FDOT TSM&O

Transportation Systems Management & Operations

District Five

Smart Signal

Design Guidance

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CREATED BY:

ATKINS North America, Inc.

482 South Keller Road
Orlando, Florida
United States of America
Tel: (407) 647-7275 | 1 (800) 284 5182

This document and its contents have been prepared and are intended exclusively for the Florida Department of Transportation (FDOT) District Five.

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List of Abbreviations

Abbreviation	Meaning
AAM	Active Arterial Management
API	Applicable Programming interface
APL	Approved Product List
ATC	Advanced Transportation Controller
ATS	Automatic Transfer Switch
ATSPM	Automated Traffic Signal Performance Measures
BIU	Bus Interface Units
Cat-6	Category 6
CAV	Connected and Autonomous Vehicle
CV	Connected Vehicle
DTOE	District Traffic Operations Engineering **OR** Department Traffic Operations Engineering
EOR	Engineer of Record
EQ	Estimated Quantities
EVP	Emergency Vehicle Preemption
FCC	Federal Communications Commission
FDM	Florida Design Manual
FDOT	Florida Department of Transportation
FHWA	Florida highway Administration
HFOV	Horizontal Field of View
HPS	High-Pressure Sodium
IEEE	Institute of Electrical and Electronics Engineers
INDOT	Indiana Department of Transportation
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
LED	Light-Emitting Diode
LRT	Light Rail Transit
MFES	Managed Field Ethernet Switch
MMU	Malfunction Management Unit
MSP	Modified Special Provision
NEMA	National Electrical Manufacturers Association
PoE	Power-over-Ethernet
PPC	Proprietary Product Certification
R-ICMS	Integrated Corridor Management System
RPMU	Remote Power Management Unit
RRR	Resurfacing, Restoration, and Rehabilitation
RSA	Roadside Alerts
SDLC	Synchronous Data Link Communications
SFP	Small-Form Pluggable
SIM	Subscriber Identity Module
SOP	Standard Operating Plan

Abbreviation	Meaning
SPAT	Signal Phase and Timing
SPD	Surge Protection Device
TEM	Traffic Engineering Manual
TIM	Traveller Information Message
TSCMA	Traffic Signal Compensation and Maintenance Agreement
TSP	Technical Special Provision **OR** Transit Signal Priority
UAO	Utility Agency Owners
UDOT	Utah Department of Transportation
UPS	Uninterruptible Power Supply
VFOV	Vertical Field of View

Section 1 - Introduction

The purpose of this document is to provide technical guidance in the implementation of the Florida Department of Transportation (FDOT) District Five *Smart Signal* Initiative including planning, technical design, construction oversight, and project management.

The intended audience for this document includes Engineers of Record (EOR), designers, technical reviews, project managers, local agencies, and other stakeholders.

DISCLAIMER:

This document is intended to be an informational resource and does not relieve the Engineer of the responsibility to design a fully functional and implementable system. The following guidance is based upon previous experience in the planning, design, deployment, and project management of smart signal systems within the District and has been made available to assist in project efforts; but does not supersede engineering judgement. The Engineer shall be responsible for practicing due diligence for all aspects of the design and is encouraged to coordinate with District personnel to better understand the current conditions and limitations of the available system(s)—including networking configuration constraints, integration status with central systems (e.g., ATMS, SunGuide), known operational issues, maintenance considerations, pace of technology, and more. Furthermore, this document is not intended to be all inclusive. The Engineer shall be responsible for all aspects of the design—including coordination efforts, procedural steps, and processes that are not explicitly defined in this document—based on individual experience and project-specific field conditions.

1.1 References

- *FDOT Standard Plans for Road and Bridge Construction,* latest version.
- *Florida Design Manual (FDM)*, latest version.
- *FDOT Standard Specifications for Road and Bridge Construction,* latest version.
- *FDOT Traffic Engineering Manual (TEM)*, latest version.
- *FDOT Basis of Estimate,* latest version.
- *FDOT Approved Products List*, latest version.
- *FHWA Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways,* 2009 Edition with Revisions 1 and 2, May 2021.
- *FHWA Traffic Detector Handbook – Third Edition*, October 2006.
- *FHWA Traffic Detector Handbook – Third Edition*, October 2006.
- *ITE ATC 5201 – Advanced Transportation Controller Standard, v06A*, January 12, 2018.
- *ITE Traffic Engineering Handbook*, 7th Edition, January 2016.
- *NEMA Standards Publication TS 2-2021, Traffic Controller Assemblies with NTCIP Requirements,* version 03.08 or later.
- *FDOT Central Office Design of Traffic Signal Detection Technologies, Informational Guide, September 2022.*

Section 2 – Smart Signal Overview

2.1 Purpose

The purpose of the *Smart Signal* implementation is to create a data-rich environment, deploy scalable infrastructure for future Connected and Autonomous Vehicle (CAV) applications, and develop standardization for traffic signal equipment at signalized intersections districtwide. The proposed architecture of the *Smart Signal* implementation will provide additional real-time data sets with improved granularity to enable a variety of applications to better manage and operate arterial roadways more efficiently. This additional data—including high-resolution controller detector data and intersection turning movement counts—will be utilized by both the Department and the local maintaining agencies operational staff to quantify and evaluate Automated Traffic Signal Performance Measures (ATSPM).

High-resolution data is defined as data that is native and processed by the local ATC controller – unprocessed data logs collected by the controller at each signalized intersection prior to the ATSPM database converting and generating signal performance metrics. The ATC controller can react in real-time as detection inputs are received, applying logic to change the status of the signal indications.

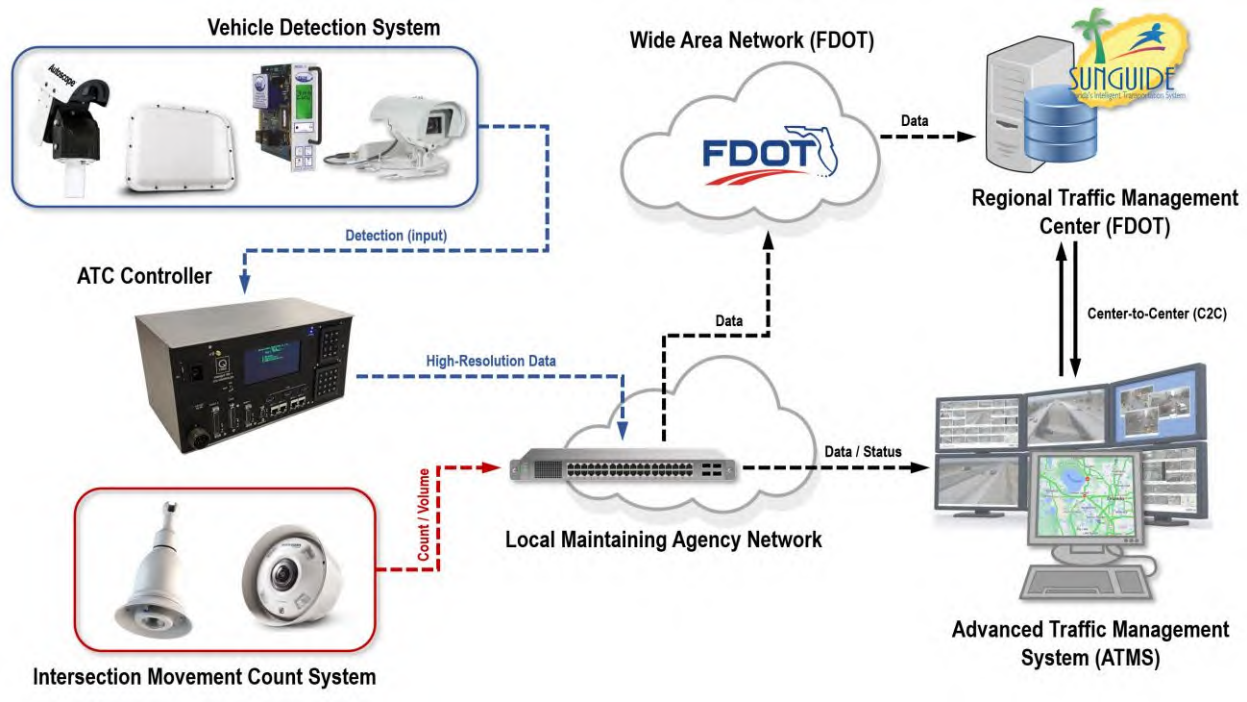


Figure 1: High-level overview of Smart Signal architecture and data flows.

The *Smart Signal* standard will ensure the infrastructure at signalized intersections provides a platform capable of accommodating CAV equipment for future applications focused on safety and mobility. Future applications may include the dissemination of real-time information to road users including signal state and phase (e.g., Signal Phase and Timing (SPAT)), traffic and roadway conditions (e.g., Traveler Information Messages (TIM), Roadside Alerts (RSA)), weather conditions (e.g. Spot Weather Impact Warning); real-time notifications to motorists for enhanced situational awareness within the intersection (e.g., Pedestrian in Crosswalk Warning, Red Light Violation Warning, Forward Collision Warning, and Vehicle Turning Right in Front of Transit Vehicle).

The districtwide *Smart Signal* implementation will provide standardization for proposed signal requirements across the Central Florida region focused on functionality. The standardization specifically provides minimum technical requirements for the system(s) but does not dictate specific equipment, products, manufacturers, or systems.

2.2 Benefits

Benefits of the districtwide *Smart Signal* implementation will be realized by a variety of stakeholder and users:

- Florida Department of Transportation (FDOT) – operations, maintenance, planning, project management
- Local Maintaining Agencies – operations, maintenance, planning, project management
- Professional Industry – traffic engineering, design, and planning
- Road Users – motorists, bicyclists, pedestrians, transit riders, emergency responders
- General Public

Example benefits for the deployment of *Smart Signals* include real-time operational improvements to motorists along arterial roadways, including reduction of average travel times, reduction of "lost time" or average delay per vehicle, improvement of travel time reliability, and more. The continuous data will feed into existing Department maintained systems to enhance the operational capabilities, such as the Active Arterial Management (AAM) and Regional Integrated Corridor Management System (R-ICMS) programs. Additional benefits from the system include improved maintenance responsiveness by providing a system for quicker recognition of issues and reduced recurring costs for traffic volume and turning movement count data collection efforts.

ATSPM provide real-time quantifiable performance at signalized intersections and the progression of traffic along a corridor. The real-time data collected will provide maintaining agencies with the status of current delays, volumes, speeds, and travel times that can be utilized to optimize mobility, manage traffic signal timing, reduce congestion, and improve safety for all roadway users. Because data is being collected continuously, maintaining agencies will be able to efficiently identify problems down to individual detection zones. **Figure 2** is a culmination of all possible metrics available within ATSPM. The data needed for traffic studies and optimization models is already being collected with ATSPM, saving costs from previously necessary signal timing data collection means and methods.

Across the nation, multiple agencies are turning to the implementation of ATSPM to improve the operations and function of their arterial network. The following illustrates two examples of successful ATSPM deployments installed by Indiana Department of Transportation (INDOT) and Utah Department of Transportation (UDOT). INDOT implemented a pilot system across eight (8) intersections, running real-time automatic data downloads integrated into a server residing at the Traffic Management Center (TMC) with front-end viewing capabilities of the performance measures, allowing INDOT to improve traffic performance. Following the success of the pilot deployment, INDOT elected to scale the system for increased benefits. UDOT initially invested heavily on communications infrastructure, allowing for quick future expansion to over 1,000 intersections with a performance measures system to process high-resolution data and optimize traffic signal operations in real-time. UDOT also developed a live public-facing performance measures website to actively display the current and historical operations at each signalized intersection.

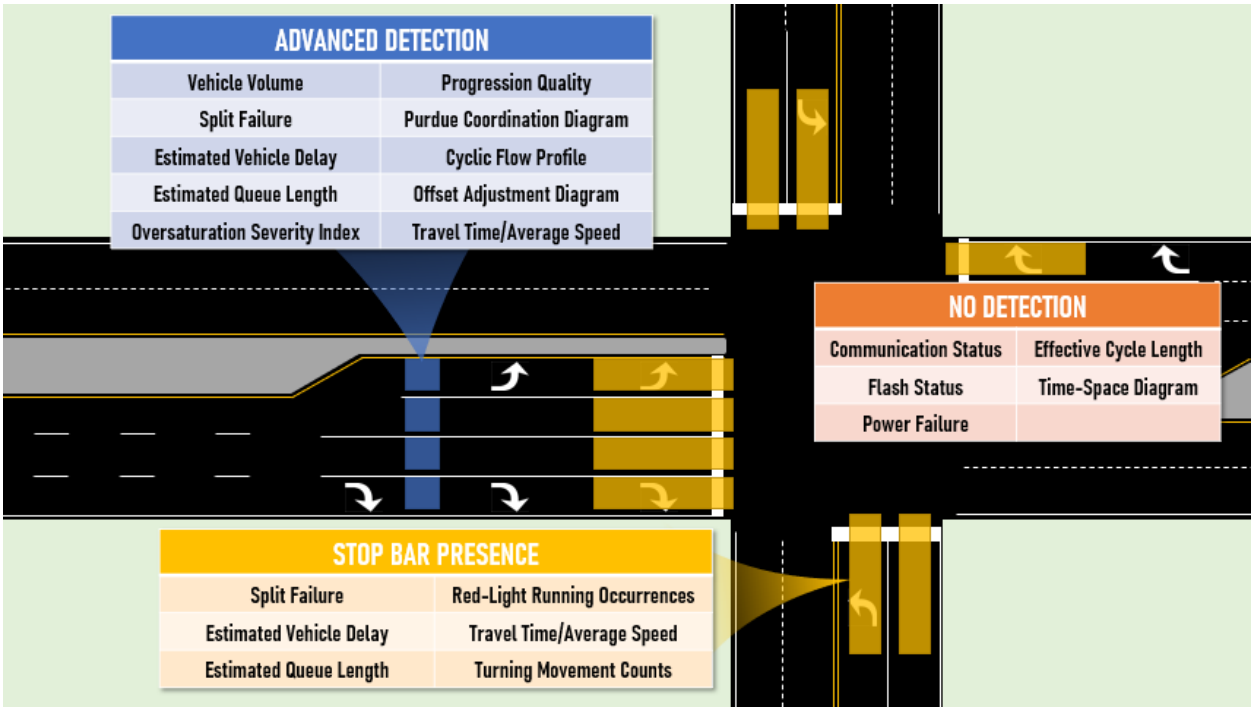


Figure 2: Sample metrics available within ATSPM based on the granularity of detection

Section 3 – Project Workflow

3.1 Roles and Responsibilities

The lifecycle of a *Smart Signal* project will incorporate four (4) primary roles, each with a unique set of contributions and responsibilities:

1. Engineer of Record
2. Department Project Manager
3. Local Maintaining Agencies
4. Third-Party Stakeholders
5. District Traffic Operation Engineer

The **Engineer of Record (EOR)** will be responsible for ownership of all engineering and design related decisions on the project. All efforts related to the analysis, review of existing conditions, identification and mitigation of potential risks, design considerations, development of technical submittal documents, and coordination will be the responsibility of the EOR. The EOR is also responsible for ensuring the proposed signal equipment are compatible with all FDOT and Signal maintaining agencies standards and requirements and will be operational successfully. This individual may be an employee of the Department or a representative of a private, third-party consulting firm.

The **Department Project Manager** will be responsible for the oversight and management level decisions on the project. Activities including scope, budget, and schedule management, document control, coordination with interested third-parties, technical review of submittal documents, and general` oversight of the design process will be the responsibility of the Department Project Manager. Acting on behalf and with the best interests of the Department, this individual may be either a direct employee of the state or a designated third-party representative.

Local Maintaining Agencies will be responsible for representing the interests of the public municipality, providing the necessary requirements and preferences to be incorporated within the project. Through continuous coordination efforts, the local maintaining agency will be responsible for providing technical input, applicable standards, and requirements for the project to meet, performing technical reviews of submittal documents, identifying specific product and/or technology preferences (e.g., Proprietary Product Certifications), and more. The local maintaining agency will be the entity responsible for the maintenance of signal equipment as identified in the executed Traffic Signal Compensation and Maintenance Agreement (TSCMA).

Third-Party Stakeholders represent a wide range of public and private entities that may have joint interest in the project, including municipalities (e.g., cities, counties), private developers, utility agency owners (UAO), product vendors, business owners, and more. Stakeholders shall share any concerns or issues and provide their inputs to the Department Project Manager and the EOR.

The **District Traffic Operations Engineering (DTOE)** will be responsible for providing final approval of key documents required throughout the lifecycle of the project, including but not limited to Proprietary Product Certifications (PPC) and ITS Certification Memorandum. Additionally, the DTOE will be an available resource and subject-matter expert to provide input on important decisions that may impact the safety and well-being of the general public.

3.2 Project Progression

Each *Smart Signal* project will be required to complete similar activities in the development of technical designs and contract documents (e.g., plans, specifications). **Figure 3** depicts a high-level flowchart of the *Smart Signal* design process, including critical milestone activities and roles.

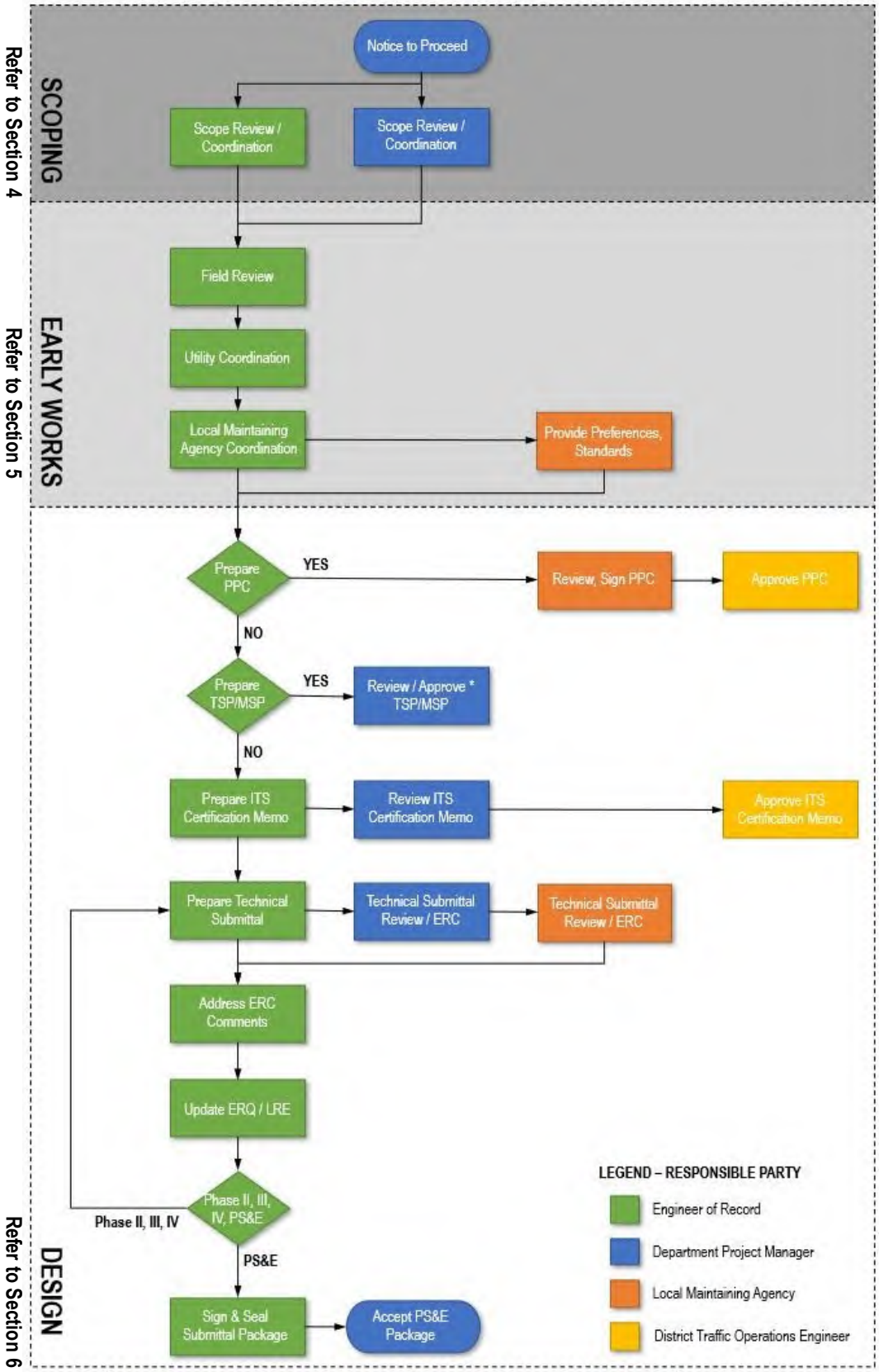


Figure 3: Smart Signal Design Process Flowchart

Section 4 – Scoping

4.1 Typical Smart Signal Scope

The implementation of the *Smart Signal* standard will be required for all projects that include any medium to major signal cabinet work under any of the following project types:

- New Construction
- Reconstruction
- Widening
- Resurfacing, Restoration, and Rehabilitation (RRR)
- Traffic Operations – with three (3) signalized intersections or more
- Pushbutton

Projects with minimal signal work (i.e., rearrangement of signal heads, adding pedestrian features only, re-spanning existing strain poles) will not require upgrading to *Smart Signal;* however, the Department may elect to incorporate *Smart Signals* into other project at its discretion. It is the Engineer of Record's (EOR) responsibility to evaluate and justify *Smart Signal* implementation in the project through coordination with both the signal maintaining agency and FDOT.

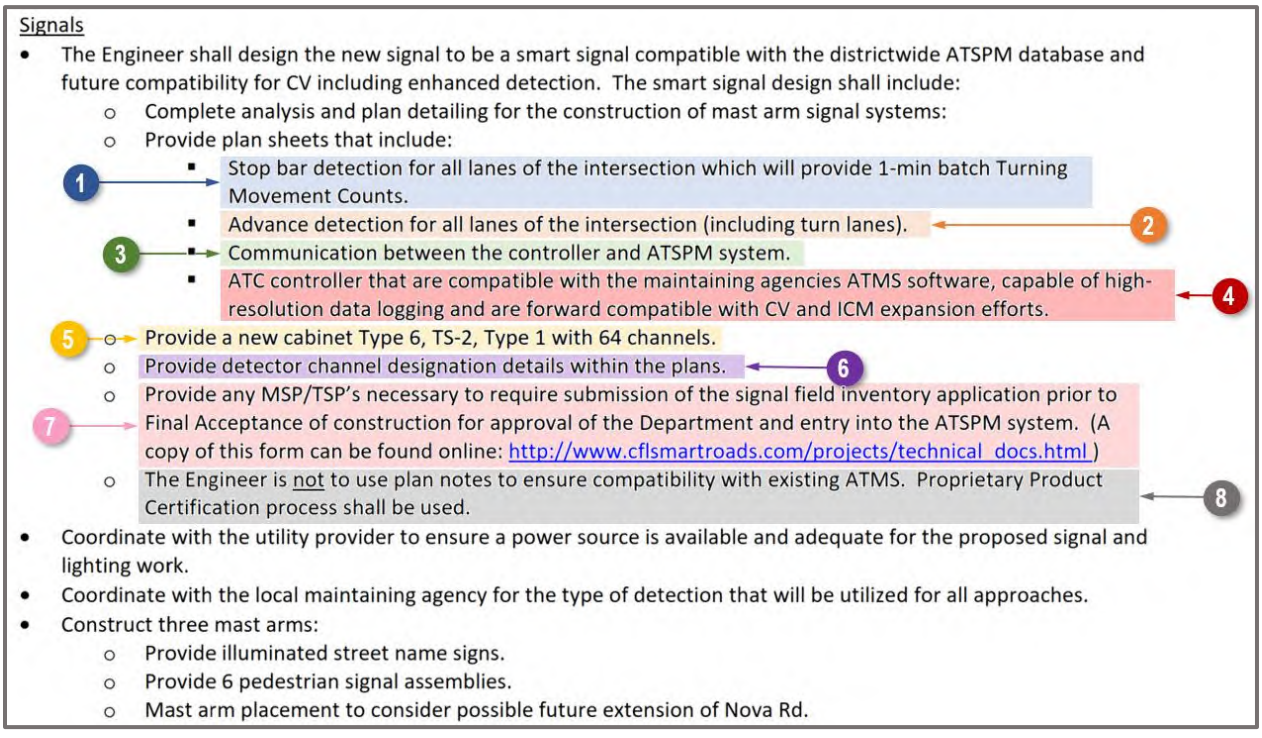


Figure 4: Example scoping language for Smart Signals typical project

The EOR shall design the new signal to be *Smart Signal* compatible with the districtwide Automated Traffic Signal Performance Measures (ATSPM) database and future compatibility for Connected and Autonomous Vehicle (CAV), including enhanced detection. There are eight (8) primary elements to be incorporated into the design of *Smart Signals*, as appropriate. The following identifies the minimum technical requirements for a *Smart Signal* project.

1. Project shall include lane-specific detection zones for all approaches, all lanes located at the stop bar capable of providing turning movement count data in one (1) minute batches.
2. Project shall include lane-specific advanced detection zones for all approaches, all lanes, including thru, left, right, and dual movement lanes.
3. Project shall include field network equipment capable of establishing a reliable, continuous communication link between the signalized intersection and the central network to reach external applications, such as ATSPM.
4. Project shall include traffic signal controller units compliant with the Advanced Transportation Controller (ATC) standard and capable of high-resolution data logging and future expansion for applications including CAV.
5. Project shall include NEMA TS-2, Type 1 controller cabinet assemblies, minimum Size 6 or better and wired for sixty-four (64) detection channels.
6. Project shall include detailed detector channel assignment providing unique channels for each detection zone.
7. Project shall include the development of necessary Technical Special Provisions (TSP) and/or Modified Special Provisions (MSP) required, including testing, integration, and as-built data collection efforts.
8. Project shall include the development and approval of necessary Proprietary Product Certifications (PPC) for Local Maintaining Agency preferences.

The EOR is responsible for thoroughly coordinating any necessary clarifications or changes with the Department Project Manager and local maintaining agency before beginning design-related activities. Failure to ensure that both the Engineer and the Department fully understand the scope and agree upon the objectives of the project may result in costly schedule delays or errors and omissions later in the project lifecycle.

4.2 Smart Signal "Ready" Projects

Within District Five, most projects with signalized intersections will include the complete implementation of the *Smart Signals* requirements; however, there are a few exceptions in which specific intersections will only be required to provide the minimal defined requirements. These limited-scope projects are referred to as *Smart Signal "Ready"* and will be constructed such that new infrastructure is capable of accommodating equipment for a full buildout in the future.

Candidates for a *Smart Signal "Ready"* deployment include limited-scope or private development permit projects, including the construction of a new or modification of an existing signalized intersection leg for a residential development or business entrance. The intent of *Smart Signal "Ready"* projects is to ensure that the magnitude of the requested signalization scope is proportional to the overall project scope and budget. *Smart Signal "Ready"* projects will also help reduce unnecessary rework by ensuring the proposed signalization infrastructure is capable of simple modifications to provide the complete *Smart Signal* functionality at a later date.

The Department Project Manager will be responsible for identifying whether or not the project includes any signalized intersections that are only required to be upgraded according to the *Smart Signal "Ready"* minimum techical requirements.

Refer to **Figure 5** for more information on the minimum technical requirements for *Smart Signal* versus *Smart Signal "Ready"* improvements.

Smart Signal Project (New Construction, 3R, Widening, Traffic Ops)	Requirement	*Smart Signal* "Ready" Project (Private Development, minimum limited-scope) [5]
YES	ATC Controller	YES
YES	NEMA Type 6 Cabinet Assembly w/ 64 input channels	YES
YES	Stop Bar Detection (all lanes, all approaches)	Conditional [1]
YES	Advanced Detection (all lanes, all approaches)	*Optional*
YES [6]	Queue Detection (left turn lanes)	Conditional [6]
YES	Intersection Movement Count (IMC) Camera	*Optional*
YES	Managed Field Ethernet Switch	YES
YES	Remote Power Management Unit	YES
Conditional [4]	Uninterruptible Power Supply	Conditional [4]
YES	Fiber Optic Communications, Infrastructure [2]	*Optional*
YES [3]	Alternative Communications (wireless, cellular)	YES [3]

[1] If the local agency or project preference for stop bar detection is in-pavement loops, the project must install loops for all lanes, all approaches impacted by the project.
[2] Minimum fiber optic communications infrastructure includes dedicated conduits, fiber optic pull box or splice vault at the cabinet base, fiber optic patch panel, splice enclosure, trunkline and drop fiber optic cables.
[3] If fiber optic communications are installed at an intersection, this requirement is null; alternative communications shall only be permitted if fiber optics communications are not feasible and approved by the Department.
[4] If the local agency preference requires UPS, install a complete assembly with battery backup system for each signalized intersection.
[5] The project is required to restore, replace, and/or upgrade all existing signalization components impacted as part of the project to the relevant Smart Signal standards.
[6] Provide queue detection where applicable based on operational needs of the intersection, traffic analysis, or historical

All projects are anticipated to meet the Smart Signal standards, unless otherwise approved by the Department.

Figure 5: Smart Signal vs. Smart Signal "Ready" project requirements

The minimum technical requirements for improvements at *Smart Signal "Ready"* intersections include the installation of the following:

- ATC controller
- NEMA TS-2, Type 1 standard controller cabinet assembly, minimum Size 6 with 64 input detection channels
- Managed Field Ethernet Switch (MFES)
- Remote Power Management Unit (RPMU)
- Network communications
- Detection technologies

Each *Smart Signal "Ready"* project shall be assessed to determine if any of the conditional requirements are applicable and need to be included within the proposed work. Conditional requirements include the following:

- **Presence (Stop Bar) Detection** – include stop bar detection for all lanes and all approaches impacted by the project if the technology preference of the Local Maintaining Agency is in-pavement loops
- **Queue Detection –** include vehicle detection systems capable of providing advanced queue detection for left and/or right turn lanes where an operational need is identified within the intersection, or requested by the Local Maintaining Agency
- **Uninterruptible Power Supply –** include an uninterruptible power supply (UPS) with battery backup system for each signalized intersection if requested by the Local Maintaining Agency

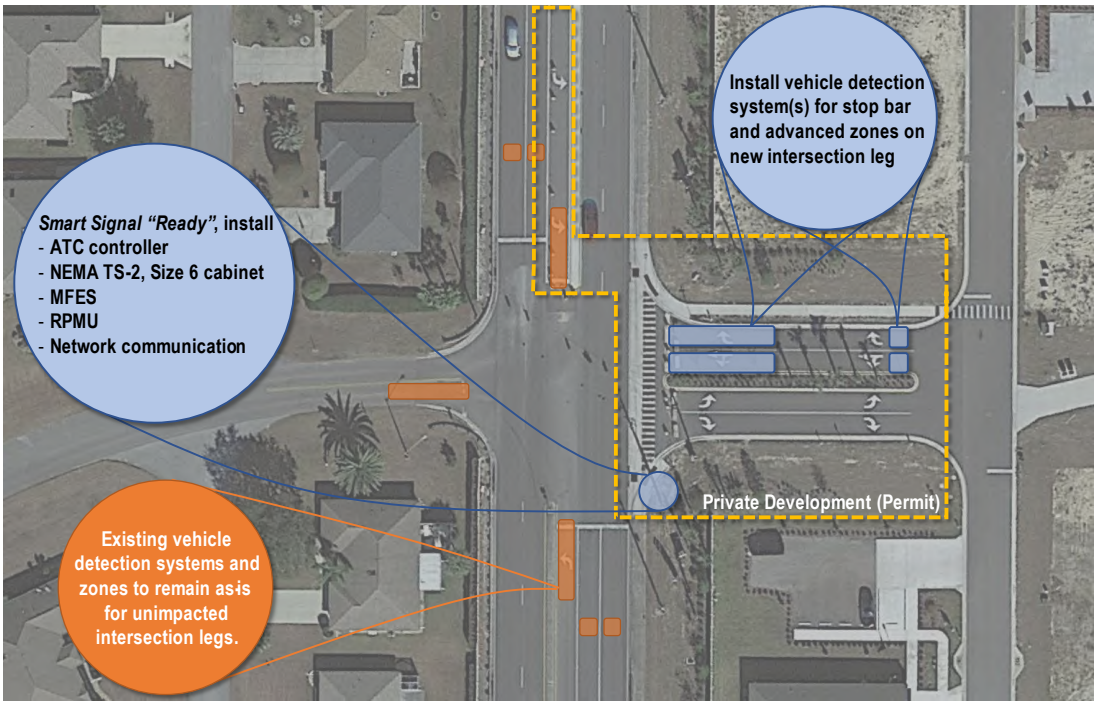


Figure 6: Example Smart Signal "Ready" improvements for permit project of a private development entrance.

Section 5 – Early Works

The *Smart Signal* development process begins with field reviews, preliminary analysis, coordination, and engineering activities required before detailed technical design. These efforts are collectively known as "early works".

5.1 Field Review

The first project development activity for each project is conducting the on-site field review. This step provides the Engineer of Record an in-depth understanding of the existing conditions and potential design constraints of the project. Furthermore, the data collected from the field will aid the Engineer of Record to identify high-level design requirements and determine potential impacts between existing infrastructure (e.g., utilities) and proposed design elements. The Engineer of Record (EOR) shall not rely on the limited available information from desktop surveys or the accuracy of as-builts drawings, as often conditions in the field are evolving. Field reviews shall be conducted for all existing and proposed intersections within the project limits.

