

NOTICE TO CONTRACTORS  
OFFICE OF THE STATE OF FLORIDA  
DEPARTMENT OF TRANSPORTATION  
801 N. BROADWAY AVENUE  
BARTOW, FLORIDA 33830

**January 27, 2012**  
District Procurement Office  
District One

**ADDENDUM NUMBER SIX**

PROJECT DESCRIPTION: I-75 Freeway Management System in Sarasota and Manatee Counties  
FINANCIAL PROJECT NO.: 414730-1-52-01, 414732-1-52-01 & 414736-1-52-01  
COUNTY: Sarasota and Manatee Counties  
CONTRACT NO.: E1J73

The Department is revising the Minimum Technical Requirements (MTR's) to reflect site specific requirements.

Minimum Technical Requirements	Page	
	63	Section 11.2, Design Requirements, second paragraph, added the following: <b>All gate locks (for both RWIS and generator sites) shall be keyed alike.</b>
	66	Section 12.1 Highway Advisory Radio, Requirements, fourth paragraph, first sentence, inserted <b>(utilizing wood support poles)</b> after antenna assemblies.
	69	Section 13.2.1, Design Requirements, added the following after the third paragraph. <b>A six-foot high Type B (chain link) fence shall enclose the generator units. Each fence shall be equipped with an eight-foot wide locking gate. The fenced enclosure shall measure 12 feet by 12 feet. The Design-Build Firm shall provide at least 4 copies of the key for each locking gate. All gate locks (for both RWIS and generator sites) shall be keyed alike. The Design-Build Firm shall install a weed barrier to prevent vegetation from growing up around the RWIS within the fence area. Gravel shall be installed on top of the weed barrier. Type B fence, weed barrier, and gravel shall comply with FDOT Supplemental Specification Sections 785-5.3.6 through 785-5.3.10.</b>

Attached is the revised Attachment A, Minimum Technical Requirements dated 1/26/2012. The Request for Proposal package dated October 5, 2011 was not revised.

Acknowledge receipt of Addendum Number Six in the space provided on the proposal.

Felipe Alvarez  
*Felipe Alvarez*  
Design Build Administrator

**PLEASE SIGN BELOW IN RECEIPT OF THIS NOTICE AND ADDITIONAL DOCUMENTS ANNOTATED ABOVE.**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Company Name

Contract No. E1J73  
Addendum No. 06

414730-1-52-01, 414732-1-52-01 & 414736-1-52-01  
1 of 3  
January 26, 2012

**ATTACHMENT A**



**FLORIDA DEPARTMENT OF TRANSPORTATION  
DISTRICT ONE**

**DESIGN-BUILD  
MINIMUM TECHNICAL REQUIREMENTS**

**For**

**I-75 Corridor Freeway Management System and  
Intelligent Transportation Systems (ITS) Integration Project in  
Sarasota and Manatee Counties**

**Contract Number: E1J73  
Financial Projects Number(s):  
414730-1-52-01, 414732-1-52-01, & 414736-1-52-01**

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## ACRONYMS

AASHTO .....	American Association of State Highway and Transportation Officials
AC .....	Alternating Current
AGM .....	Absorbent Glass Mat
AM .....	Amplitude Modulation
APL .....	Approved Products List
ASTM .....	American Society for Testing and Materials
CCTV .....	Closed Circuit Television
CLD .....	Camera Lowering Device
COTS .....	Commercial Off The Shelf
DMS .....	Dynamic Message Sign
DVRMP .....	Distance Vector Multicast Routing Protocol
EIA .....	Electronic Industries Alliance
ERM .....	Electronic Route Marker
ESS .....	Environmental Sensor Station
FCC .....	Federal Communications Commission
FDOT .....	Florida Department of Transportation
FMS .....	Freeway Management System
GBIC .....	Gigabit Interface Converter
GFI .....	Ground Fault Interrupter
GFIC .....	Ground Fault Interrupter Circuit
GPS .....	Global Positioning System
GUI .....	Graphical User Interface
HAR .....	Highway Advisory Radio
IP .....	Internet Protocol
ISO .....	International Organization for Standardization
IT .....	Information Technology
ITS .....	Intelligent Transportation Systems
ITS FM Tool .....	ITS Fiber Management Tool
LED .....	Light Emitting Diode
MPEG .....	Moving Picture Experts Group
MTR .....	Minimum Technical Requirements
MVDS .....	Microwave Vehicle Detection System
NEC .....	National Electrical Code
NEMA .....	National Electrical Manufacturers Association
NCHRP .....	National Cooperative Highway Research Program
NTCIP .....	National Transportation Communications for ITS Protocol
OSPF .....	Open Shortest Path First
OTDR .....	Optical Time-Domain Reflectometer
PIM-DM .....	Protocol Independent Multicast-Dense Mode
PIM-SM .....	Protocol Independent Multicast- Sparse Mode
<i>PPM</i> .....	<i>FDOT Plans Preparation Manual</i>
PTZ .....	Pan-Tilt-Zoom
RFP .....	Request for Proposal
RPU .....	Remote Processing Unit
RTMC .....	Regional Transportation Management Center
RTVM .....	Requirements Traceability Verification Matrix
RWIS .....	Road Weather Information System

SFP	Small Form-Factor Pluggable
SNMP	Simple Network Management Protocol
SRM	Standard Route Marker
STMC	Satellite Transportation Management Center
STP	Shielded Twisted Pair
SWIFT	Southwest Interagency Facility for Transportation
TCP/IP	Transmission Control Protocol/Internet Protocol
TERL	Traffic Engineering Research Lab
TIA	Telecommunications Industry Association
TVSS	Transient Voltage Surge Suppressor
UL	Underwriters Laboratories
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VAC	Volts Alternating Current
VDC	Volts Direct Current

## 1.0 INTRODUCTION

The Sarasota and Manatee I-75 Freeway Management System (FMS) Project is the next phase of the I-75 FMS which is a continuation of the existing Collier/Lee/Charlotte I-75 FMS. This project extends the FMS coverage from approximately one mile north of the Charlotte/DeSoto/Sarasota County line to the intersection of I-275 and I-75 in Manatee County. The Sarasota and Manatee I-75 FMS shall be integrated into the existing Southwest Interagency Facility for Transportation (SWIFT) SunGuide® Center located at the Daniels Parkway Rest Area off of I-75 in Fort Myers and the Sarasota-Manatee County Satellite Transportation Management Center (STMC) located at 2101 47<sup>th</sup> Terrace East, Bradenton. The following projects make up this contract:

- FPID 414730-1-52-01, I-75 in Sarasota County from Charlotte County Line to Manatee County Line, design and construct a FMS;
- FPID 414732-1-52-01, I-75 in Manatee County from Sarasota County line to I-275, design and construct a FMS; and
- FPID 414736-1-52-01, Integrate the FMS installed under FPID 414730-1-52-01 and 414732-1-52-01 with the Regional Transportation Management Center (RTMC) in Lee County and the Sarasota/Manatee STMC in Manatee County.

This Minimum Technical Requirements (MTR) document sets forth the minimum requirements for the design, procurement, installation, integration, and testing of the various project elements, including:

- Intelligent Transportation System (ITS) field elements:
  - Closed circuit television (CCTV) cameras
  - Non-intrusive Microwave Vehicle Detection System (MVDS)
  - Dynamic Message Signs (DMS)
  - Highway Advisory Radio (HAR) System
  - Road Weather Information System (RWIS)
  - Power & Emergency Generator System
- Fiber optic backbone cable and communications equipment that interfaces with the ITS field elements via the Ethernet communications protocol
- Transmit CCTV camera video back to the SWIFT SunGuide® Center using Moving Picture Experts Group (MPEG) 2 video compression format.
- Field device interconnection to and enhancements of the Sarasota-Manatee STMC.

Each of the aforementioned project ITS field elements shall be installed and seamlessly integrated with the existing Collier/Lee/Charlotte I-75 FMS. All integration, programming, and configuration of the individual subsystems or field components shall be considered as part of the subsystem or component installation.

The SunGuide Implementation Plan for FDOT Sarasota/Manatee County Satellite TMC Integration Project prepared by the Southwest Research Institute (SwRI) details the specific tasks that must be performed in connection with this project. The Design-Build Firm shall coordinate its activities with SwRI, including scheduling the activities that must be completed to permit SwRI to complete its tasks in a timely manner, so the Design-Build Firm can complete the project as scheduled. The Design-Build Firm shall utilize the information in the SunGuide Implementation Plan to finalize their design of the FMS and create their integration plan for approval by the Florida Department of Transportation (Department or FDOT). The SunGuide Implementation Plan details those tasks necessary to integrate the FMS as intended by the Department. SwRI is responsible for installing the SunGuide® software. The Design-Build Firm is responsible for all other integration related tasks as shown in the SunGuide Implementation Plan.

The Design-Build Firm shall provide Global Positioning System (GPS) coordinates for all pull boxes, splice boxes, conduit routing, and ITS field elements including power drops, devices and cabinets, to a

sub-foot level of accuracy. Convert these coordinates into State Plane format for ease of importing into Microstation plans. All aerials used as base maps shall be ortho-rectified and the GPS coordinates of the project elements shall be tied to the aerials on the final record set plans.

### **1.1 Requirements Classification**

The minimum requirements for some of the subsystems are further defined as:

- Design Requirements – How the subsystem/component needs to be designed
- Functional Requirements – How the subsystem/component needs to function
- Performance Requirements – How the subsystem/component needs to perform
- Materials Requirements – How the subsystem/component needs to be fabricated
- Construction Requirements – How the subsystem/component needs to be constructed

Specific requirements for testing a particular subsystem/component and training of operations/maintenance personnel are defined under the individual subsystem/component sections in this document. The general requirements for testing and training relevant for all the subsystems/components are further defined below.

### **1.2 General Testing Requirements**

The Department shall provide the Design-Build Firm with a Requirements Traceability Verification Matrix (RTVM) that calls out all contract requirements and the method of verification: analysis, demonstration, inspection or testing. The Design-Build Firm is responsible for all contract requirements and shall document the verification as the contract requirements are met.

The Design-Build Firm shall develop as part of the Test Plan Submittal and subsequent updates thereof, a Test Evaluation Matrix to be used as a tool to cross-reference each planned test to a specific contract requirement to be verified as shown in the RTVM. The Design-Build Firm shall use this Test Evaluation Matrix shall to indicate the specific functional requirements as tested and the results achieved and verified by the Engineer. This shall provide a mechanism to ensure that all contract requirements have been successfully tested and verified.

The Design-Build Firm shall develop a comprehensive test plan, submit it for approval by the Engineer, incorporate all of the Engineer's comments, execute the plan, and document the results. All Test Plans as defined below shall be submitted for review and acceptance by the Department at least 90 calendar days prior to any planned test activity. Any deviations or changes to the approved Test Plan shall be resubmitted for review and acceptance by the Department 14 calendar days prior to any planned test activity.

As a minimum, the Test Plan shall include the following:

- A step-by-step outline of the test procedures and sequence to be followed, showing a test of every function for each of the individual subsystems/components.
- A test set-up/configuration diagram showing what is being tested.
- A description of expected operation, output, and test results.
- An estimate of the test duration and proposed test schedule.
- A data form to be used to record all data and quantitative results obtained during the tests.
- A description of any special equipment, setup, manpower, or conditions required for the test.

The Design-Build Firm shall not begin testing until the Department has approved the Test Plan and Test Evaluation Matrix, including detailed procedures and data forms. The test results for each subsystem/component tested shall meet the performance requirements identified for the particular subsystem/component defined in Florida Standard Specifications for Road and Bridge Construction,

current edition, Supplemental Specifications sections 780, ITS General-Requirements; 781, ITS-Motorist Information Systems; 782, ITS-Video Equipment; 783, ITS-Fiber Optic Cable and Interconnect; 784, ITS-Network Device; 785, ITS-Infrastructure; and 786, ITS-Vehicle Detection and Data Collection, as well as the requirements defined in this MTR for each subsystem/component.

Neither witnessing of the tests by the Department nor the waiving of the right to do so shall relieve the Design-Build Firm of the responsibility to comply with the contract documents. Such actions by the Department or approval of any test results by the Department shall not be deemed as acceptance of the equipment or system tested until the successful completion of the burn-in period, as defined in the Request for Proposal (RFP). The cost of testing shall be considered to be included in the unit cost for the item tested; no separate payment will be made for testing.

Testing of the equipment and system shall include, in the following order, each preceding test must be satisfactorily completed and accepted before subsequent test(s) may begin:

#### **1.2.1 Factory Acceptance Test**

All applicable Factory Acceptance Tests shall comply with the test requirements of the relevant sections of FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786.

#### **1.2.2 Stand-alone Test**

All applicable Stand-alone Tests shall comply with the test requirements of the relevant sections of FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786.

The Stand-alone Test shall exercise all stand-alone (non-network) functional operations of the ITS device and ancillary components installed at the device site.

If any ITS device or ancillary component fails to pass its Stand-alone Test more than twice, it shall be replaced by the Design-Build Firm with a new ITS device or ancillary component of same make and model, and the entire Stand-alone Test shall be repeated until proven successful. The Stand-alone Tests shall be performed on each and every ITS device and ancillary component, including, but not limited to the following:

- CCTV Cameras
- Non-intrusive MVDS
- DMS
- HAR
- RWIS
- Device controllers
- Video controllers
- Layer 3 distribution switches
- Managed field Ethernet switches
- Fiber optic cable
- Uninterruptible Power Supplies (UPS)
- Grounding-bonding
- Emergency generators

#### **1.2.3 Subsystem Test**

All applicable Subsystem Tests shall comply with the test requirements of the relevant sections of FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786.

Tests shall be performed based on the construction project milestones. The subsystem/component test shall demonstrate that all equipment furnished, adjusted, or modified by the Design-Build Firm has been installed properly and operates according to the Department-approved Test Plan. The Design-Build Firm

shall conduct the subsystem/component test in the presence of the Department's Project Manager or designated representative. The subsystem/component test will begin within seven days after the Design-Build Firm advises the Department's Project Manager that they are ready to begin the test. The test may begin when the Design-Build Firm has satisfied the Department that all work has been completed. The subsystem test shall verify that all of the requirements defined in the MTR for the subsystem/component being tested have been met. This test shall be performed utilizing the project field equipment and communications system. The test shall demonstrate full control of the field device(s) from the Sarasota-Manatee STMC over the Ethernet Network, as well as the functions of local/remote troubleshooting/diagnostics specified in the equipment's functional requirements. The test shall be conducted with manufacturer-supplied software. The Design-Build Firm shall provide qualified personnel to support the diagnosis and repair of system equipment during the subsystem test as required. These personnel shall be available for this support within 24 hours of notification that their services are needed.

In the event the subsystem fails the test or is rejected by the Department, the Design-Build Firm shall correct the problem and repeat the test within seven days after receiving the rejection notice from the Department. The test shall be re-conducted until the Department accepts the test result.

The Design-Build Firm shall furnish and maintain all required test equipment as part of their services. The test equipment – both hardware and software – shall be the property of the Department after the completion of the test.

All test equipment utilized shall have a calibration certification in accordance with the test set manufacturer's recommendations or within the last six months.

The test equipment shall be made ready for the Department's use at the time it is needed.

If requested by the Department, the Design-Build Firm shall postpone any test for up to seven days; such postponements shall not be grounds for extension of completion time. The Department may waive its right to witness certain tests.

#### **1.2.4 Operational Test**

The Design-Build Firm shall plan, implement and document the Operational Test. The test shall demonstrate successful installation of all Sarasota and Manatee I-75 FMS subsystems, properly integrated with the SunGuide® software and operable from both the SWIFT SunGuide® Center and the Sarasota-Manatee STMC, operating continuously for a period of 30 consecutive calendar-days without failure of any subsystem, ITS device, or ancillary component. This Operational Test of the complete Sarasota and Manatee I-75 FMS is an additional test to all other tests required in the relevant sections of FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, 786, and this MTR document.

The Operational Test shall commence upon successful completion of all other applicable tests required in the relevant sections of FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, 786, and this MTR document.

The Design-Build Firm shall notify the Department in writing of the scheduled date of the Operational Test 14 calendar-days prior to the commencement of said Operational Test. No Operational Testing shall be performed without prior written approval from the Department.

In the event of a subsystem, ITS device, or ancillary component failure, with the exception of consumable items such as fuses, the Operational Test shall be shut down for purposes of testing and correcting identified deficiencies, otherwise known as System Shutdown. System Shutdown is defined as any condition which, due to manufacturer defect or workmanship deficiencies results in any subsystem, ITS

device, or ancillary component of the Sarasota and Manatee I-75 FMS Project to cease operation or lose functionality. The Department reserves the right to determine that a System Shutdown is required.

For each period of System Shutdown, and after the identified deficiency has been corrected and met all applicable tests as per this MTR, the Operational Test shall be restarted for a new 30 consecutive calendar days and shall be extended for one additional consecutive day.

If the total number of System Shutdowns exceeds three due to the same subsystem, ITS device, or ancillary component, the Design-Build Firm shall:

- Remove and replace the subsystem, ITS device or ancillary component with a new and unused unit as per the requirements of this MTR;
- Perform all applicable Stand-alone and Subsystem Tests, as deemed necessary by the Department; and
- Upon written approval from the Department, restart the Operational Test for a new 30-day period.

The Operational Test steps described herein shall be repeated as many times as deemed necessary by the Department to completely demonstrate that the Design-Build Firm's work satisfies the requirements of this MTR and all other requirements of the Contract.

In the event a problem is discovered for which it is uncertain whether the cause is hardware or software related, the 30 calendar-day Operational Test shall be stopped in order to determine and correct the cause before the restart and repeat of the Operational Test, unless otherwise directed by the Department. However, the Operational Test shall not be deemed to have been successfully completed until the problem has been corrected.

All software required for diagnosing malfunctions of hardware and software/firmware shall be supplied by the Design-Build Firm. Diagnostic software shall not be installed on Department workstations or servers at the SWIFT Center. The Design-Build Firm will not be required to submit the diagnostic software for Department approval.

#### **1.2.5 Burn-In Period**

Upon completion of the Operational Test and approval of the results by the Department, a 60 consecutive calendar-day Burn-In Period shall commence for all subsystems, ITS devices and ancillary components designed, procured, constructed, installed, mounted, integrated, made operational, and tested as part of the Sarasota and Manatee I-75 FMS Project.

The Design-Build Firm shall submit, via a schedule, the start of the Burn-In Period to be approved by the Department.

The Design-Build Firm shall certify in writing to the Department the configuration of all subsystems, ITS devices, and ancillary components prior to beginning the Burn-In Period. Corrective action by the Design-Build Firm for a failure shall be a part of the Design-Build Firm's Burn-In documentation process. Department approval shall be obtained by the Design-Build Firm for the proposed corrective action prior to the Design-Build Firm's commencement of said corrective action.

The Design-Build Firm shall submit to the Department the required documentation to prove that all units have been successfully reconfigured or updated.

The Design-Build Firm shall provide technical personnel familiar with the Sarasota and Manatee I-75 FMS Project that shall be available on-site within 24 hours of notification of the need for services.

The Burn-In Period shall consist of the Department operations staff managing, monitoring, and controlling the Sarasota and Manatee I-75 FMS Project from the SWIFT Center and the Sarasota-Manatee

STMC, in real-time, to assure conformance of the project with the RFP, the MTR, the Released for Construction plans, and all applicable standards.

The Design-Build Firm shall repair or replace any subsystem, ITS device, or ancillary component that fails to function properly due to defective materials and/or workmanship.

