,653	$331,531	$94,365	$87,803	$63,688	$29,146
	Construction Engineering and Inspection			$7,259	$20,253	$150,838	$108,164	$37,469	$78,079	$44,359	$182,342	$51,901	$48,292	$35,028	$16,030
	Contingency			$10,998	$30,687	$228,543	$163,884	$56,771	$118,301	$67,211	$276,276	$78,638	$73,169	$53,073	$24,288
	Subtotal for Mobilization, MOT, Design, Integration, CEI, and Contingency			$60,601	$169,085	$1,259,272	$903,003	$312,807	$651,838	$370,332	$1,522,278	$433,293	$403,164	$292,434	$133,829
	Total Capital Costs			$170,585	$475,953	$3,544,701	$2,541,847	$880,514	$1,834,847	$1,042,441	$4,285,033	$1,219,670	$1,134,858	$823,168	$376,712
	Annual Operations and Maintenance Cost			$17,058	$47,595	$354,470	$254,185	$88,051	$183,485	$104,244	$428,503	$121,967	$113,486	$82,317	$37,671

7.0 APPENDIX C – GLOSSARY

Acronym	Definition
ADUS	Archived Data User Service
ATC	Advanced Transportation Controller
ATMS	Advanced Traffic Management System
Cameleon	Universal Software Decoder
CCTV	Closed Circuit Television
CEI	Construction Engineering And Inspection
CMAQ	Congestion Mitigation and Air Quality
Controller	Computer used for traffic control and management located at intersections
COO	Concept Of Operations
CORBA	Common Object Request Broker Architecture
DATEX	DATa Exchange
DCT	Discrete Cosine Transform
DMS	Dynamic Message Signs
DTB	Dynamic Trailblazing
Ethernet	Also known as IEEE 802.3, used for computer networking
FDOT	Florida Department of Transportation
FE	Fast Ethernet also known as 100BASE-T
Gbps	Billion Bits Per Second
GigE	Gigabit Ethernet also known 1000BASE-T
GPS	Global Positioning System
HAR	Highway Advisory Radio
HSIP	Highway Safety Improvement Program
i2TMS	Traffic control system control
IDAS	ITS Deployment Analysis System; a software for integrating ITS into the planning process
IR	Infrared
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
LED	Light-Emitting Diode
Mbps	Million Bits Per Second
MIBs	Management Information Base
MIST	Management Information System For Transportation
MOT	Maintenance of traffic
MPEG	Moving Pictures Working Group
MPO	Metropolitan Planning Organization
Multicast Support	Delivery of information to a group of network computers simultaneously
MUTCD	Manual on Uniform Traffic Control Devices
NEMA	National Electrical Manufacturers Association
NHS	National Highway System Funds
NTCIP	National Transportation Communications For ITS Protocol
OPAC	Optimized Policies for Adaptive Control - Emerging Adaptive Traffic Control Systems
Primary Control Center	Core Level Command and Control Center used for Countywide Traffic Management
PS&E	Plans, Specifications, and Engineer's Estimate
PSTA	Pinellas Suncoast Transit Authority
RHODES	Real Time Traffic Signal Control System - Emerging Adaptive Traffic Control Systems Software
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users

SCATS	Sydney Coordinated Adaptive Traffic System - Proven Adaptive Traffic Control Systems Software
SCOOT	Splits, Cycle-time, and Offset Optimization Technique - Proven Adaptive Traffic Control Systems Software
SM-SI	System Manager-System Integrator
SNMP	Simple Network Management Protocol
SOAP	Simple Object Access Protocol
STMP	Simple Transportation Management Protocol is used for the management of transportation equipment
STP	Surface Transportation Program
TBRIA	Tampa Bay Regional Its Architecture
TMDD	Traffic Management Data Dictionary
Topology	A schematic description of the arrangement of a network, including its nodes (individual units) and connecting lines
UPS	Uninterrupted Power Supply
VIDS	Video Imaging Detection System
VLAN	Virtual Local Area Network
VME	A Computer Standard
W3C	World Wide Web Consortium
WSDL	Web Services Description Language
XML	eXtensible Markup Language