Prior to beginning each field review, the EOR is responsible for coordinating with the appropriate local maintaining agencies a minimum of five (5) days in advance. The EOR shall clearly identify the purpose of the field visit, project locations, anticipated dates and times, and request information concerning access to traffic signal controller cabinets to identify existing security features (e.g., standard Type 2 cabinet key, padlocks, electronic locking mechanisms). Additionally, the EOR is encouraged to reach out to the local maintaining agency upon arriving at the site prior to accessing any controller cabinets.

The EOR will be responsible for coordination with the local maintaining agency to identify current equipment requirements and proprietary preferences to identify legacy equipment and/or gaps in existing hardware to be replaced as part of the project.

During the field review, the EOR shall be responsible for determining the following, at minimum:

- Potential utility conflicts, either overhead or underground;
- Existing utility service points and/or potential new utility service point location(s);
- Potential clear zone, lateral offset issues or violations for existing infrastructure;
- Existing signalization and Intelligent Transportation Systems (ITS) field equipment and associated infrastructure, including, but not limited to vehicle and pedestrian detection systems, cabinets, pull boxes, conduit, cabling, signal heads, overhead signing, poles, and foundations;
- Existing infrastructure that is either damaged, non-functional, or unutilized (*the Engineer of Record shall be responsible for reporting damaged equipment and/or identified concerns to the local maintaining agency immediately).*

The field review shall also serve as opportunity for the Engineer of Record to observe real-time traffic conditions (e.g., heavy pedestrian movements, queuing turn lanes, red light violations) to identify potential operational improvements or needs to be addressed by the project.

Based of field review findings, the Engineer of Record shall determine necessary improvements needed to meet the District's *Smart Signal* standard and communicate any identified deviations from the approved scope with the FDOT Project Manager. In order to meet project requirements, it may be necessary to upgrade existing signalization equipment and ITS field devices due to either the condition or age of the equipment, as noted during the field review.

5.1.1 Existing Equipment Inventory

Below is a sample inventory checklist that can be used during the field review. It is recommended the Engineer of Record take photos of all existing equipment reviewed in the field.

Table 1: Existing Signalization Equipment Inventory Checklist

Signal Structure *(complete for each structure)*	
Type	❑ Mast arm, single ❑ Mast arm, dual ❑ Span wire, single point attachment (e.g., diagonal) ❑ Span wire, multi-point attachment (e.g., box, drop box, "H") ❑ Truss ❑ Pedestal
Material	❑ Steel ❑ Concrete ❑ Aluminum
Location / Corner	
Condition	❑ Good ❑ Fair ❑ Poor
	Damage identified:
Luminaires	❑ Yes ❑ No
	❑ High-pressure sodium (HPS) fixture ❑ LED fixture
Controller Cabinet Assembly	
Standard	❑ NEMA TS-1 (*"A", "B", "C", "D" connectors*) ❑ NEMA TS-2, Type 1 (*"A" connector, SDLC*) ❑ NEMA TS-2, Type 2 (*"A", "B", "C", "D" connectors, SDLC*) ❑ 170 / 2070 (*Caltrans*) ❑ Hybrid
Size	❑ Size 4 *(NEMA)* – 24" W x 46" H x 16" D ❑ Size 5 *(NEMA)* – 30" W x 48" H x 16" D ❑ Size 6 *(NEMA)* – 44" W x 52" H x 24" D ❑ Size 7 *(NEMA)* – 44" W x 72" H x 24" D ❑ Type 332 *(Caltrans)* ❑ Type 334 (*Caltrans*) ❑ Other
APL No.	
Manufacturer	
Date of Manufacture	
Installation	❑ Base mount ❑ Pole mount
Base Dimensions	
Location / Corner	
Main Circuit Breaker (A)	
Additional Circuit Breakers	

Conduit Sweep *(complete for each)*	
Conduit Size	
Utilization (Conduits entering cabinet)	
Destination	
Controller Unit	
Body Type	❑ NEMA TS-1 (*"A", "B", "C", "D" connectors*) ❑ NEMA TS-2, Type 1 (*"A" connector, SDLC*) ❑ NEMA TS-2, Type 2 (*"A", "B", "C", "D" connectors, SDLC*) ❑ 170 / 2070 (*Caltrans*) ❑ Hybrid
Manufacturer	❑ Econolite ❑ Intelight / Q-Free ❑ Naztec / Trafficware / Cubic ❑ Siemens / Yunex ❑ Other
Model	
Firmware Version (Can be obtained via the 'Software' menu on the controller display)	
Additional Modules (Can be obtained via the 'Software' menu on the controller display)	❑ SynchroGreen Traffic Adaptive ❑ Light Rail Transit (LRT) ❑ Transit Signal Priority (TSP) ❑ Connected Vehicle (CV) ❑ Other
Vehicle Detection System(s) *(complete per active system)*	
Type	❑ Loops ❑ Standard video ❑ Omni-directional video (fisheye) ❑ Microwave radar ❑ Video/microwave hybrid ❑ In-ground wireless magnetometers ❑ Other
Manufacturer	
Model	
In-Cabinet Equipment	

Auxiliary Signalization Equipment			
Emergency Vehicle Preemption (EVP)	❑ Yes	❑ No	
	Manufacturer		
	Model		
Transit Signal Priority (TSP)	❑ Yes	❑ No	
	Manufacturer		
	Model		
Adaptive Signal Control	❑ Yes	❑ No	
	Manufacturer		
	Model		
Accessible Pedestrian Signal (APS)	❑ Yes	❑ No	
	Manufacturer		
	Model		
Uninterruptible Power Supply (UPS)	❑ Yes	❑ No	
	Manufacturer		
	Model		
	Install Date (battery)		
Remote Power Management Unit (RPMU)	❑ Yes	❑ No	
	Manufacturer		
	Model		
	No. Available Plugs		
Utility Power Service			
Service Provider (UAO)			
Service Voltage			
Location / Corner			
Service Pole No.			
Installation	❑ Overhead ❑ Underground		
Communications			
Network Connection	❑ Yes	❑ No	
Fiber Optics	❑ Yes	❑ No	
	Type	❑ Single-Mode ❑ Multi-Mode ❑ Hybrid	
	Fiber Count		
	Patch Panel Count	(capacity)	(terminated)
	Patch Panel Manufacturer		
	Patch Panel Model		
	Connection(s)		
Wireless Radio	❑ Yes	❑ No	
	Manufacturer		
	Model		
	No. of Radios		
	Signal Destination(s)		

Cellular Modem	❑ Yes	❑ No	
	Manufacturer		
	Model		
Managed Field Ethernet Switch (MFES)	❑ Yes	❑ No	
	Manufacturer		
	Model		
	No. of Copper Ports (RJ45)	(total)	(available)
	Copper Port Assignment		
	No. of Fiber Ports (SFP)	(total)	(available)
	Fiber Port Assignment		
Intelligent Transportation Systems (ITS) Field Devices			
CCTV Camera	❑ Yes	❑ No	
	Manufacturer		
	Model		
	Type	❑ Fixed ❑ Pan-tilt-zoom, dome ❑ Pan-tilt-zoom, external positioner	
	Location / Structure		
	Wiring Architecture	❑ Analog ❑ Digital ❑ Power-over-Ethernet	
	In-Cabinet Equipment		
Bluetooth Reader	❑ Yes	❑ No	
	Manufacturer		
	Model		
	Location / Structure		
	In-Cabinet Equipment		
Connected Vehicle Roadside Unit (RSU)	❑ Yes	❑ No	
	Manufacturer		
	Model		
	Location / Structure		
	In-Cabinet Equipment		

5.2 Utility Coordination

Following the field review, the Engineer of Record is to start coordination with utility owners within the project limits. Utility coordination is required to determine adjustments to existing utility lines so there are no conflicts with the proposed construction.

It is recommended that the Engineer of Record contact Sunshine 811 to obtain an updated list of all utility providers in the area. Utility coordination may be conducted via the Engineer's preferred form of contact; however, it is imperative that all utility lines, either overhead or underground, be verified against the proposed work to be done. Plans shall be sent to utility owners for mark-ups. Verify if utilities cannot be avoided and require relocation.

Vertical clearances to all overhead lines shall be checked to determine the required clearances of the proposed signalization and/or ITS infrastructure. The Engineer of Record shall coordinate the de-energization of electrical distribution lines, as necessary. Transmission lines cannot be relocated.

The Engineer of Record is to coordinate with the agency owner (UAO) for new or revising existing utility service point, as determined during the field review. This may be provided in a conflict matrix format as depicted in **Appendix B**.

Utility coordination efforts shall be used to identify existing communications infrastructure, as well as locate potential connection points for network connectivity.

Table 2: Utility Coordination Checklist

First Steps	
Contact Sunshine 811	Provide: ❑ Project Description ❑ Project Limits
Contact Local Utility Providers	Provide: ❑ Project Description ❑ Project Limits ❑ Plan Sheets to be Marked-up
Follow-up	
Complete Utility Conflict Matrix	❑ Utility Agency Owner ❑ Contact Personnel (email, phone number) ❑ Utility Location (station, offset, top elevation) ❑ Utility Type / Size ❑ Material ❑ Description of Conflict ❑ Action ("To Remain", "To Be Removed", "To Be Relocated")
Submit Utility Adjustment Letter to Utility Agency Owner(s)	❑ Request "No Facilities Form" with UAO letterhead ***OR*** ❑ Request "No Conflict Form" with UAO letterhead
Prepare Utility Adjustment Sheet(s) ***per FDM Section 923***	

5.3 Local Maintaining Agency Coordination

The Engineer of Record (EOR) shall be responsible for the design of a functional system that meets the District's *Smart Signal* standard while simultaneously adhering to the preferences and requirements of the local maintaining agency. The EOR shall coordinate with the local maintaining agency at the early stages of the project to determine specific

needs at the project location(s), identify changes or modifications to current design standards, define necessary proprietary products, and more.

Where the local maintaining agency identifies specific technology preferences to be included in the project, the EOR will be responsible for preparing Proprietary Product Certifications (PPC) to be signed off by both a representative of the local maintaining agency and the Department Traffic Operations Engineer (DTOE). Each PPC shall be comprised of two (2) parts: the *Proprietary Products Approval Request Letter* submitted on behalf of and signed by the local maintaining agency and the PPC Form signed by the DTOE. Within each of these documents, identify the specific products being requested—including manufacturer and model number—as well as the justification (e.g., synchronization with existing deployed systems, familiarity and ease of maintenance, reduced maintenance cost, no suitable alternative). The executed document shall be provided to the FDOT Project Manager for retention with project records.

Local maintaining agencies include:

- Brevard County
- City of Melbourne
- City of Palm Bay
- City of Titusville
- City of Palm Coast
- Lake County
- Marion County
- City of Ocala
- Orange County
- City of Orlando
- City of Maitland
- City of Winter Park
- Osceola County
- City of Kissimmee
- Seminole County
- Sumter County
- Volusia County
- City of Daytona Beach

Refer to **Appendix A** for an example listing of local maintaining agency preferences for signalization equipment.

FDOT

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION
PROPRIETARY PRODUCT CERTIFICATION

To: Jim Stroz, PE, Design Engineer Date: 07/27/2021

Financial Project ID: 437938-1 New Const. ☐ RRR ☑
Federal Aid Number: N/A
Project Name: SR 19/S Central Avenue from Golden Gem Dr to south of Palmetto St
State Road Number: SR 19 Co. / Sec. / Sub.: Lake
Begin Project MP: 3.816 End Project MP: 5.044
Full Federal Oversight: No ☑ Yes ☐ Note: If Yes, submit to FHWA Director.

A justification and all supporting documents must be attached to this document.
Mark the appropriate certification:

"I, James Globig (Print Name of Initiator), ATCT Traffic Signal Supervisor (Position Title), of the Lake County (Name of Agency),
do hereby certify that in accordance with the requirements of 23 CFR 635.411(a)(2),
Mark appropriately:

☑ *that this patented or proprietary item is essential for synchronization with existing highway facilities*
☑ *that this patented or proprietary item is essential for ease of maintenance.*
☑ *that this patented or proprietary item is essential for reduced maintenance cost.*
☐ *that no equally suitable alternative exists for this patented or proprietary item."*

Signature, 7-27-2021 Date

For Department Use Only

"I, James S. Stroz, Jr. (Print Name), District Traffic Operations Engineer (Position Title),
of the Florida Department of Transportation, do hereby approve this certification request made in accordance with the requirements of 23 CFR 635.411(a)(2),
Mark appropriately:

☒ *that this patented or proprietary item is essential for synchronization with existing highway facilities.*
☒ *that this patented or proprietary item is essential for ease of maintenance.*
☒ *that this patented or proprietary item is essential for reduced maintenance cost.*
☐ *that no equally suitable alternative exists for this patented or proprietary item."*
Identify any conditions and limitations:

DocuSigned by: Signature, 7/29/2021 | 7:45 AM EDT Date

LAKE COUNTY, FL
REAL FLORIDA · REAL CLOSE

Public Works/Engineering/*Traffic Operations*
P.O. Box 7800 • 28127 CR 561• Tavares, FL 32778

July 26, 2021

Mr. Jim Stroz, PE
District Five District Traffic Operations Engineer (DTOE)
Florida Department of Transportation
719 South Woodland Boulevard
DeLand, FL 32720-6800

SUBJECT: Justification for Preferred Use of Proprietary Products for Traffic Signal and ITS Equipment for Lake County on SR 19 RRR Project (FPID: 437938-1)

Dear Mr. Stroz,

As part of the above referenced project, we are requesting approval of the attached, signed and completed Proprietary Product Certification (PPC) Form No. 630-020-07 for the following proprietary product for the Lake County Public Works – Transportation and Traffic Operations Division:

1. Cubic/Trafficware Wired Cabinet Assembly, TS-2 Size 6 model no. 70006-TS2/FL w/ ATC model controller (see below)
2. Cubic/Trafficware Commander ATC Shelf Mount Controller w/ Ethernet – NEMA TS-2, Type 2
3. Iteris Vantage Next (video vehicle detection system)
4. Hardened Networks model no. ITS-8012-24+ (v3) (managed field Ethernet switch)
5. MioVision Spectrum SmartLink (cellular modem)

This equipment is being requested for the replacement of existing and/or installation of new traffic signalization and Intelligent Transportation Systems (ITS) components along the SR 19 (Central Avenue) corridor in the City of Umatilla in Lake County, Florida. Approval of these proprietary products will allow consistency with existing equipment within the County providing synchronization and reducing cost by eliminating the need for additional training and stockpile inventory. Please find further justification for the use of these products on the following pages.

1. **Cubic/Trafficware Wired Cabinet Assembly, TS-2 Size 6 model no. 70006-TS2/FL w/ ATC model controller (see item no. 2)**
   Evidence for Synchronization:

P 352.253.6000 • F 352.253.9025

Board of County Commissioners • www.lakecountyfl.gov

Douglas B. Shields, District 1 | Sean M. Parks, *AICP, QEP*, District 2 | Kirby Smith, District 3 | Leslie Campione, District 4 | Josh Blake, District 5

Figure 7: Example Proprietary Products Certification (PPC) Form (left); Approval Request Letter (right)

In addition to identified proprietary products, the Engineer of Record shall coordinate with the appropriate local maintaining agency in advance of the design phase to request all necessary documents including available as-built drawing, signal timing plans (e.g., coordination plans, time of day plans, preemption and priority timings), standard operating plan (SOP), as well as request access to the cabinet assembly for field reviews.

It is important to note that coordination with the local maintaining agency is not a one-time activity. The local maintaining agency is to be considered a valued stakeholder for the project and should be kept abreast of the overall project progress, schedule, and design decisions, and should be included in the technical reviews for phase deliverables (e.g., Phase II).

Section 6 – Standard Design

The information provided within this Section shall be considered supplemental information to the design criteria listed within the *FDOT Central Office Design of Traffic Signal Detection Technologies, Informational Guide*.

6.1 Presence (Stop Bar) Detection / Turning Movement Count

Signal implementation will include stop bar detection for all lanes and all approaches within a signalized intersection, including left turn, right turn, and thru lanes, as well as any lanes with shared movements (e.g., right/thru). Within the *Smart Signal* architecture, stop bar detection will be used in two different functions, based on the operational configuration of the intersection: (1) generate calls to controller to actuate specific phasing, and (2) provide real-time lane-specific data to the Automated Traffic Signal Performance Measures (ATSPM) system. While stop bar detection zones for some lanes may be utilized for both functionalities (e.g., left turns), others may only be used to provide input for high-resolution data logging. In other words, some stop bar detection zones may not be related to signal operations.

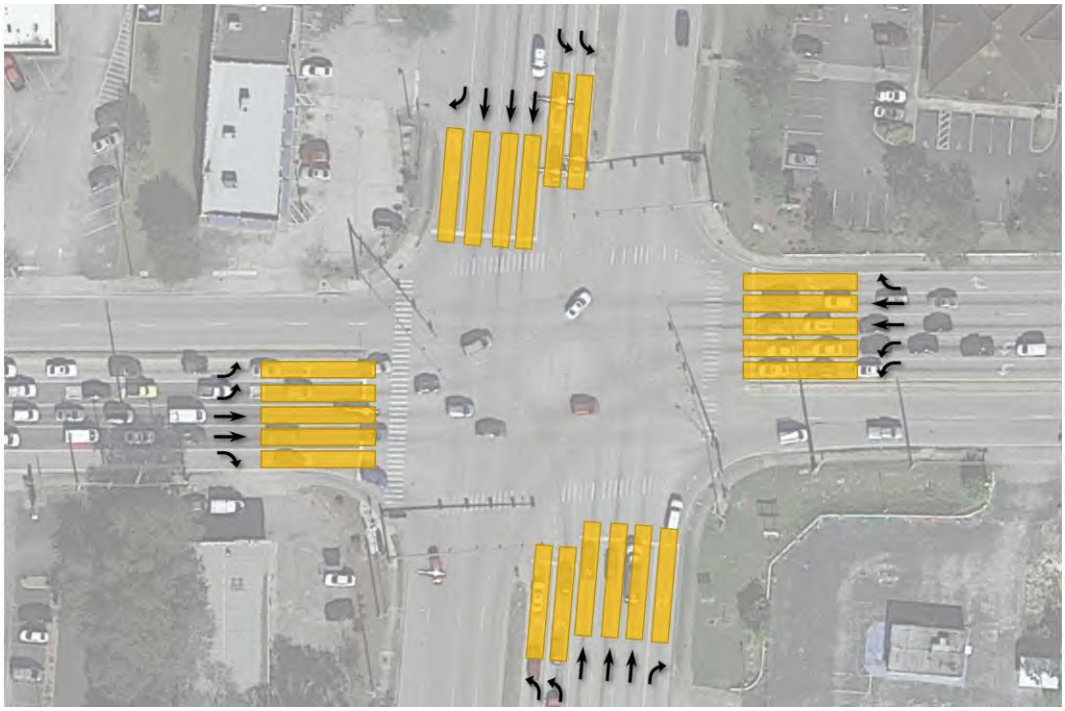


Figure 8: Example Smart Signal schema for stop bar detection provided for all lanes, all approaches

Traditionally, stop bar detection zones may only be provided for left turn lanes of both minor and major roadways (Phases 1, 3, 5, and 7), thru and right lanes for minor street approaches (Phases 4 and 8), and occasionally right turn lanes for major roadways where specific turn restrictions or overlaps exist. In order to improve the granularity of data and available performance metrics for operations, *Smart Signals* deployments will increase the stop bar detection to include all lanes and all approaches, including thru and right turn lanes for the major roadway (Phases 2 and 6).

Within the controller, all stop bar detection zones will be programmed as “presence” operation mode and provided a unique detector channel number. No stop bar detection zones may share detector channels. Each stop bar detection zone shall be reviewed to identify which channels will be programmed to generate calls for specific phases and which zones will be used for data collection only. Regardless of the function, all stop bar detection zones must be programmed into the controller. Coordinate with the local maintaining agency for any operational preferences or requirements.

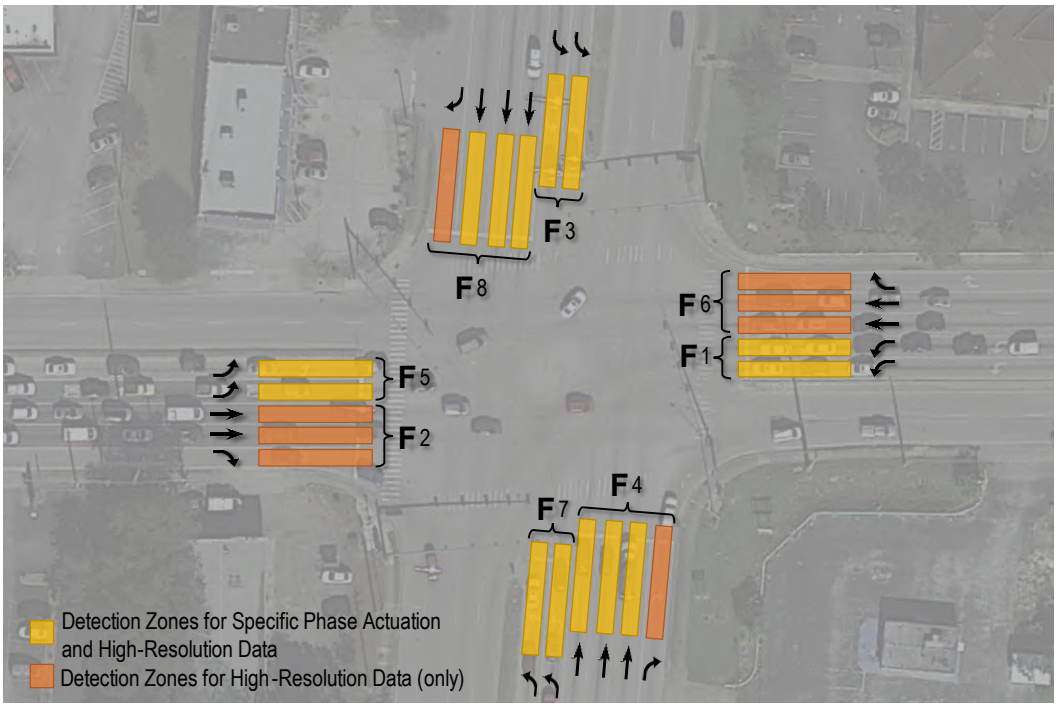


Figure 9: Example of stop bar detection zones and functionality

While the requirements for *Smart Signals* identify the data that is required for stop bar detection at signalized intersections, the standard is not intended to dictate how that information is obtained. Each local maintaining agency will likely have preferences for the specific type of technology to be utilized for stop bar detection–ranging from inductive loops, video (e.g., traditional, omni-directional, thermal), microwave radar, to hybrid technologies. One type of technology shall be utilized to provide stop bar detection for all approaches within an intersection; do not mix and match, unless otherwise approved by the Department. The Engineer of Record (EOR) will be responsible for coordinating specific technology preferences with the local maintaining agency. The EOR shall also identify any site-specific conditions that may negatively impact the performance of the proposed technology at that location. For example, coastal intersections experiencing significant salt spray may experience degraded detection over time when using video detection as the camera lens becomes cloudy; in this situation the appropriate technology may be microwave radar or inductive loops.

Supplementing stop bar detection, *Smart Signal* intersections must include a system capable of providing accurate turning movement count data for all lanes and all approaches. The system shall quantify vehicle movements—including left turn, right turn, and thru maneuvers—and provide this information in one-minute batches to the centralized server using network communication accessible through an Applicable Programming Interface (API). The system shall be capable of recording turning movement count data for all lanes, including shared-use lanes (e.g., thru-right). While systems capable of determining U-turn movements exist, this is not a requirement of the turning movement count system. Based on the preferences of the local maintaining agency the same system may be utilized to provide both stop bar detection and turning movement count data.

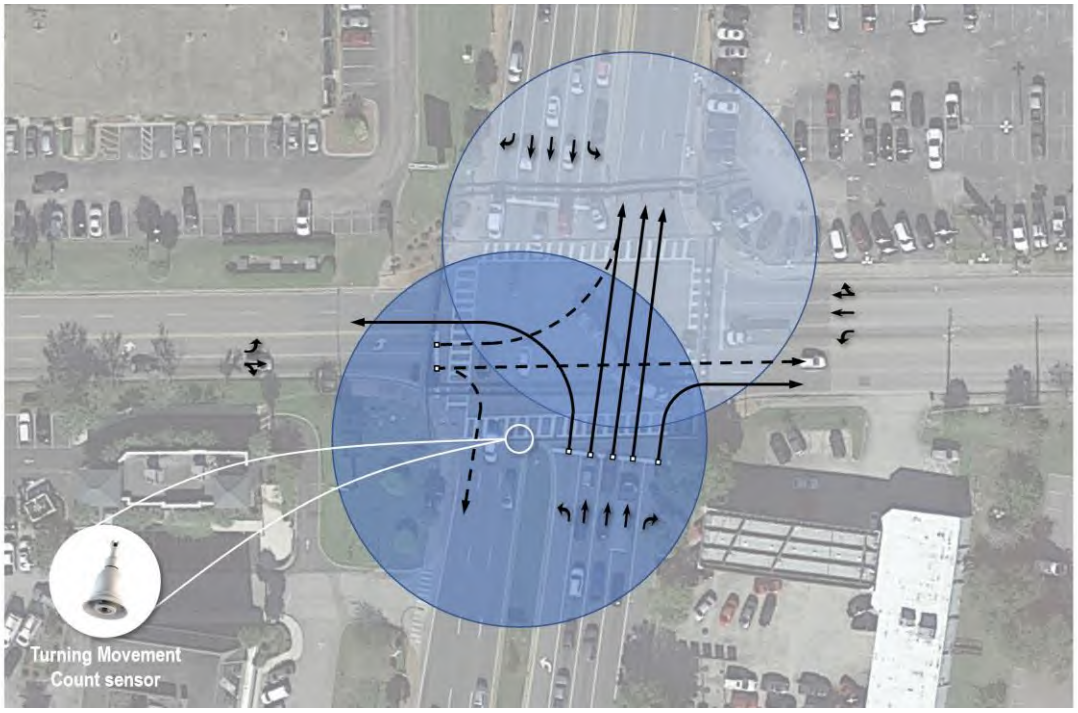


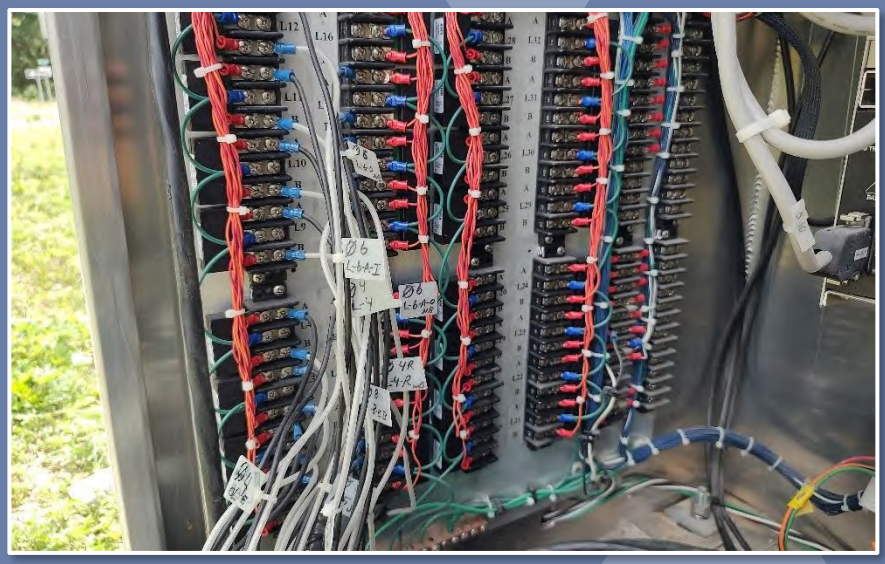
Figure 10: Example turning movement count system and detection area within signalized intersection

6.1.1 Inductive Loops

Provide inductive loop vehicle detection systems for signalized intersections where requested by the local maintaining agency to provide stop bar detection. The following provides generalized design guidance and considerations for the deployment of inductive loops:

- Design inductive loop systems in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232*, *FDOT Standard Plans for Road and Bridge Construction – Index 660-001*, and *FDOT Standard Specifications for Road and Bridge Construction – 600 Series*.
- Coordinate with the local maintaining agency to determine specific preferences for loop assemblies, including type (e.g., Type "A" vs. "F"), standard loop assembly length, and distance of leading edge either in advance of or behind the stop bar. In the event there are no local preferences, 40'-0" Type "F" loop assemblies installed with the leading edge 5'-0" in advance of the stop bar shall be considered default.
- Ensure standard 13" X 24" signalization pull boxes are provided on each intersection corner to facilitate splicing between loop lead-in wires and homerun cabling. Pull boxes shall be stamped with "FDOT Traffic Signal" and include only cabling carrying low-voltage signal. Each loop lead-in shall be uniquely spliced to a homerun cabling; do not splice multiple loops to a single homerun cable.
- Ensure underground cabling pathways are provided between loop assemblies and the controller cabinet using conduits dedicated to cabling carrying low-voltage signal.
- Ensure each homerun cable is connected to the termination block of a unique channel within the cabinet assembly detector panel. Homerun cables shall not be terminated to the same channel.
- Ensure the controller cabinet assembly includes sufficient channels to provide a unique channel for each detection zone, including detector racks, Bus Interface Units (BIU), and Synchronous Data Link Communications (SDLC) bus interfaces. Provide enough solid-state, rack mounted detector cards to ensure unique channels for all detection zones.

Type F inductive loops installed forty feet (40') in length with loop lead-in cuts. (**City of Maitland**)



Lead-in cables for Inductive loops terminated to individual channels in the detector panel of the controller cabinet assembly. (**Marion County**)

Standard detector rack with bus interface unit (BIU) and two-channel detector cards installed in controller cabinet assembly. (**Orange County**)

- Provide solid-state, rack mounted detector cards with time delay for each lane containing a right turn, including shared-use lanes (e.g., thru-right).

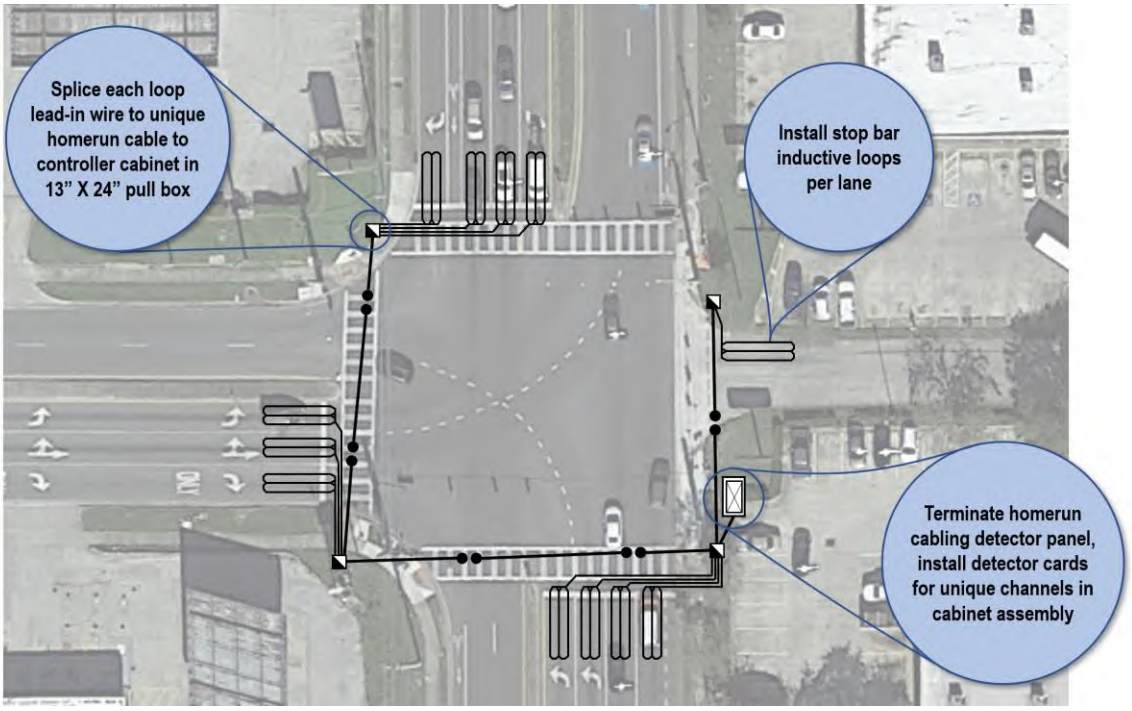


Figure 11: Example deployment of inductive loops for stop bar detection

The following pay items shall be utilized in the design and installation of inductive loop systems for stop bar detection:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **635-2-11** Pull & Splice Box, Furnish & Install, 13" X 24" Cover Size
- **660-1-ABB** Loop Detector Inductor, Furnish & Install, (Type)
- **660-2-ABB** Loop Assembly, Furnish & Install, (Type)

6.1.2 Video Vehicle Detection Systems

Provide video vehicle detection systems for signalized intersections where requested by the Local maintaining agency to provide stop bar detection. The following provides generalized design guidance and considerations for the deployment of standard (e.g., fixed lens) video detection systems:

- Design video vehicle detection systems in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232* and *FDOT Standard Specifications for Road and Bridge Construction – 600 Series*, as well as manufacturer installation guidelines and recommendations.
- Provide the appropriate number of camera sensors necessary to adequately establish detection zones for all lanes of an approach. Generally, the Horizontal Field of View (HFOV) for cameras is limited to a maximum lateral coverage of four (4) lanes within an approach. Signalized intersections with more than four (4) lanes to an approach shall include additional cameras necessary to provide all detection zones with one camera dedicated for left turn lanes and the other for thru and right turn movement lanes.
- Ensure cameras are positioned in the center of the proposed detection zones for an approach, where feasible. If the camera cannot be centered over the proposed detection zones, verify the field of view will not experience visual occlusions.