In the event of a subsystem, ITS device, or ancillary component failure, with the exception of consumable items such as fuses, the Burn-In Period shall be shut down for purposes of testing and correcting identified deficiencies otherwise known as System Shutdown. System Shutdown is defined as any condition, which due to manufacturer defect or workmanship deficiencies results in any subsystem, ITS device or ancillary component of the Sarasota and Manatee I-75 FMS Project to cease operation or lose functionality. The Department reserves the right to determine that a System Shutdown is required.

For each period of System Shutdown, and after the identified deficiency has been corrected and met all applicable tests as per this MTR, the Burn-In Period shall be restarted for a new 60 consecutive calendar-days.

If the total number of System Shutdowns exceeds three due to the same subsystem, ITS device, or ancillary component, the Design-Build Firm shall:

- Remove and replace the subsystem, ITS device or ancillary component with a new and unused unit as per the requirements of this MTR;
- Perform all applicable Stand-alone, Subsystem, and Operational Tests, as deemed necessary by the Department; and
- Upon written approval from the Department, restart the Burn-In Period for a new 60-day period.

The Burn-In Period steps described herein shall be repeated as many times as deemed necessary by the Department to completely demonstrate that the Design-Build Firm's work satisfies the requirements of this MTR and all other requirements of the Contract.

The Design-Build Firm shall correct any and all failures during the Burn-In Period at no additional cost to the Department. All corrections shall be fully documented and provided to the Department upon request.

#### **1.2.6 Final Acceptance**

Upon the Design-Build Firm's successful completion of the Burn-In Period and once all required submittals, testing, training, documentation, and warranty documentation have been successfully delivered to and approved by the Department as specified in these MTRs, the RFP, and the requirements of the FDOT Standard and Supplemental Specifications (current edition) and all applicable standards, the Department shall grant written notice of Final Acceptance.

The Department shall issue Final Acceptance based on the Department's final inspection of the entire Sarasota and Manatee I-75 FMS Project, and as deemed by the Department.

All hardware and software provided by the Design-Build Firm shall have the latest stable firmware and any necessary upgrades available at the time of Final Acceptance.

All As-Built documents shall be produced electronically using MicroStation software, signed and sealed by the Engineer of Record, and submitted by the Design-Build Firm to the Department as a condition precedent to issuance of written notice of Final Acceptance. The As-Built documents shall be submitted for Department review at the start of and as a prerequisite to the 30 day Operational Test.

The Department shall perform the final inspections of the entire Sarasota and Manatee I-75 FMS Project in the presence of a representative of the Design-Build Firm.

### 1.3 SunGuide® Software Compatibility

The Department operates the Collier/Lee/Charlotte I-75 FMS field devices from the SWIFT Center using the SunGuide® Software System. The Design-Build Firm shall integrate the Sarasota and Manatee I-75 individual ITS field elements (i.e., CCTV cameras, MPEG-2 Encoders, DMSs, MVDSs, Serial and Ethernet communication devices, HAR Transmitters and Beacons, and RWIS stations) with the respective vendor-provided subsystem software such that each of the subsystems will be operated as a stand-alone system. After the completion and acceptance of the individual ITS subsystems, the Design-Build Firm shall integrate the ITS subsystems with the existing SunGuide® central software installation at the SWIFT Center and the new SunGuide® software installation at the Sarasota-Manatee STMC.

The Design-Build Firm shall procure all licenses for the Oracle software in the Department's name. The Department anticipates that the Design-Build Firm shall purchase four Oracle licenses for the Microsoft Clustering Group at the STMC; however, the Design-Build Firm is responsible for determining the correct number of licenses. The Design/Build Firm shall purchase any necessary renewals for the Oracle licenses to extend the expiration date through one year after Final Acceptance.

The Design-Build Firm shall provide all the temporary central equipment, including the workstations or laptop computers, necessary for the testing of the individual subsystems.

Prior to the final acceptance, the Design-Build Firm shall demonstrate to the Department that all of the equipment specified in these MTRs that were installed and configured by the Design-Build Firm flawlessly operates from any SunGuide® client workstation located at the SWIFT Center and the new Design-Build Firm supplied SunGuide® client workstations at the Sarasota-Manatee STMC.

The integration of the various subsystems with the SunGuide® software is the responsibility of the Design-Build Firm. The Design-Build Firm shall coordinate with the SWIFT Center Information Technology (IT) Manager to provide the following services:

- Conduct a site survey to prepare the creation of the system database, configuration files, system graphics, and other preparatory work for the integration of the new devices into the SunGuide® software.
- Troubleshoot any Design-Build Firm-installed hardware issues (both field and central) that affect the integration work.
- Install the hardware and software required to operate the SunGuide® software compatible with current Windows 7 server or as approved by the Department.
- Provide ITS field device information, such as equipment configuration diagrams, Internet Protocol (IP) addresses, protocols, and documentation (e.g., users' manual, troubleshooting guide, ITS Fiber Management Tool forms, etc.).
- Configure the ITS field devices for integration with the SunGuide® software, including link, lane, roadway, and device configurations.
- Provide post-installation services after testing the SunGuide® software. The services shall include populating the tables and creating map links.

All the licenses for the above products shall be transferred to the Department. The installation media for the above products shall be provided and shall become the property of the Department after installation.

#### 1.3.1 Device Protocol Compliance

For the devices being deployed, the Design-Build Firm shall ensure that the protocol used by the devices to be controlled by the SunGuide® software is compliant with the protocols listed below, which are online at <http://sunguide.datasys.swri.edu/ReadingRoom/Etc/SunGuide%20Protocol%20Support.htm>

**Table 1.1: Device Protocols Supported by SunGuide®**

Subsystem	Protocol Reference	Release	Original ITN	Added in ECO	Vendor Funded Testing
DMS	NTCIP 1203, FDOT MIB (Sep 2001)	1	X		
DMS	Mark IV - I95: Document Number A316111-102 REV. A8 (June 26, 2001)	1	X		
DMS	Mark IV - Turnpike: Document Number A316111-145 Rev.A2 (Sept 26, 2000)	4.3		X	
DMS	SunGuide Trailblazer - Kimley-Horn, 2000	2		X	
CCTV Control	NTCIP 1205 v01.08 Amendment 1 v01.08 (August 2004)	1	X		
CCTV Control	American Dynamics SD Ultra VII camera firmware version 2.03, dated January 24, 2006	3		X	
CCTV Control	American Dynamics SD Ultra 8 camera firmware version 1.09, FPGA version 2006/10/31 15:18	3		X	
Video Switching: IP Video	VBrick 4200/5200	1		X	
Video Switching: IP Video	Teleste IPE301 and IPD301	1		X	
Video Switching: IP Video	Coretec VCX2400D/VCX2400E	1		X	
Video Switching: IP Video	iMpath i1000/i4100	1		X	
Video Switching: IP Video	Cornet Technology iVDO Streamer 2/4D / iVDO Streamer 2/4E	1			X
Video Switching: IP Video	Teleste MPC-E1, MPC-D2, EASI-MPC-D (1, 2, and 4 channel), EASI-MPX-D (8 channel), EASI-MPC-E (1, 2, and 4 channel)	4.3		X	
Video Wall	Barco/Argus Apollo, API ver 1.8	1		X	
Safety Barrier	Safety Barrier Device Protocol	2		X	
Traffic Detection	BiTrans B238-I4	1	X		
Traffic Detection	EIS RTMS, Issue 2 (April 2003)	2		X	
Traffic Detection	Wavetronix RTMS: SS105 SmartSensor Data Protocol V2.02	2		X	
Traffic Detection	Canoga Microloops, TM-2003-8 (June 2003)	2		X	

Subsystem	Protocol Reference	Release	Original ITN	Added in ECO	Vendor Funded Testing
Traffic Detection (AVI)	SIRIT Identity Flex Title 21 SIRIT5000FSD (Revision E 2003)	4		X	
Traffic Detection (AVI)	lTransCore Allegro IT2020	4		X	
Traffic Detection (LPR)	Inex Zamir Zap (2008)	4		X	
HAR	Highway Information Systems DR2000	2	X		
Ramp Meters	FDOT Ramp Metering Firmware V1	2		X	
RWIS	NTCIP 1204 v02.18 (April 2004)	2	X		

The Design-Build Firm may propose alternate ITS equipment; however, the Design-Build Firm shall be responsible for developing the drivers for these devices or other necessary software revisions for integration into the SunGuide® Software. The drivers for any devices shall conform to the latest SunGuide® Interface Control Document available at <http://sunguide.datasys.swri.edu/> to ensure compatibility for integration with the SunGuide® Software. The Design-Build Firm shall coordinate with the Central Office and the SunGuide® Software Developer in developing and testing the device drivers.

### 1.3.2 Network Infrastructure

The SunGuide® network infrastructure, SunGuide® servers and SunGuide® clients shall already have been installed, tested, and accepted at the SWIFT Center by FDOT District 1 as the result of the Collier/Lee/Charlotte I-75 FMS projects. The Design-Build Firm is responsible for the new SunGuide® network infrastructure, SunGuide® servers and SunGuide® clients (including 11 workstations) at the Sarasota-Manatee STMC.

The SWIFT Center IT Manager has recently implemented a Microsoft Clustering environment at the SWIFT Center to provide full redundant network services for the existing ITS devices in Collier, Lee and Charlotte Counties. The Design-Build Firm is responsible for coordinating with the SWIFT Center IT staff to implement a similar Microsoft Clustering environment at the Sarasota-Manatee STMC.

The IP address range that includes the unicast and multicast addresses have already been allocated for the District 1 ITS network. The IP addresses will be provided to the Design-Build Firm by the Department. The Design-Build Firm Integrator shall meet with the SWIFT Center Manager and SWIFT Center IT Manager prior to any work being done within the SWIFT Center or Sarasota-Manatee STMC. This Pre-Integration Meeting is to discuss any issues, concerns, and the Design-Build Firm's plan to minimize the impact to the existing ITS at the SWIFT Center.

The Design-Build Firm shall develop an integration plan to include that details all equipment, software and scheduling to occur during the integration portion of the project. The Design-Build Firm shall submit the preliminary integration plan 30 days prior to the Pre-Integratoin meeting. The plan shall be finalized after the meeting and again submitted to the Department for review and approval.

### 1.3.3 Device Worksheets

The Design-Build Firm shall coordinate with the SWIFT Center IT Manager and the Department to collect and provide the required information about each device to be utilized by the SunGuide® software. Examples of information for CCTV cameras and DMS components are identified below. Other devices

require similar information be provided. The Design-Build Firm shall coordinate with the Southwest Research Institute (SwRI) for the exact information to provide for these devices. This information shall be included in/on the Design-Build Firm's 100% plans submittal.

These device worksheets will be used as tracking sheets for the ITS devices installed as part of the Sarasota and Manatee I-75 FMS project. The Design-Build Firm, CEI, Department personnel and the SWIFT Center IT Manager will participate in a Pre-Integration Meeting to discuss the expectations of all parties during the Integration portion of the project.

The Design-Build Firm shall coordinate with the SWIFT Center Manager and SWIFT Center IT Manager prior to the 100% plan stage so that the device naming convention and sequence numbers are implemented in that submission.

The Design-Build Firm shall provide the following data for each CCTV camera to be configured:

**Table 1.2: CCTV Camera Data Configuration Documentation Requirements**

<b>Data</b>	<b>Description</b>
Camera Name	The data identifies the unique name of each camera.
Center ID	The data identifies the unique name of the center where each camera resides.
Protocol	The data specifies the protocol (values: SNMP, SNMP(PMPP)) for each camera.
Poll Process	The data provides the name of the driver for each camera.
Manufacturer	The data identifies the manufacturer of each camera.
Location Description	The data describes where each camera resides.
Roadway	The data identifies the roadway where each camera resides.
Direction	The data identifies the direction of the roadway where each camera is installed.
Latitude	The data identifies the latitude where each camera resides.
Longitude	The data identifies the longitude where each camera resides.
Op Status	The data identifies the operational status (values: Active, Error, Failed, OutOfService) of each camera.
Address Type1	The data identifies the address type (values: pmppAddress, commAddress) for each camera. (If pmppAddress, then the camera uses SNMP (PMPP); if commAddress, then the camera uses SNMP.)
Address Type2	The data specifies the address type (value: portServerAddress) of Address Type 1.
Address	The data identifies the device address of each camera.
Port Server IP	The data identifies the IP address for the port server where each camera resides.
Port Server Port Number	The data identifies the port number for the port server where each camera resides.
Community Name	The data identifies the community name for each camera.
Attach to Video Device	If selected, additional IP video parameters must be supplied.

The Design-Build Firm shall provide the following fields for IP video:

**Table 1.3: IP Video Documentation Requirements**

<b>Data</b>	<b>Description</b>
Video Device IP Address	The data identifies the IP address for the encoder.
Blackout	The data determines if the camera is restricted.
Video Device Type	The data identifies the video device type (IP video device) for the encoder.
IP Streaming Driver ID	The data identifies the unique IP video switch driver name.
Card Number	The data identifies the card number for the encoder.
Manufacturer	The data identifies the manufacturer values of the encoder.
Model	The data identifies the model of the encoder.
Streaming Type	The data identifies the streaming type (values: elementary, transport, program) for the encoder.
Secondary Interface	The data identifies the secondary interface for the encoder that enables users to maximize the number of inputs for the encoder.
Snapshot Requested	The data determines if snapshots are generated for the encoder.

The Design-Build Firm shall provide the following data for each DMS to be configured:

**Table 1.4: DMS Configuration Documentation Requirements**

<b>Data</b>	<b>Description</b>
Sign Name	The data identifies the unique name of each DMS.
Center ID	The data identifies the unique name of the center where each DMS resides.
Protocol	The data specifies the protocol (values: SNMP, SNMP (PMPP), SunGuide <sup>®</sup> (for Trailblazers) for each DMS.
Connection Type	The data specifies how each DMS is connected to the network (values: Direct, Modem, Long Distance Modem).
Poll Process	The data specifies the name of the driver for each DMS.
Packet Timeout	The data identifies the amount of time the driver will wait on a response from a DMS before timing out. The recommended time is 5 seconds.
Packet Retry Limit	The data identifies how many times a packet is attempted before it errors out. For most signs, the recommended number is 2; for signs prone to errors, this number can be increased.
Command Retry Limit	The data identifies how many times a command is attempted before it errors out. A command consists of multiple packets. The recommended number is 1.
Op Status	The data provides the operational status (values: Active, OutOfService) for each DMS.
Manufacturer	Values: Name of the sign manufacturer.

<b>Data</b>	<b>Description</b>
Number of Lines	The data identifies the number of displayable lines for each DMS.
Number of Columns	The data identifies the number of characters that can be displayed using a normal font.
Beacons	The data identifies whether the sign has beacons and, if so, specify the beacon address.
Beacon Address	The data identifies the address where the sign receives activate/deactivate beacon requests.
Day Brightness Level	The data identifies the numeric value for the brightness setting during the daytime.
Night Brightness Level	The data identifies the numeric value for the brightness setting during the nighttime.
Font	The size of the font currently displayed. Represented in horizontal pixels by vertical pixels. (Example: 5 pixels x 7 pixels)
Sign Type	Values: Fiber Optic, LED, Flip-Disk, Shutter
Location Description	This is a text field describing the location of each DMS.
Roadway	The data identifies the roadway where each DMS resides.
Direction	The data identifies the direction of the roadway where each DMS resides.
Latitude	The data identifies the latitude where each DMS resides.
Longitude	The data identifies the longitude where each DMS resides.
Address Type 1	The data identifies the address type (values: PMPP, SunGuide <sup>®</sup> ) for each DMS. (If PMPP, then the DMS protocol should be SNMP (PMPP); if SunGuide <sup>®</sup> or MarkIV, then the DMS should use the same protocol name.)
Address Type 2	The data identifies the specific address type (values: Direct, PortServer, Dialup) of Address Type 1.
Address	The data identifies the device address for each DMS.
Community Name	The data identifies the community name for each DMS.

The Design-Build Firm shall provide the following fields for each DMS connected via a TCP/IP connection:

**Table 1.5: DMS with TCP/IP Configuration Documentation Requirements**

<b>Data</b>	<b>Description</b>
Port Server IP Address	The field identifies the IP address for the port server where each DMS resides.
Port Server Port Number	The field identifies the port number for the port server where each DMS resides.

The Design-Build Firm shall be responsible for providing all data necessary to populate the SunGuide<sup>®</sup> database. The Design-Build Firm shall coordinate with and provide this data to the SWIFT Center IT Manager in accordance with a mutually agreeable format and schedule as determined in the Pre-

Integrations meeting. No additional contract time or cost will be provided to the Design-Build Firm for this effort. The SWIFT Center IT Manager will enter the appropriate data into the SunGuide® database. The Design-Build Firm shall be responsible for observing and verifying that the SWIFT Center IT Manager enters the correct data. At no time will the Design-Build Firm be granted SunGuide® administrative rights to the Department's SWIFT SunGuide® Software System.

The database developed and installed by the Design-Build Firm at the Sarasota-Manatee STMC shall be a duplicate of the complete database at the SWIFT Center, including the information on the existing Collier/Lee/Charlotte County devices. This shall also include Microsoft Clustering by Design-Build Firm personnel whose experience with Microsoft Clustering has been reviewed and approved by the Engineer.

## **1.4 Documentation Requirements**

### **1.4.1 Materials Submittal**

The Design-Build Firm shall provide the following submittals for equipment and components for each of the project elements and subsystems identified in this MTR:

*Catalog Cut-sheets:* The manufacturer/vendor-provided catalog cut-sheets shall pictorially describe the item or component in detail. The exact model of the proposed device shall be clearly marked.

*Installation Procedures:* The manufacturer/vendor-provided manual shall indicate clearly and pictorially the installation procedures for all components, subassemblies, and assemblies.

*User Manual:* The user manual shall describe, in sufficient level of detail, how the equipment must be operated. The user manual shall include such pertinent operational information as control layouts, displays, etc., for properly operating a fully functioning unit. The manual shall document operating procedures describing the initial turn-on and adjustments to ensure an operational system within the performance requirements, as well as system-level corrective maintenance procedures. The manual shall include information on troubleshooting common device errors and malfunctions.

*Maintenance Manual:* The manufacturer/vendor-provided maintenance manual shall indicate clearly and pictorially the maintenance procedures for all components, subassemblies, and assemblies. The manual shall include pertinent information on maintaining and repairing the equipment, hardware, software, connections, interfaces, and peripheral cabling as applicable. The manual shall include sections that completely describe the theory of operation using block diagrams and schematic drawings; diagnostic and repair procedures for corrective maintenance of the unit; assembly and disassembly instructions and drawings; layout drawings showing location of all components; and a complete components listing showing component type, ratings, and acceptable manufacturers. The manual shall include all pertinent preventative maintenance activities recommended by the manufacturers and the associated timeframes.

*Software Manual:* For software that is furnished for operating an individual subsystem, a software manual shall be provided describing the operation of the software, including all the features of the graphical user interface.

*Warranty Documentation:* The warranty documentation for the equipment shall warrant against all defects and/or failure in design, materials, and workmanship for the minimum warranty duration specified for each piece of equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786 or the MTR, whichever is greater. The Design Build Firm shall identify in the Technical Proposal each guaranteed feature with its associated type of distress and threshold values defining the extent and magnitude of such distresses that will necessitate remedial work and the proposed remedial action plan for each distress. Warranty documentation shall be submitted prior to and as a condition of Final Acceptance

*Integration Plan:* The Design-Build Firm shall provide a detailed plan of action that discusses the process for integrating the new devices into the existing SunGuide® Software at the SWIFT Center with minimal interruptions to the ongoing operations of the Collier/Lee/Charlotte FMS devices. The plan shall include the process for upgrading the existing video wall at the SWIFT Center. The additional workstations at the SWIFT Center and the new workstations at the Sarasota-Manatee STMC shall also be included for installation and integration. All known interruptions to services shall be planned for off-peak hours and coordinated with the SWIFT Center Manager and operations staff.