Video detection camera installed on cantilevered mounting arm for span wire intersection. (**Orange County**)

Mast arm structure with video detection camera on vertical riser mounting arm. (**City of Orlando**)

Image processing cards for video vehicle detection system installed in detector rack with bus interface unit (BIU) in controller cabinet assembly. (**Osceola County**)

- Typical camera mounting height for stop bar detection is 20'-25' above the pavement.
- For signalized intersections with mast arm structures, provide vertical riser arms to obtain the mounting height necessary for full field of view coverage. Mounting brackets will be rigidly attached to the mast arm. Ensure there is a minimum 1'-0" horizonal clearance from traffic signal heads, retroreflective backplates, overhead sign panels, and other obstructions that may impact the field of view. Do not install cameras closer than 2'-0" to the tip end of the mast arm to avoid significant "bouncing" that may negatively impact video streams.
- For signalized intersections with span wire configurations, determine if mounting assemblies that rigidly attached to the catenary and/or messenger wire are available and provide the necessary field of view coverage. Where mounting directly to the span wire structure is unavailable, mounting cameras to horizontal structures (e.g., luminaires, internally illuminated sign supports, cantilevered mounting brackets) attached to the upright supports may be acceptable. Provide a vertical riser arm to obtain the mounting height necessary and to clear all occlusion areas (e.g., large trucks in nearby lanes).

- Ensure cameras are installed providing a field of view of at least 100' behind stop bar pavement markings and at least 5'-10' in front of the stop bar for each lane to develop detection zones. It should be known, it is not a continuous detection zone from presence to advanced detection. The Vertical Field of View (VFOV) is directly proportional to the mounting height of camera sensors above the roadway. Generally, each foot above the road surface the camera is mounted provides ten feet of roadway viewing coverage.

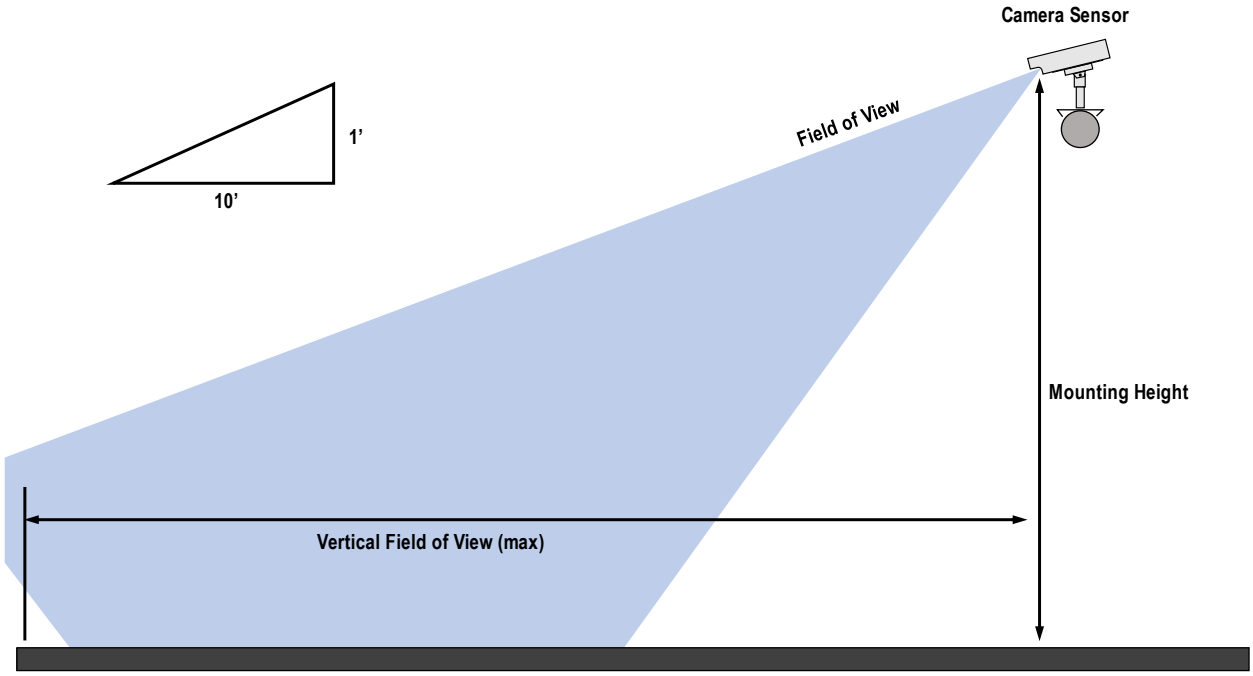
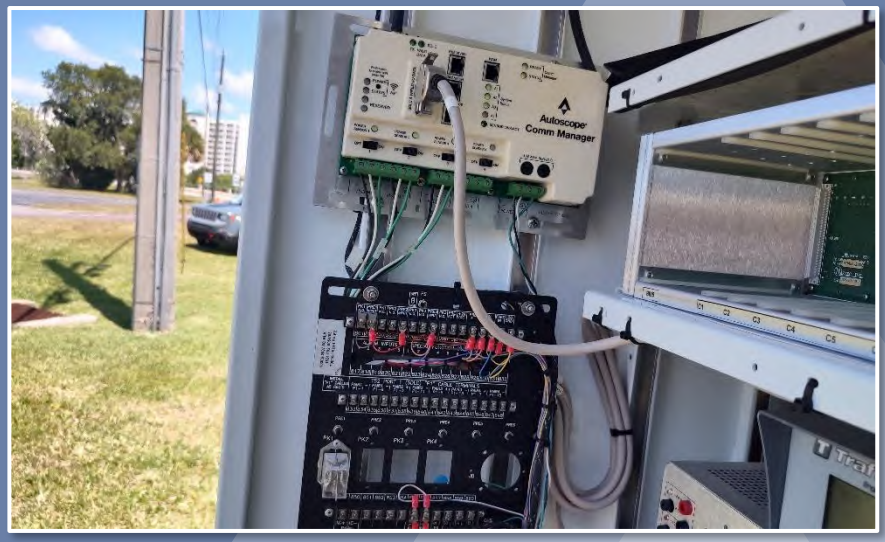


Figure 12: Video vehicle detection system Vertical Field of View (VFOV) proportionate to mounting height

- Ensure standard 13" X 24" signalization pull boxes are provided on each intersection corner where camera sensors are proposed to provide a cabling pathway and house cable slack. Pull boxes shall be stamped with "FDOT Traffic Signal" and include only cabling carrying low-voltage signal.
- Ensure underground cabling pathways are provided between camera assemblies and the controller cabinet using conduits dedicated to cabling carrying low-voltage signal.

Video detection cameras installed directly to the catenary wire of a span wire intersection. (**City of Orlando**)

Typical in-cabinet video detection array including in-line surge protection devices, circuit breakers, and power distribution assembly. (**City of Orlando**)



Proprietary in-cabinet equipment will vary from vendor to vendor providing an interface between the video detection sensors and controller. (**Brevard County**)

- Ensure the proposed camera cabling lengths do not exceed the maximum distances provided for the particular type of cable, including horizontal and vertical distances. If longer cabling lengths are required, provide the necessary media conversion (e.g., fiber optics) to achieve the required distance for communication signals.
    - Category 6 (Cat-6) Ethernet cable runs for Power-over-Ethernet (PoE) cameras shall not exceed 328' (100 m) in length (*IEEE 802.at*)
    - RG-59/U coaxial cabling runs for digital cameras shall not exceed 750' in length

  Verify the proposed cabling length will provide the minimum low-voltage power necessary for the device with consideration for voltage drop over the length. Where necessary, increase the wire gauge as needed.
- Ensure system in-cabinet equipment (e.g., video cards, processing unit) provides sufficient discrete detection channels to accommodate all proposed detection zones. Provide connection between the in-cabinet equipment and the Synchronous Data Link Communications (SDLC) bus within the cabinet assembly for data transfer to the controller.

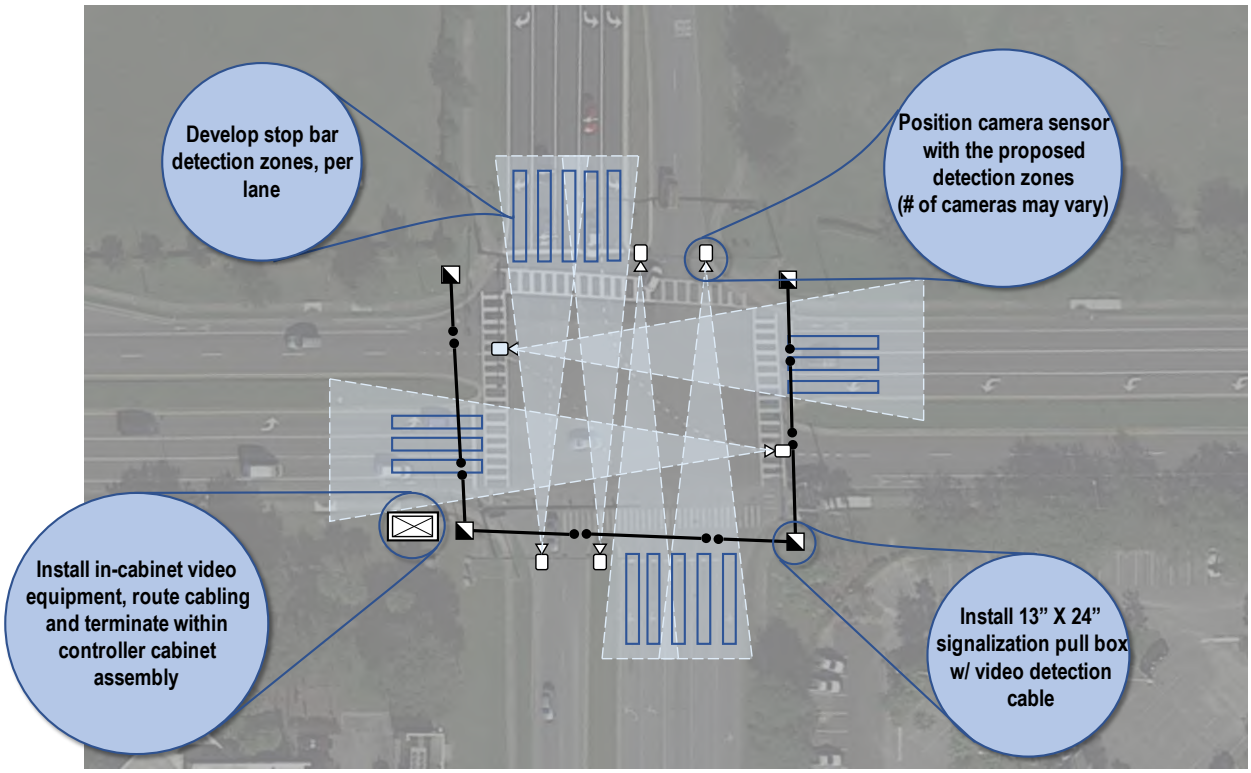


Figure 13: Example video vehicle detection system deployment for stop bar detection

It is recommended the Engineer or Record coordinates with the manufacturer of the video vehicle detection system to review proposed detection zones, sensor installation locations, in-cabinet equipment, and other site-specific considerations for design optimization.

The following pay items shall be utilized in the design and installation of video vehicle detection systems for stop bar detection:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **635-2-11** Pull & Splice Box, Furnish & Install, 13" X 24" Cover Size
- **660-4-11** Vehicle Detection System – Video, Furnish & Install, Cabinet Equipment
- **660-4-12** Vehicle Detection System – Video, Furnish & Install, Aboveground Equipment

Omni-directional camera sensor installed on cantilevered mounting arm for span wire intersection. (**City of Orlando**)

Candy cane vertical mounting arm for omni-directional camera affixed directly to concrete strain pole for a span wire intersection. (**City of Orlando**)

Mast arm structure with omni-directional camera sensor positioned towards the center of the signalized intersection. (**Seminole County**)

Specialty video vehicle detection systems, such as omni-directional lens cameras, are capable of performing dual functionality by providing stop bar detection to the controller from vehicle detection and turning movement count data from traffic detection to the centralized server. Based on the preferences of the local maintaining agency, this technology type can be utilized to provide one or both data streams within a *Smart Signal* implementation. The following provides generalized design guidance and considerations for the deployment of omni-directional video vehicle detection systems:

- Design omni-directional video vehicle detection systems in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232* and *FDOT Standard Specifications for Road and Bridge Construction – 600 Series*, as well as manufacturer installation guidelines and recommendations.
- Provide the appropriate number of camera sensors necessary to adequately establish detection zones for all lanes and all approaches. Generally, the maximum coverage area for omni-directional cameras includes a detection radius of 150' – 200'. Larger intersections may require two (2) cameras to achieve full coverage
- Ensure omni-directional cameras are installed at a height such that the coverage area completely includes the stop bar for the intended approaches. The detection radius is directly proportional to the mounting height above roadway. Generally, each foot above the road surface the camera is mounted provides seven feet of radial coverage.

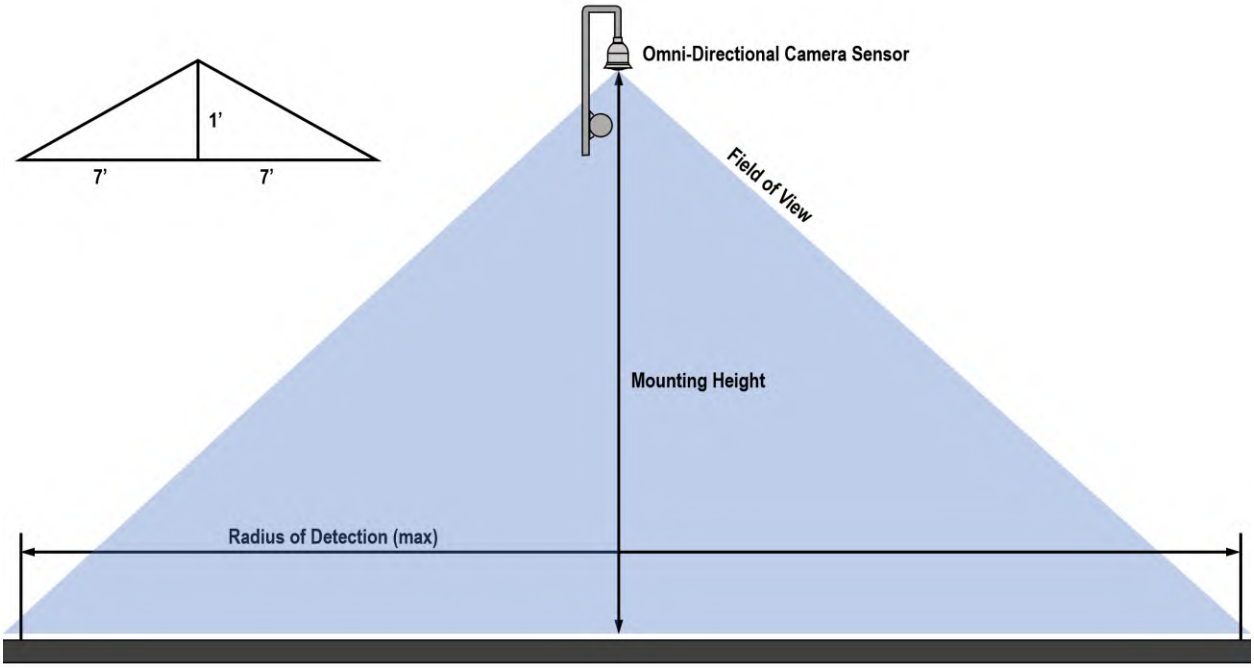
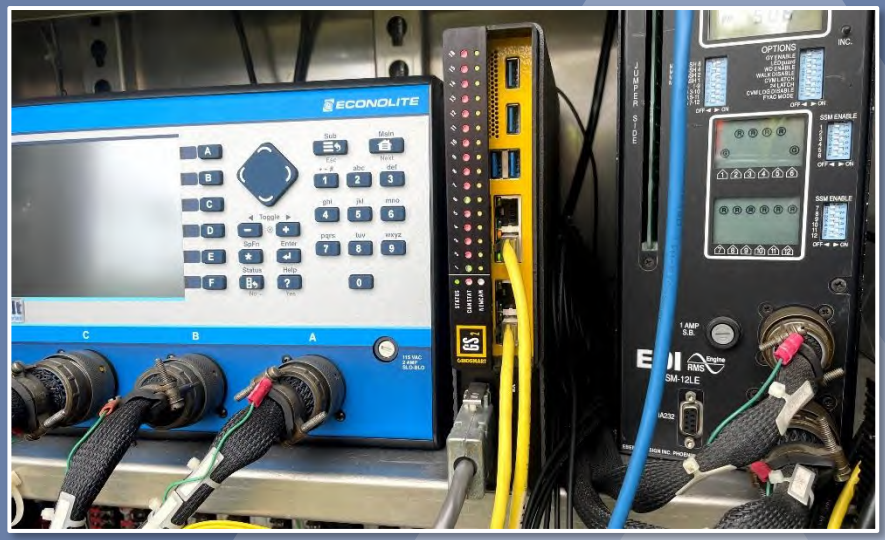


Figure 14: Omni-directional video detection system coverage radius proportionate to mounting height

- Ensure omni-directional cameras are installed ahead of stop bars for all approaches with detection zones and located as close to the center of the intersection as possible.
    - For signalized intersections with mast arm structures, provide vertical riser arms to obtain the mounting height necessary for full field of view coverage. Mounting brackets will be rigidly attached to the mast arm. Ensure there is a minimum 1'-0" horizonal clearance from traffic signal heads, retroreflective backplates, overhead sign panels, and other obstructions that may impact the field of view. Do not install cameras closer than 2'-0" to the tip end of the mast arm to avoid significant "bouncing" that may negatively impact video streams.

Larger intersections typically require two (2) omni-directional cameras to provide adequate coverage for all approaches. (**Seminole County**)

Best practice includes the installation of an in-line surge protection device to isolate omni-directional camera from the rest of the controller cabinet assembly. (**Volusia County**)



In-cabinet processing unit used to provide connection between omni-directional cameras and controller using SLDC bus connection.

- For signalized intersections with span wire configurations, cameras shall be mounted directly to the span wire support upright or to horizontal structures (e.g., luminaires, internally illuminated sign supports, cantilevered mounting brackets) attached to the upright supports. Provide a vertical riser arm to obtain the mounting height necessary and to clear all occlusion areas (e.g., large trucks in nearby lanes).

- Ensure standard 13" X 24" signalization pull boxes are provided on each intersection corner where camera sensors are proposed to provide a cabling pathway and house cable slack. Pull boxes shall be stamped with "FDOT Traffic Signal" and include only cabling carrying low-voltage signal.
- Ensure underground cabling pathways are provided between camera assemblies and the controller cabinet using conduits dedicated to cabling carrying low-voltage signal.
- Ensure the proposed camera cabling lengths do not exceed the maximum distances provided for the particular type of cable, including horizontal and vertical distances. If longer cabling lengths are required, provide the necessary media conversion (e.g., fiber optics) to achieve the required distance for communication signals.
  - Cat-6 Ethernet cable runs for PoE cameras shall not exceed 328' (100 m) in length (*IEEE 802.at*).

  Verify the proposed cabling length will provide the minimum low-voltage power necessary for the device with consideration for voltage drop over the length. Where necessary, increase the wire gauge as needed.
- Ensure system in-cabinet equipment (e.g., processing unit) provides sufficient discrete detection channels to accommodate all proposed detection zones if the system is being utilized for stop bar detection. Provide connection between the in-cabinet equipment and the SDLC bus within the cabinet assembly for data transfer to the controller. Provide an Ethernet-based connection (e.g., 10/100) between the in-cabinet equipment and the network communication equipment within the cabinet using a Cat-6 patch cable.

For lane-by-lane channel assignment schema, refer to **Subsection 6.6** for additional information.

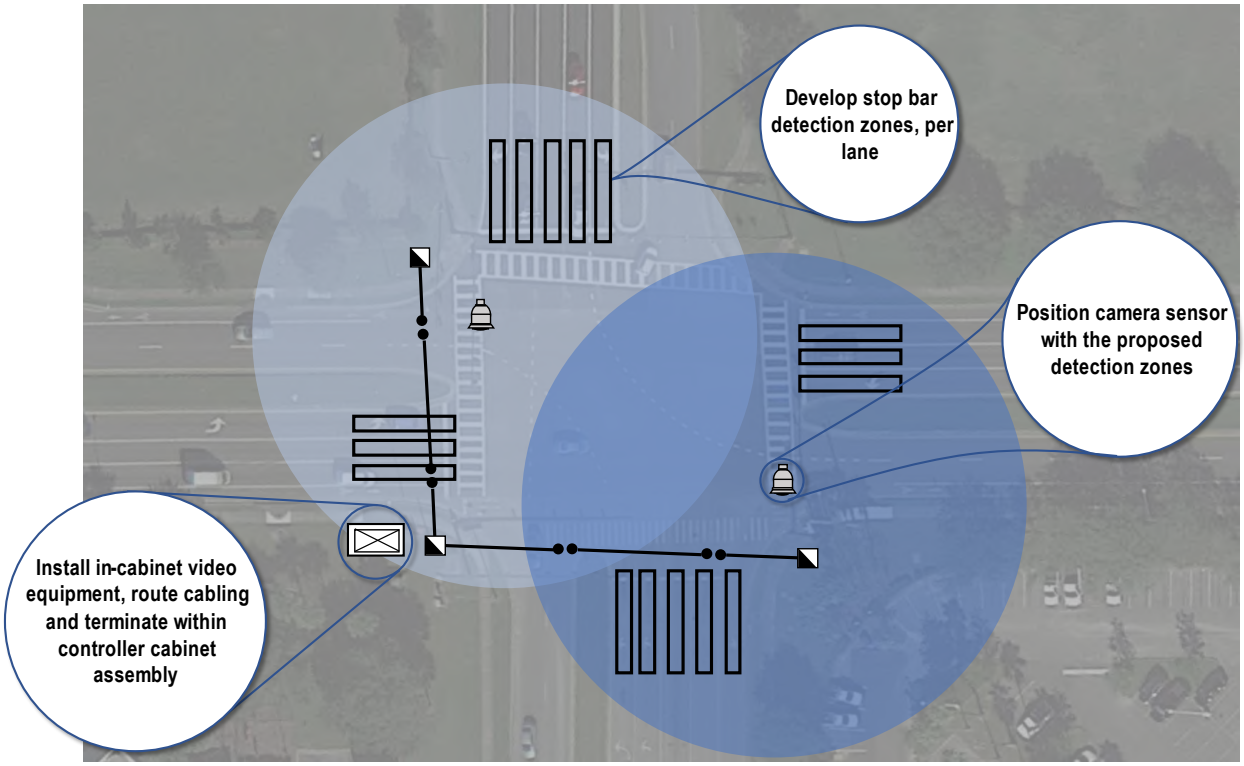


Figure 15: Example deployment of omni-directional cameras for stop bar and/or turning movement count data

Multiple microwave radar sensors installed on mast arm assemblies on the near side of the intersection for stop bar detection0. (**Volusia County**)

Span wire intersection with microwave radar sensors installed using mounting assembly attached to the catenary and messenger wires. (**Marion County**)

Multiple microwave radar sensors installed for span wire intersection stop bar detection. (**Lake County**)

It is recommended the Engineer or Record coordinates with the manufacturer of the omni-directional video vehicle detection system to review proposed detection zones, camera installation locations, in-cabinet equipment, and other site-specific considerations for design optimization.

The following pay items shall be utilized in the design and installation of omni-directional video vehicle detection systems for stop bar detection and/or turning movement counts:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **635-2-11** Pull & Splice Box, Furnish & Install, 13" X 24" Cover Size
- **660-4-11** Vehicle Detection System – Video, Furnish & Install, Cabinet Equipment ***OR***
- **660-9-11** Traffic Detection System – Video, Furnish & Install, Cabinet Equipment
- **660-4-12** Vehicle Detection System – Video, Furnish & Install, Aboveground Equipment ***OR***
- **660-9-12** Traffic Detection System – Video, Furnish & Install, Aboveground Equipment

The following pay items notes shall be included, as necessary:

- **660-4-11 *OR* 660-9-11:** Shall include all work necessary to furnish, install, and configure in-cabinet equipment to provide a completely functional camera system.
- **660-4-12 *OR* 660-9-12:** Shall include all work necessary to furnish and install cameras, mounting arms, brackets, wiring, hardware, and all ancillary components, as well as al data and power cabling required for a complete deployment.

6.1.3 Microwave Vehicle Detection Systems

Provide microwave vehicle detection systems for signalized intersections where requested by the local maintaining agency to provide stop bar detection. The following provides generalized design guidance and considerations for the deployment of microwave radar detection systems:

- Design microwave vehicle detection systems in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232* and *FDOT Standard Specifications for Road and Bridge Construction – 600 Series*, as well as manufacturer installation guidelines and recommendations.
- Provide the appropriate number of radar sensors necessary to adequately establish detection zones for all lanes of an approach. Microwave sensors vary significantly in the parameters for coverage ranges provided for stop bar detection. Refer to manufacturer documentation (e.g., data product sheets, installation guidelines) to determine the exact detection zone—including horizontal spread, vertical angle, minimum distance to object, and maximum detection distance—of each product.
- Ensure sensors are positioned such that the minimum mounting height is provided with clear line of sight and no areas of occlusion. Typical sensor mounting height for stop bar detection is 20' above the pavement. Dependent upon the specific proposed system, sensors may be located on either the near or far side of the intersection from the proposed detection zone(s). Refer to manufacturer documentation for additional information, such as recommended offset of the sensor from the edge of the first lane to be detected.
    - For signalized intersections with mast arm structures, sensors mounting brackets will be rigidly attached to the mast arm. Ensure there is a minimum 1'-0" horizonal clearance from traffic signal heads, retroreflective backplates, overhead sign panels, and other obstructions that may impact the field of view.
    - For signalized intersections with span wire configurations, determine if mounting assemblies that rigidly attached to the catenary and/or messenger wire are available and provide the necessary field of view coverage. Where mounting directly to the span wire structure is unavailable, mount sensors

Example in-cabinet processor with capacity for six (6) unique microwave vehicle detection system sensors with SDLC bus connection. (**Lake County**)

Typical in-cabinet processors for microwave sensors include embedded surge protection devices to eliminate the need for external equipment, verify with each vendor. (**Orange County**)

Two (2) microwave radar sensors installed directly to the concrete strain pole. (**Orange County**)

    - to horizontal structures (e.g., luminaires, internally illuminated sign supports, cantilevered mounting brackets) attached to the upright supports or directly to the upright support structures.
- Ensure standard 13" X 24" signalization pull boxes are provided on each intersection corner where radar sensors are proposed to provide a cabling pathway and house cable slack. Pull boxes shall be stamped with "FDOT Traffic Signal" and include only cabling carrying low-voltage signal.
- Ensure underground cabling pathways are provided between sensors and the controller cabinet using conduits dedicated to cabling carrying low-voltage signal.
- Ensure the proposed sensor cabling lengths do not exceed the maximum distances provided for the particular type of cable, including horizontal and vertical distances. If longer cabling lengths are required, provide the necessary media conversion (e.g., fiber optics) to achieve the required distance for communication signals.
    - RS-485 serial cable runs for sensors shall not exceed 1400' in length, dependent upon the selected baud rate.

  Verify the proposed cabling length will provide the minimum low-voltage power necessary for the device with consideration for voltage drop over the length. Where necessary, increase the wire gauge as needed.
- Ensure system in-cabinet equipment (e.g., processing unit, detector cards) provides sufficient discrete detection channels to accommodate all proposed detection zones if the system is being utilized for stop bar detection. Provide connection between the in-cabinet equipment and the Synchronous Data Link Communications (SDLC) bus within the cabinet assembly for data transfer to the controller.

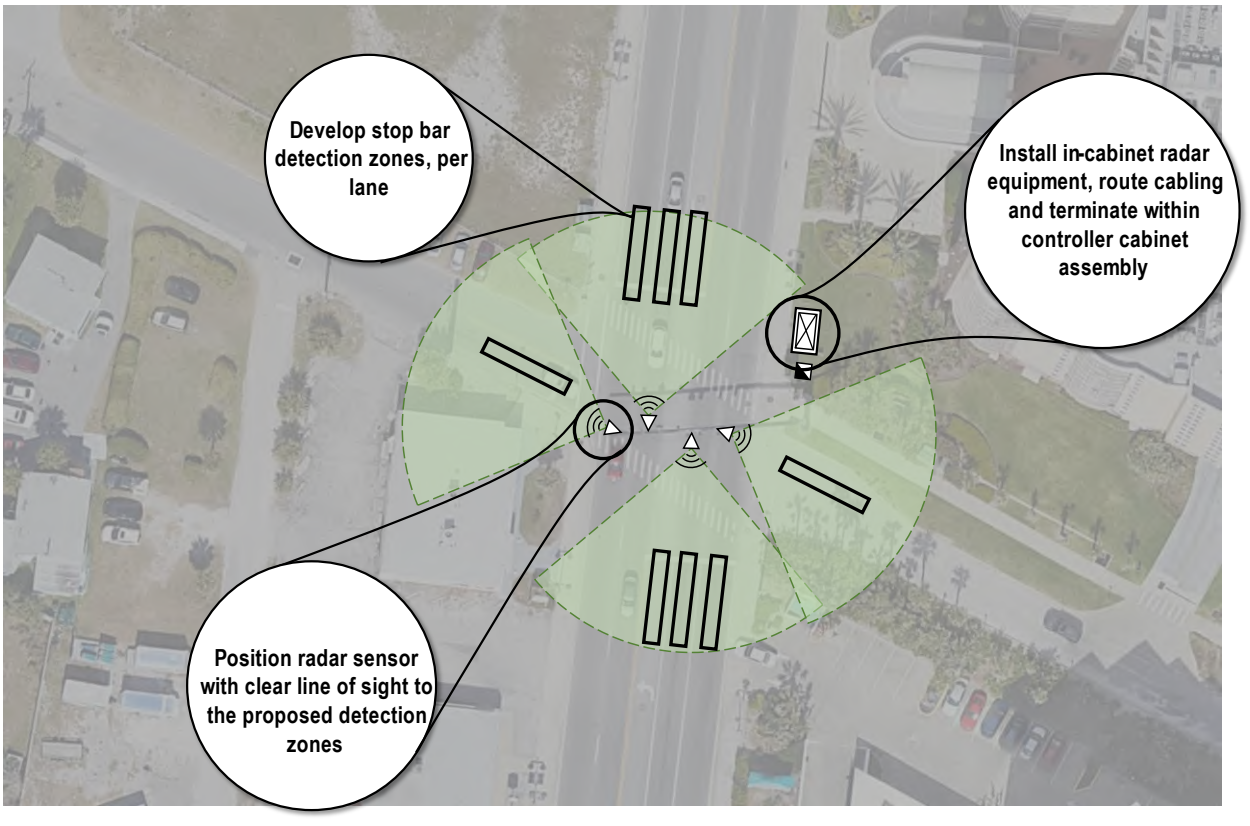
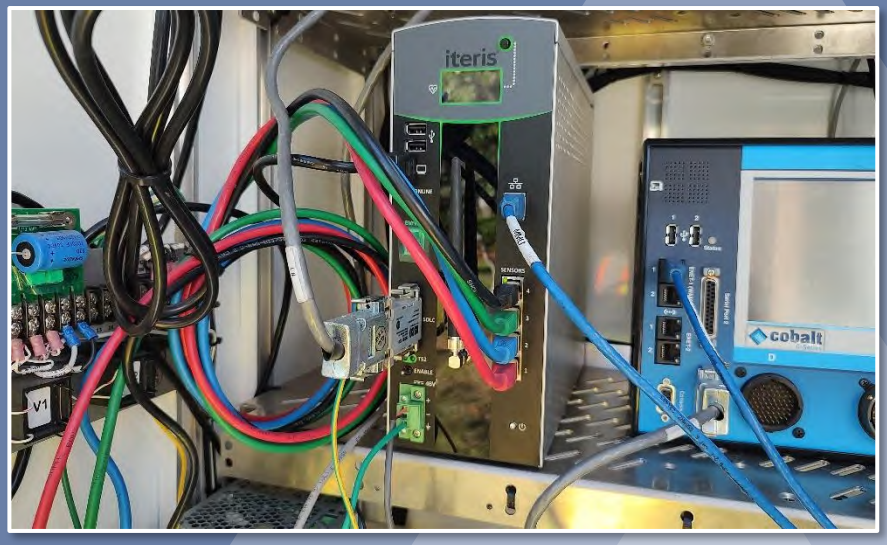


Figure 16: Example microwave radar vehicle detection system for stop bar detection

It is recommended the Engineer or Record coordinates with the manufacturer of the microwave vehicle detection system to review proposed detection zones, sensor installation locations, in-cabinet equipment, and other site-specific considerations for design optimization.