*ITS Fiber Management (ITSFM) Tool Worksheets:* These worksheets shall be completed in their entirety for use in inputting the information about the new devices into the ITSFM Tool. The forms include information about the type of device site, device make and model number, IP addresses, serial numbers, GPS coordinates, power service, fiber details, etc. The most up to date worksheets shall be provided to the Design-Build Firm, upon request, for completion prior to final acceptance of the project.

The Design-Build Firm shall not send in submittal data or cut sheets for the switches and other networking equipment until the final design is released for construction.

#### **1.4.2 Test Plans**

The Design-Build Firm shall prepare Test Plans for the individual subsystems provided for this project. The Test Plans shall be prepared based on the testing requirements identified in the individual subsystem sections of this MTR and the Supplemental Specifications. Where the test requirements are not identified, the Design-Build Firm shall prepare detailed plans for review by the Department before testing. The Test Plan shall include, as a minimum, the following sections:

- Date, time, location, and estimated duration of test
- Name of firm and names of engineers designated as witnesses
- Description of subsystem to be tested, showing a test of every function of the equipment or system to be tested
- Test equipment list
- Test objectives
- Test sequence details – a step-by-step outline of the test sequence to be followed
- Test duration
- Expected results – a description of the expected operation outputs and test results
- Test result forms – forms to be used to record all data and quantitative results obtained during the test
- A connection diagram wherever applicable
- Software - the Design-Build Firm shall supply the Department with full documentation and shall supply a copy of all diagnostic software

#### **1.4.3 Requirements Traceability Verification Matrix (RTVM)**

The Systems Engineering Process directs the development of the Requirements Traceability Verification Matrix (RTVM). The RTVM is a tracking document used to verify that contract requirements are met using four different methods: analysis, demonstration, inspection and testing. Each of the contract requirements from the RFP and this MTR shall be documented in the RTVM with a verification method.

The Department shall prepare the initial RTVM for use by the Design-Build Firm. The Design-Build Firm shall update the RTVM as contract requirements are verified by one of the four methods.

The RTVM is a living document and shall be updated and submitted to the Department for review with each milestone demonstrating and documenting how successful completion of the verification satisfies the contract requirements. The Department will review the RTVM and provide comments, as needed, to the Design-Build Firm for incorporation into the RTVM. Once the project construction is finished and the

testing is successfully completed, the RTVM should be finalized by the Design-Build Firm and delivered with the as-builts to the Department.

## **1.5 Training Requirements**

The Design-Build Firm shall provide three separate training modules:

- Training module 1:  
Training on the basic description of capabilities and functions and the purpose in the system of each subsystem or component. Training that uses vendor-provided software and hardware shall be optional based upon the preference of the Engineer.
- Training module 2:  
Training on the operation and maintenance of each subsystem and component provided in this project using the SunGuide<sup>®</sup> Software System.

### **1.5.1 Training Documentation**

The Design-Build Firm shall prepare training material for providing training on the operation and maintenance of each subsystem/component provided in this project using vendor-provided operation and management tools, including all necessary software and hardware.

The Design-Build Firm shall prepare training materials to be used on the operation and maintenance of each subsystem/component provided in this project using the SunGuide<sup>®</sup> Software System.

The training materials shall include an introductory level briefing to familiarize attendees with the subsystem/component. The training materials shall also include an engineering/operations course that provides an overview for basic understanding of the subsystem/component operation and how it fits into the overall system. The materials shall include subsystem elements, theory of operation of components, operating procedures and capabilities, hardware and software configuration, and software applications.

The Design-Build Firm shall furnish 15 sets of approved training course materials for each one of the three separate training modules. All materials, including any figures and drawings, shall also be submitted in electronic format on CD-ROM. Fifteen copies of the CD-ROM shall be submitted to the Department and shall adhere to the CD-ROM requirement and CADD deliverable sections.

All training modules shall be recorded onto DVD for use in future training of operations and maintenance personnel on the referenced material. The Design-Build Firm shall provide two sets of training DVDs to the Department at Final Acceptance.

## **1.6 Warranty**

The Design-Build Firm shall provide a manufacturer's warranty(s) for materials as described in this document. Said warranty(s) shall be transferable from the Design-Build Firm to the Department upon the expiration of the Design-Build Firm's Maintenance Agreement as described in section 1.7.

System components shall be warranted against all defects and/or failure in design, materials, and workmanship for the minimum warranty duration specified for each item of equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786 or this MTR, whichever is greater.

Any components not covered under the FDOT Standard Specifications, Supplemental Specifications, or this MTR shall have a one year warranty provided by the Design-Build Firm. If the manufacturer's warranties for project components are for a longer period, those warranties shall continue to apply.

The warranty period shall begin as of the date that the Department issues written notice of Final Acceptance. The Maintenance Agreement, as described in section 1.7, shall cover the first year of the

Warranty. At the conclusion of the Maintenance Agreement, the Design-Build Firm shall transfer the balance of the Manufacturer's Warranties to the Department.

The Department reserves the sole right to determine defects in the materials and systems installed or modified by this project and the acceptability of the warranty repair and defect correction, including adjustment of equipment provided as a part of this project.

### **1.7 Maintenance Agreements**

At the conclusion of the project and concurrent with Final Acceptance, the Design-Build Firm shall provide agreement(s) to maintain all equipment installed under this contract for a period of one year at no additional cost to the Department. The Design-Build Firm's maintenance agreement shall provide a point of contact that can be reached by telephone and/or electronic communications 24 hours/day 7 days/week and a knowledgeable technical person at the site of the failure within 4 hours of notification.

The Maintenance Agreement shall include the following services:

- Submittal of a repair or replacement plan within 48 hours from the receipt of the notice of the occurrence from the Department;
- Removal of failed equipment;
- Returning of failed equipment to the manufacturer for warranty repairs;
- Tracking and reporting on manufacturer's repair status;
- Reinstallation of the repaired equipment; and
- Testing and documentation that the repairs are satisfactorily completed.

Repairs shall be aggressively pursued to completion and restoration of equipment to service.

If the Design-Build Firm is unable or unwilling to begin the repairs of defects within five days of the receipt of notice of the occurrence by the Department, then the Department may perform the repair of the deficiencies or defects and submit a claim to the Design-Build Firm for the repairs.

Any ITS device or ancillary component that, in the opinion of the Department, fails three times after Final Acceptance and prior to the expiration of the Maintenance Agreement shall be judged as unsuitable and shall be replaced by the Design-Build Firm with a new ITS device or ancillary component of the same make and model at no cost to the Department.

The Design-Build Firm shall perform preventative maintenance services on all the ITS components covered under the Maintenance Agreement on a quarterly basis during the year following final acceptance. The Department shall provide the minimum preventative maintenance activities for the Design-Build Firm's use.

The Design-Build Firm shall provide all preventative maintenance checklists to the Department quarterly and at the end of the Maintenance Agreement term. The Design-Build Firm shall conduct a meeting with the Department to discuss the end of the Maintenance Agreement and transfer of responsibilities to the Department. This meeting shall occur 45 days prior to the end of the Maintenance Agreement term. The Design-Build Firm shall provide the Department with a schedule of the preventative maintenance activities as a stipulation of Final Acceptance.

## **2.0 ENHANCEMENTS TO THE SARASOTA-MANATEE COUNTY SATELLITE TRANSPORTATION MANAGEMENT CENTER (STMC)**

The following are the requirements for the enhancements to the Sarasota-Manatee STMC and connection to the SWIFT Center. Entry into the STMC shall require a pass issued by the STMC Operator (Manatee County). The STMC Operator will issue passes only after a complete background check, including fingerprinting, of each applicant. Since the time to complete the required checks depends on the background of the applicant, it is not possible to state the time required to complete the check. The Design-Build Firm shall include this time in their schedule as no additional time will be granted for processing of STMC pass requests.

### **2.1 Integration with the I-75 FMS**

The Sarasota-Manatee STMC SunGuide® environment is envisioned to work primarily as a remote workstation to the SWIFT Center SunGuide server installation. The I-75 FMS components within Sarasota and Manatee Counties shall operate through the remote connection at the Sarasota-Manatee STMC 16 hours per day Monday through Friday and shall turn over operations to the SWIFT Center operators overnight and on weekends. The Sarasota-Manatee STMC must also seamlessly access and manage the I-75 FMS in District 1 (Collier, Lee, Charlotte, Sarasota and Manatee County devices) without access to the SWIFT Center servers and shall serve as a redundant backup system for the I-75 FMS should a cable break occur between the two RTMCs. If a break occurs in the 96-strand fiber, the Sarasota-Manatee STMC shall control the devices north of the break and the SWIFT Center shall control the devices south of the break.

In the case of a disaster that totally disables the SWIFT Center or creates a situation requiring an evacuation, the Sarasota-Manatee STMC must be able to manage all of the devices in the I-75 FMS network.

### **2.2 Communication Equipment**

The Design-Build Firm shall install a new Gigabit Ethernet switch at the Sarasota-Manatee STMC, the same as or equivalent to the Gigabit Ethernet switch (NetIron MLX-4 Router and FastIron WS648G Switches) to be provided at the SWIFT Center per section 3.2 of this MTR. One Gigabit Ethernet port shall connect directly to the SWIFT Center's Core Gigabit Ethernet switch via a pair of dedicated fiber strands within the I-75 FMS fiber optic cable. Three Gigabit Ethernet ports shall connect to the three closest FMS field hub switches using three separate pairs of dedicated fiber strands within the I-75 FMS fiber optic cable.

The Design-Build Firm shall provide a 45 Megabit internet connection, for the exclusive use of the FDOT, at the STMC. It shall be available to and at all FDOT workstations and back office locations. This connection shall be provided as necessary to meet the requirements of the Sarasota-Manatee STMC and shall be maintained until the date of Final Acceptance.

The Design-Build Firm shall provide a new firewall that is fully compatible with the existing SWIFT Center firewall, including but not limited to Software Blade Architecture, Site to Site VPN, IPS, Advanced Routing, High Performance, and Web Security. This firewall shall include four 2-port 1000Base-SX Ethernet SFP cards. A datalink between the two firewalls shall be configured to provide a redundant path between the SWIFT Center and the Sarasota-Manatee STMC. This work shall include the configuring of any VPNs necessary for creating a redundant ring between the two RTMCs.

### 2.3 Network Infrastructure

The Design-Build Firm shall install a new set of I-75 FMS servers at the Sarasota-Manatee STMC, in four new server racks (not network racks) and identical in performance and number to the existing set of I-75 FMS servers at the SWIFT Center. The new racks shall have front and back mesh doors that are lockable with two keys per rack and all keyed alike. The cable ladder over the existing racks shall be extended over the new racks. Each rack shall consist of two (eight total) Power Distribution Units that shall provide power distribution to each server rack. These new Sarasota-Manatee STMC servers shall work as hot stand-by servers in case the SWIFT Center SunGuide® servers fail or there is a loss of connectivity with the SWIFT Center. All of the current and future I-75 FMS devices and all of the current and future SunGuide® operators shall be identical in both sets of server databases. The databases of these new servers shall automatically and dynamically synchronize with the servers of the SWIFT Center using the Gigabit Ethernet connectivity over the I-75 FMS fiber optic cable. The Sarasota-Manatee STMC servers shall be part of a Microsoft Clustering group for the SunGuide® Software System. The Design-Build Firm is responsible for the design, procurement, installation and integration of all necessary equipment to provide the above configuration. This shall include all ancillary components not specifically detailed, but necessary to make the system function as intended.

The Design-Build Firm shall provide, install, configure and integrate into the system a Smart Array Network (SAN) (HP MSA 2312sa G2) consisting of at least the following:

- High Performance Modular Smart Array controller with two 1 GbE ports per controller;
- Dual Controller;
- Four 3 Gb SAS ports per controller;
- Supports Fiber Channel ports, iSCSi ports, and SAS ports;
- RAID levels 0, 1, 3, 5, 6, 10, 50;
- Redundant power supplies;
- Supports expansion for additional enclosure;
- Non-disruptive on-line controller code upgrade;
- Heterogeneous support for 32 bit and 64 bit Windows OS;
- Qualified and certified for Windows clustering;
- Minimum of 6 TB of disk storage; and
- Web browser support.

Two servers for the SunGuide® Database each meeting at least the following criteria:

- 2x Intel Xeon 2.6 GHz Processors;
- 12 GB Memory;
- 2 x 146 GB 15K 2.5 HDD (Hot Pluggable);
- Redundant High output power supplies (Hot pluggable);
- Windows Server 2008 R2 Enterprise;
- DVD ROM;
- On-Board dual Gigabit Network Adapters;
- 2 x HBA cards to connect to SAN; and
- Oracle 11.2G with Safeguard.

Four servers for the SunGuide® Application each meeting at least the following criteria:

- 2x Intel Xeon 2.6 GHz Processors;
- 8 GB Memory;
- 2 x 146 GB 15K 2.5 HDD (Hot Pluggable);
- Redundant High output power supplies (Hot pluggable);
- Windows Server 2008 R2 Enterprise;
- DVD ROM;

- On-Board dual Gigabit Network Adapters; and
- 2 x HBA cards to connect to SAN.

## **2.4 Video Wall Display**

At the Sarasota-Manatee STMC, there shall be two independent video wall systems with their dedicated video wall controllers and video display cubes. One video wall system is dedicated to the operation of the Manatee and Sarasota Counties ATMS and has been installed by others. The second video wall system is dedicated to the operation of the I-75 FMS and shall be designed, procured, installed and integrated by the Design-Build Firm. There shall be no commonalities between these two video wall systems, except that they share the same physical wall.

To display the images from the FMS devices, the Design-Build Firm shall expand the existing video wall with 12 new display cubes similar to the existing cubes, together with ancillary equipment and cabling, so that the entire wall appears as one unit. A separate video wall controller compatible with the SunGuide<sup>®</sup> software and on the Approved Products List (APL) shall be provided. A software-based controller installed on servers is acceptable as long as it meets the requirements herein and is included on the APL.

The Design-Build Firm shall install twelve new four-channel decoder cards, dedicated to displaying 48 simultaneous I-75 FMS CCTV camera images on the new video wall. Each of the 12 video cards shall decode both MPEG-2 and MPEG-4 video streams and be configured to decode four simultaneous MPEG-2 video streams. In addition, each of these 12 decoder cards shall decode, or shall be firmware upgradable to decode H.264 video streams. The 12 cubes within the new video wall must each display 4 images simultaneously and tour (or scroll) through a total of 200 CCTV camera images.

The support structure for the 12 cubes shall support 4 additional cubes which will be installed later by others.

As part of the video wall installation, the Design-Build Firm shall remove the existing curtain covering the space intended for the 12 FDOT cubes, leave the upper curtain over the entire wall, and fill any gaps or holes in the wall surrounding the new displays and the existing ATMS video wall to provide a finished look that appears as one unit. This finished look shall incorporate a frame similar to that at the SWIFT Center.

The Design-Build Firm is responsible for protecting their equipment within the Sarasota-Manatee STMC as the video wall system is installed. The Design-Build Firm shall be responsible for repairing any damage it causes to the existing facilities in the Sarasota-Manatee STMC, performing the repairs within the current contract time at no additional cost.

### **2.4.1 Video Wall Control**

The Design-Build Firms shall provide video wall control that configures the display format of the video images on the video wall display. The video wall control shall include:

- Video wall management system software
- Remote control system
- Touch panel key pad system including:
  - Hardwire touch panel
  - Wireless touch panel

## **2.5 Workstations**

The Design-Build Firm shall provide 11 new SunGuide<sup>®</sup> FMS workstations dedicated to I-75 FMS usage at the Sarasota-Manatee STMC. The five workstations in the control room shall have four 22" LCD monitors and the six back office workstations shall have three 22" LCD monitors. The hardware of these

new workstations shall be configured as regular SunGuide® clients of the SWIFT Center, identical to the I-75 FMS client workstations located at the SWIFT Center. The Design-Build Firm is responsible for all necessary power and communications necessary to integrate these workstations into the I-75 FMS network.

These workstations shall meet or exceed the following minimum specifications:

- Intel Core 2 Quad Q9650 3.0 GHz or better CPU
- Video card(s) to handle 4 monitors
- At least 8 GB of RAM
- At least 150 GB hard drive
- DVD/CDROM drive
- 10/100/1000 Network Interface card
- Keyboard and mouse
- Speakers

These workstations shall have the following minimum software installed:

- Windows 7 Professional 64 bit Operating System
- All Windows 7 updates and security patches
- Microsoft Office Professional (Latest Version)
- Adobe Reader (Latest Version)
- The Design-Build Firm shall coordinate with the SWIFT Center Operations Manager and IT Manager to have Symantec Endpoint Protection installed and to ensure that the workstations provided are properly configured to accept the SunGuide® software.

The Design-Build Firm shall provide 24 wireless headsets, each with one earphone and a microphone. The microphones shall be configured into the network to permit each workstation operator to record HAR messages and 511 floodgate messages and listen to existing department emergency management scanners over the internet via software provided by the Department.

## **2.6 Printer, Copier, Scanner and Fax**

The Design-Build Firm shall provide two all-in-one (AIO) multifunction printer/copier/scanner/fax combinations connected to the network to provide centralized document management, distribution and production. One AIO shall be located in the back office area and one shall be located on the control room floor. The AIOs shall meet the following minimum requirements:

General Features:

- 30-sheet document feed;
- 150-sheet input capacity;
- 125-sheet output capacity;
- Media sizes: Envelope, ledger, letter, and legal; and
- Media type: Paper (standard, light, intermediate, heavy, glossy and high gloss), envelope, cardstock, transparent label.

Printer Features:

- Black and white; and
- Duplex printing from single side documents.

Copier Features:

- Black and white;
- Copy settings: contrast, resolution, reduction/enlargement, number of copies, paper size;
- Duplex copying from single side copies; and
- Reduction/enlargement: 25-400%.

**Scanner Features:**

- Color;
- Simplex and duplex; and
- Flatbed and sheet fed.

**Fax Features:**

- Auto redial;
- Fax forwarding;
- Fax auto reduction;
- Distinctive ring detection;
- 120 speed dials; and
- 120 broadcast/group dials.

**2.7 Electrical Equipment**

Preliminary provisions have been made to support the electrical requirements of the new video wall and its supporting equipment. The Department will make available the best information on the existing electrical installation, however the accuracy of the information made available is not guaranteed. The Design-Build Firm shall investigate and verify the existing electrical system conditions. The Design-Build Firm shall document the effect the proposed loads will have on the existing system as far uplink as the main building electrical disconnect switch. The Design-Build Firm shall be responsible for improvements to the existing electrical system necessary to support the equipment being installed so that the final building electrical system is fully compliant with the NEC.

**2.8 Furniture Requirements**

Per Section 946.515 (2), F.S., furniture purchases must be made from PRIDE unless a “reasonable determination” can be made that the product available from PRIDE does not meet the performance specifications, comparable price and quality requirements of the agency. The “reasonable determination” must state the specific deficiencies or shortcomings in quality and/or disparity in pricing of the PRIDE products. The Design-Build Firm shall use Form No. [375-040-66](#) to document the determination and include with the project documentation.

This is the website Uniform Resource Locator (URL) for the PRIDE furniture estore. Furniture selections are at the left of the page.

<http://www.prideestore.com/Pridestore/Products/Furniture/Default.aspx>

If the Design-Build Firm determines that furniture cannot be purchased from PRIDE, they shall use a state contract for the procurement. If the product needed is not available from either PRIDE or State Contract, the Design-Build Firm must document this by using Form No. [375-040-02](#).

State contracts available for the purchase of furniture:

[http://dms.myflorida.com/business\\_operations/state\\_purchasing/vendor\\_information/state\\_contracts\\_agreements\\_and\\_price\\_lists/state\\_term\\_contracts/furniture\\_office\\_and\\_files](http://dms.myflorida.com/business_operations/state_purchasing/vendor_information/state_contracts_agreements_and_price_lists/state_term_contracts/furniture_office_and_files)

[http://dms.myflorida.com/business\\_operations/state\\_purchasing/vendor\\_information/state\\_contracts\\_agreements\\_and\\_price\\_lists/state\\_term\\_contracts/furniture\\_educational\\_institutional](http://dms.myflorida.com/business_operations/state_purchasing/vendor_information/state_contracts_agreements_and_price_lists/state_term_contracts/furniture_educational_institutional)

[http://dms.myflorida.com/business\\_operations/state\\_purchasing/vendor\\_information/state\\_contracts\\_agreements\\_and\\_price\\_lists/state\\_term\\_contracts/furniture\\_library](http://dms.myflorida.com/business_operations/state_purchasing/vendor_information/state_contracts_agreements_and_price_lists/state_term_contracts/furniture_library)

The Design-Build Firm shall provide furniture for the five back offices and the administrative assistant area.

Each of the five offices shall contain:

- A six foot wide desk with a four foot return;
- A 5-way adjustable desk chair;
- A guest chair;
- A 4-drawer file cabinet that accepts legal size files; and
- A 4-shelf bookcase.

The TMC Manager's office shall have an additional guest chair. The administrative assistant area shall contain a counter with writing area that is installed to close off the area from the walkway. The furniture quality shall be equal to or better than that in use at the SWIFT Center.

## **2.9 Warranty**

The Design-Build Firm shall provide a manufacturer's warranty(s) for materials as described in this document. The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

System components shall be warranted against all defects and/or failure in design, materials, and workmanship for the minimum warranty duration specified for each item of equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786 or this MTR, whichever is greater.

If the manufacturer's warranties for the components are for a longer period, those warranties shall continue to apply.

All hardware requires a three-year service plan agreement for next business day parts and service from the date of Final Acceptance. All software, except the Oracle software, requires three years of licensing and telephone customer support from the date of Final Acceptance.

The Department reserves the sole right to determine defects in the materials and systems installed or modified by this project and the acceptability of the warranty repair and defect correction, including adjustment of equipment provided as a part of this project.

### **3.0 IMPROVEMENTS TO THE SWIFT CENTER**

The Design-Build Firm shall provide the following improvements to the SWIFT Center. These improvements shall be documented as part of an overall integration plan as detailed in section 1.4.1 of this MTR. The Design-Build Firm's activities in the SWIFT Center control room shall be limited to the time between 10:00 AM and 2:00 PM or between 7:00 PM and 5:00 AM the next day on week days. There are no prohibited hours on non-holiday weekends. The maximum time that the center can be "down" is 4 hours in any 24-hour period and only during the hours shown above.

#### **3.1 Video Wall Controller Upgrades**

There is an existing Barco Transform A-18 Video Wall Controller (VWC) at the SWIFT Center. The Design-Build Firm shall provide a new VWC compatible with the SunGuide<sup>®</sup> software and on the Approved Products List (APL) to integrate the new and existing CCTV camera images into the SWIFT Center video wall and to provide for the following:

- The 15 cubes in the video wall must display 4 images simultaneously and tour (or scroll) through a total of 200 CCTV images
- Switching capability must be installed and available for two existing large screen monitors – one in the lobby and one in the downstairs conference room
- Switching capability must be installed and available for 6 future large screen monitors
- Decoding of MPEG-2, MPEG-4, and H.264 video streams

A software-based controller installed on servers is acceptable as long as it meets the requirements herein and is included on the APL. All controllers must be capable of integration with SunGuide<sup>®</sup>.

The Design-Build Firm shall procure and install the additional equipment needed such that the new images are integrated seamlessly into the wall display and large screen monitors and that the previously available functionality is available to/for the new cameras installed as part of this construction contract.

There is an existing Crestron control system at the SWIFT Center that includes a hardwired touchpanel, a wireless touchpanel and a media controller. The Design/Build Firm shall reintegrate this system with the new video wall controller or provide an alternate solution for approval by the Department.

#### **3.2 Standby Switch**

The Design-Build Firm shall provide a new switch for the SWIFT Center with a minimum of 40 fiber ports (1 Gig each) and a minimum of 96 copper ports 10/100/1000 Layer-2. This switch shall mirror the current core switch that consists of a Layer-3 router and 2 Layer-2 switches with 48 copper ports each. This switch is intended as a backup to the core switch and will be installed by others.

#### **3.3 Warranty**

The Design-Build Firm shall provide a manufacturer's warranty(s) for materials as described in this document.

System components shall be warranted against all defects and/or failure in design, materials, and workmanship for the minimum warranty duration specified for each item of equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786 or this MTR, whichever is greater.

If the manufacturer's warranties for the components are for a longer period, those warranties shall continue apply.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

All hardware requires a three-year service plan agreement for next business day parts and service from the date of Final Acceptance. All software, except the Oracle software, requires three years of licensing and telephone customer support from the date of Final Acceptance.

The Department reserves the sole right to determine defects in the materials and systems installed or modified by this project and the acceptability of the warranty repair and defect correction, including adjustment of equipment provided as a part of this project.

## **4.0 CAMERA SURVEILLANCE SYSTEM**

### **4.1 Description**

There is a camera surveillance system monitoring I-75 in Collier, Lee, and Charlotte Counties from the Collier/Broward County line to approximately one mile north of the Charlotte/Desoto/Sarasota County line. The SWIFT Center monitors the camera images on this section of I-75.

In this Sarasota and Manatee County FMS, the SWIFT Center will monitor the additional CCTV cameras required. As part of this project, all new and existing camera images shall be integrated into the new video wall at the Sarasota-Manatee STMC that shall function as a redundant backup to the existing SWIFT Center camera surveillance system.

The CCTV camera system shall provide complete coverage for the project limits per the following minimum requirements:

- Space cameras at approximately one mile, or closer if required for complete coverage, between the existing CCTV one mile north of the Charlotte/Desoto/Sarasota County Line and the intersection of I-275 and I-75.
- Provide viewing coverage of both directions of cross roads and on- and off-ramps at all interchanges.
- Provide full video coverage of both directions of I-75 within the project limits without gaps per the video survey.
- Camera placement shall allow the RTMC/STMC operators to read all DMS messages for confirmation of message and confirm all HAR Beacons when lit.
- Provide full coverage in areas with trees in the median such that trimming of the trees will not be required to maintain the specified coverage.

#### **4.1.1 Camera Assembly**

A camera assembly is defined as a CCTV color/monochrome camera enclosed in a domed environmental housing filled with dry nitrogen, an integral motorized lens, a camera positioner, an integral receiver/driver, and all mounting hardware and power supplies. The camera shall be capable of individual, or local, camera site control by way of a laptop computer.

- The camera assembly shall be compliant with FDOT Supplemental Specification 782-1.
- The camera shall have a minimum 35x motorized optical zoom lens with automatic iris.
- The camera assembly shall provide Image Stabilization capability to compensate for the blurring of the image when the camera experiences movement due to strong winds, especially when zoomed in.
- The dome enclosure of the CCTV camera shall be capable of maintaining at least 50 percent for a minimum of 18 months.

#### **4.1.2 Software**

The image from each camera site and the control data transmitted to the camera assembly from the SWIFT Center and/or STMC central computer shall be transmitted over the Ethernet network. The image shall be encoded in the MPEG-2 digital format at the camera site and decoded with the SWIFT Center and/or STMC head-end equipment.

The system operator shall have the ability to address each camera assembly at a camera site via the Ethernet communication network.

#### **4.1.3 Camera Lowering Device**

The camera lowering device (CLD) shall be compliant with the FDOT Supplemental Specification 785-3.2.2.

The CLD shall support the camera assembly while in the locked position at the top of the pole and while lowering the camera to the ground.

The CLD shall consist of a system to raise and lower the CCTV camera assembly and shall include the cables, mechanical connectors, pulleys, cable guides, electrical connectors, and all other supporting components.

The CLD shall include a suspension contact unit for electrically connecting the power, data, and video cables of the CCTV camera assembly.

The connector pins for power, video, and control signals shall be made of material for maximum conductivity and corrosion resistance.

#### **4.1.4 Camera Site**

A camera site is defined as a single roadway location, containing a centrifugally cast, pre-stressed concrete pole with grounding and lightning protection, a CLD, a camera assembly, a grounded CCTV camera cabinet, a Video Encoder, a field Ethernet switch, power supplies including an UPS, all mounting hardware, and any and all other equipment required for a fully functional CCTV camera site.

#### **4.1.5 Video Encoder**

The Video Encoder shall be compliant with the FDOT Supplemental Specification 784-3.

The Video Encoder shall convert the CCTV camera's analog image into an encoded video stream. This encoded video stream shall support the MPEG-2 compression standard. The encoder shall support the transport mode and configured to use this mode by default.

In addition to the serial login, telnet login, and Simple Network Management Protocol (SNMP), the Video Encoder shall support a web browser interface for configuration and management.

The Design-Build Firm shall furnish all materials with the most recently developed and approved product versions that meet or exceed all FDOT standards, specifications, and requirements before the system is considered for acceptance. It is the Design-Build Firm's responsibility to ensure that all features, functions, and performance measures are met.

## **4.2 Design Requirements**

The Design-Build Firm shall select all camera sites for optimum viewing of I-75, the on-ramp and off-ramp conditions and the arterial cross streets for both day and night operations. In order to prevent light saturation of the CCTV camera image, the CCTV camera site shall be located more than 50 feet away from any high mast lighting pole.

The location of the network of cameras shall provide:

- Full viewing coverage of both directions of I-75 within the project limits.
- Viewing of both directions of cross roads at interchanges.
- Viewing of all ramps at interchanges.
- Verification of SunGuide messages on DMS assemblies.
- Verification of HAR sign beacon activation.

All camera poles shall be located outside the clear zone as applicable to ramps and mainline travel lanes or behind existing guardrail in accordance with the FDOT *Roadway Design Standards*. If placed behind existing guardrail, there shall be enough room for a vehicle, including high lift trucks, to access the site for maintenance of the camera. Camera poles shall not be placed in the median or on the top or side of overpass slopes.

The selection of pole height and location shall be the responsibility of the Design-Build Firm, but shall be approved by the Department prior to final design.

Pole positioning for each camera site prior to placement of the pole shall be the responsibility of the Design-Build Firm, but shall be approved by the Department prior to final design. This positioning is required so that the occlusion created by the camera pole can be limited to the restricted field of view.

The Design-Build Firm shall perform a 360 degree field of view video survey at the proposed camera height for each CCTV camera site utilizing a bucket truck and the Design-Build Firm's proposed camera. The video survey shall provide a full coverage view of the I-75 corridor. The Design-Build Firm shall record these surveys for the Engineer's review and acceptance. The Design-Build Firm shall submit the video survey with the 60% plan submittal.

The minimum mounting height of the CCTV camera is 40 feet above the highest point of the roadway at the selected location. The camera height at interchanges shall be such that traffic stopped on overpasses does not obstruct the view. The camera view shall be free of obstructions. The maximum CCTV camera mounting height shall be 65 feet above ground level.

### **4.3 Functional Requirements**

Each camera site shall be provided with the appropriate communication equipment, including image encoding devices, a terminal server (if required) for the packaging of low-speed control data, and one Ethernet switch that takes the encoded images and duplex data stream and transmits this digital data to the SWIFT Center and/or STMC head-end equipment.

All network communication interconnection devices shall be specified in design documents submitted by the Design-Build Firm. When a fiber trunk cable is used for the interconnection process, the drop cable mid-span splicing process shall be utilized. The drop cable shall be terminated and placed within a fiber optic cable patch panel in an approved camera assembly control cabinet. From there, fiber optic patch cords shall be used to connect communication devices, unless otherwise specified.

Maintenance and construction of an installed assembly shall not require lane closures.

### **4.4 Applicable Standards**

The image from each camera site and the control data being transmitted to the camera assembly from the SWIFT Center and/or STMC central computer shall be transmitted over the Ethernet network. The image shall be encoded in the MPEG-2 digital format at the camera site and decoded with the SWIFT Center and/or STMC head-end equipment.

The system operators shall have the ability to address each camera assembly contained within a camera site by way of the Ethernet communications network. All communications between the SWIFT Center and/or STMC central computer and the camera site shall comply with the National Transportation Communications for ITS Protocol (NTCIP) requirements defined in the NTCIP 1205 standard.

The most recent versions of the NTCIP 1201, 1205 v01.08 Amendment 1 (August 2004), 1208, 2104, 2202, and 2301 standards shall apply to CCTVs for NTCIP compliance.

## 4.5 Material Requirements

The Design-Build Firm shall furnish all materials with the most recently developed and approved product versions that meet or exceed all applicable standards, specifications, and requirements before the system is considered for acceptance. It is the Design-Build Firm's responsibility to ensure that all camera system and subsystem features, functions, and performance measures specified are met.

All materials furnished, assembled, fabricated, or installed shall be new products obtained from the manufacturer or reseller. The materials, equipment, and components shall be Commercial Off The Shelf (COTS) products.

The supplied CCTV camera assembly shall be compatible with the SunGuide® Software System and shall be listed on the Approved Products List (APL) prior to installation.

### 4.5.1 Pole

All CCTV camera poles shall be compliant with the FDOT Supplemental Specification 785-3.

All camera poles shall be concrete poles. Suppliers must be on the FDOT State Materials Office listing of approved Materials/Producers Listings for Concrete-Drainage, Incidental and Pipe Sources.

The design criteria for the structural design of support structures and foundations shall be based on the Department's Design Standards, Department's Structures Manual Volume 9, and on the *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (LTS-4)* with current Interims. Poles shall be designed for a 3-second gust of 130 mph with a design life of 50 years.

The following requirements apply to the manufacture of centrifugally cast, pre-stressed concrete poles. All poles measuring up to and equal to 75 feet in height shall be designed to have a maximum deflection not greater than 1 inch in a 130-mile per hour wind speed. All poles measuring more than 75 feet in height shall be designed to have a maximum deflection not greater than 1.5 inches in a 130-mph wind speed. This deflection shall be measured at the top of the support structure where the base of the pan-tilt device is attached. Minimum pole height shall be 40 feet above the roadway edge of travel.

Material requirements for pre-stressed spun concrete camera poles shall include:

- Concrete – Section 346 Class VI
- Provide written certification from the manufacturer of the pole(s) that it meets the requirements of this section, Standard Index 18113, and are the same pole(s) as shown on the approved shop drawings. This includes the shop drawings and calculations for poles in accordance with note 5 of Standard Index 18113.
- Construct concrete poles in accordance with Section 450. Assume responsibility for performance of all quality control testing and inspections required by Sections 346 and 450, however; the PCI personnel and plant certifications are not required
- Ensure that each pole is permanently and legibly marked as to pole manufacturer, pole type, length and the date cast at the same position as shown on the shop drawings.
- Hardware – All structural steel hardware shall conform to the *ASTM A36* standard and zinc alloy AC41A shall conform to the *ASTM B240* standard. The finish shall be hot-dipped and galvanized as required by the *ASTM A153* standard.
- Electrical ground – All poles shall be supplied with an electrical ground consisting of a #4 braided copper ground wire cast into the pole's wall at the hand hole box location.

The pole shall be designed and constructed so that all wiring and grounding facilities are concealed within the pole. All hand holes, couplings, through-bolt holes, and ground wires shall be cast into the pole

during the manufacturing process. The pole shall provide a continuous taper of 0.18 inch for every 1 foot of length.

All cable entry holes shall be installed according to the location selected by the Design-Build Firm based on the requirements. The cable entry holes shall be sized as required and shall be free from sharp edges for the passage of electrical wiring. Entry holes shall be compliant with the FDOT Design Standards Index No. 18113.

The CLD shall be mounted to a specially designed tenon bolted to the top of the pole as required. All poles shall have a minimum inside raceway dimension of 4 inches at the tip of the pole. All poles shall be provided with a fish wire to facilitate cable installation.

#### **4.6 Construction Requirements**

The Design-Build Firm shall furnish all tools, equipment, materials, supplies, and manufactured hardware, and shall perform all operations and equipment integration necessary to provide a complete, fully operational surveillance system.

The Design-Build Firm shall install the cameras and CLDs level so that the horizon is level when viewing from the SWIFT SunGuide Center and/or STMC.

#### **4.7 Testing Requirements**

All CCTV tests shall comply with the test requirements of FDOT Supplemental Specifications 782-1.4.1 and 782-1.4.2.

The Design-Build Firm shall perform the following three separate tests:

- **Stand-alone Test:** This test shall be a local full functionality test ensuring the encoded MPEG-2 streams are decoded over the Ethernet Network by a software decoder running on a laptop computer and a local pan-tilt-zoom (PTZ) test over the Ethernet Network utilizing an NTCIP PTZ control program running on the same laptop computer and ensuring at least three presets are working correctly utilizing the same NTCIP control program on the same laptop computer. These tests shall be exercised over the Ethernet Network by connecting the laptop computer to an Ethernet port of the closest Ethernet Switch. The Design-Build Firm shall provide the laptop computer, software decoder, and the NTCIP PTZ control program.
- **Subsystem Test:** This test shall be performed at the SWIFT Center and the STMC. All of the steps of the Stand-alone Test shall be exercised in an identical manner with the exception of connecting to an Ethernet Switch port that is located at the SWIFT Center and the STMC.
- **Operational Test of the Complete System:** This test shall be performed at the SWIFT Center and the STMC utilizing the SunGuide<sup>®</sup> System Software over the Ethernet Network running on a SunGuide<sup>®</sup> client machine to ensure the encoded MPEG-2 streams are decoded, a remote test of the PTZ functions and at least three presets are working correctly. The Department shall provide the SunGuide<sup>®</sup> client machine to the Design-Build Firm for testing from the SWIFT Center. The Design-Build Firm is responsible for providing the SunGuide<sup>®</sup> client machine at the Sarasota-Manatee STMC.

The Design-Build Firm shall notify the Engineer at least 14 calendar days prior to installation of the camera assembly so that the Engineer, or the designated representative(s), can be present at installation to establish the appropriate settings for the pan and tilt stops.

The Engineer shall be notified at least 14 calendar days in advance of the proposed date for all testing as defined above. The Engineer has the right to witness such tests or to designate a representative or entity to witness such tests on the Department's behalf.

If during the witnessing of any one of the above tests it is determined that a camera view is not as approved or per the above requirements, the camera site shall be adjusted to provide the appropriate view.

#### **4.8 Training and Manual Requirements**

The Design-Build Firm shall provide a maintenance manual for each assembly, including detailed specifications and information regarding the inventory of installed assemblies by location and corresponding serial numbers. The manual shall include weight and dimension information, the operating temperature and relative humidity requirements, and the system's general maintenance procedures. The manual shall also include:

- Resolution
- Sensitivity
- Optical zoom range
- Digital zoom range
- Zoom and focus presets
- Pan and tilt presets
- Ethernet connection specifications
- Power consumption
- An EIA 232/422/485 camera control interface

The Design-Build Firm shall also provide documentation, one set per camera site, detailing the technical and operational aspects of the completed installation. This documentation shall include device manuals, system diagrams, cabling diagrams, all field Engineering notes specific to each installation, full warranty information, and any other documentation required by the Engineer.