Hybrid video-radar unit installed on cantilevered mounting arm attached to the concrete strain pole at a span wire intersection. (**Lake County**)

Centered over the approach, hybrid video-radar unit installed on mast arm structure. (**Orange County**)



In-cabinet processing unit for hybrid video-radar unit with connection to SDLC bus. (**Osceola County**)

The following pay items shall be utilized in the design and installation of microwave vehicle detection systems for stop bar detection:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **635-2-11** Pull & Splice Box, Furnish & Install, 13" X 24" Cover Size
- **660-3-11** Vehicle Detection System – Microwave, Furnish & Install, Cabinet Equipment
- **660-3-12** Vehicle Detection System – Microwave, Furnish & Install, Aboveground Equipment

6.1.4 Hybrid Systems (Video/Radar)

Provide hybrid systems (Video/Radar) for signalized intersections where requested by the Local maintaining agency to provide both stop bar detection and advance detection. The following provides generalized design guidance and considerations for the deployment of hybrid systems (Video/Radar):

- Design hybrid systems (Video/Radar) in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232* and *FDOT Standard Specifications for Road and Bridge Construction – 600 Series*, as well as manufacturer installation guidelines and recommendations.
- Ensure hybrid systems (Video/Radar) are installed ahead of stop bars for all approaches with detection zones and located as close to the center of the intersection as possible.
    - For signalized intersections with mast arm structures, provide vertical riser arms to obtain the mounting height necessary for full field of view coverage. Mounting brackets will be rigidly attached to the mast arm. Ensure there is a minimum 1'-0" horizonal clearance from traffic signal heads, retroreflective backplates, overhead sign panels, and other obstructions that may impact the field of view. Do not install cameras closer than 2'-0" to the tip end of the mast arm to avoid significant "bouncing" that may negatively impact video streams.
    - For signalized intersections with span wire configurations, cameras shall be mounted directly to the span wire support upright or to horizontal structures (e.g., luminaires, internally illuminated sign supports, cantilevered mounting brackets) attached to the upright supports. Provide a vertical riser arm to obtain the mounting height necessary and to clear all occlusion areas (e.g., large trucks in nearby lanes).
- Ensure standard 13" X 24" signalization pull boxes are provided on each intersection corner where hybrid sensors are proposed to provide a cabling pathway and house cable slack. Pull boxes shall be stamped with "FDOT Traffic Signal" and include only cabling carrying low-voltage signal.
- Ensure underground cabling pathways are provided between the hybrid sensor assemblies and the controller cabinet using conduits dedicated to cabling carrying low-voltage signal.
- Ensure the proposed camera cabling lengths do not exceed the maximum distances provided for the particular type of cable, including horizontal and vertical distances. If longer cabling lengths are required, provide the necessary media conversion (e.g., fiber optics) to achieve the required distance for communication signals.
    - Cat5e Ethernet cable runs for PoE cameras shall not exceed 328' (100 m) in length (*IEEE 802.at*).

  Verify the proposed cabling length will provide the minimum low-voltage power necessary for the device with consideration for voltage drop over the length. Where necessary, increase the wire gauge as needed.
- Ensure system in-cabinet equipment (e.g., processing unit) provides sufficient discrete detection channels to accommodate all proposed detection zones if the system is being utilized for stop bar detection. Provide connection between the in-cabinet equipment and the SDLC bus within the cabinet assembly for data transfer to the controller. Provide an Ethernet-based connection (e.g., 10/100) between the in-cabinet equipment and the network communication equipment within the cabinet using a Cat5e and RJ-45 cable.

Hybrid radar-video unit installed on mast arm on the far-side of signalized intersection approach. (**Osceola County**)

In-cabinet equipment array for hybrid radar-video unit inclusive of in-line surge protection devices and power distribution. (**Osceola County**).

Hybrid video-radar sensors provide the ability to capture both stop bar and advanced detection zones for a single approach simultaneously. (**City of Orlando**)

It is recommended the Engineer or Record coordinates with the manufacturer of the microwave vehicle detection system to review proposed detection zones, sensor installation locations, in-cabinet equipment, and other site-specific considerations for design optimization.

The following pay items shall be utilized in the design and installation of hybrid systems (Video/Radar) for stop bar and advanced detection:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **635-2-11** Pull & Splice Box, Furnish & Install, 13" X 24" Cover Size
- **660-4-11** Vehicle Detection System – Video, Furnish & Install, Cabinet Equipment ***OR***
- **660-9-11** Traffic Detection System – Video, Furnish & Install, Cabinet Equipment
- **660-4-12** Vehicle Detection System – Video, Furnish & Install, Aboveground Equipment ***OR***
- **660-9-12** Traffic Detection System – Video, Furnish & Install, Aboveground Equipment

6.2 Advanced Detection

In addition to stop bar detection, *Smart Signal* implementations will include advanced detection zones for all lanes and all approaches of a signalized intersection. Advanced detection zones will be utilized to provide real-time, lane-by-lane data to the various systems for each approach lane. Providing a minimum of two points of detection in each lane (e.g., one stop bar, one advanced) enables enhanced performance metrics for the monitoring and management of current and historical traffic conditions. Beyond providing just data, advanced detection zones may be utilized in the operations of an intersection based on the preferences of the local maintaining agency and the specific needs of a location. In total, there are three (3) categories of advanced detection zones to be provided within *Smart Signal* intersections, each with specific functionality and applications: extended call, queue discharge, and data only.

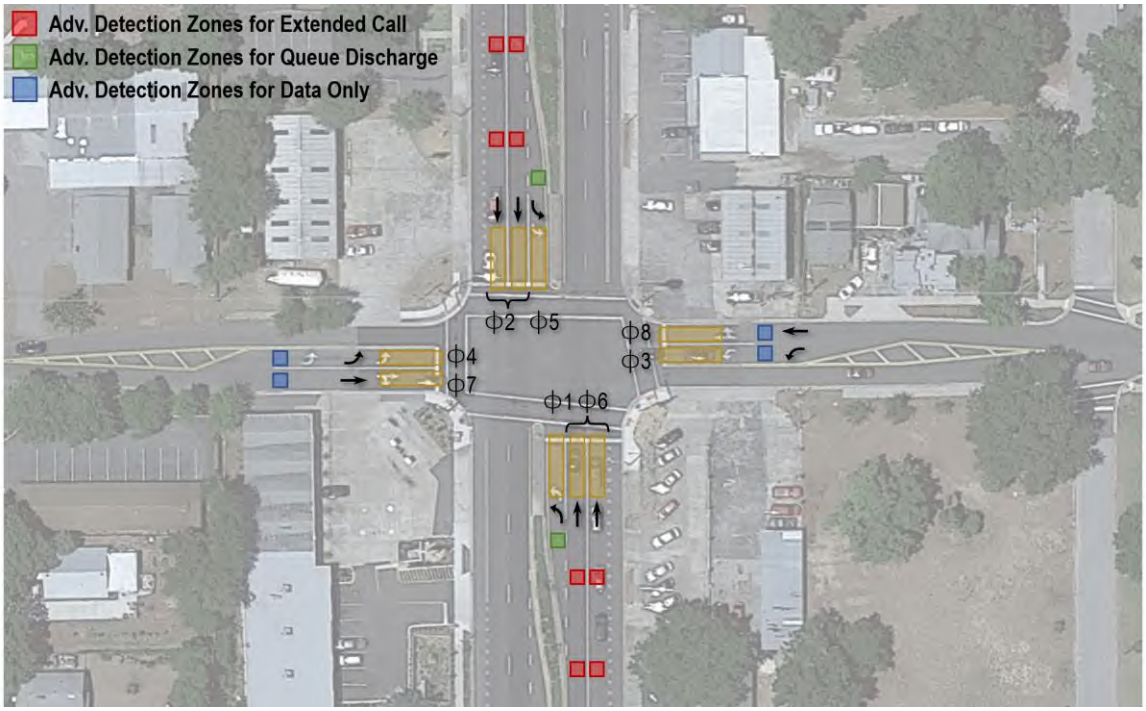


Figure 17: Example intersection with various functionality for advanced detection zones

Extended Call

Extended call utilizes advanced detection zones to generate calls to the controller requesting additional time for the existing green phase. While typically employed for thru movements on major roadways, extended call may be implemented for turning movements and thru movements on minor streets, where appropriate. This function provides safe phase termination of high-speed intersection approaches to avoid dangerous scenarios for either hard braking or rapid acceleration during the yellow change interval, known as the dilemma zone. Within the cabinet assembly, each advanced detection zone utilized for time extension will be configured for "pulse" operations and programmed to the associated phase in the controller as extension.

Extension calls can be achieved by either single point or multi-point advance detection zones, based on the preferences of the local maintaining agency or the unique needs of the intersection. The objective for time extension is to ensure vehicles approaching the intersection are provided enough time to either reach the next detector or intersection limits safely. The quantity, location, and spacing of advanced detection zones is proportional to the approach speed and may vary dependent upon the preferences of the Local maintaining agency. In the event there are no local preferences, the following guidance shall be utilized for extended time detection placement.

Table 3: Dilemma Zone Detection Chart

Posted Speed (MPH)	Distance from Stop Bar to First Zone (D_1)	Distance from Stop Bar to Second Zone (D_2)	Extension (T_1) (seconds)
40	106'	244'	1.9 s
45	132'	298'	2.0 s
50	160'	356'	2.2 s
55	189'	419'	2.4 s
60	223'	488'	2.6 s
65	258'	561'	2.8 s

Refer to the *FHWA Traffic Detector Handbook* for additional design guidance related to the deployment of extended call advanced detection zones.

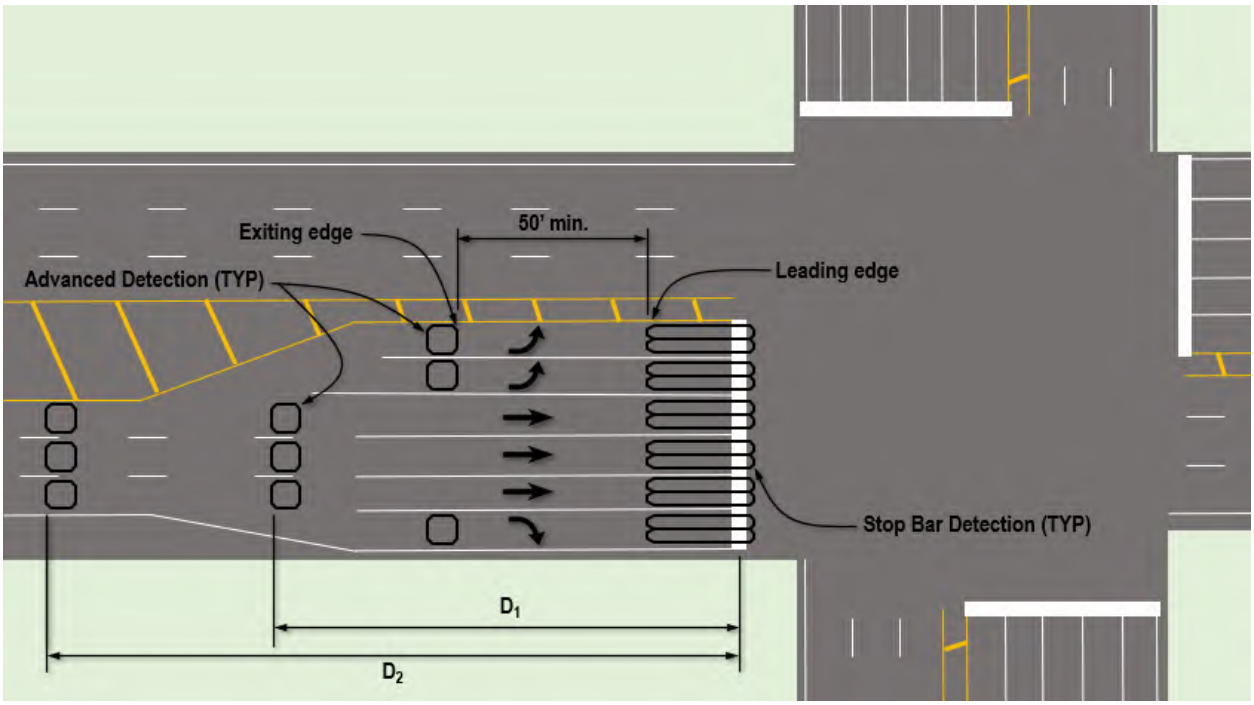


Figure 18: Example loop assemblies in-lane placements and spacing

Queue Discharge

Advanced detection may be utilized to provide queue discharge functionality where signalized intersections experience significant queues resulting in spillback volume from one lane to another. Typically located at the end of left or right turn lane storage bays, advance detection zones for queue discharge will be configured as "presence" operation and generate priority detection calls to the controller. The low-priority detection call will initiate the controller transition to the appropriate phase necessary to clear the developed queue.

The application of queue discharge detection shall be implemented at signalized intersections where a history of significant queues exists. Coordinate with the Local maintaining agency to determine appropriate locations for queue discharge.

Data Only

Advanced detection zones are required for all approach lanes within the signalized intersection. Where advanced detection zones are not necessary to modify the operation of the signalized intersection, zones will be programmed into the controller as "pulse" operation and serve only to provide input to the high-resolution data logger.

Unlike extended call or queue discharge applications, data only advanced detection zones are not tied to approach speed, specific locations within the intersection, or minimum spacing requirements. Each zone is required to be installed behind the established stop bar detection zone for that particular lane and provided the minimum spacing necessary to differentiate the two zones.

6.2.1 Inductive Loop

Provide inductive loop vehicle detection systems for signalized intersections where requested by the local maintaining agency to provide advanced detection. The following provides generalized design guidance and considerations for the deployment of inductive loops:

- Design inductive loop systems in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232*, *FDOT Standard Plans for Road and Bridge Construction – Index 660-001*, *FDOT Standard Specifications for Road and Bridge Construction – 600 Series*, and *FHWA Traffic Detector Handbook*.
- Provide 6'-0" X 6'-0" Type "B" loop assemblies for advanced detection in each lane at locations identified for each application below:
    - Extended Call – Coordinate with the local maintaining agency to identify preferences for advanced detection, including single point versus multi-point detection, specific lane placement, and spacing of loop assemblies based on approach speed.
    - Queue Discharge – Install one (1) loop assembly in each lane experiencing significant queues causing spillback into adjacent lanes. Position each loop assembly at the beginning of the storage bay or at the point where queued vehicles impede other lanes. Ensure the entire loop is positioned within the specified lane and will not receive false calls from vehicles entering into other lanes.
    - Data Only – Loops providing only high-resolution data to the controller are not tied to the operation of the intersection and therefore are more flexible in the available placement locations within lanes. Install one (1) loop assembly in each lane of the approach. Ensure a minimum of 50' edge-to-edge spacing is provided between the leading edge of the stop bar loop and the exiting edge of the advanced detection loop. For minor street approaches for small roadways where providing the minimum spacing is not possible, provide a minimum of 25' edge-to-edge spacing between stop bar and advanced detection loops
- Ensure standard 13" X 24" signalization pull boxes are provided adjacent to each set of advanced detection loop assemblies to facilitate splicing between loop lead-in wires and homerun cabling. Pull boxes shall be stamped with "FDOT Traffic Signal" and include only cabling carrying low-voltage signal. Each loop lead-in shall be uniquely spliced to a homerun cabling; do not splice multiple loops to a single homerun cable.
- Ensure underground cabling pathways are provided between loop assemblies and the controller cabinet using conduits dedicated to cabling carrying low-voltage signal.
- Ensure each homerun cable is connected to the termination block of a unique channel within the cabinet assembly detector panel. Homerun cables shall not be terminated to the same channel.
- Ensure the controller cabinet assembly includes sufficient channels to provide a unique channel for each detection zone, including detector racks, BIU, and Synchronous Data Link Communications (SDLC) bus interfaces. Provide enough solid-state, rack mounted detector cards to ensure unique channels for all detection zones.

Type B inductive loops provided for advanced detection in the left turn and thru movement lanes. (**Marion County**)

Loop lead-in wires for advanced detection cut in asphalt pavement surface to homerun pull box. (**Marion County**)

Electrical splices for loop lead-in wire and homerun cabling installed in pull box each spliced to an individual circuit. (**City of Orlando**)

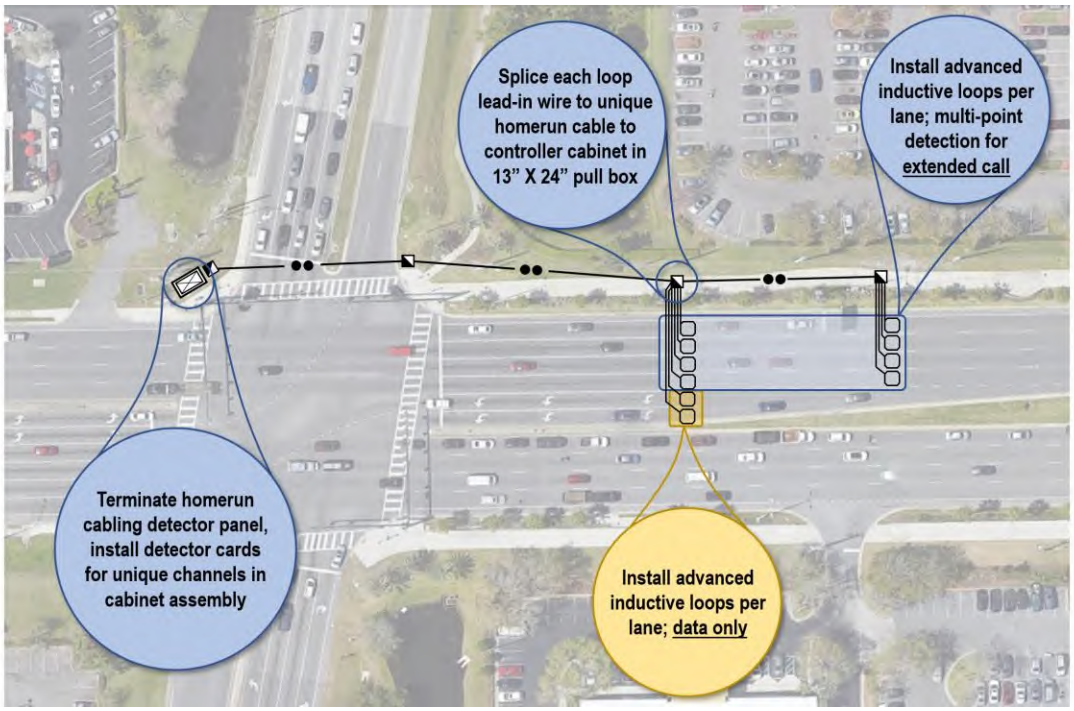


Figure 19: Example deployment of inductive loops for advance detection extended time and data only functions

The following pay items shall be utilized in the design and installation of inductive loop systems for advanced detection:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **635-2-11** Pull & Splice Box, Furnish & Install, 13" X 24" Cover Size
- **660-1-ABB** Loop Detector Inductor, Furnish & Install, (Type)
- **660-2-102** Loop Assembly, Furnish & Install, Type B

6.2.2 Video Vehicle Detection Systems

Provide video vehicle detection systems for signalized intersections where requested by the local maintaining agency to provide advanced detection. The following provides generalized design guidance and considerations for the deployment of standard (e.g., fixed lens) video detection systems. Note, video vehicle detection systems may provide limited maximum viewing distances not suitable for some advanced detection applications requiring zones further from the intersection (e.g., multi-point detection for extended call). Ensure the proposed video detection system can provide the necessary detection zones without requiring additional infrastructure (e.g., supplement poles).

- Design video vehicle detection systems in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232* and *FDOT Standard Specifications for Road and Bridge Construction – 600 Series*, as well as manufacturer installation guidelines and recommendations.
- Provide the appropriate number of camera sensors necessary to adequately establish detection zones for all lanes of an approach for advanced detection. Generally, the HFOV for cameras is limited to a maximum lateral coverage of four (4) lanes within an approach. Signalized intersections with more than four (4) lanes to an approach shall include additional cameras necessary to provide all detection zones with one camera dedicated for left turn lanes and the other for thru and right turn movement lanes.

Vertical riser mounting arm installed to provide greater elevation of video detection camera above the roadway surface for advanced detection zones. (**City of Orlando**)

Video detection camera mounted on luminaire support arm for increased elevation above the road surface in a span wire intersection. (**City of Orlando**)

LCD color monitor installed in controller cabinet assembly displaying active vehicle calls for advanced detection zones. (**Orange County**)

- Ensure cameras are positioned in the center of the proposed detection zones for an approach, where feasible. If the camera cannot be centered over the proposed detection zones, verify the field of view will not experience visual occlusions.
    - For signalized intersections with mast arm structures, provide vertical riser arms to obtain the mounting height necessary for full field of view coverage. Mounting brackets will be rigidly attached to the mast arm. Ensure there is a minimum 1'-0" horizonal clearance from traffic signal heads, retroreflective backplates, overhead sign panels, and other obstructions that may impact the field of view. Do not install cameras closer than 2'-0" to the tip end of the mast arm to avoid significant "bouncing" that may negatively impact video streams.
    - For signalized intersections with span wire configurations, determine if mounting assemblies that rigidly attached to the catenary and/or messenger wire are available and provide the necessary field of view coverage. Where mounting directly to the span wire structure is unavailable, mounting cameras to horizontal structures (e.g., luminaires, internally illuminated sign supports, cantilevered mounting brackets) attached to the upright supports may be acceptable. Provide a vertical riser arm to obtain the mounting height necessary and to clear all occlusion areas (e.g., large trucks in nearby lanes).
- Ensure cameras are installed providing a field of view of providing adequate coverage for each lane to develop advanced detection zones. The VFOV is directly proportional to the mounting height of camera sensors above the roadway. Generally, each foot above the road surface the camera is mounted provides ten feet of roadway viewing coverage.
- Ensure standard 13" X 24" signalization pull boxes are provided on each intersection corner where camera sensors are proposed to provide a cabling pathway and house cable slack. Pull boxes shall be stamped with "FDOT Traffic Signal" and include only cabling carrying low-voltage signal.
- Ensure underground cabling pathways are provided between camera assemblies and the controller cabinet using conduits dedicated to cabling carrying low-voltage signal.
- Ensure the proposed camera cabling lengths do not exceed the maximum distances provided for the particular type of cable, including horizontal and vertical distances. If longer cabling lengths are required, provide the necessary media conversion (e.g., fiber optics) to achieve the required distance for communication signals.
    - Cat-6 Ethernet cable runs for Power-over-Ethernet (PoE) cameras shall not exceed 328' (100 m) in length (*IEEE 802.at*)
    - RG-59/U coaxial cabling runs for digital cameras shall not exceed 750' in length

  Verify the proposed cabling length will provide the minimum low-voltage power necessary for the device with consideration for voltage drop over the length. Where necessary, increase the wire gauge as needed.
- Ensure system in-cabinet equipment (e.g., video cards, processing unit) provides sufficient discrete detection channels to accommodate all proposed detection zones. Provide connection between the in-cabinet equipment and the Synchronous Data Link Communications (SDLC) bus within the cabinet assembly for data transfer to the controller.

It is recommended the Engineer or Record coordinates with the manufacturer of the video vehicle detection system to review proposed detection zones, sensor installation locations, in-cabinet equipment, and other site-specific considerations for design optimization.

The following pay items shall be utilized in the design and installation of video vehicle detection systems for stop bar detection:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **635-2-11** Pull & Splice Box, Furnish & Install, 13" X 24" Cover Size
- **660-4-11** Vehicle Detection System – Video, Furnish & Install, Cabinet Equipment
- **660-4-12** Vehicle Detection System – Video, Furnish & Install, Aboveground Equipment

6.2.3 Microwave Vehicle Detection Systems

Provide microwave vehicle detection systems for signalized intersections where requested by the Local maintaining agency to provide advanced detection. The following provides generalized design guidance and considerations for the deployment of microwave radar detection systems:

- Design microwave vehicle detection systems in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232* and *FDOT Standard Specifications for Road and Bridge Construction – 600 Series*, as well as manufacturer installation guidelines and recommendations.
- Provide the appropriate number of radar sensors necessary to adequately establish detection zones for all lanes of an approach. Microwave sensors vary significantly in the parameters for coverage ranges provided for advanced detection. Refer to manufacturer documentation (e.g., data product sheets, installation guidelines) to determine the exact detection zone—including horizontal spread, vertical angle, minimum distance to object, and maximum detection distance—of each product.
- Ensure sensors are positioned such that the minimum mounting height is provided with clear line of sight and no areas of occlusion. Dependent upon the specific proposed system, sensors may be located on either the near or far side of the intersection from the proposed detection zone(s). Refer to manufacturer documentation for additional information.
    - For signalized intersections with mast arm structures, sensors mounting brackets will be rigidly attached to the mast arm. Ensure there is a minimum 1'-0" horizonal clearance from traffic signal heads, retroreflective backplates, overhead sign panels, and other obstructions that may impact the field of view.
    - For signalized intersections with span wire configurations, determine if mounting assemblies that rigidly attached to the catenary and/or messenger wire are available and provide the necessary field of view coverage. Where mounting directly to the span wire structure is unavailable, mount sensors to horizontal structures (e.g., luminaires, internally illuminated sign supports, cantilevered mounting brackets) attached to the upright supports or directly to the upright support structures.
- Ensure standard 13" X 24" signalization pull boxes are provided on each intersection corner where radar sensors are proposed to provide a cabling pathway and house cable slack. Pull boxes shall be stamped with "FDOT Traffic Signal" and include only cabling carrying low-voltage signal.
- Ensure underground cabling pathways are provided between sensors and the controller cabinet using conduits dedicated to cabling carrying low-voltage signal.
- Ensure the proposed sensor cabling lengths do <u>not</u> exceed the maximum distances provided for the particular type of cable, including horizontal and vertical distances. If longer cabling lengths are required, provide the necessary media conversion (e.g., fiber optics) to achieve the required distance for communication signals.
    - RS-485 serial cable runs for sensors shall <u>not</u> exceed 1400' in length, dependent upon the selected baud rate.

  Verify the proposed cabling length will provide the minimum low-voltage power necessary for the device with consideration for voltage drop over the length. Where necessary, increase the wire gauge as needed.

- Ensure system in-cabinet equipment (e.g., processing unit, detector cards) provides sufficient discrete detection channels to accommodate all proposed detection zones if the system is being utilized for stop bar detection. Provide connection between the in-cabinet equipment and the Synchronous Data Link Communications (SDLC) bus within the cabinet assembly for data transfer to the controller.

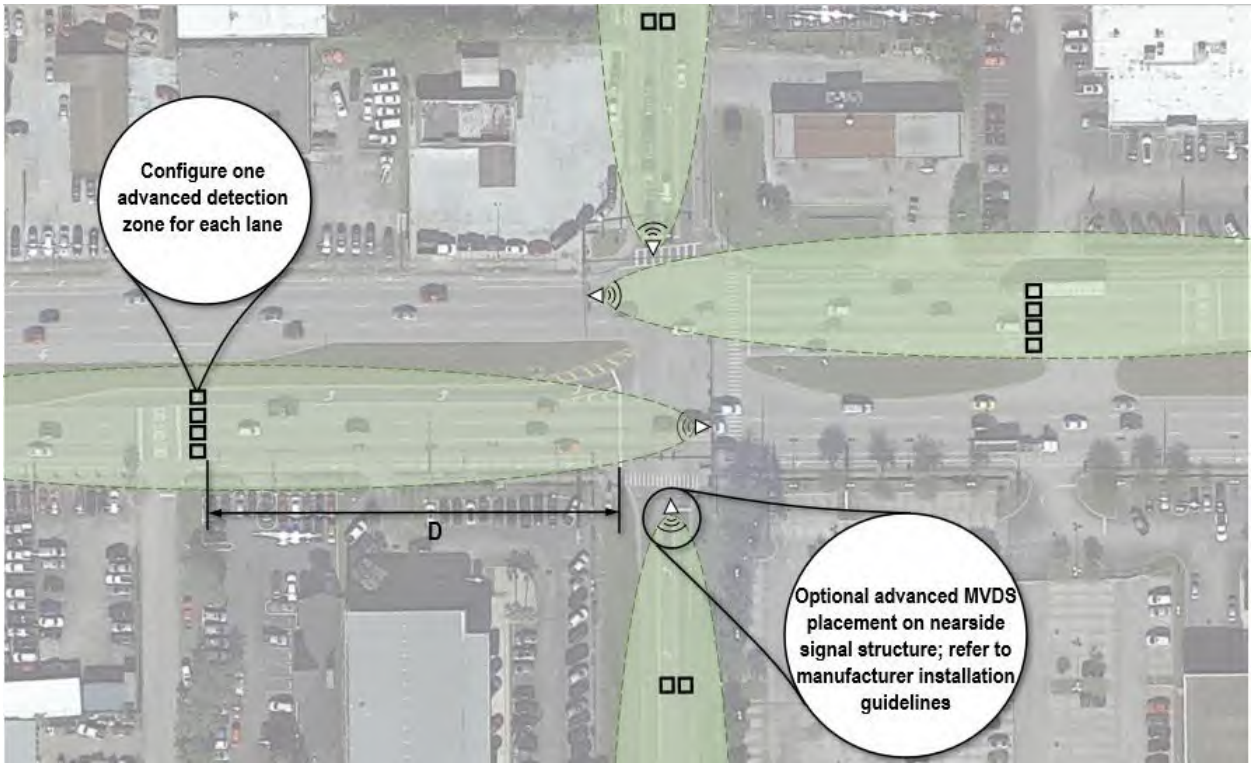


Figure 20: Example microwave radar vehicle detection system for advanced detection zones

It is recommended the Engineer or Record coordinates with the manufacturer of the microwave vehicle detection system to review proposed detection zones, sensor installation locations, in-cabinet equipment, and other site-specific considerations for design optimization.

The following pay items shall be utilized in the design and installation of microwave vehicle detection systems for advanced detection:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **635-2-11** Pull & Splice Box, Furnish & Install, 13” X 24” Cover Size
- **660-3-11** Vehicle Detection System – Microwave, Furnish & Install, Cabinet Equipment
- **660-3-12** Vehicle Detection System – Microwave, Furnish & Install, Aboveground Equipment

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6.3 Network Communications

Each signalized intersection shall provide means for communication between the signalization equipment in the field and the appropriate network, whether the local maintaining agency or Department. Multiple technologies can be used to establish network communications—including fiber optic cabling, point-to-point wireless radios, and cellular modems—each providing a unique set of benefits and limitations.

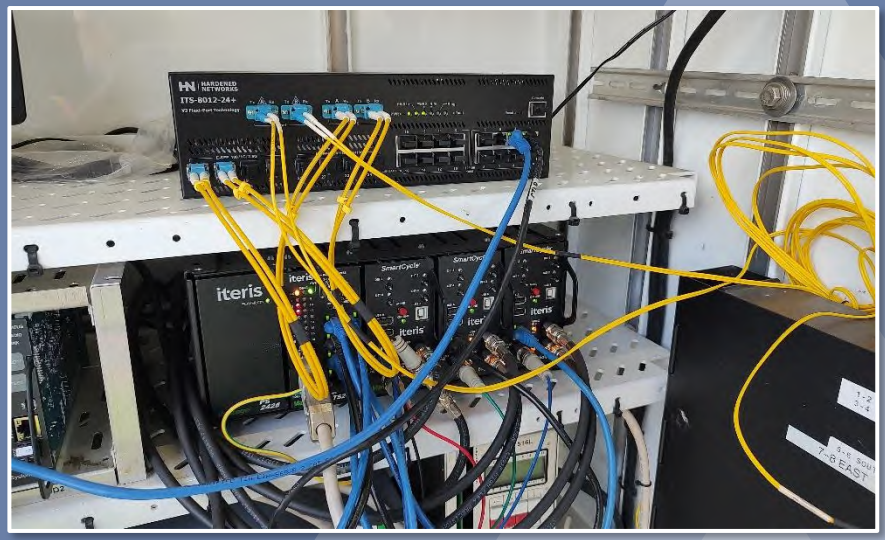
Table 4: Pros and Cons for Available Network Communication Technologies

Fiber Optics	
Pros	*Cons*
• Low cost for maintenance; no recurring licensing or monthly subscription costs • High reliability and quality of connection • Greater bandwidth and capacity for network traffic • Capable of long-distance connections • Enhanced security • Resistant to interference, noise • Scalable to handle future growth	• Higher capital costs for initial installation • Higher likelihood for physical damage (e.g., unintended cable breaks) • Requires skilled technicians for fiber optic connection installation (e.g., splicing, terminations)
Point-to-Point Wireless Radios	
Pros	*Cons*
• Low costs for initial deployment, less infrastructure • Average cost for maintenance; no recurring licensing or monthly subscription costs • Requires limited to no underground infrastructure, less susceptible to unforeseen damage • Flexible network architecture options (e.g., P2P, P2MP; licensed vs. unlicensed) • Ability to traverse long distances, difficult terrain (e.g., bodies of water)	• Limited reliability, variable quality of connection • Limited bandwidth and capacity for network traffic • Higher security risk • Susceptible to environmental degradation (e.g., interference, noise) • Requires clear line of sight between radios (e.g., vegetation, tall structures) • Requires skill technicians for configuration, troubleshooting, and maintenance
Cellular Modem	
Pros	*Cons*
• Low costs for initial deployment, less infrastructure • Low costs for maintenance activities • Requires no underground infrastructure, less susceptible to unforeseen damage • No specialized skillset necessary for maintenance	• Requires monthly subscription cost • Quality of connection, reliability based on third-party cellular provider's network strength • Limited bandwidth and capacity for network traffic • Higher security risk

The Engineer of Record (EOR) shall be responsible for determining the appropriate means of communication for each signalized intersection based on coordination with the Department, local maintaining agency preferences, existing conditions, and pertinent project constraints.