The Design-Build Firm shall also supply a minimum of two days of on-site training for operations and maintenance personnel regarding all functional, operational, and mechanical aspects of the camera assembly and the supporting network communication devices.

#### **4.9 Warranty**

The Design-Build Firm shall provide a manufacturer warranty against all defects and/or failure in design, assembly, fabrication, materials and workmanship for the minimum warranty duration specified for each type of equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786 as applicable.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

## 5.0 COMMUNICATIONS HARDWARE

### 5.1 Description

The existing I-75 FMS field communications backbone consists of a gigabit Ethernet network connecting the SWIFT Center to localized hub sites. These hub sites act as aggregation points for edge switches located at CCTV cameras, DMSs, and other remote sites. All hub switches shall be gigabit Ethernet (1000Mbps) compatible.

An Ethernet edge switch with a minimum of two single mode fiber optic ports shall be used at all fiber drop locations where an optical signal needs to be converted into an electrical (Ethernet) signal. All edge switches shall be fast Ethernet compatible.

**A subset of an Ethernet edge switch is the media converter. The Design-Build Firm shall determine the required number of single mode fiber ports and 10/100 BaseT (copper) ports needed at locations which require a media converter. Design Requirements**

### 5.2 Design Requirements

#### 5.2.1 General

The Design-Build Firm shall determine the minimum required number of ports in all Ethernet switches.

The Design-Build Firm shall design the overall network communications, including locating hubs in conjunction with the SWIFT Center IT Manager.

The Design-Build Firm shall document that ITS equipment and Ethernet devices that are compliant with these MTRs and are compatible with the ones used for the Collier, Lee and Charlotte County FMS.

The Design-Build Firm's design shall assume the CCTV cameras will use six Mbps of bandwidth per camera.

The design shall account for the optical loss in the fiber optic cable, connectors, and communications hardware.

#### 5.2.2 Ethernet Core Switch

The existing Net Iron MLX core switch from Foundry Networks is located in the SWIFT Center in the communications equipment room.

The Design-Build Firm shall determine the minimum required number of additional (GBIC) blades consisting of a minimum of twenty optical GBIC or SFP-based ports, each capable of transmitting data at 1000 Mbps for the existing Net Iron MLX core switch.

*Optical Ports:* The GBIC or SFP-based ports (exact minimum number of ports to be determined by the Design-Build Firm) shall be capable of transmitting data at 1000 Mbps and be user configurable with standard reach (LX) or long reach (ZX) optics able to transmit over 25 miles.

Each GBIC shall consist of a pair of fibers with SC connectors for standard GBICs and LC connectors for SFP GBICs; one fiber will transmit data and one fiber will receive data and shall meet the following minimum requirements:

For LX GBIC:

- Optical receiver sensitivity: -20 dBm

- Optical transmitter power: -9.5 to -3 dBm
- Transmission distance: 25 miles or more
- Operating wavelength: 1310 nm

For ZX GBIC:

- Optical receiver sensitivity: -23 dBm
- Optical transmitter power: 0 to 5 dBm
- Transmission distance: 45 miles or more
- Operating wavelength: 1550 nm

For locations where edge switches communicate directly with the core switch, the 100FX ports shall be used. Each optical port shall consist of fiber pairs; one fiber will transmit data and one fiber will receive data, and shall meet the following minimum requirements:

- Optical receiver sensitivity: -30 dBm
- Optical transmitter power: -19 to -14 dBm
- Maximum transmission distance: Medium haul, 25 miles
- Operating wavelength: 1300 nm

The Design-Build Firm shall furnish all materials with the most recently developed and approved product versions that meet or exceed all applicable standards, specifications, and requirements before the system is considered for acceptance. It is the Design-Build Firm's responsibility to ensure that all system and subsystem features, functions, and performance measures are met as specified in this MTR.

### 5.2.3 Ethernet Hub Switch

Hub switches shall be placed at locations identified by the Design-Build Firm. The hub switches shall act as aggregation points for the edge switches located at CCTV camera sites, DMS sites, MVDS sites, RWIS sites, HAR transmitter and beacon sites, and similar remote locations. Hub switches shall be field hardened or located in a climate controlled communications equipment room as determined by the Design-Build Firm. Each hub switch shall communicate with the core switch(es) via a Gigabit Ethernet fiber optic cable connection. Hub switches shall meet the MTRs and be capable of handling expansion within the District 1 ITS network.

Hub switches shall be compatible with the modified core switch, and compatible with the existing system and switches.

The Design-Build Firm shall determine the minimum required number of 1000LX single mode fiber Gigabit ports that are capable of transmitting data at 1000 Mbps. Also, the Design-Build Firm shall determine the minimum required number of optical 100FX ports (for communications with the edge switches) that are capable of transmitting data at 100 Mbps.

*Copper Ports:* The Gigabit Ethernet hub switch (10/100/1000 Mbps ports) shall be capable of supporting jumbo frames, advanced Layer 2 and base Layer 3 switching, and be software upgradeable to full enterprise Layer 3. The switch shall include support for IP routing protocols such as RIPv1/v2 and OSPF, and support for multicast routing, including PIM-SM, PIM-DM, and DVMRP.

The Design-Build Firm shall determine the minimum number of ports. The connectors shall be RJ45 for Category 5 Unshielded Twisted Pair (UTP).

*Optical Ports:* The GBIC or SFP-based ports (exact minimum number of ports to be determined by the Design-Build Firm) shall be capable of transmitting data at 1000 Mbps and user configurable with standard reach (LX) or long reach (ZX) optics able to transmit over 25 miles.

The Design-Build Firm shall determine the minimum number of ports. Each optical port shall consist of fiber pairs; one fiber will transmit data and one fiber will receive data.

Each GBIC shall consist of a pair of fibers with SC connectors for standard GBICs and LC connectors for SFP GBICs. Each GBIC shall consist of a pair of fibers; one fiber will transmit data and one fiber will receive data and shall meet the following minimum requirements:

For LX GBIC:

- Optical receiver sensitivity: -20 dBm
- Optical transmitter power: -9.5 to -3
- Transmission distance: 6 miles or
- Operating wavelength: 1310 nm

For ZX GBIC:

- Optical receiver sensitivity: -23 dBm
- Optical transmitter power: 0 to 5 dBm
- Transmission distance: 45 miles or
- Operating wavelength: 1550 nm

The 100BaseFX ports shall provide communications with field hardened Edge switches. Each optical port shall consist of fiber pairs; one fiber will transmit data and one fiber will receive data and shall meet the following minimum requirements:

- Optical receiver sensitivity: -30 dBm
- Optical transmitter power: -19 to -14 dBm
- Maximum transmission distance: Medium haul, 25 miles
- Operating wavelength: 1300 nm

The Design-Build Firm shall furnish all materials with the most recently developed and approved product versions that meet or exceed all applicable standards, specifications, and requirements before the system is considered for acceptance. It is the Design-Build Firm's responsibility to ensure that all system and subsystem features, functions, and performance measures are met as specified in this MTR.

#### **5.2.4 Ethernet Aggregation Switch**

In its network architecture, the Design-Build Firm may elect to use an Ethernet Aggregation Switch that the Ethernet Edge switches connect to over 100Mbps fiber optic links and the Ethernet Aggregation Switch may connect either to another Ethernet Aggregation Switch or to the Ethernet Hub Switch over 1Gbps fiber optic links.

The Design-Build Firm shall identify Ethernet Aggregation Switches that are compliant with these MTRs and are compatible with the ones used for the Collier, Lee and Charlotte County FMS.

#### **5.2.5 Ethernet Edge Switch**

Edge switches shall be placed at locations identified by the Design-Build Firm. At a minimum, these locations shall include CCTV camera sites, DMS sites, MVDS sites, HAR transmitter and beacon sites, RWIS sites, and similar remote locations. Edge switches shall be field hardened. Each edge switch shall communicate with a predetermined hub switch or aggregate switch via a fast Ethernet fiber optic cable connection. The edge switches shall meet the MTRs and be capable of handling expansion within the District 1 ITS network.

The Ethernet edge switch shall be compliant with the FDOT Supplemental Specification 784-1. All Ethernet edge switches shall be an AC power only version. AC to DC power adapters are not acceptable.

The Ethernet edge switch shall be DIN rail mountable.

#### 5.2.6 Media Converter

Media converters shall be placed at locations identified by the Design-Build Firm. At a minimum, these locations may include MVDS, DMS, RWIS, and hub sites. The media converters shall be field hardened.

The Design-Build Firm shall provide 10/100BaseTX to 100BaseFX media converters and all necessary connections, interfaces, jumper cabling, and fasteners for installing the devices in a 19-inch standard rack.

The media converter shall support conversion of 10/100BaseTX electrical interface to 100BaseFX optical interface and act as a Layer 2 bridge in forwarding all Ethernet packets received on both electrical and optical links. The media converter shall be interoperable with the edge switch, hub switch, and Gigabit Ethernet switch for optical networking.

The media converter shall include the following features:

- A manual switch for hard-setting the optical port to either the full-duplex or half-duplex mode
- Auto-negotiation for speed and auto-cross MDI/MDI-X on RJ45 ports
- Switch-enabled link fault signaling to forward lost link awareness to each connected host
- A full array of status/diagnostic LEDs (power, link, speed)

The media converter shall meet the following requirements:

- Number of Ports: Two RJ45 10/100 BaseTX ports and one or two fiber 100BaseFX ports
- Fiber Media Type: single mode fiber.
- Distance: Over 6000 feet

The media converter shall meet the following environmental requirements:

- Operating temperature: -30° F to 165° F (-34° C to 74° C)
- Storage temperature: -40° F to 165° F (-40° C to 74° C)
- Relative humidity: 5% to 95% non-condensing
- Cooling Method: Convection cooled, case is used as heat sink

The media converter shall be rack mountable (DIN rail or panel mount) into a standard 19-inch EIA rack. All mounting kits, brackets, and hardware for mounting into a standard 19-inch rack shall be provided.

The power supply of the media converter shall meet the following requirements:

- 120/240 VAC;
- Min input 85 VDC;
- Max input 264 VDC;
- Fuse rating 3.15 amps; and
- Max power 3 W.

*Copper Ports:* The Design-Build Firm shall determine the minimum number of ports. The connectors shall be RJ45 for Category 5 UTP.

*Optical Ports:* The Design-Build Firm shall determine the minimum number of ports. Each optical port shall consist of fiber pairs; one fiber will transmit data and one fiber will receive data. The Design-Build Firm shall determine the connector type (SC, ST or LC).

### 5.3 Construction Requirements

The Design-Build Firm shall furnish all tools, equipment, materials, supplies, and manufactured hardware, and shall perform all operations and equipment integration necessary to provide a complete, fully operational Gigabit Ethernet network. All equipment shall be mounted in 19-inch communications racks. All cabling shall be:

- Neatly tagged with permanent labels at both ends of every cable
- Secured with wire ties and cable management hardware in the communications racks
- Grounded to rack grounding hardware

### 5.4 Training and Manual Requirements

#### 5.4.1 Submittals

The Design-Build Firm shall provide the following documentation for equipment and components for each applicable device. The outline, provided below, shall be used as a guide for assembling a documentation package for submission to the Engineer. This guide does not relieve the Design-Build Firm from submitting additional information to form a complete submittal package.

- Catalog cut-sheets: Information provided by the manufacturer or vendor that pictorially describes the item or component
- Manufacturer specifications: A detailed specification prepared by the item or component manufacturer
- Installation procedures: A manual prepared by the manufacturer that indicates the installation procedures for components, subassemblies, or assemblies
- Operation Procedures: A manual prepared by the manufacturer that indicates the proper operations and detailed troubleshooting procedures for all components, subassemblies, and assemblies
- Maintenance procedures: A manual prepared by the manufacturer that indicates the maintenance of all components, subassemblies, and assemblies
- Training schedule: A schedule prepared by the Design-Build Firm that outlines the time for the required training sessions
- Training material: Course material for each of the training sessions required

The Design-Build Firm shall submit the submittal data and shop drawings for all equipment, materials, test procedures, and routine maintenance procedures required 30 calendar days before installation. The submittal data shall be provided to the Engineer for approval and shall include six copies of the manufacturer's descriptive literature, technical data, operational documentation, service documentation, and other pertinent materials that fully describe applicable equipment, hardware, software, interfaces, and peripheral cabling required for a fully operational system.

#### 5.4.2 Documentation

The Design-Build Firm shall provide three sets of documentation for all components in accordance with these MTRs. The documentation shall be assembled in volumes of three-ring binders that include title pages, indices, page numbering, and section dividers. The documentation shall consist of the following types of manuals:

*User's Manuals:* The user's manual shall describe, in sufficient level of detail, how the equipment must be operated. The user's manual shall include pertinent operational information such as control layout, displays, and procedures for properly operating a fully functional unit.

*Maintenance Manual:* The manufacturer/vendor-provided maintenance manual shall indicate clearly and pictorially the maintenance procedures for all components, subassemblies, and assemblies. The manual shall include pertinent information on maintaining and repairing the equipment, hardware, software, connections, interfaces, and peripheral cabling as applicable. The manual shall include sections that

completely describe the theory of operation using block diagrams and schematic drawings; diagnostic and repair procedures for corrective maintenance of the unit; assembly and disassembly instructions and drawings; layout drawings showing location of all components; and a complete components listing showing component type, ratings, and acceptable manufacturers.

*System Documentation Manual:* The system documentation manual shall describe the overall operation of the equipment with block level diagrams, identify all equipment in the system with module and option numbers, give a functional description for each system element, and explain how they function together in a complete operational system. The system documentation manual shall document operating procedures describing the initial turn-on and adjustments to ensure an operational system within the performance requirements as well as system-level corrective maintenance procedures.

*Software Manual:* The software manual shall fully document the device management software including full descriptions of functions, flowcharts, and utilities required to support, configure, monitor, and manage each type of device, as well as listings and associated descriptions for complete operation of software programs.

### 5.4.3 Training

The Design-Build Firm shall prepare and deliver training courses on the communications devices and applicable components for individuals designated by the Department, to include up to 10 personnel. Two types of training courses shall be provided involving engineering/operation personnel and maintenance personnel (two-day course for engineering/operations personnel and one-day course for maintenance personnel). The training shall be delivered on dates mutually agreeable to the Design-Build Firm and to the Department. The Design-Build Firm shall provide the Department with a 30-day Notice of Intent to carry out the training so that arrangements can be made for attendance.

The training courses shall be developed to pertain specifically to the system, presuming that the course participants have no prior knowledge of the system and associated technology. The Design-Build Firm shall be responsible for providing an indoor classroom for training, which shall be comfortable and within close proximity of the SWIFT Center. The Design-Build Firm shall provide a draft of the training material to the Engineer for review and approval at least 60 days prior to the scheduled training. Adequate time shall be afforded for review and revision of the draft training materials. The Design-Build Firm shall furnish the classroom, audio-visual equipment, demonstration equipment, and "hands-on" equipment in support of the envisioned training. Each training participant shall receive a copy of course materials, including both comprehensive and presentation manuals. The Design-Build Firm shall provide two additional copies of these documents to the Engineer. The Design-Build Firm shall include all training-related costs in the unit price bid for each device. There will be no separate payment for training.

The training materials shall include an introductory-level briefing to familiarize attendees with each device. The engineering/operations course shall include an overview of the basic understanding of IP and Ethernet, subsystem elements, theory of operation of components, operating procedures and capabilities, hardware and software configuration, and software applications. The Design-Build Firm shall provide training that includes "hands-on" use of all communications devices installed. The maintenance course shall include relevant topics in electronics, communications, and cabling, and provide a detailed description and explanation of theory of operation of major device components; operation, test, and installation procedures; plus troubleshooting, diagnostics, and maintenance to the replaceable module level. The maintenance course shall also show how the system documentation should be used to operate, diagnose, maintain, and expand the system. The maintenance course shall also provide "hands-on" use of the system, laptop computer and software (to be provided by the Design-Build Firm during the course), system test equipment, and any other system equipment supplied.

## **5.5 Warranty**

The Design-Build Firm shall provide a manufacturer warranty against all defects and/or failure in design, assembly, fabrication, materials and workmanship for all equipment, materials, and operating system software furnished for the minimum warranty duration specified for each type of equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786 as applicable.

The warranty for the Ethernet hub switch and media converter shall be five years.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

## 6.0 DYNAMIC MESSAGE SIGN

The Design-Build Firm shall install Dynamic Message Signs (DMS) as part of this project.

### 6.1 Design Requirements

The DMSs shall be compliant with the FDOT Supplemental Specification 781-3.

The DMSs shall be a walk-in type full-matrix display as described in FDOT Supplemental Specification 781-3.1.3.2.

The brightness and color of each pixel shall be uniform over the sign's entire face from 200 to 1,100 feet in all lighting conditions.

All DMS, except the northbound DMS prior to the I-275 interchange, shall be mounted on cantilever structures. The left edge of the DMS housing shall be placed over the left lane line of the right most through lane. The northbound DMS prior to the I-275 interchange shall be mounted on a half-span truss structure. This DMS shall be mounted so that it is centered over the through lanes.

*Cantilever Support Structure:* The sign support structure shall be furnished and installed as described in FDOT Standard Specification 700. The sign structure includes the furnishing and installation of all structures, foundation installations, and all ancillary items required to furnish and install an approved sign structure. The Design-Build Firm shall design the Cantilever Sign Structure according to the FDOT Structures Manual. The Cantilever Sign Structure shall comply with the FDOT Design Standards Index No. 11310, 18302 and 18303.

The locations of the DMSs in the Conceptual Device Layout are intended to provide sufficient advance notification for drivers to divert to other routes. The locations were selected to minimize impacts upon existing signage. Each DMS shall be located outside the clear recovery area without the installation of guardrail, as defined in the *Roadway and Traffic Design Standards*. Any request to vary the location of a DMS will include the location and message of all adjacent signs.

The height of the DMS and structure shall provide a minimum clearance of 19.5 feet from the highest portion of the roadway that the sign spans for the existing conditions and known proposed improvements.

The DMS structure shall include a catwalk for access to the inside of the sign from the edge of the roadway. The catwalk shall be designed as shown in FDOT Design Standards Index No. 18302.

The DMS sign and enclosure shall be designed in accordance with the FDOT *Plans Preparation Manual* (PPM), Volume I, and designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) *Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals* (current adopted edition) (25-year reoccurrence). Sign performance shall not be impaired due to continuous vibration caused by wind, traffic, or other factors. This includes the visibility and legibility of the display.

The DMS housing shall be designed and constructed to comply with the fatigue-resistance requirements of NCHRP Report 412, *Fatigue-Resistant Design of Cantilevered Signal, Sign, and Light Supports*. The Design-Build Firm shall construct the DMS structure foundation in accordance with the FDOT Standard Specification Section 455. The foundations shall be drilled shafts, except in unusual circumstances, and shall be designed according to the FDOT's *Structures Design Guidelines for Load and Resistance Factor Design* (current edition), or by using Brom's procedure and hand calculations. Both of these methods consider lateral loading of the shafts, which is a primary concern in foundation design.

The supplied DMS shall be compatible with the SunGuide® Software System and shall be listed on the APL prior to installation.

## **6.2 Functional Requirements**

All materials furnished, assembled, fabricated, and installed shall be new corrosion-resistant products obtained from the manufacturer or reseller, and approved by the Engineer. All details and device functions shall be thoroughly inspected and tested by the Engineer before system acceptance. Failure to meet all details and device functions and all applicable standards, MTRs, and requirements, shall be grounds for rejection of the equipment.