Each model of managed field Ethernet switch (MFES) includes a variety of ports for fiber optic medium (e.g., SFP) and copper (e.g., RJ-45). (**Seminole County**)

Managed field Ethernet switch and power supply installed on DIN rail rigidly affixed to the front of a shelf within the controller cabinet assembly. (**Osceola County**)



Managed field Ethernet switch with optical bypass capabilities provides redundancy in the case of power outage requiring additional fiber optic jumper connections. (**Lake County**)

The Engineer of Record (EOR) shall be responsible for determining the appropriate means of communication for each signalized intersection based on coordination with the Department, local maintaining agency preferences, existing conditions, and pertinent project constraints.

Each signalized intersection shall be provided with a managed field Ethernet switch (MFES) installed within the traffic signal controller cabinet regardless of the selected communication means. The EOR shall coordinate with the local maintaining agency to identify the specific technical requirements of the switch or if there are any existing proprietary product requirements of the local maintaining agency for synchronization with the existing deployments. Ensure each switch provides the minimum number of 10/100 copper Ethernet ports (RJ-45) and 10/100/1000 small-form pluggable (SFP) fiber optic ports necessary to accommodate the field devices and network connections proposed with a minimum of two (2) spare copper ports (RJ-45) for future use. The EOR shall coordinate with the local maintaining agency to identify if any specific port schema exists (e.g., Port No. 1 remains open for maintenance).

The following pay items shall be utilized in the design and installation of managed field Ethernet switches:

- **684-1-1** Managed Field Ethernet Switch, Furnish & Install

Based on the specific needs of the project, the Engineer of Record may be required to include pay item notes with specifics information related to the MFES per local maintaining agency preferences.

Two-section lid fiber optic splice vault (30” X 60”) with concrete apron. (**Marion County**)

Warning label for fiber optic cable within the vicinity adhered to the outside of the controller cabinet assembly. (**Lake County**)

Fiber optic patch panel installed in controller cabinet assembly with two (2) fully terminated twelve-count connector panels. (**City of Orlando**)

6.3.1 Fiber Optics

Where applicable, provide fiber optic cabling and associated hardware at and in between signalized intersections to provide network communications between the field equipment and the appropriate central network. The following provides generalized design guidance and considerations for the deployment of fiber optic communications:

- Design fiber optic cabling in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 233* and *FDOT Standard Specifications for Road and Bridge Construction – 633 Series*, as well as manufacturer installation guidelines and recommendations.
- The Engineer of Record is responsible for performing link loss calculations to ensure the proposed design does not exceed the allowable maximum loss. Minimize splice connections and termination, when feasible.

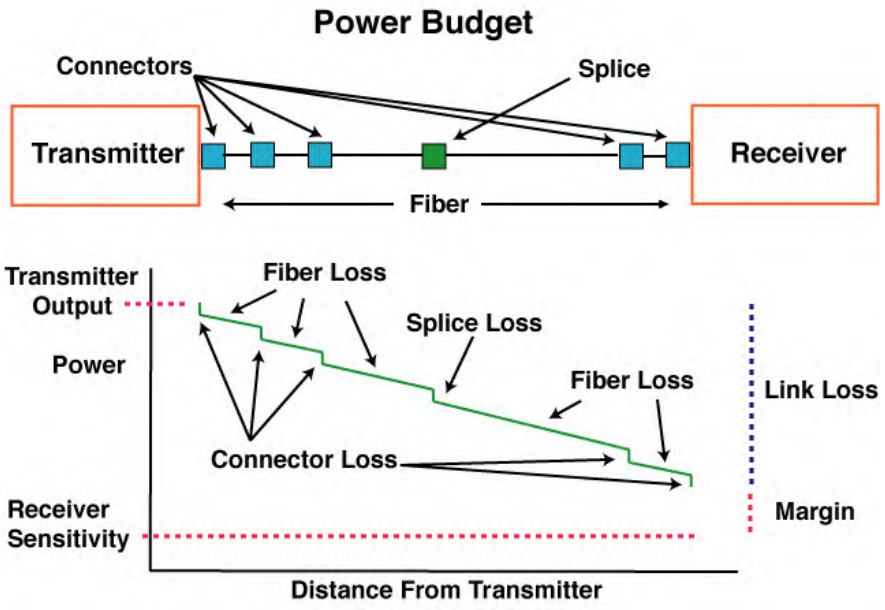


Figure 21: Fiber optic link power budget

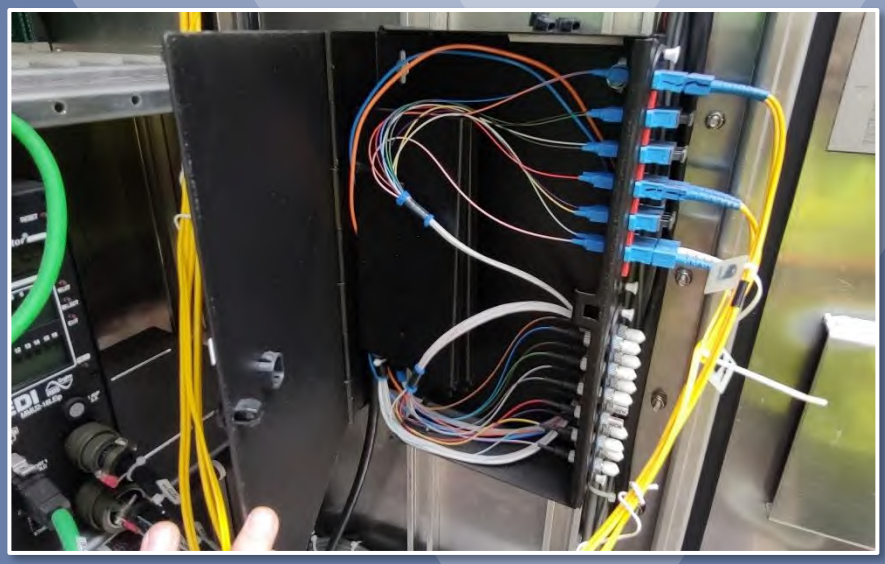
- Provide fiber optic cabling with dedicated infrastructure—including underground conduit, vertical risers, sweeps, pull boxes, junction boxes, and splice vaults. Do not collocate fiber optic cables with any wiring or cables carrying low or high voltage.
- Provide 12-count (minimum) fiber optic drop cables for connection between the backbone and traffic signal controller cabinet at each signalized intersection. Provide a 48-count (minimum) fiber optic drop cable to all communication hubs. Provide a 96-count (minimum) fiber optic cable for all backbone communications, unless otherwise directed. The EOR is responsible for coordination with the local maintaining agency to identify specific preferences on fiber optic cabling counts.
- Ensure conduit runs for fiber optic cabling are straight or provided with sweeping arcs, where appropriate. Conduit runs shall ensure cabling does not exceed the minimum bending radius parameters as defined by *ANSI/TIA/EIA-568 B.3*. The standard states, "[…] cable must support a bend radius of ten (10) times its diameter under no load (on the reel), and twenty (20) times the outside diameter when subject to the cable's rated load limit."

Typical round fiber optic splice vault (36” diameter) installed at the base of the controller cabinet assembly. (**City of Orlando**)

Interior of round fiber optic splice vault with conduit sweeps, cabling slack, and underground splice enclosure. (**Orange County**)

Example aerial fiber optic line with snow-shoe cable storage fixture and overhead splice enclosure. (**City of Orlando**)

- Provide fiber optic splice enclosures wherever fusion splice connections are proposed to protect against exposure from the surrounding environment. Ensure splice enclosures provide cable ports necessary to accommodate a minimum of four (4) fiber optic cables simultaneously.
- Within fiber optic splice enclosures, provide one (1) splice tray for each buffer tube within the backbone cable where fibers are to be spliced. *For example, if the 96-count fiber optic backbone is spliced to four (4) fibers of a drop cable, provide a total of one (1) splice tray; if the 144-count fiber optic backbone is butt-spliced to a separate 144-count fiber optic backbone, provide a total of twelve (12) splice trays*.
- For underground fiber optic cabling installations, ensure the following:
    - Provide a minimum of two (2) two-inch conduit sweeps for fiber optic communications within the traffic signal controller cabinet foundation.
    - Provide a minimum of two (2) two-inch conduits for all fiber optic cabling runs—one for fiber and one for tone wire (future).
    - Provide fiber optic pull boxes (24" X 36") at the base of each traffic signal controller cabinet unless a fiber optic splice vault is located on the same corner within 100' of the cabinet.
    - Provide fiber optic splice vaults (30" X 60" or 36" round) at all signalized intersections with fiber optic communications.
    - Provide underground splice enclosures installed within splice vaults attached to the interior wall.
- For aerial fiber optic cabling installations, ensure the following:
    - Coordinate with utility agency owners (UAO) to identify potential shared-use poles and attachment heights for aerial fiber optic cabling. The EOR is responsible for obtaining all necessary attachment permits from the UAO.
    - Provide vertical risers attached to shared-use utility pole for fiber optic cabling transitions from underground to aerial attachments. Ensure underground-to-aboveground conduit transitions are installed a minimum of 6" below grade.
    - Provide aerial fiber optic cables with messenger wires for all overhead spans between poles for structural support. Messenger wire shall be removed for all cabling segments installed underground.
    - Provide overhead cable storage brackets—or "snow-shoes"—with associated mounting hardware where cabling slack is necessary. Install "snow-shoes" spaced every ¼ mile (1,320') to ½ mile (2,640') with 200' of cabling slack.
    - Provide aerial fiber optic splice enclosures affixed to overhead messenger wires with mounting hardware and stainless-steel banding. Install splice enclosures where fiber optical cables transition from aboveground to underground (e.g., fiber optic drops).
- Provide fiber optic connection hardware within the traffic signal controller cabinets to facilitate network communications. In-cabinet equipment necessary for a complete installation includes:
    - Fiber optic patch panel
    - Fiber optic connector panel – minimum one (1) connector panel for each buffer tube terminated
    - Fiber optic buffer fan-out kit – minimum one (1) kit for each buffer tube terminated
    - Fiber optic jumper cables, duplex or singlex – provide a minimum number of jumpers between the patch panel and switch for each active and redundant circuit within a signalized intersection
- Terminate the fiber optic drop cable fully within the traffic signal controller cabinet providing termination connections within the patch panel for each fiber. Ensure the patch panel and connector panels are sized to accommodate terminations for the entire drop cable.
- Provide specialized fiber optic connections to enable optical bypass where requested by the Local maintaining agency. Optical bypass switches shall be provided specific circuits for redundant pathways.
- The EOR is responsible for coordination with the local maintaining agency to determine the specific needs and design considerations of the fiber optic communication system, including:
    - Fiber optic circuitry (e.g., active circuits, redundant circuits, spare)



Interior of fiber optic patch panel installed to the controller cabinet wall with 24-count fiber optic drop terminated into connector panels. (**Orange County**)

Shelf-mounted fiber optic patch panel with twelve-count connector panel. (**City of Orlando**)

Connections between the fiber optic patch panel and the managed field Ethernet switch is developed using fiber optic jumpers; yellow for single-mode, orange for multi-mode. (**Lake County**)

- Unidirectional or bi-directional data transfer
- Network architecture (e.g., bus, ring)
- Splicing schema (e.g., buffer tube, fiber pairing)

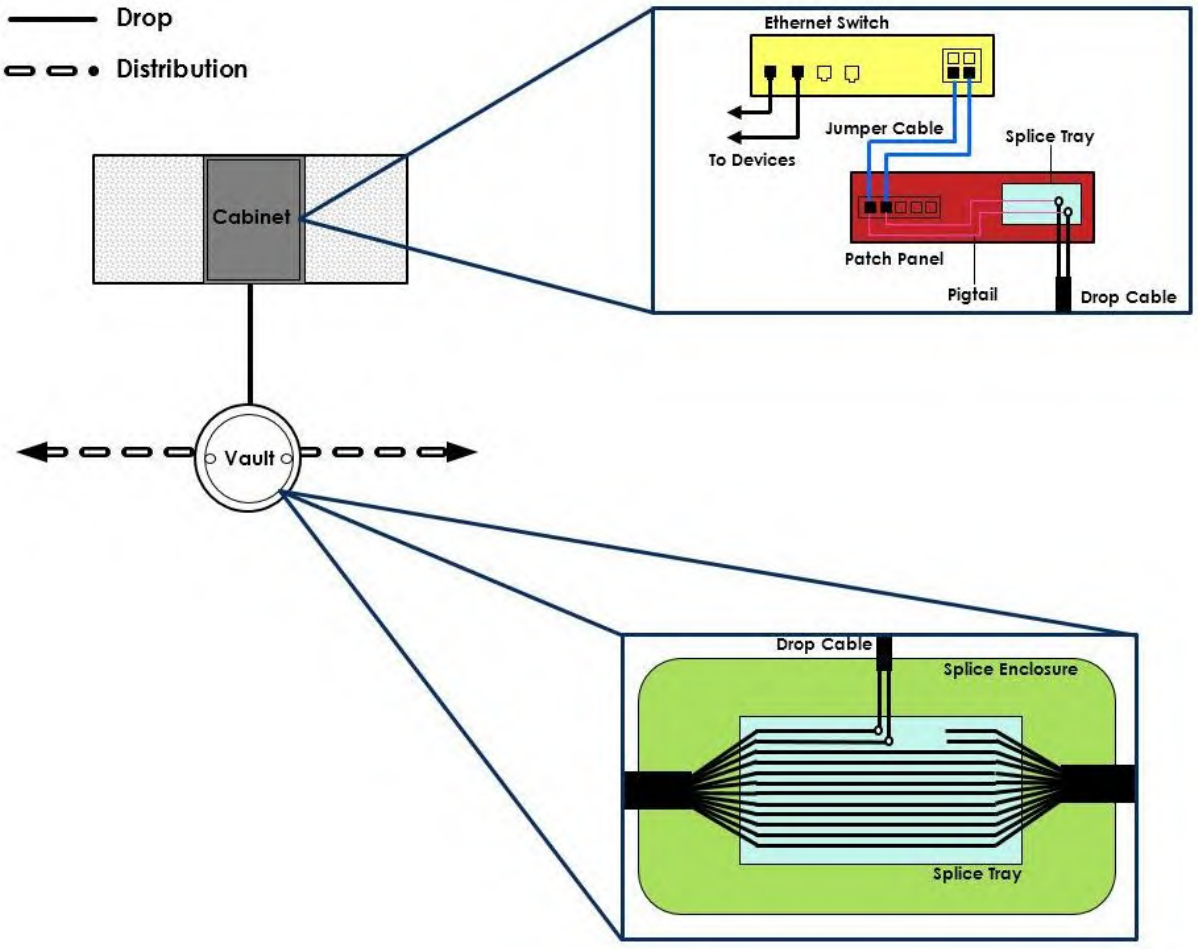


Figure 22: Example of type underground fiber optic connection hardware and in-cabinet equipment

The following pay items shall be utilized in the design and installation of fiber optic communications:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **633-1-ABC** Fiber Optic Cable, Furnish & Install, (Location) (Count)
- **633-2-31** Fiber Optic Connection, Install, Splice
- **633-2-32** Fiber Optic Connection, Install, Termination
- **633-3-11** Fiber Optic Connection Hardware, Furnish & Install, Splice Enclosure
- **633-3-12** Fiber Optic Connection Hardware, Furnish & Install, Splice Tray
- **633-3-14** Fiber Optic Connection Hardware, Furnish & Install, Buffer Fan Out Kit
- **633-3-16** Fiber Optic Connection Hardware, Furnish & Install, Patch Panel – Field Terminated
- **633-3-17** Fiber Optic Connection Hardware, Furnish & Install, Connector Panel
- **633-6** Fiber Optic Cable Locator[1]

[1] To be used when there is existing buried fiber optic cable within project limits. Locator is not needed for projects without existing fiber optic cable.

Multiple point-to-point wireless radios installed to vertical riser mounting arm creating connection between signalized intersections. (**Marion County**)

Dish-style point-to-point wireless radio installed on mast arm structure. (**City of Orlando**)

Point-to-point wireless radio install directly to concrete strain pole in a span wire intersection to develop clean lines of sight between intersections. (**City of Orlando**)

- **635-2-12** Pull & Splice Box, Furnish & Install, 24" X 36" Cover Size
- **635-2-13** Pull & Splice Box, Furnish & Install, 30" X 60" or 36" Round Cover Size

6.3.2 Point-to-Point Wireless Radio

Where applicable, provide point-to-point wireless radios and associated hardware at signalized intersections to provide network communications between the field equipment and the appropriate central network. The following provides generalized design guidance and considerations for the deployment of wireless radios:

- Design cellular modem deployment in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 233*, as well as manufacturer installation guidelines and recommendations.
- Establish wireless links using client subscriber units (i.e., point-to-point) and access points (i.e., point-to-multi-point) radios, as appropriate. Client subscriber units create a dual-direction communication link between two (2) points. Access points are capable of creating dual-direction communication links with multiple client units simultaneously.
- Ensure reliable network communication is provided for a minimum of one (1) location within the project. The Engineer of Record shall be responsible for developing a network architecture capable of routing traffic between the signalized intersections and the appropriate central network. Where feasible, the network architecture shall include redundant pathways for communication in the event of wireless link failure.
- Ensure clear line of sight is provided between radio units. Verify the wireless link is free of obstructions from trees and vegetation, overhead signs, bridge structures, changes in elevation, horizontal curves, and other elements that may degrade connection signal. If a clear line of sight is unavailable, ensure the proposed wireless radio units are capable of delivering the high-performance signal transmission in partial obstruction conditions.
- The EOR shall be responsible for coordination with the local maintaining agency to determine specific requirements of the proposed wireless system, including radios operating within the licensed versus unlicensed spectrum. Licensed radios require registration with the Federal Communications Commission (FCC) prior to operation, which would be the responsibility of the EOR.
- Determine the minimum bandwidth throughput necessary for each proposed wireless link (e.g., 100 Mbps) based on the existing and proposed field devices. Ensure a minimum of 20% capacity is provided in the calculation of the worst-case scenario.
- The EOR shall be responsible for identifying wireless radios that meet the minimum technical requirements necessary to establish a reliable wireless link, including:
    - Signal-to-Noise Ratio (dB)
    - Bit Error Rate
    - Bandwidth Throughput (Mbps)
    - Latency (sec)
    - Link Availability

  Ensure all technical requirements of the wireless system are defined in a Technical Special Provision (TSP) or Modified Special Provision (e.g., Section 684).
- In-cabinet equipment for wireless radio installations shall include Power-over-Ethernet (PoE) injectors, power supplies, and surge protection devices (SPD).
- Provide physical connection between each wireless radio units and the managed field Ethernet switch to route data to the appropriate central network. Provide Cat-6 Ethernet cable runs for PoE that do not exceed 328' (100 m) in length (*IEEE 802.at*)
- Do not collocate PoE with power cables either within the same conduit or pull boxes.

Shelf-mounted cellular modem acting as router to provide network connection between the controller and local maintaining agency network. (**Lake County**)

Cellular modem with embedded antenna; however, external antennas may be installed to the exterior of controller cabinet assemblies to boost signal strength, where needed. (**Marion County**)

Cellular modems provide routing capabilities to act as network communication devices at locations where switches are not present and multiple network-enabled devices are required; maximum of three (3) RJ-45 ports. (**Brevard County**)

- Provide mounting hardware necessary to rigidly affix the wireless radio units to the signal support structures, including vertical risers and mounting brackets. The EOR shall be responsible for determining the appropriate mounting height for radio units to establish a clear line of sight.

The following pay items shall be utilized in the design and installation of wireless radio systems:

- **633-8-1** Multi-Conductor Cable, Furnish & Install
- **684-6-AB** Wireless Communication Device, Furnish & Install, (Type)

6.3.3 Cellular Modem

Where applicable, provide a broadband cellular modem and antenna at signalized intersections to provide network communications between the field equipment and the appropriate central network. The following provides generalized design guidance and considerations for the deployment of cellular modems:

- Design cellular modem deployment in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 233*, as well as manufacturer installation guidelines and recommendations.
- Ensure cellular modems are compatible with the AT&T FirstNet communications provides a removable subscriber identity module (SIM) card. Each cellular modem shall be equipped with redundant SIM card slots for multiple carriers in the event of a cellular provider failure or loss of signal.
- Verify available cellular signal strength within the signalized intersection using a smartphone registered on the AT&T network. Ensure the area provides reliable signal strength with a minimum 4G LTE speed. If minimum speeds are unavailable, the Engineer of Record shall coordinate with the Department for a design exception or alternative options.
- The EOR shall determine if an external antenna is required to achieve minimum communication speeds. External antennas shall be installed on the outer face of controller cabinets with field drilled holes carrying coaxial cabling to the cellular modem. Ensure all field drilled holes are watertight and prevent water intrusion into the cabinet.
- Ensure the proposed location for the antenna possess strong cellular signal strength and avoid locations within close proximity to buildings or other structures that may impede signal.
- The EOR shall be responsible for the development of TSP – Section 695 defining the minimum technical requirements of the cellular modem.

The following pay items shall be utilized in the design and installation of cellular modems:

- **695-8-11** Traffic Monitoring Site Communications Modem, Furnish & Install

Trafficware (*now Cubic ITS*) 980-ATC controller unit, NEMA TS-2, Type 1 model. (**Seminole County**)

Trafficware (*now Cubic ITS*) ATC controller unit, NEMA TS-2, Type 1 model. (**Brevard County**)

Trafficware (*now Cubic ITS*) COMMANDER ATC controller unit, NEMA TS-2, Type 1 model; shown in bench testing phase.

6.4 Controller

Each intersection upgraded to the *Smart Signal* standards will require a signal controller unit compatible with the *Institute of Transportation Engineers (ITE) ATC 5201 – Advanced Transportation Controller (ATC) Standard, v06A*. The deployment of ATC-standard controllers will ensure that each signalized intersection provides the ability to perform high-resolution data logging the firmware native to the controller unit. The data logger within the controller records intersection parameters—including inputs (e.g., detection calls) and outputs (e.g., phasing, timing)—at a resolution of ten (10) times a second. This data is transmitted across the network to be utilized by the centralized ATSPM system, providing real-time insight into the operations of signalized intersections for improved monitoring, maintenance, and management.

The Engineer of Record (EOR) shall be responsible for coordination with the local maintaining agency to identify preferences for controllers—including manufacturer, model, body style type (e.g., TS-2 Type 1 or Type 2), compatible firmware version, additional software modules, and more. The EOR shall verify the proposed controller is compatible with the associated cabinet assembly for the signalized intersection. Where existing controller cabinet assemblies are to remain, the proposed ATC controller type shall match the existing connection type (e.g., Type 1 – SDLC interface; Type 2 – "A", "B", "C", "D" MS-type connectors).

Cubic Intelligent Transportation Systems (*formerly Trafficware*)

980-ATC (Trafficware)

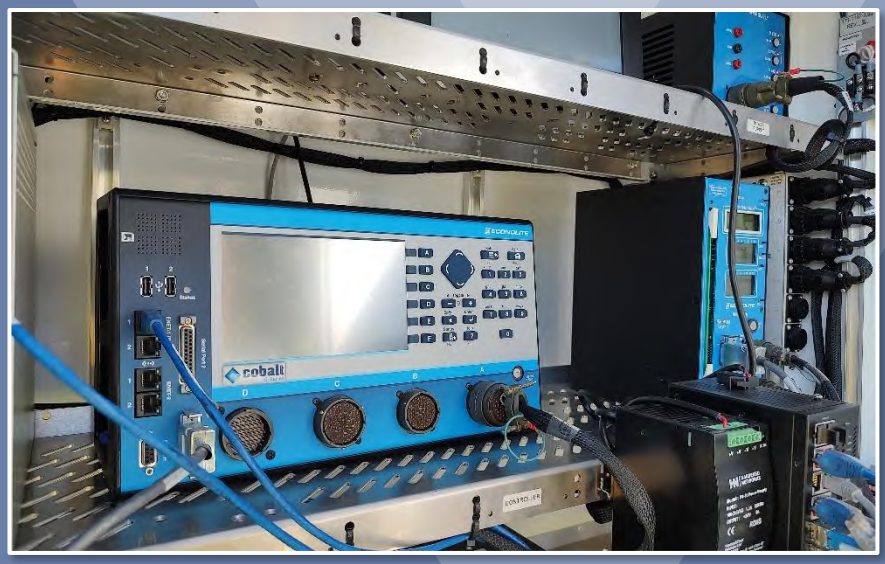
Minimum Firmware - v76.10, or newer
Available Software Module Add-Ons:

- SynchroGreen Traffic Adaptive
- Light Rail Transit (LRT)
- Transit Signal Priority (TSP)

COMMANDER™ ATC

Minimum Firmware – all versions
Available Software Module Add-Ons:

- SynchroGreen Traffic Adaptive
- Light Rail Transit (LRT)
- Transit Signal Priority (TSP)
- Connected Vehicle (CV)



Econolite Cobalt ATC controller unit, TS-2, Type 2 model, operated as Type 1 ("A" connector only). (**Osceola County**)

Q-Free (*formerly Intelight*) XN-2 ATC controller unit, TS-2, Type 2 model, operated as Type 1 ("A" connector only). (**Lake County**)

Siemens (*now Yunex Traffic*) m60 ATC controller unit, TS-2 Type 2 model, operated as Type 1 ('A" connector only). (**Marion County**)

Econolite Control Products

Cobalt®

Minimum Firmware – all versions
Available Software Module Add-Ons:

- Centracs® Adaptive
- Intersection Monitor
- Connected Vehicle Co-Processor

Q-Free (*formerly Intelight*)

X3-ATC (Intelight)

Minimum Firmware – all versions
Available Software Module Add-Ons:

- MAXTIME Adaptive
- MAXTIME Ramp Meter
- MAXTIME Intersection Control
- MAXTIME Connected Vehicle

XN-2

Minimum Firmware – all versions
Available Software Module Add-Ons:

- MAXTIME Adaptive
- MAXTIME Ramp Meter
- MAXTIME Intersection Control
- MAXTIME Connected Vehicle

Yunex Traffic (*formerly Siemens ITS*)

m60 ATC (Siemens)

Minimum Firmware – all versions
Available Software Module Add-Ons:

- *To Be Determined*

NEMA Type 6 controller cabinet assembly with stand-alone UPS cabinet on shared concrete base (foundation) with generator security anchor. (**Lake County**)

"Piggyback" UPS cabinet attached to the exterior side wall of the NEMA Type 6 controller cabinet assembly; some agencies may elect to wrap cabinet exteriors to match local aesthetic requirements. (**Osceola County**)

NEMA Type 6 controller cabinet assembly with matte black powder-coat finish and additional rear door. (**Seminole County**)

The following pay items shall be utilized in the design and installation of ATC controllers. Note, locations where existing controller cabinet assemblies are to be removed, the pay item number for cabinet removal accounts for all in-cabinet equipment, including the traffic signal controller; do not provide a separate pay item number for controller removal. Similarly, complete controller cabinet assemblies include controller units, therefore at location where complete assemblies are to be installed there is no need to provide a separate pay item number for controller units:

- **671-2-11** Traffic Controller Without Cabinet, Furnish & Install in Existing Cabinet, NEMA
- **671-2-50** Traffic Controller, Relocate – Without Cabinet
- **671-2-60** Traffic Controller, Remove – Cabinet to Remain

6.5 Cabinet Assembly

Smart Signal improvements will include new controller cabinet assemblies adhering to the National Electrical Manufacturer's Association (NEMA) TS-2 standard with minimum Size 6 dimensions and sixty-four (64) detection input channels. Each project shall assess the existing cabinet assembly to determine whether or not the cabinet will require either replacement or modification. Complete assemblies shall include a completely wired cabinet, in-cabinet equipment (e.g., power supplies, malfunction management unit (MMU), load bay with switches, detector panel, detector racks with BIUs, Synchronous Data Link Communications (SDLC) bus, power panel), concrete foundation, conduit sweeps, and all other elements for a complete installation.

Each controller cabinet assembly shall meet the requirements of the TS-2 specifications and the minimum dimensions for Size 6 cabinets (44" width by 52" height by 24" depth), as defined in the NEMA Standards Publication TS 2-2021. Based on the preferences of the local maintaining agency, cabinets may be increased to Size 7 where requested. Size 6 cabinet assemblies shall include a minimum of two (2) full size shelves for installation of in-cabinet equipment.

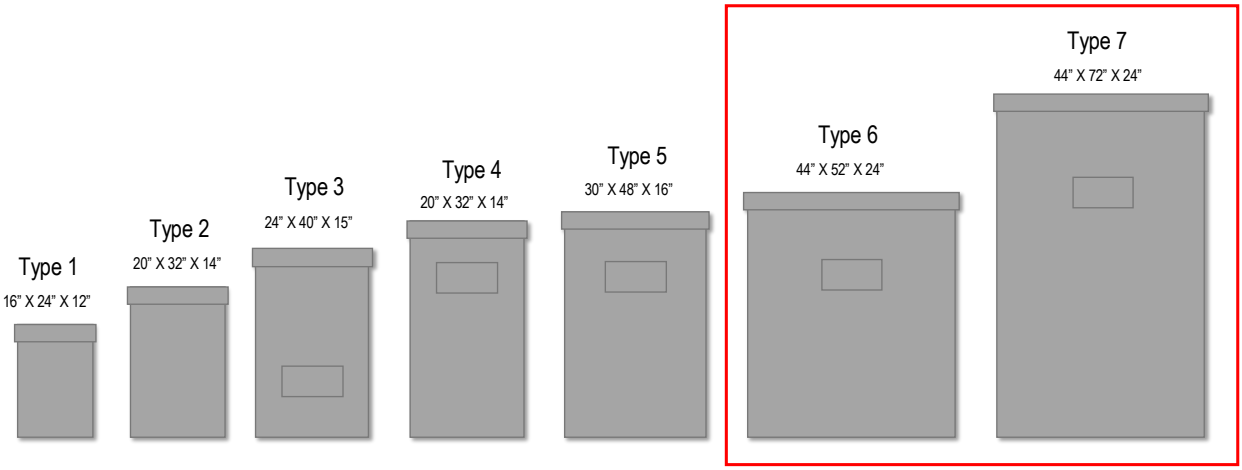
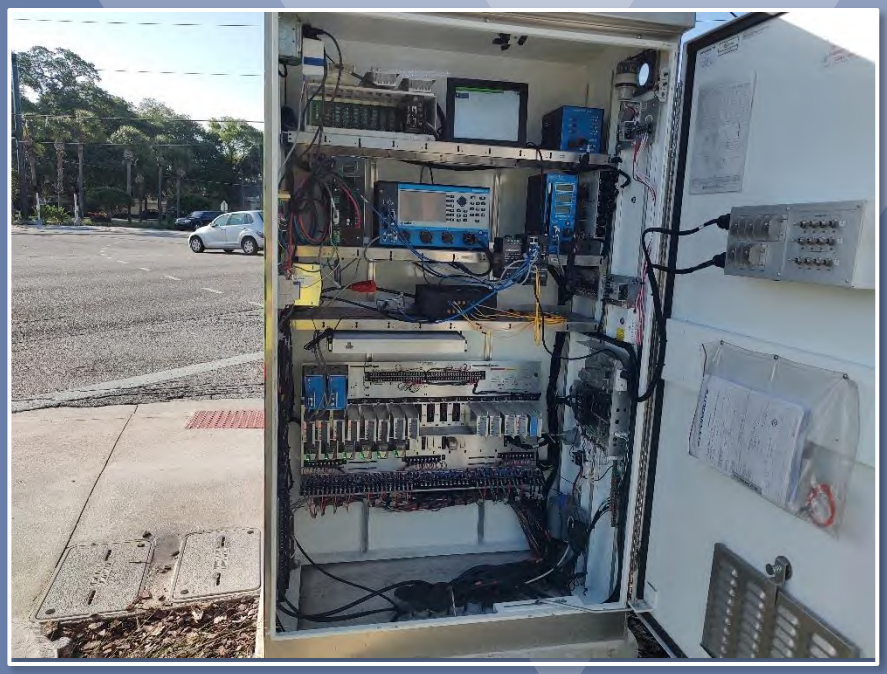
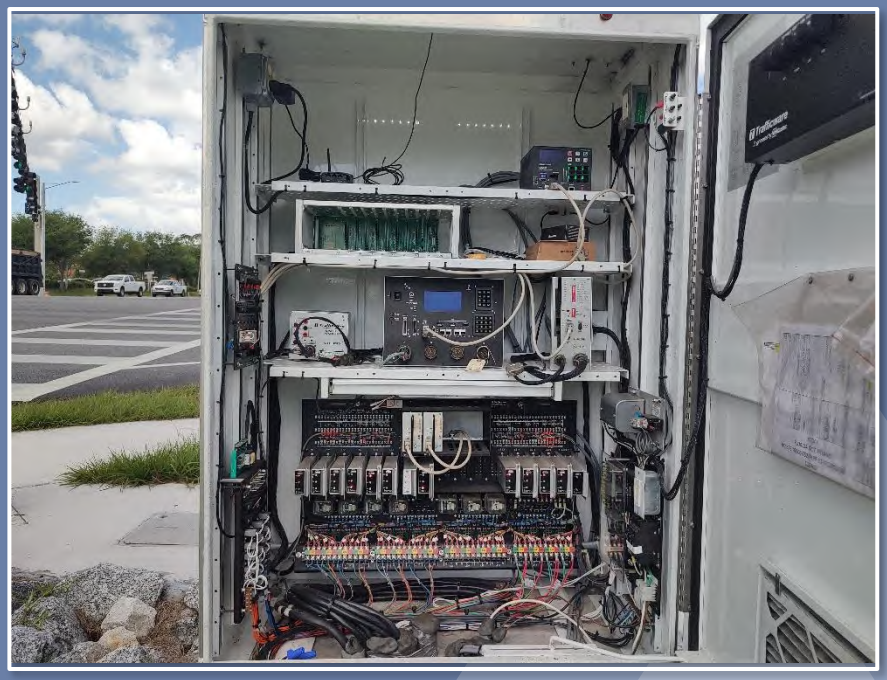


Figure 23: NEMA controller cabinet assembly sizing comparison

Each cabinet assembly shall be outfitted to accommodate a minimum of sixty-four (64) detection input channels, including detector panel assembly with sixty-four (64) channel terminal connections, SDLC bus interfaces to accommodate a minimum of four (4) BIUs, and physical shelf space to install four (4) ten-position, sixteen-channel detector racks. The actual number of detector racks or in-cabinet equipment attached to the SDLC bus interface included for each signalized intersections may vary based on site-specific conditions and the selected detection technology, but all cabinet assemblies shall be capable of providing the minimum number of detection channels.



Interior of NEMA Type 6 controller cabinet assembly with hybrid video-radar vehicle detection system. (**Osceola County**)



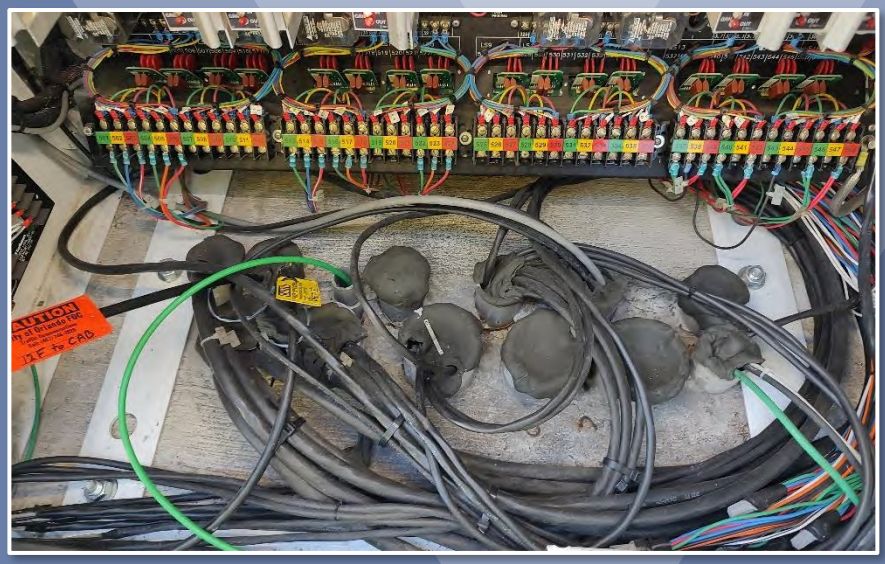
Interior of NEMA Type 6 controller cabinet assembly with microwave radar vehicle detection system. (**Lake County**)

The Engineer or Record shall be responsible for coordination with the local maintaining agency to identify specific technology preferences, including manufacturer and model of cabinet assemblies and/or in-cabinet hardware for synchronization with existing deployments. Coordination with the local maintaining agency shall also determine technical specifications for cabinet assemblies, including:

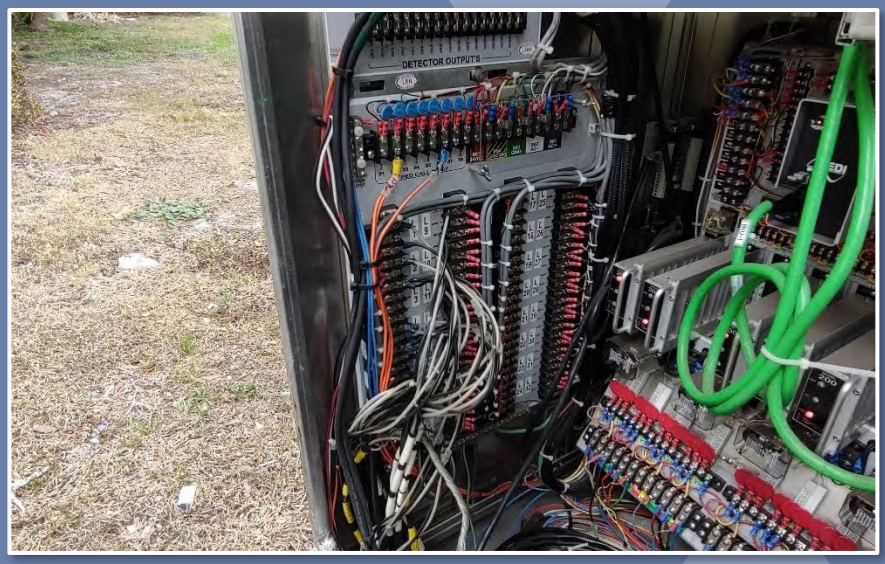
- Single door versus dual door cabinets (e.g., front and rear)
- Cabinet door locking mechanisms and minimum number of keys (e.g., standard Corbin Type 2, electronic key)
- Wiring configuration for either NEMA TS-2 Type 1 or TS-2 Type 2 standard (e.g., "A", "B", "C", "D" MS-type connectors)
- Requirements for ancillary and emergency power, including uninterruptible power supply (UPS) line interactive or double-conversion, automatic transfer switch (ATS), external generator connection, stand-alone versus "piggyback" battery backup cabinets
- Aesthetics requirements for powder coating or specialty color finishes
- Minimum number and allocation of conduit sweeps
- Internal wiring and connection labeling

For existing signalized intersections, determine if the existing controller cabinet assembly meets the current *Smart Signal* requirements and can either be re-utilized or modified. Verify existing wiring configuration, cabinet dimensions, minimum number of detection channels, anchor bolt pattern, quantity and size of conduit sweeps, and state of all in-cabinet equipment. Where existing cabinet assemblies do not meet the applicable standards, provide new assemblies complete with concrete bases, cabinets, conduit sweeps, and service slabs. The following provides generalized design guidance and considerations for the deployment of controller cabinet assemblies:

- Design controller cabinet assemblies in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232*, *FDOT Standard Plans for Road and Bridge Construction – Index 676-010*, and *FDOT Standard Specifications for Road and Bridge Construction – 600 Series*.
- Provide a minimum of twelve (12) conduit sweeps between pull boxes at the foot of the cabinet base with the following allocation. Refer to **Section 6.7 – General Infrastructure** for additional information on conduit utilization:
    - One (1) electrical service wire (high voltage)
    - One (1) grounding
    - Two (2) Intelligent Transportation Systems (ITS) field devices (low voltage)
    - Two (2) fiber optic communications
    - Three (3) signalization detection systems – input (low voltage)
    - Three (3) signalization traffic control systems – output (high voltage)
    - One (1) UPS electrical service wire (high voltage) (*optional*)

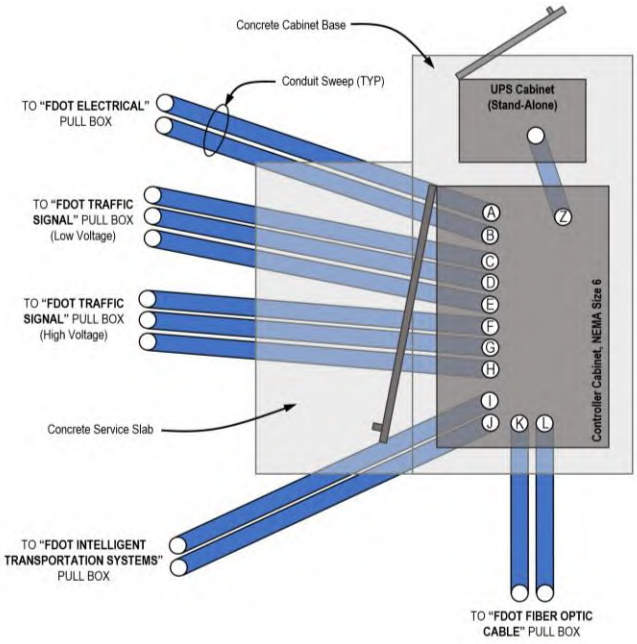


Provide a minimum of thirteen (13) conduit sweeps sized appropriately to facilitate all future cabling needs. (**Lake County**)



Example detector panel installed on the interior wall of the controller cabinet assembly; provide cabinet assemblies with the ability to support a minimum of sixty-four (64) discrete detection channels. (**Orange County**)

Interior of "piggyback" cabinet housing uninterruptible power supply (UPS) head unit and battery array. (**City of Orlando**)



ID	MIN. SIZE	CONDUIT UTILIZATION
A	2"	ELECRICAL SERVICE WIRE (HIGH-VOLTAGE)
B	1"	GROUND WIRE
C	2"	DETECTION SIGNAL (LOW-VOLTAGE)
D	2"	DETECTION SIGNAL (LOW-VOLTAGE)
E	2"	DETECTION SIGNAL (LOW-SIGNAL) / SPARE
F	2"	SIGNAL (HIGH-VOLTAGE)
G	2"	SIGNAL (HIGH-VOLTAGE) / SPARE
H	2"	INTERNALLY ILLUMINATED SIGN (HIGH-VOLTAGE)
I	2"	ITS DEVICE (LOW VOLTAGE)
J	2"	ITS DEVICE (LOW VOLTAGE) / SPARE
K	2"	FIBER OPTIC COMMUNICATIONS
L	2"	FIBER OPTIC COMMUNICATIONS / SPARE
Z	2"	UPS ELECTRICAL SERVICE WIRE (HIGH-VOLTAGE)

Figure 24: Minimum conduit sweeps and allocation for controller cabinet assembly

- Provide service slabs for all doors of the controller cabinet assembly, including front and rear doors where applicable. Dimensions for service slabs shall be 44" (L) by 30" (W) by 3" (D). Where cabinet bases are installed immediately adjacent to existing or proposed sidewalks, service slabs may be omitted with approval by the Department.
- Ensure controller cabinet assemblies are installed such that the cabinet doors can fully open without obstruction (e.g., walls, vegetation, utility poles). Position cabinets such that maintenance personnel can access the cabinet within the right-of-way and personnel can observe the intersection with doors opened away from traffic.

The following pay items shall be utilized in the design and installation of controller cabinet assemblies. Note, locations where existing controller cabinet assemblies are to be removed, the pay item number for cabinet removal accounts for all in-cabinet equipment, including the traffic signal controller, UPS, networking equipment, and more. Do not provide a separate pay item number for item-specific removals. Additionally, complete controller cabinet assemblies include controller units as part of the pay item number, therefore at location where complete assemblies are to be installed there is no need to provide a separate pay item number for controller units.

- **670-5-112** Traffic Controller Assembly, Furnish & Install, NEMA, Two Preemption
- **670-5-500** Traffic Controller Assembly, Relocate Controller with Cabinet
- **670-5-600** Traffic Controller Assembly, Remove Controller with Cabinet
- **676-1-1BB** Traffic Signal Controller Cabinet (no controller), Furnish & Install, (Description, Function)
- **676-1-500** Traffic Signal Controller Cabinet (no controller), Modify
- **685-1-AB** Uninterruptible Power Supply, Furnish & Install, (Type)

6.6 Detector Channel Assignment

To provide the granularity of data from the signalized intersections to the various systems ingesting this information, the *Smart Signal* standards requires each intersection to develop a site-specific detector channel assignment. The detector channel assignments will ensure that the appropriate infrastructure is installed, configured, and integrated in a manner to guarantee unique detection channels for each zone.

The Engineer of Record shall be responsible for coordination with the local maintaining agency to identify specific requirements for detection channel assignments. If the agency does not have specific requirements, the default schema for the District shall be implemented. The EOR shall coordinate with the Department for the standard detector chart sheet to be utilized. The EOR is to ensure two or more different detection types are not combined in the same BIU.

The default schema shall increase detector channel assignments incrementally by one (1) starting with the inside lane and working to the outside; and working from the stop bar to the advanced detection zones for each approach. When all of the zones for a single approach are counted, the schema rotates counterclockwise and begins the pattern again. The pattern shall begin with *Channel 01* as the innermost lane (i.e., nearest to the centerline) for the mainline approach with Movement 2 (thru). For intersections with left turn lanes, *Channel 01* will be the inside lane of Movement 5 (left). For one-way roadway or T-intersections without a Movement 2, the schema shall begin on the mainline approach with Movement 6 (thru) and repeat the same pattern.

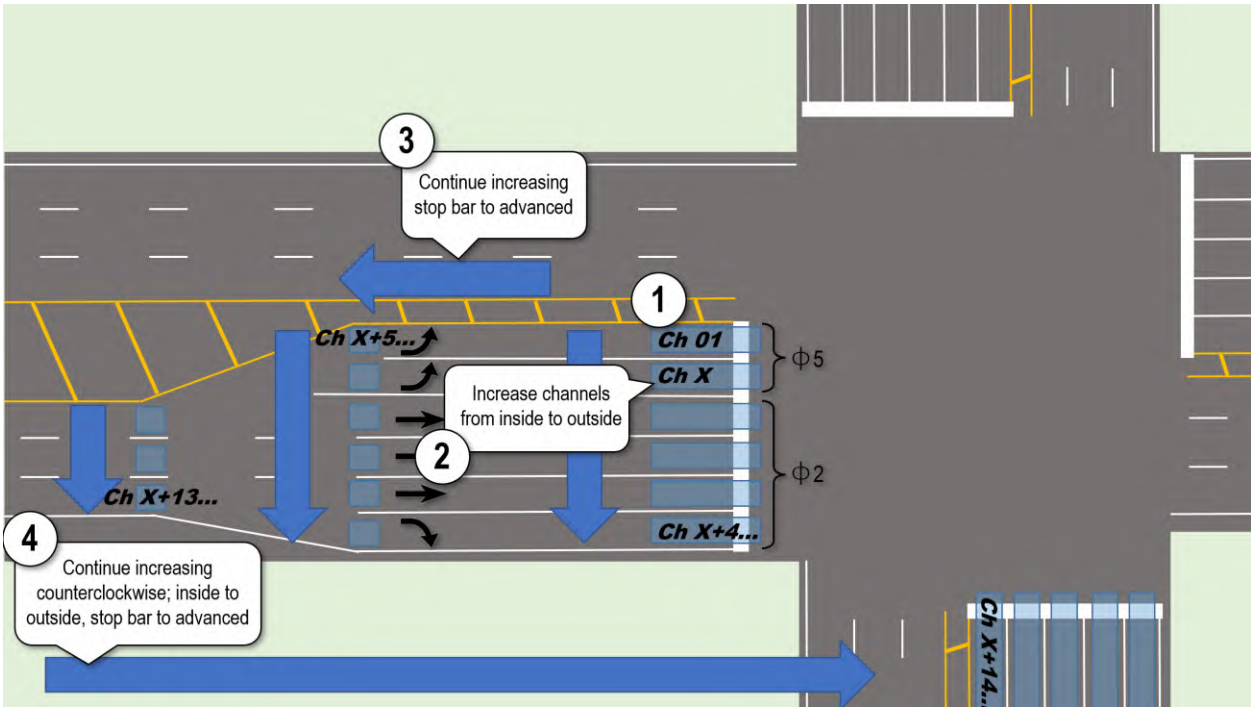


Figure 25: Default detector configuration schema channel assignments

Provide concrete aprons around all pull boxes collocating multiple boxes where feasible. Ensure boxes are separated per function (e.g., low-voltage signal versus high-voltage signal).

Example electrical transformer serving as the utility service point where the UAO will tap power for the signalized intersection.

Prestressed concrete Type P-II 12' pedestal poles are to be installed for all electrical power service equipment (e.g., meter, disconnect); avoid installing power service equipment on strain poles or cabinet exteriors.

6.7 General Infrastructure

The following provides generalized design guidance and considerations to build the necessary infrastructure for a complete *Smart Signal* system:

- Design in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 233*, *FDOT Standard Specifications for Road and Bridge Construction – 630 Series, FDOT Standard Specifications for Road and Bridge Construction – 635 Series,* and *FDOT Standard Specifications for Road and Bridge Construction – 639 Series*
- This document is not intended to be all inclusive and will not provide design guidance for signalization or pushbutton infrastructure.
    - Design signalization infrastructure in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 232, FDOT Standard Specifications for Road and Bridge Construction – 632 Series, FDOT Standard Specifications for Road and Bridge Construction – 634 Series, FDOT Standard Specifications for Road and Bridge Construction – 646 Series,* and *FDOT Standard Specifications for Road and Bridge Construction – 649 Series.*
    - All pedestrian features added or modified should be designed "Accessible Pedestrian Signal Ready" to permit future upgrades without reconstructing curb ramps or relocating pedestrian poles to meet spacing requirements.
- For electrical service runs between the utility service point and the signalized intersection equipment, ensure electrical pull boxes are spaced no greater than 600 feet apart.
- Unless otherwise specified by the maintaining agency, ensure conduit sizing as follows:
    - 3" conduit for signal
    - 2" conduit for detection (loop lead-in, video detection, etc.) and other low voltage equipment
    - 2" conduit for street lighting
    - 3" conduit for communication
    - 1" conduit for grounding
    - 3" spare conduit for signal
    - 3" spare conduit for communications
- Coordinate with the utility provider to ensure a power source is available and adequate for the proposed signal work. Perform electrical power draw calculations to ensure the minimum amperage is available and communicated with the Utility Agency Owner (UAO). Provide a minimum of twenty-five percent (25%) additional capacity for future loads. Ensure the calculations factor in the power draw loads for maintenance needs (e.g., vacuum, drill).
- Electrical service meter and service disconnect shall be located on a prestressed concrete Type P-II pedestal (12') located on the same intersection corner and adjacent to the controller cabinet, where feasible. Provide a dedicated electrical pull box at the baes of the Type P-II pole with rigid-galvanized steel conduits for all aboveground-underground transitions affixed to the pole. Where the utility service point and meter are not able to be located on the same intersection corner, or greater than 250' from the controller cabinet, provide an additional branch disconnect at the controller cabinet for ease of maintenance.
- Ensure voltage drop calculations are performed for all electrical service conductor runs and the plans provide the appropriate wire sizing in American Wire Gauge (AWG). Voltage drop shall not exceed 3.0%, unless otherwise approved by the Department.
- Grounding protection shall be designed in accordance with the applicable provisions of *FDOT Design Manual (FDM) – Section 233.3.8 and FDOT Standard Specifications for Road and Bridge Construction – 620 Series.*

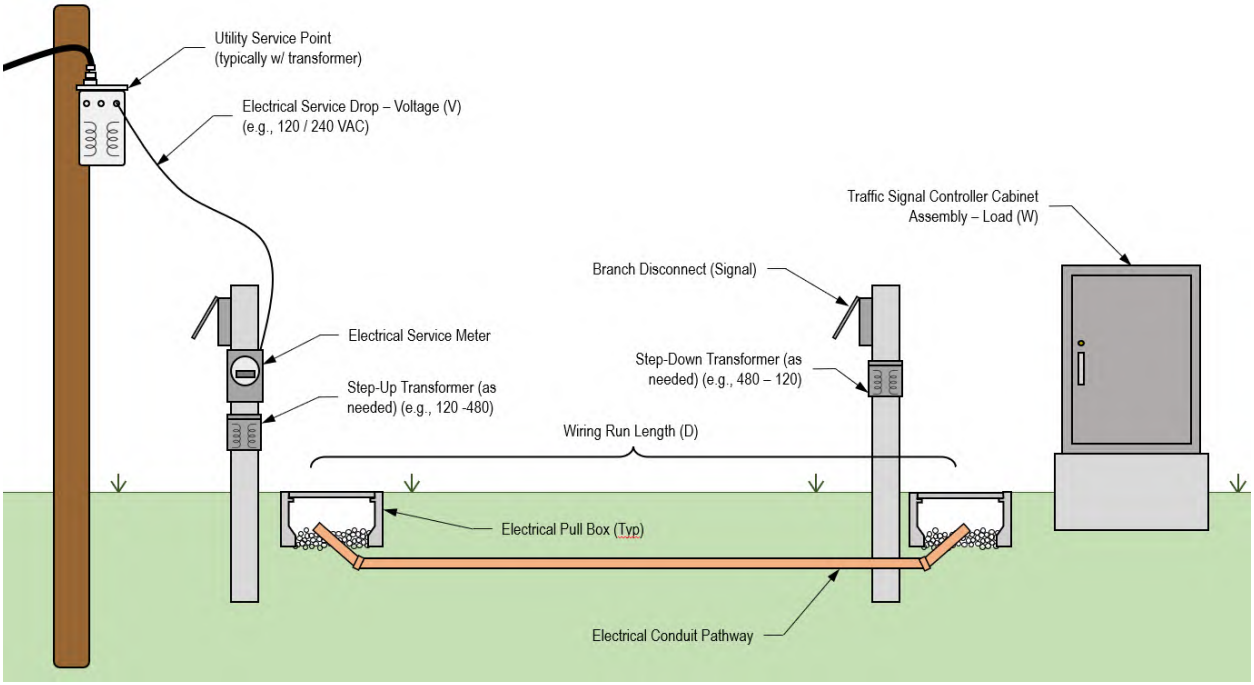


Figure 26: Typical Power Service Design

The following pay items shall be utilized in the design and installation of any general infrastructure:

- **630-2-AB** Conduit, Furnish & Install, (Installation Method)
- **635-2-1B** Pull & Splice Box, F&I, (Nominal Cover Dimensions)
- **635-3-1B** Junction Box, Furnish & Install, (Type)
- **639-1-1BC** Electrical Power Service, F&I, (Type of Service), (Meter Base)
- **639-2-1** Electrical Service Wire, Furnish & Install
- **639-3-1B** Electrical Service Disconnect, F&I, (Type Mount)
- **639-6-1BC** Electrical Power Service- Transformer, F&I, (Size), (Phase and Windings)
- **641-2-12** Prestressed Concrete Pole, F&I, Type P-II Service Pole

Section 7 – Special Design Considerations

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Section 8 – Technical Submittal

FDM Section 301 Sequence of Plans Preparation, *Smart Signal* Plan – Detail Sheets are Project Specific. Below is additional guidance for FDOT District 5 project specific *Smart Signal* Plans – Detail Sheets and the typical sequence of plans production, as well as the typical deliverables associated with a project including *Smart Signal* deployment.

Table 5: Phase Submittals Deliverables

Summary of Phase Submittals				
Provide *Smart Signal* Plans – Detail Sheets listed as applicable				
DELIVERABLE(S):		**Phase II**	**Phase III**	**Phase IV**
1	***Smart Signal* Plans**			
	Key Sheet	P	C	F
	Signature Sheet (if required)	P	C	F
	General Notes with Pay Item Notes	P	C	F
	Project Layout	P	C	F
	Pedestrian Pole Information	P	C	F
	Controller Timings	P	C	F
	Emergency Vehicle Preemption (EVP) Phasing and Timing	P	C	F
	Detection Channel Assignment Detail	P	C	F
	Interconnect / Communication Plan	P	C	F
	Splicing Diagrams	P	C	F
	Guide Sign Worksheet	P	C	F
	Mast Arm / Strain Pole Details	P	C	F
	Miscellaneous Structure Plans		P	F
	Mounting Details*	P	C	F
	Cabinet Installation Detail	P	C	F
	Managed Field Ethernet Switch Detail	P	C	F
	Wiring Diagrams	P	C	F
	Maintenance of Communication Plan (MOC)		P	F
	Temporary Traffic Control Plan		P	F
	Utility Location Summary		P	F
	Report of Core Borings		P	F
2	**Estimated Quantities (EQ) Report**		P	F
3	**Calculations (e.g., Power Draw, Conduit Fill)**		P	F
4	**Modified Special Provisions (MSP) / Technical Special Provisions (TSP)**	P	C	F
5	**Proprietary Product Certification (PPC)**	P	C	F
6	**ITS Certification Memo**	P	C	F

* Examples of typical Vehicle Detection Mounting Details include but are not limited to mounting details for the following types of devices: video detection, microwave radar, Bluetooth, and turning movement count system.

Status Key:
P – Preliminary
C – Complete but subject to change
F – Final

8.1 Plans Production

Ensure all *Smart Signal* Plans are developed to meet the requirements set forth in the latest version of *FDOT Standard Plans, FDOT Standard Specifications for Road and Bridge Construction,* and the District Five *ITS Design Review Checklist* located on https://cflsmartroads.com/. The following provides general guidance for the development of plan sheets and details.

Key Sheet – Develop Key Sheet in accordance with *FDM Section 327.2*. Engineer shall make the determination if this project requires the Key Sheet to be developed as a lead or component plan set and adjust accordingly.

General Notes – Develop General Notes sheet in accordance with *FDM Section 327.5.* Engineer shall ensure the provided notes are sufficient to cover all aspects of the project and shall include District Five specific signalization notes. Additionally, the General Notes sheet shall include a pictorial legend defining any atypical symbology utilized within the plan sheets and all necessary pay item notes. Pay item notes are required for proposed work that requires specific direction to the Contractor outside of the direction given within the Standard Plans and Specifications, as well as all adjust/modify pay item numbers. Pay item notes shall match to approved Proprietary Product Certifications (PPC) on project.

Pay item notes shall include, but is not limited to:

- Identifying appropriate EVP/TSP plans, modules, and all work necessary to convert existing databases, time of day plans, signal timing and phasing information for ATC Controllers
- Detailing necessary materials and work specific to the local maintaining agency

Refer to Section 6 – Standard Design for sample pay item notes specific to various design elements.

Project Layout – Develop Project Layout sheet in accordance with *FDM Section 309.* The Engineer shall select the appropriate common scale (e.g., 1" = 2000') for the Project Layout sheet necessary to depict all project information in a clean, easy-to-read format. At a minimum, project Layout sheets shall include the following:

- Begin Project Limits (w/ stationing)
- End project Limits (w/ stationing)
- North Arrow
- Scale
- County Line (as applicable)
- Street Names for Major intersections and Interchanges
- Plan sheet Numbering
- Signal ID No. and Device Type and ID No. (existing and proposed) (w/ stationing)
- Match Lines (as required)

If the project does not include baseline or centerline stationing, provide the appropriate latitude/longitude information for project limits and device locations.

Plan Sheets – Develop *Smart Signal* Plan Sheets in accordance with *FDM Section 327.6*. Plan Sheets shall be developed at either 1" = 40' or 1" = 50' scale.

Smart Signal specific requirements for Plan Sheets are as follows. Plan Sheets shall include the Global Intersection ID in the bottom right-hand corner from NOEMI Data Integration View. Ensure Plan Sheets clearly depict the existing and proposed signalization infrastructure including, but not limited to, field devices, structures, cabinets, conduits, pull boxes, and electrical equipment. The Plan Sheets shall also include topographical information (e.g., survey, aerial

photography) necessary to properly identify existing conditions and site constraints, such as right-of-way lines, underground and overhead utilities, roadway and drainage infrastructure, landscaping signalization equipment, sign structures, and more. Provide textual callouts with sufficient information for the Contractor to understand the proposed work, including brief descriptions of work (e.g., activity, size, type) and pay item numbers with the associated quantities and units. Conduit callouts shall include total number of runs and proposed utilization (e.g., low-voltage signal, high-voltage signal, fiber optics, power). Provide textual callouts with sufficient information for the Contractor to understand any removal work to be done and pay item numbers with the associated quantities and units. Ensure all *Smart Signal* devices and structures – including existing and proposed – are properly identified with the corresponding ID number(s), as well as stationing and offset from the baseline/centerline. If the project does not include a baseline or centerline, provide latitude and longitude information for each device. Callouts shall clearly identify the unique components of the *Smart Signal* system. If area within the plan sheet is heavily congested or require additional clarity, provide an inset with a higher level of detail and an increased scale (e.g., 1" = 10').

Detection Channel Assignment Detail – Ensure detection zones are called out on the Plan Sheets to indicate the locations of stop bar detection zones, advanced detection zones, and turning movement count detection zones. The Detection Channel Assignment Detail shall clearly match detection zones as called out in the plans to specific, unique channels and connections for the controller cabinet assembly. Ensure the Contractor is provided information for how the data is to be collected.

Additional Detail Sheets – Develop additional details as required to provide project-specific requirements and construction details. These may include, but are not limited to:

- Splicing Diagrams
- Wiring Diagrams
- Managed Field Ethernet Switch Detail
- Mounting Details (i.e., Turning Movement Count Camera, Video Detection, Radar Detection, Wireless Radio)
- Power Service Details
- Mast Arm Tabulation
- Internally Illuminated Street Name Signs Worksheet
- Mast Arm Assemblies Data Table
- Foundation Details
- Report of Core Borings
- Utility Verification Sheet

8.2 Estimated Quantities (EQ) Report

Develop Estimated Quantities (EQ) Report in accordance with *FDM Section 902.*

8.3 Calculations

During early works efforts (e.g., field review(s)), the Engineer should take note of existing conduit paths within the project limits. As-builts may provide information such as the size of the conduit installed, but it is important to note how many cables run within those existing conduits and the diameters of each cable. The total cross-sectional area occupied by the existing plus proposed cables shall not exceed 40% of the inner diameter of the conduit. This is applied to existing and proposed conduit.

During design, the Engineer should complete power draw calculations to determine the sufficient power source required. Power draw is a limiting factor of design as there is only so much demand a transformer can serve -

eventually a ceiling will be reached. Every device installed will require a different amount of power, so having appropriate cut sheets and data for the specific devices which are to be installed will provide more accurate numbers. Keep in mind, the distance from power source to device will also impact your power required.

8.4 Modified Special Provisions / Technical Special Provisions

Modified Special Provisions (MSP) shall be required when an implemented Specification does not adequately address the specific needs of the project. The required MSP will be a revision of the implemented Specification and will require approval from both the District and State Specifications Office. **Appendix E** includes sample MSP submittals that have been approved by FDOT.

Technical Special Provisions (TSP) shall be required when there is not an applicable section of the *FDOT Standard Specifications for Road and Bridge Construction* to cover the proposed type of work. Each TSP will require approval from the District Specifications Office.

8.5 Proprietary Product Certification (PPC)

Based on the distinct needs of the District and local agency preferences, there are a number of items in which a specific product or manufacturer is required to be used through Proprietary Products Certifications (PPC) to accommodate either synchronization with existing systems, unique functionality, or logistics. Each PPC must be submitted to the District for review and approval by the District Traffic Operations Engineering (DTOE) utilizing the established request letter and PPC form templates available on https://cflsmartroads.com/. PPC forms must include an attestation statement for why a product is essential to the project and/or why no equally suitable alternative exists. **Appendix C** includes sample PPC letters that have been approved by FDOT.

Refer to **Appendix A** for Local maintaining agency Equipment Preferences, as there may be signalization equipment preferred by local agencies which are not listed in the FDOT Approved Product List (APL).

8.6 ITS Certification Memo

Following completion of early works efforts (e.g., fields reviews, utility coordination, local agency coordination), it is the responsibility of the Engineer of Record to submit an ITS Certification Memo, identifying all personnel and agencies within the project limits that were contacted and identifying all existing communications and ITS field devices. The ITS Certification Memo acts as official record and provides plan of action to maintain, replace, or remove identified equipment.

Refer to **Appendix F** for a sample ITS Certification Memo.