The equipment to be furnished at each DMS field site shall include, but not be limited to:

- LED DMS (i.e., the face within the housing)
- Sign controllers
- DMS support structures
- DMS mounting brackets and hardware
- DMS walkway platforms with permanent safety rails, and mounting brackets and hardware
- All necessary cabling
- Required network communication devices
- Required grounding and transient voltage protection devices
- Ground-mounted control boxes on concrete pads
- UPS
- All ancillary items required to furnish a fully operating DMS

The DMS shall be programmed to display 25 characters on each of the 3 lines of text.

The sign status request command shall provide a report that includes information on the message currently being displayed. The report shall include information on the number of pixels on, display parameters, remaining display time, fonts used, and character spacing, as well as the sign number, location, and identification information. The report shall also contain details regarding the sign's appearance (e.g., lit, blank, or neutral) and the status of the pixels, fans, internal temperature sensors, ambient temperature sensors, and power supplies.

### **6.2.1 Sign Controller Communication Interface**

The Sign Controller Communication Interface shall comply with the requirements of the FDOT Supplemental Specification 781-3.1.11.

### **6.2.2 Operational Safety**

The DMS equipment shall meet all of the requirements in Section 2.1.4 of the NEMA TS-1 standard regarding primary input power interruption.

The DMS equipment shall meet all of the requirements in Section 2.1.6 of the NEMA TS-1 standard regarding power service transients.

In the event of a communication link failure with the SWIFT Center and/or STMC central computer, the sign controller shall set the sign to neutral after a user-defined number of minutes unless communication has been restored within the defined period. This function shall apply only when the sign controller is in the master control mode.

### **6.3 Construction Requirements**

#### **6.3.1 General**

No DMS installation shall be allowed prior to the availability of power. Each DMS shall be fully functional under local control within 72 hours of sign mounting.

The equipment design and construction shall utilize the latest available techniques with a minimum number of different parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality. The equipment shall be designed for ease of maintenance. All component parts shall be readily accessible for inspection and maintenance. Test points shall be provided and labeled for checking essential voltages. All external connections shall be with connectors. The connectors shall be keyed to preclude improper hookups.

All markings and identifications shall be silk-screened and sealed or otherwise indelible using material and methods approved by the Engineer.

The DMS sign structure shall be constructed according to the FDOT's *Standard Specifications for Road and Bridge Construction, Supplemental Specifications, and/or Special Provisions and Structures Standard Drawings*.

#### **6.3.2 Deliverables**

The Design-Build Firm shall provide software and documentation for the SWIFT Center central computer software system and its components. These shall include, but are not limited to:

- All documentation concerning the sign controller communication protocol, including information needed to define the interface design, software codes, message definitions, and message sequences for DMS control and feedback
- Welding reports
- One complete copy of the manufacturer's documentation for plug-in circuit cards used in the microcomputer chassis
- DMS software for configuration management and diagnostic troubleshooting

### **6.4 Training and Manual Requirements**

Operational and maintenance training for the entire DMS system, including UPS, shall be provided to designated personnel during installation, testing, and debugging. This training shall be provided through practical demonstrations, seminars, and other related technical procedures. Training shall be limited to include up to 10 personnel, and shall be provided at a time and location approved by the Engineer. The training shall include, but not be limited to:

- Hands-on operation of all sign control hardware in the classroom and field
- Explanation of all system commands, their functions, and usages
- Insertion of data
- Required preventative maintenance procedures
- Servicing procedures
- System troubleshooting or problem identification procedures
- A minimum of 40 hours of instruction for the system's operational and maintenance procedures. The Design-Build Firm shall submit a training agenda and one complete set of training materials (i.e., the manual and accompanying schematics), along with the proposed instructor's qualifications, to the Engineer for approval at least 60 calendar days before the training is scheduled to begin. The Engineer shall review and approve the training material, or request changes

- The training shall be conducted after the completion of all system integration tests. The Engineer shall approve the training schedule time and location. All training will be video recorded by the Design-Build Firm and the discs provided to the FDOT for later use.

#### **6.4.1 Final DMS System Acceptance**

The Final DMS System Acceptance procedure shall start after all the tests defined in FDOT Supplemental Specification 781-3.8 have been successfully performed. Final system acceptance shall be defined as the time when all work and materials described in the plans have been furnished and completely installed by the Design-Build Firm; all parts of the work have been approved and accepted by the Engineer.

#### **6.4.2 Shop Drawings**

The DMS system supplier shall submit shop drawings, as required by Section 5-1.4 of the Standard Specifications for Road and Bridge Construction for approval by the Engineer before fabrication. Each individual DMS shall be delivered to the site with two sets of as-built drawings. The Engineer shall verify that the drawings correspond with the preconstruction shop drawings. Both types of drawings shall include, but not be limited to, the sign structural members and attachment support details.

#### **6.4.3 Manufacturer Qualification**

The Traffic Engineering Research Laboratory (TERL) shall certify the DMSs before submission for approval. In addition, the DMS manufacturer shall meet the following requirements:

*Manufacturer Reference:* The DMS system manufacturer shall submit three state department of transportation (DOT) references in which the manufacturer has furnished and is successfully operating multiple walk-in type enclosure LED sign systems of three lines of 18-inch high characters, 25 characters per line full matrix signs on state or interstate highways.

These DMS systems shall be permanently mounted on overhead sign structures and shall be supplied by the manufacturer under the current corporate name for a period of no less than five years. Reference data shall include the manufacturer's corporate name and address, and the current contact's name and telephone number. This information shall be provided prior to project submittal. Failure to furnish the above references shall be sufficient reason for rejection of the manufacturer's equipment. The Department reserves the right to contact additional references. Any poor or unsatisfactory reference, as determined by the Department in its sole and absolute discretion, may cause the manufacturer to be rejected.

The manufacturer shall have been engaged in the design and manufacture of DMS systems, DMS electronics, and control systems for a minimum of 10 years, and shall demonstrate to the Department a minimum of 100 LED DMSs that are contained in walk-in housings and that are currently in operation.

### **6.5 Warranty**

Equipment, structures and parts furnished under these MTRs shall be guaranteed to perform according to the manufacturer's published requirements. The equipment and parts furnished for the DMS system shall be new, of the latest model, and fabricated under high quality standards.

The Design-Build Firm shall provide a manufacturer warranty against all defects and/or failure in design, materials, assembly, fabrication and workmanship for the minimum warranty duration specified for each equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786, as applicable.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

## 7.0 FIBER OPTIC COMMUNICATIONS INFRASTRUCTURE

### 7.1 Description

The fiber optic infrastructure shall include the items listed below to provide an Ethernet network infrastructure over single mode fiber optic transmission media between the field devices, the SWIFT Center and the Sarasota-Manatee STMC.

These fiber optic items include, but are not limited to:

- Conduit and locate system
- Fiber optic cable plant
- Pull boxes
- Splice boxes
- Splice enclosures
- Splice trays

#### 7.1.1 Conduit

The Design-Build Firm shall install two 1.25-inch SDR 11 HDPE conduits for underground locations. The fiber optic cable shall be housed in one of these 1.25-inch conduits. The other 1.25-inch conduit shall be left empty as a spare for use in the future. No other cable shall occupy the same conduit as the fiber optic cable and the Design-Build Firm shall provide additional conduits for these other cables as necessary. The conduit shall comply with the FDOT Supplemental Specification Section 783-2. The Design-Build Firm shall install a minimum 2-inch conduit(s) for electrical power. These conduits shall be installed eight feet inside the right-of-way fence and shall follow the fence line. Fiber optic cable markers shall be placed ten feet inside the right-of-way fence line and adjacent to each pull box and splice box.

When installation of a conduit requires directional boring, the same HDPE conduit shall be used without any sleeve. The directional bore should also include provisions of the locate wire.

When installation of a conduit requires jacking under paved surfaces, an intermediate metal conduit shall be used as sleeve for the underground HDPE conduit.

When installation of conduit requires bridge mounting, conduit shall be 4" diameter bullet resistant fiberglass (BRFG) outerduct conduit with two 1.25-inch SDR 11 inner ducts. A separate 2" rigid steel conduit shall be used for electrical cable where necessary. Both the 4" and 2" conduits shall be attached to the outside wall of the bridge. A licensed structural engineer shall design the attachment to existing bridges. There shall be no overstress to any structural element of the bridge as a result of any new attachment. Approval of the District Bridge Maintenance Engineer is required for any new bridge attachment. Below is a list of bridges and canals with potential for bridge-mounted conduits.

<b>Bridge No.</b>	<b>Bridge Name</b>
130066	Braden River
130102	Salt Marsh
130104	Jeffrey Dale Young Bridge (Manatee River)
130076	CSX Railroad
170132	Big Slough Canal
170128	Myakka River
170108	Salt Creek

For under water installations, the HDPE inner duct shall be placed inside HDPE outer duct. All other waterway crossings within the limits of this project shall be by directional bore and not bridge attachment.

### 7.1.2 Fiber Optic Cable

The fiber optic cable system components shall be compliant with the FDOT Standard Specification 783-1.

Fiber optic cable shall be used in the I-75 FMS network infrastructure to provide data and device control and communications between the SWIFT Center, the Sarasota-Manatee STMC, other transportation management centers (TMCs), ITS devices, and other identified stakeholder facilities.

Fiber optic cable sizes shall be:

- *Main Route Cable:*  
The Design-Build Firm shall provide 96-strand single mode fiber optic cable along the northbound side of I-75 starting at the existing splice box approximately one mile north of the Charlotte/Desoto/Sarasota County line to a planned splice box at the northbound off ramp for the intersection of I-275 and I-75.
- *STMC Interconnect Cable:*  
There is an existing 48-strand single mode fiber optic cable installed by others from a pull box at the intersection of SR-70 and I-75 to the equipment room adjacent to the control room at the Sarasota-Manatee STMC. The Design-Build Firm shall use this cable to connect the devices installed on I-75 and the STMC. The Engineer will provide the final (as installed) Optical Time-Domain Reflectometer (OTDR) test results to the Design-Build Firm. The Design-Build Firm shall test this cable and compare the new results to the test data provided by the Engineer. Repairs to this cable if necessary will be accomplished by FDOT. The Design-Build Firm shall allow 90 days in its construction schedule for any required repairs by the FDOT before termination of this cable begins.
- *Drop Cables:*  
The Design-Build Firm shall provide 12-strand single mode pre-terminated cable into cabinets and devices located on either the northbound or the southbound side of I-75.

The splicing of the fiber optic cable plant shall include the assignment of:

- One buffer tube for core switch to hub switch communications
- Two buffer tubes for hub switch to local switch communications
- One buffer tube for the Statewide WAN project

The remaining four buffer tubes are reserved as spare for future use. Fiber optic splices shall provide a continuous optical path for the transmission of optical pulses from one optical fiber length to another. All fiber optic splices shall consist of fusion-spliced optical fiber and the installation of a splice enclosure around the cable.

The Design-Build Firm shall furnish and install a locate system compliant with the FDOT Supplemental Specification 783-2. Locate wire shall not be installed in the same conduit as fiber optic cable. The Design-Build Firm shall furnish electronic box markers for all splice vaults and pull boxes. The Design-Build Firm shall provide three (3) electronic box marker locators as part of this project.

The Design-Build Firm shall furnish and install fiber optic pull boxes. Pull boxes shall be compliant with the FDOT Supplemental Specification 783-3. Fiber optic pull boxes shall not house any other cable other than fiber optic cable.

The Design-Build Firm shall furnish and install splice vaults. Splice vaults shall be compliant with the FDOT Supplemental Specification 783-3. Fiber optic splice vaults shall not house any other cable other than fiber optic cable.

All pull box and splice box covers shall be stamped with "FDOT FIBER OPTIC CABLE". All pull boxes shall be stackable and all splice vaults shall have manholes that are extendable.

The Design-Build Firm shall furnish and install splice enclosures. Splice enclosures shall be compliant with the FDOT Supplemental Specification 783-3 and 783-1.2.2.1.

## **7.2 Design Requirements**

The installation of the fiber optic communications network shall meet the minimum required depth of the conduit system as outlined in the Specifications and Standard Indexes. Additionally, it shall have a minimum of 10 feet of cover when installed in the median of the highway. The fiber optic trunk cable shall be placed at 8 feet from the existing limited access right of way fence. It shall be directional bored under wetlands and drainage canals and may be attached to bridges as previously stated. The Design-Build Firm shall use the orange buffer for all device drops and shall coordinate with FDOT for all other fiber allocations.

### **7.2.1 Fiber Optic Pull Boxes**

The fiber optic pull boxes shall comply with the FDOT Supplemental Specification 783-3.2.2. The Design-Build firm shall avoid placement of fiber optic pull boxes in wetland areas.

### **7.2.2 Fiber Optic Splice Boxes**

The fiber optic splice boxes shall comply with the FDOT Supplemental Specification 783-3.2.3. The Design-Build firm shall avoid placement of fiber optic splice boxes in wetland areas.

### **7.2.3 Fiber Optic Splice Enclosures**

The splice enclosures shall comply with FDOT Supplemental Specification 783-1.2.2.1.

### **7.2.4 Fiber Optic Splice Trays**

The splice trays shall comply with FDOT Supplemental Specification 783-1.2.2.2.

### **7.2.5 Fiber Optic Splices**

It is the Design-Build Firm's responsibility to ensure that all splicing equipment and material, along with the terminating connectors and their associated hardware, comply with FDOT Supplemental Specification 783-1.3.2. The Design-Build Firm shall provide all splice loss measurement information as part of their as-built documentation for review at the start of the Operational Test.

All splice enclosures, organizers, cable end preparation tools, and procedures shall be compatible with the fiber optic cable and approved by the Engineer.

All optical fiber splices shall be contained within a splice enclosure.

### **7.2.6 Fiber Optic Patch Panels**

All patch panels, including pre-terminated and field assembled and terminated, shall comply with FDOT Supplemental Specification 783-1.2.4.

### **7.2.7 Route Markers**

Where the conduit and fiber are placed at 8 feet from the limited access right of way, route markers shall be placed 10 feet from the right of way line at fiber pull box and splice box locations.

### **7.2.8 Electronic Box Markers**

Provide an electronic box marker that is compliant with Supplemental Specification 783-2.2.4.3 in all splice vaults and pull boxes, including fiber optic, electric and multi-conductor boxes.

### **7.3 Performance Requirements**

The Design-Build Firm shall furnish all materials with the most recently developed and approved product versions that meet or exceed all applicable standards, specifications, and requirements before the system is considered for acceptance. It is the Design-Build Firm's responsibility to ensure that all fiber optic infrastructure features, functions, and performance measures are met.

All materials furnished, assembled, fabricated, or installed shall be new products obtained from the manufacturer or reseller. The materials, equipment, and components shall be COTS products.

#### **7.3.1 Fiber Optic Jumper Cables**

All fiber optic jumper cables shall comply with the FDOT Supplemental Specification 783-1.2.3.

### **7.4 Material Requirements**

#### **7.4.1 Trunk Cable**

The single mode fiber optic cable shall be compliant with the FDOT Supplemental Specification 783-1.

#### **7.4.2 Drop Cables**

*Optical Fiber:* The optical fiber used in the fiber optic drop cables shall comply with the requirements for the trunk cable except for the size.

*Cable Strength:* The cable strength for fiber optic drop cables shall comply with the requirements for the trunk cable, with the exception of the pulling tension requirement. The fiber optic drop cables shall withstand a pulling tension of 300 pounds.

*Configuration:* The fiber optic drop cable configuration shall comply with the requirements for the trunk cable.

*Ripcord:* The fiber optic drop cable shall contain ripcords as required for the trunk cable.

*Color Coding:* The fiber optic drop cable shall comply with the color coding required for the trunk cable.

*Bend Radius:* The fiber optic drop cable shall meet the minimum bend radius requirements for the trunk cable.

*Temperature:* The fiber optic drop cable shall comply with the shipping, storage, and operating requirements detailed for the trunk cable.

### **7.5 Construction Requirements**

#### **7.5.1 Fiber Optic Cable**

All fiber optic cable shall be installed in approved conduit by either the cable pulling or cable blowing (i.e., air assisted) method.

#### **7.5.2 Fiber Optic Cable Splicing**

The Design-Build Firm shall furnish all labor, tools, equipment, materials, and supplies necessary to splice and terminate fiber optic cable. The Design-Build Firm shall provide all labor and equipment necessary to move inventory out of the designated storage facility and to transport it to the installation location.

All incidental parts necessary to complete the installation, but not specified, shall be provided as necessary to produce a complete and properly operating system. The Design-Build Firm shall provide a splice plan showing the approximate location and configuration of any splices in the system for approval by the Engineer. The splicing diagram shall include all fibers from cabinet patch panel to the trunk line including all pull and splice vaults.

### **7.5.3 Route Marker**

The Design-Build Firm shall install Standard Route Markers (SRM) compliant with the FDOT Supplemental Specification 783-2.2.1.1.

The Design-Build Firm shall install Locate Wire and Locate Wire Surge Protection system compliant with the FDOT Supplemental Specification 783-2.2.3.

### **7.5.4 Fiber Optic Pull Boxes and Splice Boxes**

The Design-Build Firm shall furnish all labor, tools, equipment, materials, and supplies necessary to install pull boxes and splice boxes, the associated covers, racking, steps, and grouting, including dewatering, shoring, backfilling, compaction tamping, and restoration.

All pull boxes and splice boxes shall be installed according to the manufacturer's recommendations and shall comply with the FDOT Supplemental Specification section 783-3.3. Additionally, an electronic box marker to locate pull and splice boxes shall be provided. The Design-Build Firm shall not install any pull box or splice vault on a slope.

Installation of pull boxes and splice boxes, including the placement of hardware and the termination of fiber optic conduit, shall be completed before cable installation.

Before ordering the precast structures, the Design-Build Firm shall verify the required installation depth to ensure that any required extensions or adjustment collars will provide for the required construction tolerances. The Design-Build Firm shall be responsible for furnishing and constructing pull boxes and splice boxes with tops that are flush with the finished grade.

Pull boxes and splice boxes shall be assembled to provide a plumb structure with uniform bearing at all points. Where conduit enters, it shall be mechanically sealed with a neoprene molded duct organizer device. All joints between precast elements shall be sealed with a sealant material according to the manufacturer's recommendations and all penetrations shall be sealed with a no-shrink grout.

In areas where excavation reveals unstable material, such material shall be excavated to a depth of one foot below the structure's bottom and replaced with one foot of washed crushed 0.75-inch grade gravel stone at the excavation base before installing the pull box or the splice box.

All sheeting, bracing, and shoring required for safety shall be installed in compliance with applicable requirements and specifications. Backfill material shall be of suitable stability and shall be placed in one foot layers, each layer being compacted pneumatically. No backfill shall be placed against a structural wall until all connecting structural members are installed, and backfilling and compaction requirements have been met.

Any area where more than one box is installed, the boxes shall be grouped so that a concrete pad can be installed around all adjacent boxes to make a more stable box structure.

Fiber optic conduit shall be terminated and sealed with preinstalled conduit connectors. Conduit connectors shall be factory-installed to accept the type, size, and quantity of conduit or pipe being installed. The Design-Build Firm shall take precautions to ensure that the conduit at the pull box or splice box connections is not damaged during the installation of backfill material.

## **7.6 Testing Requirements**

### **7.6.1 Manufacturer Testing and Certification of Fiber Cable**

The Design-Build Firm shall perform tests complying with the FDOT Supplemental Specification Section 783-1.4.

The Design-Build Firm shall provide the manufacturer's on-reel test results for Engineer's approval before installing the fiber optic cable. These on-reel tests shall include, but not be limited to, end-to-end loss for every fiber strand of the 96 single mode fiber. The manufacturer's on-reel OTDR test results shall clearly show each one of the 12 single mode fiber strands is tested in each one of the 8 buffer tubes.