FDOT TSM&O

Transportation Systems Management & Operations

District Five

Smart Signal

Appendices

Appendix A: Local Maintaining Agency Preferences

Maintaining Agency	Controller	Cabinet Assembly	Malfunction Management Unit (MMU)	Power Supply	Uninterruptible Power Supply (UPS)	Loop Detector Cards	Video Vehicle Detection System	Microwave Vehicle Detection System	Wireless Access Point	Preemption / Priority System	CCTV Camera	Intersection Movement Count (IMC) Platform	Bluetooth Travel Time Reader	Managed Field Ethernet Switch	Vehicular Signal Head	Pedestrian Signal Head	Pedestrian Detector (Standard)	Accessible Pedestrian System	Other Miscellaneous Information
Brevard County	Cubic* Commander ATC, TS-2 type1 APL No. 671-016-014	Cubic* Wired Cabinet Assembly 70006-TS2/FL, Size 6 w/ 64 Channels APL No. 676-023-004	Cubic* MMU-516E-L APL No. 678-016-007	Cubic* NEMA TS2 Shelf Mount APL No. 678-017-005			(1) Cubic*** w/ 8x6 Camera and GS2 Processing Unit APL No. 690-015-036 (2) Econolite Autoscope Vision System APL No. 690-015-037				Bosch AUTODOME IP Starlight 7000i	GridSmart Systems w/ 8x6 Camera and GS2 Processing Unit APL No. 690-015-036	Iteris** BlueTOAD Spectra APL No. 660-027-007	Ruckus ICX7150-C12P					
City of Melbourne	Cubic* - Commander ATC w/ Scout 85.2 or Higher, TS-1 Type 1 APL No. 671-016-014	Cubic* - Wired Cabinet Assembly 70006-TS-2/FL with Double Door, Size 6 w/ 64 Channels APL No. 676-023-004	Cubic* - MMU2 - 16LEp APL No. 678-016-007	Cubic* - Nema TS2 Shelf Mount PS2D APL No. 678-017-005	Alpha Novus 1100 Stand Alone w/ Cabinet Enclosure	Cubic - LCD 2 Channel TS2 Rack Mounted			Ubiquiti Powerbeam AC 5ghz High-Performance Air Max Bridge w/ 420 mm Dish	3M Opticom GPS TS-2 Rack Mounted	Bosch 7000HD	Cubic - Gridsmart GS2 Processing Unit/w/ 2 Ball Cameras, 1 In: Count Module APL No. 690-015-036	Iteris** - Blue TOAD Spectra APL No. 660-027-007	ITS Express 8042 Plus Bypass	Polycarbonate	Polycarbonate	Camball	Polara Navigator	Mast Arm 8 phase SOP 10 w/ 4-Section FYA's, Luminaires will be LED Cobra Head, Overhead Signs will be TCS - thin edge right mount LED
City of Palm Bay																			
City of Titusville	Cubic* 980 ATC TS-2 Type 1 APL No. 671-016-008	Cubic* - Wired Cabinet Assembly 70006-TS-2/FL with Double Door, Size 6 w/ 64 Channels APL No. 676-023-004	Cubic* MMU-516E-L APL No. 678-016-007	Cubic* NEMA TS2 Shelf Mount APL No. 678-017-005			Cubic*** Gridsmart APL No. 690-015-036a										Bulldog Polara APL No. 685-003-011a		
Flagler County																			
Lake County	TS2-1 Intelight/QFREE Controller (N-1 or (N+2, Ethernet Enabled Include a generator switch box panel	70006-TS2/FL Type 6 with rear door TS2-1 APL No. 676-023-004	Any on APL	Any on APL	Any on APL		Iteris Vantage Next APL No. 690-015-045	Wavetronix Radar Detection Matrix and Advanced	PEPLink FirstNet		Bosch Security Systems, Camera - Dome-VG5-ITS1080P-3096 APL No. 692-002-019			Hardened Networks model no. ITS-80124+	Any on APL	Any on APL	Any on APL	Any on APL	
Marion County	Siemens Eagle m50 ATC w/ SEPAC 5.3 firmware	Temple/Eagle NEMA TS2 (Size 6) w/ Cyberlock and UPS cabinet	EDI MMU-16LEp		Alpha FXM-HP1100 (8-hr min) Line interactive w/ Universal Generator Transfer Switch (Part no. 020-186-21)		Iteris Vantage Next Detection System Major: Vantage Vector camera/radar Minor: Vantage Next camera		Simrex		Sigura PTZ PD310 w/ PM08 mounting bracket	Goldsmart Smartmount Ball Camera	Iteris** Vantage Velocity BT	Ruckus, Layer 3 ICX7150-C12P-2X10GR	Aluminum top w/ polycarbonate bottom & reflectorized backplates 4-section heads w/ FYA				
City of Ocala	Cubic* - Commander ATC TS-2 Type 1 APL No. 671-016-014	Cubic* - Wired 7006-TS2/FL/PP Type 6- 64 channels (City Standard on file with Cubic) APL No. 676-023-004	Cubic* MMU-516E-L APL No. 678-016-007	Cubic* - Nema TS2 Shelf Mount PS2D APL No. 678-017-005	Alpha FXM- HP1100	Cubic* 2 Channel LCD Detector	Iteris Next / Vector				AXIS Q6135-LE PTZ CONI 4220 HID		Iteris** - Blue TOAD Spectra APL No. 660-027-007	ITS Express 8020			Polara Bulldog Black BDL Series		Box style intersector or Mast Arms, Street Lighting to remain separated from traffic signal, Double sided free swinging LED illuminated street signs
Orange County	Intelight NEMA TS2 Type 2 XN-2 APL No. 671-017-015	TCSMPXX TS2-71 Series APL No. 676-023-007	EDI-MMU2-16Lexp APL No. 678-016-008	EDI-PS200 APL No. 678-017-003	Alpha FXM 1100 APL No. 685-002-009L	EDI – Detector 2 Channel Auto Rack Mount APL No. 690-008-025	Iteris NEXT Vector (4) for Mast Arms Intersections APL No. 690-015-045-a Cubic WiBeil Camera and GS2 Processing Unit for Span Intersections APL No. 690-015-036	SmartMicro – TRUGRD Stream APL No. 690-018-010	Movision Smartlink APL No. 660-027-009	Opticom APL No. 663-001-005	VG5-ITS Autodome Series VG5 ITS 1080P APL No. 692-002-019		BlueTOAD APL No. 660-027-004	ITS Express ITS 8012-24 V3 APL No. 684-002-028			Polara BDL3 – B button APL No. 685-003-011a	Campbell Company – Guardian APL No. 685-004-010	BOS: Southern MFG Co APL No. 700-012-010 RRFB: Tapco APL No. 654-001-009
City of Orlando	980 ATC NEMA TS2-2 APL No. 671-016-008 (FDOT Locations ONLY) Commander ATC Traffic Controller - NEMA TS2 Type 2 (Trafficware), Scout APL No. 671-017-014	Trafficware Group Wired Cabinet Assembly TS-2 Size 6 APL No. 676-023-004	Eberle Design, Malfunction Management Unit Type 16, MMU2-16LEp APL No. 678-016-008	Trafficware Group, Cabinet Power Supply (TS2), PS2D APL No. 678-014-005	We would like to standardize to selected manufacturer used for UPS expansion project FDOT LAP fM #447398-1-38-01	No preference follow APL	(Iteris) If video detection is specified in plans	Wavetronix-Diamma Zone Protection System SS-200V and SS-200E (SmartSensor Advance) APL No. 690-026-002 Wavetronix-Vehicle Detector, Microwave SS225-SS226 SmartSensor Matrix APL No. 690-018-004 Wavetronix-Traffic Data Detector, Smartsensor-SmartSensor HD APL No. 690-020-004	No preference follow APL	Global Traffic Technologies, Preemption System, 764 GPS & IR (IR Phase Selector if specified in plans) APL No. 663-001-005	Bosch Security Systems, Camera - Dome-VG5-ITS1080P-3096 APL No. 692-002-019	GRIDSMART Technologies, Vehicle Detector - Video, GS Series APL No. 690-015-036	We currently do not have any	ITS Express 8000 Series APL No. 684-002-007	no preference follow APL	no preference follow APL	no preference follow APL	Pelco APL No. 685-004-009	(Lighting Per OUC) Streetworks discrete LED USSL-PA2B-740-U-T3-BK-10K-PR7 BIU: Trafficware Group, Bus Interface Unit, (TS2), BIU-170-TW APL No. 678-018-005 Load Switch: Power Distribution & Control, Load Switch, SSS-90-3 APL No. 678-004-009 Load Switch (Flasher): Power Distribution and Control, Flasher Type 3, SSF-90-3 APL No. 678-007-007 Flasher Transfer Relay: Flash Transfer Relay (Sinclhens-Dunn, LLC) APL No. 678-005-009
City of Maitland	Siemens m50 APL No. 671-017-012 Intelight APL No. 671-017-015	Temple APL No. 676-023-006	EDI MMU2-16LEp APL No. 678-016-008	EDI 5A48P APL No. 678-017-003	Alpha FXM- 1100 Series APL No. 685-002-020	EDI LMD224 APL No. 690-009-013	Iteris Vantage Next APL No. 690-015-045	Wavetronix APL No. 690-018-006	No preference	Global Traffic Technologies, Preemption System, 764 GPS & IR (IR Phase Selector if specified in plans) APL No. 663-001-005	No Preference	No Preference	No Preference	ITS Express ITS-8012-24 V3-K APL No. 684-002-028	No preference	No preference	No preference	Polara ICCUS2 APL No. 685-004-007	
City of Winter Park																			
Osceola County	Econolite Cobalt 2100 APL No. 671-017-014	Econolite R77 APL No. 676-023-001	EDI MMU2-16LEp APL No. 678-016-008	Econolite PS-250		EDI: LMD227 APL No. 690-017-008	Iteris Vantage Next APL No. 690-015-045		Movision	GTT 764 GPS & IR APL No. 663-001-006	TKH Square PD910 APL No. 692-002-015	Iteris Vantage Next w/Vector APL No. 690-015-045	Iteris** Vantage Velocity BT	ITS Express ITS-8012-24 V3-K APL No. 684-002-028	Mobotrex	Mobotrex	Polara BDL3-B APL No. 685-003-011	Polara iNS APS Pedestrian System APL No. 685-004-012	
City of Kissimmee	Econolite Cobalt 2100 APL No. 671-017-014	Econolite R77 APL No. 676-023-001	EDI MMU2-16LEp APL No. 678-016-008	Econolite PS-250	Alpha FXM1100 APL No. 685-002-020	EDI: LMD227 APL No. 690-017-008	Iteris Vantage Next APL No. 690-015-045		Movision	GTT 764 GPS & IR APL No. 663-001-006	TKH Square PD910 APL No. 692-002-015	Iteris Vantage Next w/Vector APL No. 690-015-045	Iteris** Vantage Velocity BT	ITS Express ITS-8012-24 V3-K APL No. 684-002-028	Mobotrex	Mobotrex	Polara BDL3-B APL No. 685-003-011	Polara iNS APS Pedestrian System APL No. 685-004-012	
Seminole County	Cubic Commander ATC, TS-2 Type 1 APL No. 671-016-014	Cubic Cabinet Assembly 70006-TS2/FLPP/S2-E2-WCD9110000 Cubic Cabinet Assembly 70006-TS2/FLPP/64-E2-WCD9110000	Cubic MMU APL No. 678-016-007	Cubic NEMA TS-2 Shelf Power Supply APL No. 678-017-005	APC 1300w UPS W12PT CABLE AND BYPASS SWITCH (9535-0123-APC-1300-BYP12) APL No. 685-002-018-a	Cubic LCD Detector Model 722L APL No. 690-017-009	Mivision SmartSense - 2 Camera detection plus GRIDSMART 2-Camera System with GS2 CPU APL No. 690-015-041-c APL No. 690-015-036			GTT 764 GPS with 3100 receiver and IR APL No. 663-001-006	Bosch VG5-ITS Autodome Series VG5-ITS1080P-30X kit APL No. 692-002-019	Mivision SmartSense - 2 Camera detection plus APL No. 690-015-041-c GRIDSMART 2-Camera System with GS2 CPU APL No. 690-015-036	Iteris** - Blue TOAD Spectra APL No. 660-027-007 Iteris** - BlueTOAD Spectera RSU APL No. 660-027-010	ITS Express ITS-8012-24 V3 Plus w/2-sfp-1000lx/60 gig optics APL No. 684-002-028		Dialight APL No. 653-022-014	Polara BDL3 APL No. 685-003-011	Pelco, Intellicross APL No. 685-004-009	Mast Arm Lighting - GE Evolve APL No. 715-005-017
Sumter County	Siemens m50 APL No. 671-017-012 Intelight/m3 APL No. 671-017-012	Temple TS2 Type 1 / Size Type 6 w/ 64 channels of vehicle detection APL No.676-023-006 TCS TS2 Type 1 / Size Type 6 w/ 64 channels of vehicle detection APL No.676-023-006	EDI MMU2-16LEp or EDI 16MMU-LE (Eberle Design) APL No. 678-016-008 The conflict monitor shall be networkable	EDI 5A48P APL No. 678-017-003	Alpha FXM1100 - The UPS should be networkable APL No. 685-002-020	EDI LMD224 APL No. 690-009-013	Iteris Next APL No. 690-015-045	Wavetronix APL No. 690-018-006		GTT 764 GPS & IR APL No. 663-001-006				ITS Express Siemens RS900G w/ 8 copper ports and dual 1000BASE-X SFP APL No. 684-002-028	Traffic Signal heads will be aluminum and black in color. Mounting Hardware: Astro Bracket with 120 inch steel braided cables and a 48 inch tube.	Countdown Type		Polara ICCU S2 APL No. 685-004-007	
Volusia County	Econolite Cobalt 2100, NEMA TS2 Type 2 APL No. 671-017-010	Econolite Type IV Cab APL No. 676-023-005			Econolite DBL "M" LED Series APL No. 685-003-001		Econolite Vision APL No. 690-015-037				Bosch VG5-ITS Autodome Series (Firmware version 5.32.0090) (Note: Model tested: VG5-ITS720P-30X4, Firmware version 5.32.0090) APL No. 692-002-004		Wavetronix SS-226 Smartsensor Matrix APL No. 690-018-004 Wavetronix SS-200V and SS-200E (SmartSensor Advance) APL No. 690-026-002	ITS Express ITS-8042, Plus, Series V3 (Note: 80 series including the ITS-80122-24/80/42, V3, and Plus model tested ITS-8042, FW Version V1.0 (2019-12-29t08:48:42-08:00)) Firmware updated to v1.0b (j) Supports SSH, HTTPS, RADIUS, TACACS+, SCP and SFTP) APL No. 684-002-028					
City of Daytona Beach	Cubic* - Commander ATC TS-2 Type 1 - Version 76.xxx APL No. 671-016-014	Cubic Size 6 Cabinet NEMA TS2-1	Cubic* - MMU 516 -L		Alpha FXM1100 Wifi-Communication Module APL No. 685-002-020		Iteris Vantage Vector Hybrid Detection System Iteris Vantage Next Iteris Vantage Radius	Wavetronix Matrix Sensor Stop Bar Detection Wavetronix Advance Sensor Click 650 (Cabinet Interface)			Bosch NDP-75-Z-Z30 Bosch Autodome Flex Mount VGA-A-9043			Transitions Networks Model SIS7040-284-LRT			Campbell Company Model DCC 200, Mount Screws ø10 and 3	Polara Engineering	

Notes:
* Cubic, formerly Trafficware
** Iteris, formerly Trafficcast
*** Cubic, formerly GridSmart

Appendix B: Utility Coordination

Project:

STATE PROJ. NO.	SHEET NO.
	X of Y

Utility Agency:
Contact Person:

STATION	OFFSET (m)	UTILITY TYPE/SIZE	MATERIAL	DESCRIPTION OF CONFLICT	TO REMAIN	TO BE REMOVED OFFSITE	TO BE ADJUSTED	TO BE RETIRED IN PLACE	TO BE RELOCATED	INCLUDED IN FDOT PROJECT	PRIOR TO FDOT PROJECT	CONCURRENT WITH FDOT PROJECT	REMARKS AND COMMENTS

* ALL CONFLICTS IDENTIFIED ARE PRELIMINARY. ADDITIONAL CONFLICTS MAY BE IDENTIFED.

* THE CONFLICTS IDENTIFIED IN THIS MATRIX BY THE F.D.O.T. DO NOT RELIEVE THE UTILITYCOMPANY/OWNER FROM THE RESPONSIBILITY TO IDENTIFY ALL CONFLICTS WITH THEIR FACILITIES.

*FAILURE BY THE OWNER TO IDENTIFY A CONFLICT MAY RESULT IN A CLAIM BROUGHT AGAINST THE UTILITY AGENCY BY THE FDOT.

*STATION/OFFSET REFERENCED FROM CENTERLINE OF CONSTRUCTION UNLESS OTHERWISE SPECIFIED.

UAO LETTERHEAD

Re:

I hereby certify that (**UAO NAME**) **HAS** existing facilities located within the above project limits and have determined that no relocation will be necessary. I have based this information off a field review and Atkins preliminary construction plans dated **(February 27, 2007)**. I have attached a set of marked plans with existing facilities to remain shown in green.

OR
(Please delete which paragraph is not applicable)

I hereby certify that **(UAO NAME) DOES NOT HAVE** any facilities located within the above project limits, as per the Atkins preliminary construction plans dated **(February 27, 2007)**.

_____ _____
SIGNED DATE

_____
PRINT NAME

_____
TITLE

Appendix C: Proprietary Product Certification (PPC)

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

PROPRIETARY PRODUCT CERTIFICATION

To: _____ Date: _____
Design Engineer

Financial Project ID: _____ New Const. ☐ RRR ☐
Federal Aid Number: _____
Project Name: _____
State Road Number: _____ Co. / Sec. / Sub.: _____
Begin Project MP: _____ End Project MP: _____
Full Federal Oversight: No ☐ Yes ☐ Note: If Yes, submit to FHWA Director.

A justification and all supporting documents must be attached to this document.
Mark the appropriate certification:

"I, _____, _____, of the _____,
Print Name of Initiator *Position Title* *Name of Agency*

do hereby certify that in accordance with the requirements of 23 CFR 635.411(a)(2),
Mark appropriately:

☐ *that this patented or proprietary item is essential for synchronization with existing highway facilities*
☐ *that this patented or proprietary item is essential for ease of maintenance.*
☐ *that this patented or proprietary item is essential for reduced maintenance cost.*
☐ *that no equally suitable alternative exists for this patented or proprietary item."*

_____, _____
Signature *Date*

For Department Use Only

"I, _____, _____
Print Name *Position Title*

of the Florida Department of Transportation, do hereby approve this certification request made in accordance with the requirements of 23 CFR 635.411(a)(2),
Mark appropriately:

☐ *that this patented or proprietary item is essential for synchronization with existing highway facilities.*
☐ *that this patented or proprietary item is essential for ease of maintenance.*
☐ *that this patented or proprietary item is essential for reduced maintenance cost.*
☐ *that no equally suitable alternative exists for this patented or proprietary item."*
Identify any conditions and limitations:

_____, _____
Signature *Date*

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

PROPRIETARY PRODUCT CERTIFICATION

To: Mario J. Bizzio, P.E.
Design Engineer

Date: 1/28/2019

Financial Project ID: 439682-5-52-01 New Const. ☐ RRR ☒
Federal Aid Number: N/A
Project Name: Milling and Resurfacing of I-4 Eastbound from SR 46 to the Seminole County Line
State Road Number: 400 Co. / Sec. / Sub.: 77160000
Begin Project MP: 12.355 End Project MP: 14.135
Full Federal Oversight: No ☒ Yes ☐ Note: If Yes, submit to FHWA Director.

A justification and all supporting documents must be attached to this document.
Mark the appropriate certification:

"I, Nicholas Spatola, P.E. (Print Name of Initiator), *Project Manager* (Position Title), *of the Faller, Davis & Associates, Inc.* (Name of Agency),

do hereby certify that in accordance with the requirements of 23 CFR 635.411(a)(2),
Mark appropriately (choose only one option):

☐ *that this patented or proprietary item is essential for synchronization with existing highway facilities.*
☒ *that no equally suitable alternative exists for this patented or proprietary item."*

Signature, January 28th, 2019 (Date)

For Department Use Only

"I, James S. Stroz, Jr. (Print Name), District Traffic Operations Engineer (Position Title),

of the Florida Department of Transportation, do hereby approve this certification request made in accordance with the requirements of 23 CFR 635.411(a)(2),
Mark appropriately (choose only one option):

☐ *that this patented or proprietary item is essential for synchronization with existing highway facilities.*
☒ *that no equally suitable alternative exists for this patented or proprietary item."*
Identify any conditions and limitations:

Signature, 1/30/19 (Date)

FALLER, DAVIS & ASSOCIATES, Inc.
HIGHWAY ENGINEERING SPECIALISTS
DESIGN | ENVIRONMENTAL | OPERATIONS

1/24/2019

Mr. Mario Bizzio, P.E.
FDOT District Five Design Engineer
719 South Woodland Boulevard
DeLand, Florida 32720

Subject: Proprietary Product Certification Justification Letter & Backup Documentation
FPID: 439682-5
Project Name: I-4/SR 400 FROM SR 46 TO E OF SR 600 (US 17/92) (EB ONLY)
(Peek ADR 3000 w/ STOPWATCH)

Mr. Mario Bizzio, P.E.
FDOT District Five Design Engineer
719 South Woodland Boulevard
DeLand, Florida 32720

Subject: Proprietary Product Certification Justification Letter & Backup Documentation
FPID: 439682-5
Project Name: I-4/SR 400 FROM SR 46 TO E OF SR 600 (US 17/92) (EB ONLY)
(Peek ADR 3000 w/ STOPWATCH)

Dear Mr. Bizzio,

Please see the attached Proprietary Product Certification Form 630-020-07 completed in accordance with Procedure 630-020-005 adopted on August 20, 2014. Please also see the required justification below:

1) **Description of the project need for the proprietary product.**
   a. Project Description: The I-4/SR 400 FROM SR 46 TO E OF SR 600 (US 17/92) (EB ONLY) project includes the installation of a rack mounted traffic monitoring Site Vehicle Speed/Classification Unit as part of the Intelligent Transportation System (ITS) along I-4/SR 400 at existing PTMS site 770266. The Traffic Monitoring Site Vehicle speed/classification unit provides traffic data such as vehicle speed, volume, classification and occupancy as a non-intrusive alternative to inductive road-embedded dual-loop systems.

   b. Capabilities: There is a need to provide data in 30 second intervals to update travel time information as part of the Advanced Traffic Management System (ATMS). At the same location there is a need to record volume data at an accuracy level that meets national Highway Performance Monitoring System (HPMS) accuracy levels.

c. Compatibility with Existing Software: SunGuide software is used to control the ATMS. Devices need to work within SunGuide.

d. Proprietary Product Description: Of the devices that meet the accuracy requirements, only one device is capable of reporting data in 30 second bins via an IP network:
   i. Peek ADR 3000 with StopWatch

2) **Factual and technical supporting evidence for Unique Need.**
Function: An evaluation of the pool of potential products and a description of why other products cannot meet the Contracting Agency's needs:
   a. The State of Florida has an Approved Products List for items that meet performance requirements of HPMS for controllers. Those items are listed below:
      i. Peek ADR 3000 TRAFICOMP III
      ii. Diamond Traffic Phoenix II
   b. Of the pool of two possible controllers, one is not applicable:
      i. Diamond Traffic Phoenix II does not support 30 second bins reported over an IP Network.

3) **Explanation how the evidence links it to the project need.**
   a. This is a resurfacing project that is milling out the current PTMS site and affecting the ATMS site.
   b. The function of connecting to the ATMS for travel time information is required based on the FDOT standard of sensors every ½ mile on limited access corridors.
   c. FDOT standards provide communication via an IP network to work with the central software: SunGuide.
   d. Reporting information to HPMS is identified as a need based on federal standards.

4) **Factual and technical supporting evidence that no alternatives are available.**
   a. Enclosed is a manual for the Diamond Traffic Phoenix II, showing it does not support 30 second bins reported over an IP Network. As such, it cannot be joined to an IP network and provide the required recording intervals.

If you have any questions please feel free to contact me at (407) 644-2116 or via email at nspatola@fallerdavis.com.

Sincerely,

Nicholas J. Spatola, P.E.
Faller, Davis & Associates, Inc.
Project Manager

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

PROPRIETARY PRODUCT CERTIFICATION

To: Mario Bizzio, P.E.
Design Engineer

Date: 7/12/2018

Financial Project ID: 438003-1-52-01 New Const. ☐ RRR ☒
Federal Aid Number: D517-085-B
Project Name: I-95 from Volusia County Line to N of Palm Coast Parkway
State Road Number: I-95 Co. / Sec. / Sub.: Flagler County / Section 73001000
Begin Project MP: 0 End Project MP: 11.553
Full Federal Oversight: No ☒ Yes ☐ Note: If Yes, submit to FHWA Director.

A justification and all supporting documents must be attached to this document.
Mark the appropriate certification:

"I, Erik Spillmann P.E. (Print Name of Initiator), *ITS Engineer of Record* (Position Title), *of the BCC Engineering* (Name of Agency),

do hereby certify that in accordance with the requirements of 23 CFR 635.411(a)(2),
Mark appropriately (choose only one option):

☐ *that this patented or proprietary item is essential for synchronization with existing highway facilities.*
☒ *that no equally suitable alternative exists for this patented or proprietary item."*

Signature , 7/12/2018 *Date*

For Department Use Only

"I, JAMES S. STROZ, JR. *Print Name*, DTOE *Position Title*,

of the Florida Department of Transportation, do hereby approve this certification request made in accordance with the requirements of 23 CFR 635.411(a)(2),
Mark appropriately (choose only one option):

☐ *that this patented or proprietary item is essential for synchronization with existing highway facilities.*
☒ *that no equally suitable alternative exists for this patented or proprietary item."*
Identify any conditions and limitations:

Signature , 7/16/18 *Date*

June 11, 2018

Mr. Mario Bizzio, P.E.
FDOT District Five Design Engineer
719 South Woodland Boulevard
Deland, Florida 32720

Subject: Proprietary Product Certification Justification Letter & Backup Documentation
FPID: 438003-1-52-01, 438003-2-52-01
(Wavetronix HD Microwave Vehicle Detector)

Dear Mr. Bizzio,

Please see the attached Proprietary Product Certification Form 630-020-07 completed in accordance with Procedure 630-020-005 adopted on August 20, 2014. Please also see the required justification below:

1) **Description of the project need for the proprietary product.**
   a. Project Description: The I-95 Flagler County Resurfacing project includes the installation of road-side mounted microwave vehicle detectors (MVDS) as part of the Intelligent Transportation System (ITS) along I-95. MVDS provide traffic data such as vehicle speed, volume, classification and occupancy as a non-intrusive alternative to inductive road-embedded dual-loop systems.

   b. Dual-Radar Capabilities: Microwave vehicle detectors can be classified in two different categories, single antenna and dual antenna units. Single antenna MVDS have the limitation of assuming a vehicle length to obtain vehicle speed, and their inability to detect vehicle heading direction. Whereas, dual antenna, also known as dual radar, do not have to assume a vehicle length to determine vehicle's speed. Dual-radar MVDS use two embedded radio antennas operating at different microwave frequencies. This configuration is very close to the true operating behavior of the dual inductive road loops. By measuring the fraction of a millisecond that it takes a vehicle to pass the two microwave beams, the dual-radar MVDS can accurately determine vehicle speed. The order in which the antennas received their signal is used to determine vehicle heading direction. This later feature allows for the dual-radar detector to determine the vehicle travel direction.

   c. Compatibility with Existing MVDS: The Department has already installed Wavetronix HD series MVDS in other areas of the ITS network. It is the same product already in use and is guaranteed to be compatible with the existing system.

   d. Proprietary Product Description: The dual radar microwave vehicle detector system includes the following primary components:
      i. Wavetronix Smart Sensor (SS) High-Definition (HD) series

2) **Factual and technical supporting evidence for Synchronization.**
   a. Function: the proprietary product is necessary for the satisfactory operation of the existing facility.

i. This product is the same product already in use, and is guaranteed to be compatible with the existing infrastructure.

b. Logistics: the proprietary product is interchangeable with products in the Contracting Agency's maintenance inventory.
   i. This product is the same product already in use, and is guaranteed to be interchangeable with the existing maintenance inventory.

c. Training costs for staff, such as significant training required to effectively maintain and operate an unfamiliar product.
   i. The current Department staff and ITS Maintenance Contractor are familiar and trained to use the existing product. By proposing the same product, no additional training costs are anticipated.

3) **Explanation how the evidence links it to the project need.**
   a. FDOT District 5 will be able to log in the SunGuide database, vehicles traveling the wrong way, allowing the Department to correlate this data with accident data logged into the system. Wrong way driving accidents are commonly associated with people driving reverse on an off-ramp after realizing that they took the wrong exit, or drivers driving the wrong direction in the mainline shoulder after realizing that they missed a highway exit. The implementation of a system capable of detecting and logging these events will improve road safety, by identifying problematic areas and improving incident response times.

   b. Additionally, FDOT District 5 will seek integrating the reverse driving direction (vehicle travel direction) into the SunGuide software, as an enhancement to the TSS subsystem (the MVDS driver within SunGuide), in which the TSS graphical map's links are updated with a distinctive color, indicating that a lane or segment of roadway is operating in reverse mode. This feature will be instrumental during evacuation and road closure conditions that cause vehicles to travel in the reverse direction under the guidance of a proper temporary traffic diversion maintenance of traffic (MOT).

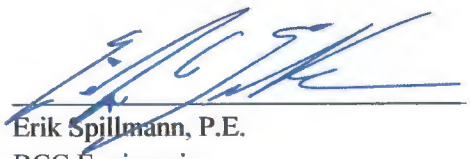
4) **Factual and technical supporting evidence that no alternatives are available.**
   a. There are five MVDS products currently listed in the FDOT Approved Products List (APL), classified under the Traffic Data Detection System – Microwave category. The manufacturers with products in this category are GovComm, Image Sensing Systems, and Wavetronix. All three vendors have single antenna units (also known as single radio). Wavetronix has one MVDS product series that offers the dual-radar configuration. The Wavetronix model series with dual-radar capabilities is the Smart Sensor (SS) High Definition (HD) series on the APL. The GovComm GC-R series, Image Sensing Systems MVDS G4 Model K4 and Model SX-300, and the Wavetronix MVDS model SS105V do not offer dual-radar functionality.

   b. The FDOT District 5 has therefore concluded, as a strategic safety measure to be built into their ITS network, the need to implement the unique dual-radar MVDS. Based on the capabilities and availability of the Wavetronix Smart Sensor HD models on the APL, District 5 seeks to process these MVDS models as unique proprietary products with no suitable alternative that also synchronize with the existing MVDS facilities.

If you have any questions please feel free to contact me at (407) 951-6444 or via email at

espillmann@bcceng.com.

Sincerely,



Erik Spillmann, P.E.
BCC Engineering
Sr. ITS Engineer

Appendix D: Technical Special Provision (TSP)

TECHNICAL SPECIAL PROVISION

FOR

CONNECTED VEHICLE ROAD SIDE UNIT

FINANCIAL PROJECT ID: 436325-2-52-01

The official record of this Technical Special Provision is the electronic document signed and sealed under Rule 61G15-23.004 F.A.C.

I hereby certify that this Technical Special Provision was prepared under my responsible charge and that it has been reviewed in accordance with procedures adopted and implemented by the Florida Department of Transportation.

Professional Engineer:	Paul J. Mannix
Date:	August 18, 2020
Fla. License No.:	57712
Firm Name:	Atkins North America, Inc.
Firm Address:	482 South Keller Road
City, State, Zipcode:	Orlando, Florida 32810
Certificate of Authorization:	No. 24
Pages:	1-6

T681 – CONNECTED VEHICLE ROAD SIDE UNIT

T681-1 Description.

Furnish and install a Connected Vehicle (CV) Road Side Unit (RSU) in accordance with the Contract Documents. The CV RSU is a component of the CV equipment.

T681-2 Materials.

The Connected Vehicle (CV) equipment must be compatible with United States Department of Transportation (USDOT) approved Security Credential Management System (SCMS) message security solution for vehicle-to-infrastructure (V2I) communications and meet the applicable industry standards listed in Table T681-2.1.

Table T681-2.1
CV Equipment Requirements and Standards

Document Identifier	Description
FHWA-JPO-17-589 (April 28, 2017)	Dedicated Short-Range Communications Roadside Unit Specifications https://rosap.ntl.bts.gov/view/dot/3600
3GPP Release 14 (or later)	https://www.3gpp.org/ftp/Specs/latest/Rel-14/
IEEE 802.11-2012 (or later)	Institute of Electrical and Electronics Engineers (IEEE) Standard for Information technology--Telecommunications and information exchange between systems local and metropolitan area networks--Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications
IEEE 1609.0-2013 (or later)	IEEE Guide for Wireless Access in Vehicular Environments (WAVE) - Architecture
IEEE 1609.2-2016 (or later)	IEEE Standard for WAVE -- Security Services for Applications and Management Messages
IEEE 1609.3-2016 (or later)	IEEE Standard for WAVE -- Networking Services
IEEE 1609.4-2016 (or later)	IEEE Standard for WAVE -- Multi-Channel Operation
IEEE 1609.12-2016 (or later)	IEEE Standard for WAVE -- Identifier Allocations
IEEE 802.3at-2009	Standard for Power over Ethernet
FCC Title 47, Parts 0, 1, 2, 15, and 90	Federal Communications Commission (FCC) Code of Federal Regulations (CFR)

The CV equipment includes hardware, software, ancillary devices, and all material necessary to enable wireless V2I communications. Ensure that all assembly hardware, including nuts, bolts, external screws and locking washers less than 5/8 inch in diameter, are Type 304 or 316 passivated stainless steel. Use stainless steel bolts, screws and studs meeting the requirements of ASTM F593. Use nuts meeting the requirements

of ASTM F594. Ensure all assembly hardware greater than or equal to 5/8 inch in diameter is galvanized. Use bolts, studs, and threaded rod meeting the requirements of ASTM A307. Use structural bolts meeting the requirements of ASTM F3125, Grade A325.

The CV equipment must be FCC certified. Ensure that the FCC identification number is displayed on an external label and that all devices operate within their FCC frequency allocation of 5.9 GHz Dedicated Short-Range Communication (DSRC) and Cellular V2X (C-V2X). Both the antennas and the base units must be FCC certified if they are approved separately.

CV equipment must be capable of remote firmware updates to include SCMS updates and other related firmware updates. Device manufacturers must make firmware updates available to the Department and maintaining agency at no cost.

DSRC and C-V2X capabilities are required. Concurrent DSRC and C-V2X operation is not required.

T681-2.1 Roadside Unit (RSU): The RSU must be a commercially available production grade device that provides information and supports public safety operations in a V2I/V2X communication environment. Preconfigure RSUs to account for specific site to be ready for the installation and operation at the site shown on the plans. This includes MAP data. Identify site specific conditions in advance of the device installation.