### **7.6.2 Post-Installation Testing of fiber cable**

The Design-Build Firm shall perform the following post-installation tests:

- All OTDR testing shall comply with the *EIA/TIA-455-61* standard.
- All fibers from both cable end points shall be tested with an OTDR. Fibers that are not terminated at installation shall be tested using a bare fiber adapter after the splice enclosures and access points are closed to check for macrobending problems. Tests shall be performed at both 1310 nm and 1550 nm.
- The loss value of the pigtail connector at each termination panel and its associated splice shall not exceed 0.5 dB. For values greater than 0.5 dB, the splice shall be broken and respliced until an acceptable loss value is achieved and/or the pigtail connector is repaired or replaced.
- Any rejected cable shall be removed and replaced at the Design-Build Firm's expense. The Design-Build Firm shall conduct the test again on any cable segment that is replaced at no additional cost to the Department. The cable shall be rejected if any fiber strand fails the bi-directional end-to-end attenuation test.
- No active devices shall be connected for this test and all fiber optic connectors shall be capped.

### **7.6.3 Route Marker System Testing and Certification**

The Design-Build Firm shall perform tests complying with FDOT Supplemental Specification Section 783-2.4.

### **7.6.4 Fiber Pull Box and Splice Box Testing and Certification**

The Design-Build Firm shall perform tests complying with FDOT Supplemental Specification Section 783-3.4.

### **7.6.5 Fiber Optic Pull Box and Splice Box Manufacturer Testing and Certification**

The Engineer reserves the right to require certifications from the manufacturer for materials and equipment that may not require formal testing to ensure compliance, and to require testing on questionable materials or equipment at no additional cost to the Department.

## **7.7 Training and Manual Requirements**

The Design-Build Firm shall conduct a minimum of 40 hours of training for up to 10 representatives designated by the Engineer on procedures of basic installation, splicing, terminating, testing of the fiber optic cable, maintenance and typical failures and failure resolution for the fiber. The training shall include the use of basic test instruments and a fusion splicing machine, splice closures, cleaning agents and other care products, connectors, fiber distribution panels, drop cables, and any other applicable element used in the project.

The goal of the training is to leave the attendee with a basic understanding of fiber optics, typical test instruments including an OTDR and power meter and source, an understanding of typical fixes and hazards associated with fiber optic transmissions, and basic theory of fiber optic transmission. The

Design-Build Firm shall submit to the Engineer for approval a draft training plan and course content. Once approved, the Design-Build Firm shall supply 15 copies of the training material for distribution to the attendees.

### **7.8 Warranty**

The Design-Build Firm shall provide a manufacturer's warranty against all defects and/or failure in design, materials and workmanship for the minimum warranty duration specified for each equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786, as applicable.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

## **8.0 FIELD CABINETS**

### **8.1 Description**

The Design-Build Firm shall design, furnish and install all field cabinets to house any combination of the following communications equipment or interface equipment to the following field devices:

- UPS
- Transient Voltage Surge Suppressors (TVSS), grounding and bonding
- CCTV camera assembly
- DMS assembly
- Ethernet edge switches
- Ethernet aggregate switches (dependent on design)
- Ethernet hub switches
- MPEG-2 encoders
- HAR assembly
- RWIS assembly
- Non-intrusive MVDS assembly

The Design-Build Firm shall install the above system equipment within pole- or base-mounted, lockable weatherproof cabinets. Cabinets shall protect those electrical and electronic devices from rain, dust, dirt, and other harmful elements of nature. The cabinets shall include:

- Lightning protection for all devices installed at the site
- Interior cabinet lighting
- #2A Corbin lock with 2 keys for each lock
- Re-usable metal air filters
- UPS
- Grounding and bonding
- Concrete service pad

All field cabinet devices shall have grounding and surge suppression compliant with the FDOT Supplemental Specification Section 785-2. The Design-Build Firm shall utilize full size field cabinets, type 336 or larger, at all device sites. The Department will not allow the use of equipment enclosures in lieu of a full size cabinet.

### **8.2 Requirements**

All field cabinets shall be compliant with the FDOT Supplemental Specification 785-4.

The Design-Build Firm shall specify the size of the cabinet for all the equipment installed within the cabinet at the particular location. The cabinets shall be sized to space the equipment appropriately to ensure easy access to the proposed equipment.

Each cabinet shall contain four duplex 120 volts alternating current (VAC) industrial-grade receptacles. Two of these receptacles shall be ground fault interrupter circuit (GFIC) compliant units used for field maintenance purposes only. The maintenance receptacles shall be orange in color and marked GFIC. Two standard duplex receptacles shall be used for auxiliary devices.

Each cabinet shall be provided with a one-unit rack-mount power distribution unit containing at least eight outlets, and at least one outlet shall be accessible on the front panel. The rack-mount power distribution unit shall be equipped with a master on/off switch and a resettable 15 amp circuit breaker.

Each cabinet shall be equipped with a contact closure feature that sends an alert via the network connections to the SWIFT Center and/or the Sarasota-Manatee STMC when the door is opened and closed.

Each cabinet shall be equipped with an aluminum pull-out drawer mounted in the rack assembly. The pull-out drawer shall have ball bearing telescoping guides to allow full extension from the rack assembly. When extended, the storage compartment shall open to provide storage space for cabinet documentation and other miscellaneous items. The pull-out drawer shall be provided with a recessed handle and be of adequate construction to support a weight of 20 pounds without sagging when extended. The top of the storage compartment shall be hinged aluminum. The height of the storage compartment shall not exceed 3.5 inches (two-units). The pull-out drawer shall be placed at a height within the cabinet to allow a person to use a laptop supported by the drawer.

Each cabinet shall be equipped with a metal, reusable filter per Supplemental Specification 785-4.2.8.

Each cabinet shall contain a rack-mountable UPS that meets the requirements specified in this MTR.

Each UPS unit shall include a minimum of six 120VAC outlets. The UPS shall meet the following material requirements:

- Rack mounted in 19-inch EIA rack in field cabinets
- Internal sealed Absorbent Glass Mat (AGM) type, maintenance free batteries
- 10/100 BaseT Ethernet interface port
- Status lights: power on, power source, and overload
- Alarms: audible and remote notification
- Manual power on/off switch

The UPS shall have a terminal for connecting the UPS to a TVSS surge protection device. Each UPS unit shall be configured for remote monitoring from the SWIFT Center and/or the Sarasota-Manatee STMC. The UPS remote monitoring software shall perform the following functions:

- Data logging
- Event logging
- Fault notification
- Unattended system shutdown
- Manage all network UPS units
- Operating system shutdown
- Power event summary
- Recommended actions
- Risk assessment summary
- Run command file
- System event log integration

The UPS shall meet the following performance requirements:

- Size each unit to operate all devices in the cabinet for a minimum duration specified in section 8.3 of this MTR.
- Output voltage distortion: Less than 5 percent
- Nominal input voltage:120VAC
- Nominal output voltage:120VAC
- Input frequency: 50/60 Hz  $\pm$ 3Hz, auto-sensing
- Output frequency (sync to mains): 57-63 Hz for 60 Hz nominal frequency
- Waveform type: Sine wave
- Operating temperature: -30°F -165°F

- Operating relative humidity: 95 percent
- Storage temperature: -40°F -168°F
- Storage relative humidity: 95 percent
- Noise filtering: Full time multi-pole noise filtering shall meet 0.3% IEEE surge let-through; zero clamping response time shall meet Underwriters Laboratory (UL) 1449
- Management: Via a Web graphical user interface (GUI), SNMP and VT100 compatible terminal software (Hyper-terminal)

The components such as surge suppressors and power distribution shall operate properly and meet the ambient temperature range, relative humidity, applied power, shock, and vibration range of NEMA TS-2.

Alternating current (AC) isolation shall be provided within the cabinet. All cabinets shall be configured to accept 120 VAC from the utility. Cabinets shall be configured with the following minimum number of breakers and outlets:

- Two 15 amp branch circuit breakers in cabinets that are provided with 120 or 120/240 VAC power. One breaker shall feed the GFIC duplex outlet. The second breaker shall feed the other devices in the cabinet.
- Outlets shall be provided for each piece of equipment plus 2 spare outlets.

The circuit breakers shall be UL listed and have an interrupt capacity of 5,000 amperes and insulation resistance of 100 Mega ohms at 500 volts direct current (VDC). The power distribution blocks shall be suitable for use as power feed and junction points for two- and three-wire circuits. The AC neutral and equipment ground wiring and terminal blocks shall be isolated from the line wiring by an insulation resistance of at least 10 Mega ohms when measured at the AC neutral.

The Design-Build Firm shall provide all patch cables for connecting equipment furnished and installed according to these MTRs. These patch cables shall include all necessary data (Category 6 and single mode fiber optic cables) and video (Composite, S-Video, Component Video, HDMI) cables. All cabinet wiring shall be tagged and identified by the use of insulated pre-printed sleeves. The wire markers shall identify the cable in plain words with sufficient details without abbreviations or codes.

The Design-Build Firm shall furnish all materials with the most recently developed and approved product versions that meet or exceed all applicable standards, specifications, and requirements before the system is considered for acceptance. All materials furnished, assembled, fabricated, or installed shall be new products obtained from the manufacturer or reseller. The materials, equipment, and components shall be COTS products.

In addition, all cabinets shall be equipped with:

- A 10-inch x 2-inch x ¼-inch copper grounding buss with mounting holes
- 120 VAC power supply
- Fiber optic termination panel
- TVSS units

The location of the cabinets shall be:

- Outside the clear zone or behind guardrail; guardrail shall not be installed solely to protect cabinets
- Convenient and accessible for maintenance personnel
- Not in conflict with known future widening projects
- Convenient to power sources and field devices
- Pole-mounted cabinet at each CCTV camera location, placed so the cabinet is not directly under the CCTV camera
- Pole-mounted cabinet at each MVDS location

- Ground-mounted at each DMS location, placed so a technician can view the sign message while working in the cabinet
- Not located in low lying/wet areas.
- Not on a slope or where there is a drop off.

### **8.3 Functional Requirements**

#### **8.3.1 CCTV Camera Cabinet**

Any cabinet serving a CCTV camera shall house, at a minimum, the following items:

- Video encoder
- Ethernet switch
- Fiber optic termination
- UPS with sufficient capacity to hold the site's electrical load (including the CCTV camera) for four hours

The CCTV camera cabinet shall be interconnected to the CCTV camera assembly using a composite cable carrying the video, serial data, and power.

#### **8.3.2 DMS Cabinet**

Any cabinet serving a DMS shall house, at a minimum, the following items:

- DMS controller
- Ethernet switch
- Power-on indicators
- Waterproof local/remote switches and LED indicators
- Communication interface devices
- UPS with sufficient capacity to continue providing communications to the sign and DMS messages for two hours
- EIA-232 cables a minimum of four feet long to connect laptop computers

The power-on indicator shall indicate when the display system interface circuits are energized.

The Design-Build Firm shall be responsible for all connections between the sign and field cabinet, and for any required wiring harnesses and connectors.

#### **8.3.3 Ethernet Hub Equipment Shelter**

Ethernet hub equipment shelter shall comply with supplemental specification 785-5 and shall contain:

- Dual HVAC redundant system for a climate controlled environment
- UPS with sufficient capacity to hold the site's electrical load, less HVAC, for four hours

#### **8.3.4 Non-Intrusive MVDS Cabinet**

Any cabinet serving a non-intrusive MVDS shall house, at a minimum, the following items:

- Power and signal TVSS
- Single port terminal server
- UPS with sufficient capacity to hold the site's electrical load for four hours
- Ethernet edge switch

The non-intrusive MVDS shall connect to the communications network through an EIA 232/422/485 connection on the terminal server and then to a locally available Ethernet switch. For those units with an Ethernet port, connect it to the available Ethernet switch without use of a terminal server.

### **8.3.5 RWIS Cabinet**

Any cabinet serving a RWIS shall house, at a minimum, the following items:

- Ethernet edge switch
- UPS with sufficient capacity to hold the site's electrical load for four hours
- Remote processing unit
- Local control panel
- Environmental sensor support equipment

The RWIS shall connect to the communications network through an EIA 232/422 connection on the terminal server and then to a locally available Ethernet switch.

### **8.3.6 HAR Cabinet**

Any cabinet serving a HAR transmitter site shall house, at a minimum, the following items:

- Ethernet edge switch
- UPS with sufficient capacity to hold the site's electrical load for three days

The HAR shall connect to the communications network via a locally available Ethernet switch.

## **8.4 Applicable Standards**

All Category 5 unshielded twisted pair (UTP)/shielded twisted pair (STP) network cables shall comply with the *EIA/TIA-568-A* standard.

Each cabinet shall be ISO 9001 certified at the time of bid letting.

## **8.5 Construction Requirements**

The Design-Build Firm shall furnish all tools, equipment, materials, supplies, and manufactured hardware, and shall perform all operations and equipment integration necessary to provide a complete, fully operational field cabinet. All components shall be securely mounted inside the cabinet. For cabinets housing the same types of equipment, they shall be consistent; all cabinets shall be configured the same including, but not limited to, placement of the equipment inside the cabinet, equipment type and model, wiring, labeling, and mounting technique. The placement and mounting of equipment and cabling shall not interfere with general maintenance activities, testing, and future replacement of failed devices or removal of the cabinet from the foundation, and/or removal of working equipment or other cabinet contents.

The Design-Build Firm shall use stranded copper for all conductors, including those in jacketed cables. Neatly arrange all wiring, firmly lace or bundle it, and mechanically secure the wiring without the use of adhesive fasteners. Route and secure all wiring and cabling to avoid sharp edges and to avoid conflicts with other equipment or cabling. Terminate all wiring on a terminal block, strip, buss bar, device clamp, lug, or connector; do not splice any wiring. Label all wiring, cables, terminal strips, patch panels and distribution blocks. Use strain reliefs for all cabling with connectors, all cabling entering knockouts or ports at the equipment, and where appropriate.

Fasten all components of the cabinet assembly to be mounted on cabinet side panels with hex-head or Phillips-head machine screws. Install the screws into tapped and threaded holes in the panels. The components include, but are not limited to, terminal blocks, bussbars, panel, socket or DIN mounted TVSS, circuit breakers, accessory and equipment outlets, and DC power supply chassis. Each cabinet mounted UPS unit shall be configured for remote monitoring from the SWIFT Center and the Sarasota-Manatee STMC.

Fasten all other cabinet components with hex-head or Phillips-head machine screws installed with nuts (with locking washer or insert) or into tapped and threaded holes. Fasten stud-mounted components to a mounting bracket providing complete access to the studs and mounting nuts. All fastener heads and nuts (when used) shall be fully accessible within a complete cabinet assembly, and any component shall be removable without requiring removal of other components, panels or mounting rails. Do not use self-tapping or self-threading fasteners.

The Design-Build Firm shall install a concrete service pad at each cabinet location. For pole-mounted cabinets, the service pad shall be installed flush with the pole. For base-mounted cabinets, the service pad shall be installed flush with the cabinet face. The service pad shall measure 30 inches from the face of the cabinet by 36 inches wide. The service pad shall provide a level surface for a technician to access the cabinet and have a slope of 1/4 to 1 inch for drainage.

### **8.6 Document Requirements**

All cabinet as-built drawings shall be submitted to the Engineer for approval prior to installation in the cabinet. All markings and identifications shall be silk screened on the panel and sealed with a clear sealer, an acrylic, or a material approved by the Engineer.

### **8.7 Warranty**

The Design-Build Firm shall provide a manufacturer warranty against all defects and/or failure in design, materials, assembly, fabrication and workmanship for the minimum warranty duration specified for each equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786, as applicable.

The UPS units shall carry a manufacturer's warranty of two years.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

## **9.0 GROUNDING AND TRANSIENT SURGE PROTECTION**

### **9.1 Description**

The Design-Build Firm shall provide a system to protect field devices and electronic equipment from lightning and voltage surges using National Electrical Code (NEC) & Transient Voltage Surge Suppressor (TVSS) technology and standards.

Grounding and TVSS shall comply with FDOT Supplemental Specification Section 785-2.

### **9.2 Functional Requirements**

All TVSS devices shall have an ambient operating temperature of -40° F to 165° F with 95 percent noncondensing relative humidity.

#### **9.2.1 Device Data/Video Supply and Line Side**

The Low-voltage TVSS devices shall comply with the FDOT Supplemental Specification Section 785-2.4.4.

### **9.3 Warranty**

The Design-Build Firm shall provide a manufacturer warranty against all defects and/or failure in design, assembly, fabrication, materials and workmanship for the minimum warranty duration specified for each equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786, as applicable.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

## **10.0 NON-INTRUSIVE MICROWAVE VEHICLE DETECTION SYSTEM**

### **10.1 Description**

The non-intrusive microwave vehicle detection system (MVDS) is a non-invasive detection system installed above ground on the roadside (i.e., side-fire-mounted). The detection system uses a low-power microwave radar beam to measure vehicle presence and generate volume, occupancy, and speed data. The system shall transmit data in serial format using the EIA-232 communications port or an IP interface. The connection to the ITS network shall be through a device server.

### **10.2 Design Requirements**

The new MVDS assemblies shall be installed at the locations as determined by the Design-Build Firm. The minimum spacing for MVDS placement is:

- At each off ramp location, beyond the gore, where it can detect both the exiting and mainline traffic
- Every 1 mile except within 2 miles of an interchange
- Every 1/2 mile within 2 miles of an interchange

In some locations, it may be necessary to place two detectors to produce accurate measurements for both directions of travel and/or the exiting and mainline traffic at an interchange.

The location of each MVDS shall consider the existing and proposed geometry of I-75 and its ramps. There is proposed construction of road widening and noise barrier walls that must be considered in the placement of the detectors. The setback and mounting height must follow the manufacturer's recommended criteria in order to meet the performance requirements described in these MTRs. Each lane of the detected ramp and mainline must be an individual detection zone.

MVDSs shall have both EIA-232 and Ethernet access capability.

### **10.3 Functional Requirements**

The MVDS equipment shall comply with all applicable sections of the FDOT Supplemental Specification 786.

The configuration and control software for the MVDS shall be compatible with the SunGuide® Software System.

Maintenance and construction of an installed assembly shall not require lane closures.

The Design-Build Firm shall provide software updates at no cost to the FDOT during the warranty period. It shall be possible to use a laptop computer with an operating system compatible with the SunGuide® software for detector assembly, setup, calibration, diagnosis, and data retrieval.

### **10.4 Performance Requirements**

#### **10.4.1 Environmental**

The detector shall not be sensitive to temperature variations and shall operate across the temperature range of -30° F to 165° F without performance variations. The sensor shall not rely on temperature compensation circuitry to prevent abnormal operation. The assembly, operating continuously in its application, shall have a designed mean time between failures (MTBF) of 10 years, or 87,600 hours.

#### **10.4.2 Detection**

At a 9600-baud rate, the detector shall be capable of reporting full volume, occupancy, and speed data for a minimum of eight travel lanes. The detector shall meet the overall accuracy requirements specified under all weather and traffic conditions experienced in the detection site area. The unit shall not be adversely affected by varied weather conditions, such as rain, fog, or winds.

#### **10.5 Material Requirements**

The Design-Build Firm shall furnish all materials with the most recently developed and approved product versions that meet or exceed all applicable standards, specifications, and requirements before the system is considered for acceptance. It is the Design-Build Firm's responsibility to ensure that all required detection assembly features, functions, and performance measures are met.

All materials furnished, assembled, fabricated, or installed shall be new products obtained from the manufacturer or reseller. The materials, equipment, and components shall be COTS products.

The detector shall include the required assembly installation hardware at each individual detection site. The mounting and installation of the assembly shall ensure that detection quality is not degraded due to assembly movement and vibration.

#### **10.6 Construction Requirements**

The Design-Build Firm shall furnish all tools, equipment, materials, supplies, and manufactured hardware, and perform all operations and equipment integration necessary to provide a complete and fully operational system, according to the manufacturer's recommendations and all applicable standards, specifications, and requirements.

A factory-trained and certified representative shall conduct a detailed preconstruction site survey prior to the 90% plans submittal so that the recommended MVDS locations are clearly identified within that submittal. The site survey shall identify the exact location and details of each detection station. The Design-Build Firm shall submit the detailed location information to the Engineer with the 90% plans submittal for approval.

The Design-Build Firm shall prepare shop drawings that detail a complete detection assembly, and all other components to be supplied and constructed. The drawings shall detail the exact location and placement of system components, and shall include installation details for the required cables. All cabling shall be installed according to the manufacturer's recommendations.

Each detector shall be mounted in a side-fire configuration. The detector shall be mounted level from side to side. When collocating the MVDS with a CCTV camera location, the MVDS shall be mounted so the CCTV camera does not conflict when lowering. The Design-Build Firm shall supply the software and a laptop computer to be used for zone calibration.

The Design-Build Firm shall oversee assembly installation on a pole at a height above the road's surface as recommended by the manufacturer. All detection zones shall be contained within the specified elevation angle according to the manufacturer's recommendations and shall be capable of fully detecting all vehicle types in a maximum of eight lanes.

All equipment shall be installed according to the manufacturer's recommendations.

### **10.7 Testing Requirements**

The Design-Build Firm shall perform tests for each MVDS installation as shown in FDOT Supplemental Specification Section 786-5.

The Design-Build Firm shall provide all the required hardware, software, and labor to perform tests for each MVDS installation.

### **10.8 Training and Manual Requirements**

The Design-Build Firm shall be responsible to conduct a minimum of two hours onsite operational instruction for up to 10 representatives designated by the Engineer, for each type of MVDS unit installed. The Design-Build Firm shall provide training and maintenance manuals for each assembly, including detailed specifications and information regarding all installations.

The Design-Build Firm shall provide an inventory of installed assemblies by location and corresponding serial number. The inventory shall include weight and dimension specifications; power consumption information; the operating temperature range and relative humidity specifications; and general maintenance procedures.

The Design-Build Firm shall provide documentation detailing the technical and operational aspects of the completed installation. Documentation shall include device manuals; system diagrams; cabling diagrams; all field-engineering notes specific to each installation; full warranty information and any other documentation required by the Engineer.

### **10.9 Warranty**

The Design-Build Firm shall provide a manufacturer warranty against all defects and/or failure in design, assembly, fabrication, materials and workmanship for the minimum warranty duration specified for each equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786, as applicable.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

## **11.0 ROAD WEATHER INFORMATION SYSTEM**

### **11.1 Description**

The road weather information system (RWIS) shall comply with the FDOT Supplemental Specification 781-5.

### **11.2 Design Requirements**

The RWIS assemblies shall be located as follows:

- As shown on the Conceptual Device Layout
- Outside the clear recovery area
- Final locations shall be determined by Design-Build Firm to maximize accuracy of weather sensors

A six-foot high Type B (chain link) fence to protect the sensors shall enclose the RWIS. The communications cabinets shall be located inside the fence. Each fence shall be equipped with an eight-foot wide locking gate. The fenced enclosure shall measure 12 feet by 12 feet. The Design-Build Firm shall provide at least 4 copies of the key for the locking gate. All gate locks (for both RWIS and generator sites) shall be keyed alike. The Design-Build Firm shall install a weed barrier to prevent vegetation from growing up around the RWIS within the fence area. Gravel shall be installed on top of the weed barrier. Type B fence, weed barrier, and gravel shall comply with FDOT Supplemental Specification Sections 785-5.3.6 through 785-5.3.10.

### **11.3 Applicable Standards**

The RWIS shall comply with the standards listed in the FDOT Supplemental Specification Section 781-5.3.

### **11.4 Performance Requirements**

The Design-Build Firm shall provide an appropriate means of conversion for any device that requires a different input source. Each device shall be provided with appropriate surge suppression and grounding-bonding. Power and control devices shall be protected separately.

### **11.5 Material Requirements**

The Design-Build Firm shall furnish all materials with the most recently developed and approved product versions that meet or exceed all applicable standards, specifications, and requirements before the system is considered for acceptance. It is the Design-Build Firm's responsibility to ensure that all features, functions, and performance requirements are met.

All materials furnished, assembled, fabricated, or installed shall be new products obtained from the manufacturer or reseller. The materials, equipment, and components shall be COTS products.

#### **11.5.1 Remote Processing Unit (RPU)**

The RPU shall comply with FDOT Supplemental Specification Section 781-5.2.5. The RPU shall be capable of transmitting all collected data to the SWIFT Center and/or Sarasota-Manatee STMC using Ethernet communications over single mode fiber optic cable that transfers data at a minimum rate of 10 Mbps.

RWIS software shall comply with FDOT Supplemental Specification Section 781-5.2.7.

**11.5.2 Sensors**

The sensors shall comply with FDOT Supplemental Specification Sections 781-5.2.1 and 781-5.2.2.

**11.5.3 ESS**

The Environmental Sensor Station (ESS) shall comply with FDOT Supplemental Specification Sections 781-5.2.3.

**11.5.4 Foundation and Pole**

The RWIS foundation and pole shall comply with the FDOT Supplemental Specification Section 781-5.2.9. The poles shall be concrete poles designed to withstand winds of 150 MPH with gusts to 180 MPH.

**11.6 Construction Requirements**

The Design-Build Firm shall furnish all tools, equipment, materials, supplies, and manufactured hardware, and shall perform all operations and equipment integration necessary to provide a complete, fully operational system.

All equipment shall be installed according to the manufacturer's recommendations or as directed by the Engineer.

**11.7 Testing Requirements**

The Design-Build Firm shall perform all the tests outlined in the FDOT Supplemental Specification Section 781-5.5.

**11.8 Training and Manual Requirements**

The Design-Build Firm shall be responsible to conduct a minimum of two days onsite functional, operational, and mechanical training for all aspects of a RWIS and its supporting network communication devices for up to 10 representatives designated by the Engineer, for each type of unit installed.

The Design-Build Firm shall provide a training and maintenance manual for the RWIS assembly, including detailed minimum technical requirements and information for all installed environmental sensor units, and RPUs. The Design-Build Firm shall provide an inventory of installed assemblies by location and corresponding serial number. The manual shall also include weight and dimension specifications; power consumption information; the operating temperature range and relative humidity specifications; and the system's general maintenance procedures.

The Design-Build Firm shall provide documentation detailing the technical and operational aspects of completed installations. Documentation shall include device manuals, system diagrams, cabling diagrams, all field engineering notes specific to each installation, full warranty information, and any other documentation as required by the Engineer.

**11.9 Warranty**

The Design-Build Firm shall provide a manufacturer warranty against all defects and/or failure in design, assembly, fabrication, materials and workmanship for the minimum warranty duration specified for each equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786, as applicable.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

## **12.0 HIGHWAY ADVISORY RADIO**

### **12.1 Requirements**

The Highway Advisory Radio (HAR) system shall consist of amplitude modulated (AM) transmitter stations, flashing beacon signs, and command and control station equipment. The HAR, including its components and antenna system must be designed in accordance with the HAR manufacturer's recommendations so that it functions as a system and thus optimally. The Design-Build Firm shall detail the site and antenna design in the plans.

The HAR system shall comply with the FDOT Supplemental Specification 781-4 and these MTRs.

The FMS HAR system shall be compatible with the Department's SunGuide® Software system.

The AM transmitter stations shall include the antenna assemblies (utilizing wood support poles), power supplies and battery storage system, and all other necessary items to make a fully functioning HAR transmitter system. The antenna assembly shall include a ground counterpoise system. A driven ground rod or group of ground rods is not acceptable.

The Design-Build Firm shall install 10 HAR transmitter stations and 20 flashing beacons as shown on the Conceptual Device Layout. Each transmitter shall be associated with two flashing beacons, except as shown on the Conceptual Layout drawings. The locations of the HAR transmitters in the Conceptual Device Layout were selected to provide full coverage of the corridor without overlapping. The locations of the HAR flashing beacon signs in the Conceptual Device Layout were selected to minimize impacts upon existing signage.

The HAR frequency shall be 1640 MHz, which is already in use within the Charlotte County portion of the FMS. The Design-Build Firm is responsible for the Federal Communication Commission (FCC) licensing of each new HAR transmitter. The Design-Build Firm shall not be granted extra time for delays associated with the FCC licensing.

Each of the HAR transmitters shall work as an independent HAR station announcing its own audio message. The HAR system control software module shall allow the user to dynamically adjust the AM radio transmitter power from 0 to 10 watts in the increments of 0.1 watts. When two adjacent HAR stations are working in independent HAR station mode, the HAR system control software shall be configurable by the user to adjust each HAR station AM radio transmitter power output so that there shall be a silent gap of about ½-mile between the two adjacent HAR transmitter stations.

The SunGuide® Software system does not have the capability of adjusting the output power of the HAR from 0 to 10 watts in the increments of 0.1 watts. The Design-Build Firm shall install HAR manufacturer's software on all SWIFT Center operator workstations and all Sarasota-Manatee STMC workstations to provide this output power adjustment capability.

Each of the HAR transmitters shall synchronize with other HAR transmitters in the system. When these HAR stations are working in synchronized mode, there shall not be any silent gaps and the HAR system shall operate as one seamless system.

The beacons shall include:

- A static sign
- Two flashing lights of 12 inches in diameter
- Two support posts to mount the sign on
- Ethernet over Single Mode Fiber based beacon controller

- UPS with sufficient capacity to hold beacon's electrical load, including the Ethernet edge switch, for three days
- Remote control unit
- All other necessary items to make a fully functioning beacon system with HAR transmitter

The flashing beacons shall comply with the FDOT Supplemental Specification Section 781-4.2.9.

Solar panels shall not be used to charge the back-up batteries, instead the UPS specified in section 6.3.6 shall be used.

The HAR system shall provide IP-based control for operating and managing the complete HAR system.

The HAR stations and beacons shall be located outside the clear zones. Recommended locations for the HAR stations and beacons are shown in the Conceptual Device Layout. The preferred placement of the HAR beacon signs is in advance of the DMS assembly before an interchange.

## **12.2 Construction Requirements**

The HAR system installation shall comply with the FDOT Supplemental Specification Section 781-4.3.

The HAR system shall be integrated into the fiber optic network for a hard-wired connection to the SWIFT Center and the Sarasota-Manatee STMC.

## **12.3 Testing Requirements**

The Design-Build Firm shall test the entire HAR system utilizing the Department's SunGuide® Software system and the vendor software in both the independent operating mode of multiple HAR stations and their associated flashing beacons, and in synchronized mode of multiple HAR stations and their associated flashing beacons from both the SWIFT Center and the Sarasota-Manatee STMC. For testing purposes, it may be necessary for Department staff to ride along the corridor to verify both types of operation. The test results shall be clearly documented and provided to the Engineer. It should be noted that testing of the HAR transmitters is not allowed before the FCC licenses are received.

The Design-Build Firm shall also test the entire HAR system according to the FDOT Supplemental Specifications Section 781-4.4.

## **12.4 Training and Manual Requirements**

The Design-Build Firm shall be responsible to conduct a minimum of two days onsite functional, operational, and mechanical training of the complete HAR system and its supporting network communication devices for up to 10 representatives designated by the Engineer, for each type of unit installed. The Design-Build Firm shall comply with the testing requirements.

The Design-Build Firm shall supply a complete configuration and operations training utilizing Department's SunGuide® Software system. This training shall include both the independent operating mode of multiple HAR stations and their associated flashing beacons and the synchronized mode of multiple HAR stations and their associated flashing beacons.

The Design-Build Firm shall provide a training and operations/maintenance manual for the HAR system assembly, including detailed information for all installed HAR system components, modules, and software. The Design-Build Firm shall provide an inventory of installed assemblies by location and corresponding serial number. The manual shall also include weight and dimension specifications; power

consumption information; the operating temperature range and relative humidity specifications; and the system's general maintenance procedures.

The Design-Build Firm shall provide documentation detailing the technical and operational aspects of completed installations. Documentation shall include device manuals, system diagrams, cabling diagrams, all field engineering notes specific to each installation, full warranty information, and any other documentation as required by the Engineer.

### **12.5 Warranty**

The Design-Build Firm shall provide a manufacturer warranty against all defects and/or failure in design, assembly, fabrication, materials and workmanship for the complete HAR system including individual components for the minimum warranty duration specified for each equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786, as applicable.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.

## **13.0 UTILITIES**

### **13.1 Description**

The Design-Build Firm is responsible to provide power for all of the field devices within the project.

The Design-Build Firm shall arrange and coordinate the installation of power services along the Sarasota and Manatee I-75 FMS Project route.

The Design-Build Firm shall provide full payment to the electric utility for extending the existing power service to provide power to the field devices where needed along the project route.

Power drops shall be designed and installed to comply with the NEC and FDOT Standard Specification 639. In addition to other requirements referenced to herein, electric pull boxes shall be spaced not more than 500 feet apart.

Voltage design drop calculations shall comply with the suggested limits defined in NEC Article 210.19 (A) (1) FPN #4 and NEC Article 215.2 (A)(3) FPN #2. These calculations shall define all service points, circuits emanating from those points, details of all loads on all circuits, the nominal voltage on each circuit, the voltage drop for each link of each circuit, the percent voltage drop for each circuit and the wire size selected for each link of each circuit. These calculations shall include sizing and ratings of all circuit breakers, transformers, fused switches and transfer switches planned for installation. These calculations shall be submitted with the 90% submittal and with each subsequent submittal with all data appropriately updated. An allowance of 9.0 Amps shall be included at the end of the circuit for a convenience outlet.

Where Transformers are used, they shall be provided with +/- 2.5% & +/- 5% voltage taps. These taps shall not be used to fulfill the voltage drop and wire size requirements of this MTR.

Where circuits run both north and south from a power service point, separate circuits, each with its individual circuit breaker, shall be provided. A main disconnect circuit breaker shall be provided at each power service point.

### **13.2 Engine Generator Backup System**

The Department requires an engine generator backup system similar to the one in place within Collier and Lee Counties. The existing backup system powers all DMSs and all communication switches necessary to control and place messages on those DMSs. The object of the engine generator backup system is to provide messages on those DMSs within Sarasota and Manatee Counties when there is no electrical power from the service provider.

#### **13.2.1 Design Requirements**

The Design-Build Firm shall design the system to allow for message posting and the necessary communications to the signs and between the SWIFT Center and the Sarasota-Manatee STMC. The Design-Build Firm shall provide and install diesel-electric generator units at all power service point locations that provide power for a DMS and those locations that provide power for the communications backhaul. The units shall be sized to carry the full electric load fed from that point, plus 20%, for 24 hours. Only one unit will be allowed at any location. The FDOT has standardized on 7.5 KVA, 120/240 VAC 1 phase, 15 KVA 120/240 VAC 1 phase, and 25 KVA 120/240 VAC 1 phase units and effort should be expended to utilize these sizes. Request for variance to these sizes requires approval of the Engineer.

The 25 KVA units shall be designed for permanent installation and the 7.5 KVA and 15 KVA units shall be designed to be temporarily installed.

Each power service point location shall be equipped with a concrete pad, designed to support the generator unit, a lockdown method to secure the unit, a permanently installed electrical transfer switch to transfer the load from commercial to generator unit power, and housing to protect the unit. The 7.5 KVA units shall include a permanently mounted cabinet to protect the unit from theft. The Design-Build Firm is responsible for designing a cabinet that meets the exhaust and air flow requirements of the generators provided so the units do not overheat. The cabinet design shall address the need for ease of installing and removing the 7.5 KVA generators. Each location shall be bonded and grounded as required by the NEC.

A six-foot high Type B (chain link) fence shall enclose the generator units. Each fence shall be equipped with an eight-foot wide locking gate. The fenced enclosure shall measure 12 feet by 12 feet. The Design-Build Firm shall provide at least 4 copies of the key for each locking gate. All gate locks (for both RWIS and generator sites) shall be keyed alike. The Design-Build Firm shall install a weed barrier to prevent vegetation from growing up around the RWIS within the fence area. Gravel shall be installed on top of the weed barrier. Type B fence, weed barrier, and gravel shall comply with FDOT Supplemental Specification Sections 785-5.3.6 through 785-5.3.10.

Locations served by 7.5 KVA and 15 KVA units shall be equipped with manual transfer switches while locations served by the 25 KVA units shall be equipped with an automatic transfer switch. Transfer switches shall be fused to protect the downstream components.

#### **13.2.2 Remote Monitoring Requirements**

The 25 KVA generator units and associated automatic transfer switches shall be provided with performance monitoring equipment permanently installed that report to and are controlled by the SWIFT Center and the Sarasota-Manatee STMC. This equipment should provide, as a minimum, the following data to the SWIFT Center and/or the STMC as appropriate:

- Status of Commercial Power
- Position of Transfer Switch
- Status of diesel engine
- Diesel engine speed
- Diesel engine coolant temperature
- Diesel engine oil pressure
- Electric generator output voltage
- Electric generator output current

These units shall be remotely programmable to automatically start from 0.5 to 5 minutes after commercial power fails and to assume the electric load within 5 minutes after that. An alarm shall be provided to advise the operator, at the SWIFT center and/or STMC, that commercial power has been restored so that the operator may transfer the load and shut down the unit.

#### **13.2.3 Testing**

The Design-Build Firm shall test the engine generator backup system as a complete system. The test shall last for a minimum of 6 hours and the Design-Build Firm shall monitor the generators to verify that they work as designed. The Design-Build Firm shall coordinate this test with the SWIFT Center Manager and the SWIFT Center IT Manager.

#### **13.2.4 Deliverables**

The Design-Build Firm shall provide copies of the unit operations and maintenance manuals for each unit supplied to the FDOT.

#### **13.2.5 Training**

The Design-Build Firm shall provide training on this equipment. This training shall consist of 2 hours of classroom theory on operations for both operation personnel and maintenance personnel and 6 hours of

hands on training in the field for maintenance personnel for up to 10 representatives designated by the Engineer.

### **13.3 Remote Power Management**

The Design-Build Firm shall provide remote power management (RPM) for controlling multiple network devices and services. The RPM shall individually control AC power for up to eight connected devices. Once connected to the network, the RPM shall provide access and control using a standard web browser and your password. The Design-Build Firm shall supply remote power management in each cabinet servicing a DMS within the Sarasota/Manatee FMS.

The RPM shall provide the following minimum functionalities:

- Eight outlets;
- Network connections via Ethernet;
- Network control/support via HTTP server & SNMP agent TCP/IP;
- Scheduled event control including day of week and specific time start-up and shutdown; and
- Notifications including pagers and network broadcast messages.

#### **13.3.1 Testing**

The Design-Build Firm shall test the RPM with each connected device. The Design-Build Firm shall coordinate this test with the SWIFT Center Manager and the SWIFT Center IT Manager.

### **13.4 Warranty**

The Design-Build Firm shall provide a manufacturer warranty against all defects and/or failure in design, assembly, fabrication, materials and workmanship for the complete Engine Generator Backup system including individual components for the minimum warranty duration specified for each equipment in the FDOT Supplemental Specifications 780, 781, 782, 783, 784, 785, and 786, as applicable.

The engine generator units shall carry a manufacturer's warranty of two years. The transfer switches and transformers shall carry a manufacturer's warranty of 18 months.

The warranty period shall not begin until the date that the Department issues written notice of Final Acceptance.