Provide RSUs that are interoperable with all FDOT APL approved ATC traffic signal controllers.

Ensure that the RSU is permanently marked with manufacturer name or trademark as well as part number and serial number. Ensure that the markings are visible after installation.

T681-2.1.1 Wired Interfaces: The RSU must include a wired Ethernet interface.

T681-2.1.2 DSRC Interface: The RSU must include a commercial grade radio that transmits and receives DSRC messages within the 5.9GHz band. Supports Single Channel Continuous and dual Channel Alternating DSRC Channel Modes simultaneously.

T681-2.1.3 Cellular Interface: The RSU must be compatible with 5G and support C-V2X direct communication (LTE V2X PC5 mode 4), defined by 3GPP Rel-14 (or later).

T681-2.1.4 Bluetooth® Interface: The RSU must function as a probe data detector and meet the requirements of Section 660 for probe data detection systems using automatic vehicle identification (AVI) technology. The integrated AVI detection system portion of the RSU must capture and forward MAC addresses, in real-time and unmodified, to a server on the Department's private traffic control system network. Coordinate device, system, and network configuration with the Engineer.

T681-2.1.5 Antennas: Ensure that antennas are provided for all radio frequency (RF) connectors on the RSU. Only those antennas tested with the device to obtain the FCC Grant of Equipment Authorization (or similar antennas with equal or lesser gain) may be used and must not be co-located or operated with any other antenna or transmitter, except in accordance with the FCC multi-transmitter policy. Antennas must be removable to allow for the antennas to be installed at a distance from the RSU unit or replaced as needed.

T681-2.2 Configuration and Management: RSU must be provided with all hardware, software, configuration tools and software licenses required for local and

remote configuration, operation, and management including access to all user-programmable features as well as health and status monitoring, event logging, and diagnostic utilities. Configuration and management functions must be password protected. Access to all user-programmable features, alarm monitoring, configuration parameters, event logging and diagnostic utilities must be through a vendor provided Graphical User Interface (GUI). The RSU must be provided with an open application programming interface (API) and software development kit available to the Department at no additional cost. The RSU must automatically recover from a power failure once power is restored. Ensure that all programmable settings are restored to their previous configurations and that the system resumes proper operation.

T681-2.3 System Communication: The RSU must be assigned an IPv4 address provided by the Department. The RSU must be IPv6 compatible.

T681-2.4 Electrical Specifications: Ensure the RSU is provided with a power over ethernet (PoE) injector as detailed in the plans. Powered ports on the PoE injector must meet the requirements set forth in IEEE 802.3at. Ensure the PoE injector operates using a nominal input voltage of $120V_{AC}$. If the PoE injector requires nominal input voltage of less than $120V_{AC}$, furnish the appropriate voltage converter.

T681-2.5 Environmental Requirements: Ensure equipment performs all required functions during and after being subjected to the transients, temperature, voltage, humidity, vibration, and shock tests described in NEMA TS2, 2.2.7, 2.2.8, and 2.2.9.

T681-2.6 Ports and Connectors: The RSU must include all necessary ports and connectors for a complete assembly. Type N weatherproof RF ports are required for the antennas. All ports must be legibly and permanently marked designating their intended use. All labels must be weather resistant.

T681-2.7 FCC License: Compile all information required to register RSU devices and locations with the FCC and provide this information to the Engineer for review in accordance with Section 7-2. Support the permitting effort until complete.

T681-3 Installation.

Install and configure all equipment in accordance with the Contract Documents, manufacturer's recommendations, and as directed by the Engineer. Furnish all equipment with the appropriate power and communication cables, mounting brackets, and mounting hardware according to the manufacturer's recommendations. Ensure that cables comply with NEC sizing requirements and meet all other applicable standards, specifications, and local code requirements.

Cut all wires to their proper length before assembly. Do not double back any wire to take up slack. Neatly lace wires into cables with nylon lacing or plastic straps. Secure cables with clamps and provide service loops at all connections. Ensure that all unshielded twisted pair/shielded twisted pair Ethernet network cables are compliant with the EIA/TIA-568-B standard and UL type CMX outdoor. Verify that all field wiring meets applicable National Electric Code (NEC) requirements.

T681-3.1 RSU Installation: Install RSUs on existing poles or sign structures, or on new poles, as shown in the Plans. Ensure that status indicators remain unobstructed and visible.

Submit electronic configuration file backups to the Engineer following field testing. Backup files must include MAP files, communication settings, firmware, and all other files and settings required to program a new replacement RSU.

The RSU, mounting hardware, and any other related material that is exposed to the environment must be designed for 150 mph wind speeds and meet the requirements of the Department's Structures Manual.

T681-3.2 Testing:

T681-3.2.1 General: Subject all equipment to field acceptance tests. Develop and submit a test plan for field acceptance tests to the Engineer for consideration and approval. The Engineer reserves the right to witness all field acceptance tests.

T681-3.2.2 Field Testing: Once the CV equipment has been installed, conduct local field acceptance tests at each field site according to the submitted test plan. Perform the following:

1. Verify that physical construction has been completed as detailed on the Plans.
2. Inspect the quality and tightness of ground and surge protector connections.
3. Verify proper voltages for all power supplies and related power circuits.
4. Connect devices to the power sources. Verify that the LED on the RSU turns on.
5. Verify all wire and cable connections are correct and secure.
6. Verify the configuration of CV device network interfaces.
7. Connect to the CV equipment using Secure Shell from a remote computer.
8. Verify over the air RSU broadcasts using a multi-channel test tool (MCTT).
    a. Ensure that the MCTT calibration certification is submitted to the Engineer.
    b. Ensure that the data logging is active on all units under test and the data logs are sent to the required data repository.
    c. Test DSRC with the security on and off. With mismatched security certificates, ensure that the message is logged but the payload is not decoded. With matching security certificates, ensure full payload is decoded.
    d. Scan all DSRC channels and document that all sources of potential interference have been successfully mitigated.
    e. Verify that the MCTT received TIMs, including SPaT and MAP data, where applicable.

T681-4 Warranty.

Ensure that the manufacturer will furnish replacements for any part or equipment found to be defective during the warranty period at no cost to the Department or the maintaining agency within 10 calendar days of notification. Ensure that CV equipment has a manufacturer's warranty covering defects and remote troubleshooting for a minimum of two (2) years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

T681-5 Method of Measurement.

The Contract unit price for each RSU furnished and installed, will include furnishing, placement, and testing of all materials and equipment, and for all tools, labor, equipment, hardware, operational software packages and firmware, supplies, support,

personnel training, shop drawings, documentation, and incidentals necessary to complete the work.

T681-6 Basis of Payment.

Price and payment will be full compensation for furnishing all materials and completing all work as specified in this section and shown in the Plans.

Payment will be made under:

Item No. 920-681- Connected Vehicle Road Side Unit – each.

TECHNICAL SPECIAL PROVISION

FOR

ITS Automatic Vehicle Identification System
(AVI):

Financial Project ID:
435443-1-52-01

The official record of this Technical Special Provision is the electronic file signed and sealed under Rule 61G 15-23.003, F.A.C.

Prepared by: Kevin R Carey, P.E.
Date: March 2, 2015
Fla. License No.: 61635
Firm Name: Faller, Davis & Associates, Inc.
Firm Address: 258 Southhall Lane Suite 210
City, State, Zip Code: Maitland, FL 32751
Certificate of Authorization: 5864

Pages: 1-4

T660 ITS Automatic Vehicle Identification System (AVI)

T660-1 Description: Provide a Bluetooth AVI device that is powered by solar or traffic signal cabinet power supply. The device shall communicate via a cellular or ethernet connection with the Florida Department of Transportation (FDOT) servers.

T660-1.2 Materials: The device shall be Class 1 rated and shall operate on either a 120-240 VAC connection using a 12 VDC adapter, a 12 VDC battery, or a Power Over Ethernet connection.

T660-1.3 Construction Requirements: The location and type (solar or cabinet power supply) of AVI device shall be installed as shown in the contract documents.

T660-1.4 Operation, Configuration, and Management: The device network setting shall be user configurable. The system shall collect and report data continuously, 24 hours a day and 7 days a week. The device shall collect and archive all detections with a travel time of at least 30 seconds. The system shall record multiple hits as a Bluetooth device travels through the area of detection, not a single data entry per Bluetooth device unit. The data shall upload to the server automatically at least every 60 seconds, and the system shall have provisions for not losing data if upload fails. The device shall maintain a local cache of data with provisions for a minimum of two weeks' worth of data stored in non-volatile, user-replaceable storage. The device shall automatically set time each day and have a battery backed real-time clock source.

T660-1.4.1 Device Detection Range: The device shall detect at a minimum the area depicted in the plans. The device shall support RP-SMA omni-directional antennas for Bluetooth signal. The device shall be configured as a class 1 Bluetooth device via a web based interface. The device shall be capable of detecting up to at least a 300 foot range.

T660-1.5 Communications: The device shall use TCP/IP and or UDP/IP communications over 10/100-BaseTX Ethernet network, or GSM network with a data plan. The unit shall use Bluetooth Class 1 rated devices.

T660-2 Software Interface: The device drivers shall communicate with vendor specific protocols in order to relay information from the devices into the SunGuide system. The system shall have a probe based protocol that will allow the SunGuide system to efficiently process vendor specific data and diagnose issues with the field device.

T660-2.1 TCP/IP Interface: The device shall allow SunGuide to establish a TCP/IP connection to the device, in order to allow the system to easily identify connectivity issues with the device and the source of any data from a field device. The device shall allow SunGuide to remove the source device identification field from the data provided by the field device.

T660-2.2 Data Format: The data shall be provided in an XML format. All messages that the device sends or receives shall be fully documented and provided to FDOT. Each message shall be clearly delimited from another message, and any delimiters shall be documented.

T660-2.3 Data Message: Data messages shall be sent immediately upon the MAC address being received by the field Bluetooth device. The MAC address shall be unique to the vehicle device and shall be easily matched to the same vehicle device passing a different Bluetooth device. The timestamp shall be formatted in the same way across all field devices. Any additional information provided by the data message shall be well documented and include a definition of what data is being reported including the units of measurement or other necessary information needed by the data processing application to interpret and make decisions based on the data.

T660-2.4 Heartbeat Message: The device shall send a heartbeat message which consists of device status and any problems the device might be experiencing. This message shall be sent by the field device on a regular interval regardless of additional data messages being sent.

T660-2.5 Time Synchronization of Devices: The device shall have a timestamp consistent with other devices and the software interpreting the data. The device shall either support a request to set the time on the device or support a process that syncs to a configured NTP server.

T660-3 Method of Measurement: The quantity to be paid for shall be the Contract unit price for each component of an AVI detection system, furnished and installed, and will include furnishing, placement, testing of all materials and equipment, and for all tools, labor, equipment, hardware, operational software packages and firmware, supplies, support, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the work.

T660-4 Warranty: The AVI shall include a minimum three year warranty on furnished equipment, software for material, workmanship, design, and manufacturers defects. The Contractor shall not purchase the equipment prior to the issuance of Notice to Proceed. The Contractor shall assign to the Department the above manufacturer's or other seller's warranties that come with those products, material or supplies. Assignment of such warranties shall be effective on the date of Final Acceptance. To the extent that any of such warranties do not extend to subsequent purchasers or owners or such warranties contain a limitation on assignment, the Contractor agrees that the Contractor purchased the products, materials, and supplies, on behalf of the Department with the intent that the Department be the original end user of the product and intended recipient of any warranties. All documents associated with or describing any such warranties shall be delivered to the Department along with the other project final acceptance documents and shall be deemed to be a part of the required final acceptance documentation. Contractor shall not take any action or fail to act in any way which voids any such warranties.

T660-5 Basis of Payment: Price and payment will be full compensation for all work specified in this Technical Special Provision.

Payment will be made under:

Item No. 660-6-122	Vehicle Detection System – AVI, Bluetooth, F&I, Above Ground Equipment

TECHNICAL SPECIAL PROVISION

FOR

Managed Field Ethernet Switch
(MFES):

Financial Project ID:
435443-1-52-01

The official record of this Technical Special Provision is the electronic file signed and sealed under Rule 61G 15-23.003, F.A.C.

Prepared by: Kevin R Carey, P.E.
Date: March 2, 2015
Fla. License No.: 61635
Firm Name: Faller, Davis & Associates, Inc.
Firm Address: 258 Southhall Lane Suite 210
City, State, Zip Code: Maitland, FL 32751
Certificate of Authorization: 5864

Pages: 1-3

T684 Managed Field Ethernet Switch (MFES)

T684-1 Description: Provide a MFES that is powered by cabinet power supply and provides Power-over-Ethernet (POE) connections. The MFES shall be compatible with FDOT network protocols.

T684-1.2 MFES Device Details: The device shall be 19" rack mountable. The device shall occupy no more than one rack unit. The device shall operate between 0°C and 45°C (32°F and 110°F). The device shall operate between 5% and 95% relative humidity, non-condensing.

T684-1.3 Networking Standards: The device shall comply with all applicable IEEE networking standards for Ethernet communications, including but not limited to:

- IEEE 802.1D-2004 standard for media access control (MAC) bridges used with the rapid spanning tree protocol (RSTP).
- IEEE 802.1p standard for mapping to priority queue and quality of service (QOS).
- IEEE 802.1Q-2005 standard for virtual local area network (VLAN) bridges.
- IEEE 802.1w standard for rapid spanning tree protocol (RSTP).
- IEEE 802.1X standard for port-based network access control (PNAC).
- IEEE 802.3 standard for local area network (LAN) and metropolitan area network (MAN) access and physical layer specifications. (10BASE-T).
- IEEE 802.3ab standard for gigabit Ethernet over copper (1000BASE-T).
- IEEE 802.3ad standard regarding dynamic and static link aggregation.
- IEEE 802.3af standard regarding POE.
- IEEE 802.3at standard regarding Power-over-Ethernet plus (POE+).
- IEEE 802.3u supplement standard regarding 100Base TX/100Base FX.
- IEEE 802.3x standard regarding flow control with full duplex operation.
- IEEE 802.3z standard regarding gigabit Ethernet (1000BASE-SX/TX).

T684-1.4 Optical Ports: The device shall provide a minimum of two optical 100Base FX ports capable of transmitting data at one gigabit per second. The optical port shall operate at distances of up to 70 km.

T684-1.5 Copper Ports: The device shall provide a minimum of twelve 10/100/1000 Mbps copper ports and two copper 10/100/1000 Mbps uplink ports. All copper ports shall be Type RJ-45.

T684-1.6 Electrical Specifications: The MFES device shall operate between 100V and 240V, and use no more than 1.8 amps.

T684-2 Warranty: The MFES shall include a five year warranty for all component parts. The Contractor shall not purchase the equipment prior to the issuance of Notice to Proceed. The Contractor shall assign to the Department the above manufacturer's or other seller's warranties that come with those products, material or supplies. Assignment of such warranties shall be effective on the date of Final Acceptance. To the extent that any of such warranties do not extend to subsequent purchasers or owners or such warranties contain a limitation on assignment, the Contractor agrees that the Contractor purchased the products, materials, and supplies, on behalf of the Department with the intent that the Department be the original end user of the product and intended recipient of any warranties. All documents associated with or describing any such warranties shall be delivered to the Department along with the other project final acceptance documents and shall be deemed to be a part of the required final acceptance documentation. Contractor shall not take any action or fail to act in any way which voids any such warranties.

T684-3 Method of Measurement:
The quantity to be paid for shall be the Contract unit price for each MFES device, furnished and installed, placement, testing of all materials and equipment, and for all tools, labor, equipment, hardware, operational software packages and firmware, supplies, support, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the work.

T684-4 Basis of Payment:
Price and payment will be full compensation for all work specified in the Technical Special Provision.

Payment will be made under:

Item No. 684-1-1 Managed Field Ethernet Switch – Furnish & Install

Appendix E: Modified Special Provision (MSP)

MODIFIED SPECIAL PROVISION APPROVAL REQUEST

(REV 3-8-16)

Date: 8/31/2020 **District: 5** **Type: Project Specific**

Letting Month: January 2021 **FPID Number: 436325-2-52-01**

Requested by: Noemi Rodriguez Bonilla, P.E. **Office/Phone: 386-943-5327**

Specification being modified: 684 NETWORK DEVICES

Affected Pay Items: 684-

Expected Cost Impact to this project: No significant cost impact anticipated. The project budget was estimated based on the use of network devices similar to those already in use throughout the District, including the Managed Multilayer Ethernet Switch (MMES) described in this MSP.

Project Description: The Event Management Phase II project builds upon an existing system used by FDOT, Volusia County, and the City of Daytona Beach to manage traffic entering and existing events and provide parking guidance for the Daytona International Speedway. The system also provides motorist guidance as part of incident management operations on I-95. Changes to Speedway parking facilities, the need for signing at other decision points, the need to provide parking guidance for Volusia County beaches, and desired system operational improvements require that the existing system be modified and updated.

Background Data: The District 5 ITS network topology requires Ethernet switches for access and distribution that include routing features that are not commonly supported by the typical Managed Field Ethernet Switch (MFES) as described in section 684. This MSP introduces a subarticle describing a MMES including the routing capabilities required by the District. These requirements have typically been required on previous District 5 projects as a technical special provision (TSP). However, the Department requested during the project design review process that they be incorporated as a MSP.

***Name and PE Number of PE signing and sealing the Modified Special Provision:**

* *Project Specific Modifications to the Standard Specifications or Workbook Specifications must be signed and sealed by the Professional Engineer responsible for this Special Provision under the following statement and kept in the Project Files maintained in the District.*

PE Name: Paul Mannix **PE Number: 57712**

I hereby certify that this Specification was prepared under my responsible charge, and that it has been reviewed in accordance with procedures adopted and implemented by the Florida Department of Transportation.

The official record of this Special Provision has been electronically signed and sealed using a Digital Signature as required by 61G15-23.004, F.A.C. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Professional Engineer:	Paul Mannix
Date:	8/31/2020
Fla. License No.:	57712
Firm Name:	Atkins North America, Inc
Firm Address:	482 South Keller Road
City, State, Zipcode:	Orlando, FL 32837
Certificate of Authorization:	24
Pages:	6

NETWORK DEVICES
(REV 8-31-20)

ARTICLE 684-5 is deleted and the following substituted:

684-5 Managed Multilayer Ethernet Switch.

684-5.1 Description: Furnish and install a Managed Multilayer Ethernet Switch (MMES) as shown in the Plans. The MMES must comply with the John S. McCain National Defense Authorization Act for Fiscal Year 2019, section 889, Prohibition on Certain Telecommunications or Video Surveillance Services or Equipment.

684-5.2 Materials:

684-5.2.1 General: Ensure that the MMES is fully compatible and interoperable with the ITS trunk Ethernet network interface and supports half and full duplex Ethernet communications.

Ensure that the MMES includes Layer 3 routing features including use of Open Shortest Path First (OSPF) routing protocol, Routing Information Protocol (RIP), Generic Routing Encapsulation (GRE), and Virtual Router Redundancy Protocol (VRRP). Ensure the MMES includes any license(s) required to utilize all available Layer 3 features.

Furnish a MMES that provides 99.999% error-free operation and that complies with the Electronic Industries Alliance (EIA) Ethernet data communication requirements using single-mode fiber optic and Category 5E/6 cables. Ensure the MMES provides a switched Ethernet connection for each remote ITS field device and spare port capacity.

Ensure that the MMES has a minimum mean time between failures (MTBF) of 10 years, or 87,600 hours, as calculated using the Bellcore/Telcordia SR-332 standard for reliability prediction.

684-5.2.2 Networking Standards: Ensure that the MMES complies with all applicable Institute of Electrical and Electronics Engineers (IEEE) networking standards for Ethernet communications, including but not limited to:

1. IEEE 802.1Q standard for Local and Metropolitan Area Networks – Bridges and Bridged Networks used with port-based Virtual Local Area Networks (VLANs) and Rapid Spanning Tree Protocol (RTSP).
2. IEEE 802.1p standard for QoS.
3. IEEE 802.3 standard for local area network and metropolitan area network access and physical layer specifications.
4. IEEE 802.3u supplement standard regarding 100BASE-TX/100BASE-FX.
5. IEEE 802.3x standard regarding flow control with full duplex operation.
6. IEEE 802.3z supplement standard regarding 1000BASE-X.

684-5.2.3 Optical Ports: Ensure that all fiber optic link ports operate at 1310 or 1550 nanometers in single mode. Ensure that the optical ports are Type ST, SC, LC, or FC only, as shown in the Plans or as directed by the Engineer. Do not use mechanical transfer registered jack (MTRJ) type connectors.

Furnish small form factor pluggable transceivers as shown in the Plans for each MMES. Ensure the MMES is configured with the number and type of ports detailed in the Contract Documents. Provide a MMES having a minimum of four Gigabit Ethernet (GbE) SFP

ports with optical transceivers unless otherwise shown in the Plans. Optical ports must have an optical power budget of at least 15 dB unless otherwise shown in the Plans. Provide optical ports designed for use with a pair of fibers; one fiber will transmit (TX) data and one fiber will receive (RX) data.

684-5.2.4 Copper Ports: Provide a MMES that includes a minimum of twelve 10/100/1000BASE TX ports unless otherwise shown in the Plans. All copper ports must be Type RJ-45 and shall auto-negotiate speed and duplex (i.e., full or half).

684-5.2.5 Configuration, Management, and Operation: Ensure that the MMES can be managed individually and as a group for configuration, performance monitoring, and troubleshooting. Ensure that the MMES includes Layer 2 and Layer 3 capabilities, including Quality of Service (QoS), Internet Group Management Protocol (IGMP), rate limiting, security filtering, routing functions, and management. Ensure that the MMES supports IPv4, IPv6, and is suitable for network access and aggregation, with Layer 2 and Layer 3 protocols and features that include:

1. Port-based VLAN support and VLAN tagging that meets or exceeds specifications as published in the IEEE 802.1Q standard and has a minimum 4-kilobit VLAN MAC address table.
2. A minimum switching capacity of 200 Gbps, minimum forwarding capacity of 150 million packets per second, and ability to support 10,000 IPv4 routes.
3. Support of, at a minimum, IGMP Version 2.
4. Support of remote and local setup and management via secure shell and secure Web-based graphical user interface.
5. Support of the Simple Network Management Protocol. Verify that the MMES can be accessed using the resident EIA-232 management port or a telecommunication network.
6. Support of Remote Authentication Dial-In User Service (RADIUS) or Terminal Access Controller Access Control System Plus (TACACS+).
7. Support of remote monitoring of the Ethernet agent and the ability to be upgraded to switch monitoring.
8. Support of Secure Copy (SCP) or Secure File Transfer Protocol (SFTP) and either Network Time Protocol (NTP) or the Simple Network Time Protocol (SNTP). Ensure that the MFES supports port mirroring for troubleshooting purposes when combined with a network analyzer.
9. Sampled Flow Network Monitoring export protocol capable of being turned on or off on individual Ethernet ports without affecting traffic.
10. OSPF routing protocol.
11. RIP.
12. GRE.
13. VRRP.

684-5.2.6 Mechanical Specifications: Ensure the MMES is a stackable switch that occupies only one rack unit (RU) when mounted with the MMES front panel facing the cabinet door. Ensure equipment is permanently marked with manufacturer name or trademark, part number, and serial number.

Ensure that every conductive contact surface or pin is gold-plated or made of a noncorrosive, nonrusting, conductive metal.

Do not use self-tapping screws on the exterior of the assembly.

All parts shall be made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal.

684-5.2.7 Electrical Specifications: MMES must be capable of operating on a nominal voltage of 120 volts alternating current (VAC). Ensure the MMES includes redundant and hot-swappable power supplies. Supply an appropriate voltage converter as needed for each device to be powered from cabinet power, including cabinet uninterruptable power supply (UPS) output.

Ensure that the MMES has diagnostic light emitting diodes (LEDs), including link, TX, RX, and power LEDs.

684-5.2.8 Environmental Specifications: Ensure that the MMES has a minimum operating temperature range of 23 to 122 degrees Fahrenheit and storage temperature range of -13 to 158 degrees Fahrenheit. Ensure that the MMES has a minimum non-condensing relative humidity operating range of 5% to 95% at 158 degrees Fahrenheit.

684-5.3 Installation:

684-5.3.1 General: Mount the MMES inside a field site cabinet utilizing a rack mount kit that does not exceed 1RU. Ensure that the MMES is resistant to all electromagnetic interference. Ensure that the MMES is mounted securely and is fully accessible by field technicians. Ensure that all unshielded twisted pair/shielded twisted pair Ethernet network cables are compliant with the EIA/TIA-568-B standard.

684-5.3.2 Testing: Subject the MMES to all tests as required by the project specifications and technical special provisions.

ARTICLE 684-6 is deleted and the following substituted:

684-6 Warranty.

684-6.1 General: Ensure that the manufacturer will furnish replacements for any part or equipment found to be defective during the warranty period at no cost to the Department or the maintaining agency within 10 calendar days of notification.

The Contractor must assign any and all manufacturers' or other sellers' warranties that come with any products, materials, or supplies incorporated into or consumed in the project in any way to the Department. Should any such warranties not extend to subsequent purchasers or owners or such warranties contain a limitation on assignment, Contractor agrees that Contractor purchased the products, materials and supplies on behalf of the Department and that the Department is the recipient of all warranties. All documents associated with or describing such warranties shall be delivered to the Department along with the other project final acceptance documents and shall be deemed to be a part of the required final acceptance documentation. Contractor shall not take any action or fail to act in any way that would void any such warranties.

684-6.2 MFES: Ensure that the MFES has a manufacturer’s warranty covering defects for five years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

684-6.3 Device Server: Ensure that the device server has a manufacturer’s warranty covering defects for five years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608**.**

684-6.4 Digital Video Encoder and Decoder: Ensure that the DVE or DVD has a manufacturer’s warranty covering defects for two years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

684-6.5 Media Converter: Ensure that the media converter has a manufacturer's warranty covering defects for five years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

684-6.6 Managed Multilayer Ethernet Switch: Ensure that the MMES has a manufacturer's warranty covering defects for five years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

ARTICLE 684-7 is deleted and the following substituted:

684-7 Method of Measurement.

The Contract unit price for each MFES, MMES, device server, DVE, DVD, or media converter furnished and installed, will include furnishing, placement, and testing of all equipment and materials, and for all tools, labor, hardware, operational software packages and firmware, supplies, support, personnel training, shop drawings, documentation, and incidentals necessary to complete the work.

Provide software-based decoders at no additional cost when furnished in conjunction with DVEs. A software-based DVD provided individually must be paid under the pay item below.

ARTICLE 684-8 is deleted and the following substituted:

684-8 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 684- 1-	Managed Field Ethernet Switch-each.
Item No. 684- 2-	Device Server-each.
Item No. 684- 3-	Digital Video Encoder with Software Decoder-each.
Item No. 684- 4-	Digital Video Decoder-each.
Item No. 684- 5-	Media Converter-each.
Item No. 684-	Managed Multilayer Ethernet Switch-each.

MODIFIED SPECIAL PROVISION APPROVAL REQUEST
(REV 3-8-16)

Date: 08/20/2020 **District:** 5 **Type:** Project Specific

Letting Month: 10/2020 **FPID Number:** 441133-1-52-01

Requested by: Jeremy H. Dilmore, P.E. **Office/Phone:** 386-943-5000

Specification being modified:
685 Traffic Control System Auxiliaries

Affected Pay Items: 685-518

Expected Cost Impact to this project: The units are expected to cost approximately $1400

Project Description: I-95 Resurfacing from South of Dunn Ave to South of Airport Rd.

Background Data:
The project includes installation of wrong way driving deterrents on 2 SR 9 (I-95) off-ramps in Volusia County. Project will install new signing, striping, and wrong way vehicle detection systems. This MSP provides the specifications for the Remote Power Management Unit.

Name and PE Number of PE signing and sealing the Modified Special Provision:

PE Name: Jeremy H. Dilmore **PE Number:** 67510

I hereby certify that this Specification was prepared under my responsible charge, and that it has been reviewed in accordance with procedures adopted and implemented by the Florida Department of Transportation.

The official record of this package has been digitally signed and sealed by Jeremy Harvey Dilmore, P.E. on the date indicated here as required by 61G15-23.004 F.A.C. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Firm Name:	Florida Department of Transportation
Firm Address:	719 South Woodland Blvd
City, State, Zip Code:	DeLand, Florida 32720
Certificate of Authorization:	
Pages:	1 – 3

TRAFFIC CONTROL SYSTEM AUXILIARIES
(REV 07-02-20)

ARTICLE 685-2 is expanded by the following:

685-2.3 Remote Power Management Unit (RPMU): Use a RPMU as shown in the Plans. The RPMU must be designed for installation in a roadside Traffic Cabinet to provide remote control of electrical receptacles.

685-2.3.1 Configuration and Management: Provide a RPMU that supports local and remote configuration and management, including access to all user-programmable features as well as alarm monitoring, event logging, and diagnostic utilities.

Configuration and management functions must be password protected.

The RPMU must include an event scheduler that can store a minimum of 60 events.

The RPMU must include LED indicators for relay inputs and outlet status.

Upon loss of communications the RPMU must maintain each receptacle and relay in its currently stored state of operation.

Upon restoration of electrical power after an outage the RPMU automatically restores each receptacle and relay to its previously stored state of operation and all configurable parameters are retained.

The unit must support SNMP v2c, including trap notifications of receptacle state changes.

685-2.3.2 Communication Interfaces: Provide an Ethernet port (RJ45) for local control using a laptop PC and remote control via a network connection.

685-2.3.3 Electrical: Provide a minimum of 4 NEMA 5-15R receptacles, nominal 120 V_{AC}. Provide a minimum current capacity of 12 amperes (amps).

685-2.3.4 Mechanical: All parts must be made of corrosion-resistant materials such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal. All fasteners exposed to the elements must be Type 304 or 316 passivated stainless steel.

685-2.3.5 Environmental: Operate properly during and after being subjected to the environmental testing procedures described in NEMA TS 2 2016, Sections 2.2.7, 2.2.8, and 2.2.9.

ARTICLE 685-3 is expanded by the following:

Install the RPMU in accordance with the manufacturer’s recommendations. Include a RPMU operation and maintenance manual in the cabinet where the RPMU is installed that includes cabinet wiring schematics, electrical interconnection drawings, parts layout and parts lists.

ARTICLE 685-6 is deleted and the following substituted:

685-6 Method of Measurement.

The Contract unit price for each UPS or RPMU, furnished and installed, will include furnishing, placement, and testing of all equipment and materials as specified in the Contract Documents, and all tools, labor, operational software packages and firmware, supplies, support, personnel training, shop drawings, documentation (including the field acceptance test plan), and incidentals necessary for a complete and accepted installation.

ARTICLE 685-7 is deleted and the following substituted:

685-7 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 685- 1-	Uninterruptible Power Supply - each
Item No. 685- 2-	Remote Power Management Unit - each

MODIFIED SPECIAL PROVISION APPROVAL REQUEST
(REV 1-19)

Date: 2/10/2019 **District:** 5 **Type:** Project Specific

Letting Month: April, 2019 **FPID Number:** 440900-1&2-52-01

Requested by: Dale W. Cody, PE **Office/Phone:** (407) 644-1898

Specification being modified: 685

Affected Pay Items: 685-504

***Expected Cost Impact to this project: $61,000**
* Give an estimate of dollar impact (added cost or cost savings) to the project if this Modified Special Provision is used in lieu of the corresponding statewide implemented specification.

Project Description: I-75 Florida's Regional Advanced Mobility Elements (FRAME). This project will add additional technology along I-75 and signalized intersections located parallel to I-75 in Sumter and Marion Counties in order to provide Connected Vehicle (CV) functionality as well as signal data optimization within this region of District 5.

Background Data: The project includes the installation of roadside units (RSUs) that include Dedicated Short-Range Communications (DSRC) radios. The installation of RSUs will allow for the transmission of Signal Phase and Timing (SPAT) data, CV emergency vehicle preemption (EVP), and CV transit signal priority (TSP) applications. The Department desires to use power distribution units (PDU) in order to minimize maintenance calls throughout the life of this project.

***Name and PE Number of PE signing and sealing the Modified Special Provision:**
* Project Specific Modifications to the Standard Specifications or Workbook Specifications must be signed and sealed by the Professional Engineer responsible for this Special Provision under the following statement and kept in the Project Files maintained in the District.

PE Name: Dale W. Cody, PE **PE Number: 53995**

I hereby certify that this Specification was prepared under my responsible charge, and that it has been reviewed in accordance with procedures adopted and implemented by the Florida Department of Transportation.

The official record of this Special Provision is the electronically signed and sealed under Rule 61G15-23.004, F.A.C.

Professional Engineer:	Dale W. Cody
Date:	2/10/2019
Fla. License No.:	53995
Firm Name:	Metric Engineering, Inc.
Firm Address:	525 Technology Park, Suite 153
City, State, Zip code:	Lake Mary, Florida 32746
Certificate of Authorization:	2294
Pages:	1-2

SECTION 685
TRAFFIC CONTROL SYSTEM AUXILIARIES
(Rev 2-8-19)

SUBARTICLE 685-2.1 is deleted and the following substituted:

685-2.1: General: Use traffic control system auxiliaries listed on the Department's Approved Product List (APL) except for the Power Distribution Unit (PDU). Equipment must be permanently marked with the manufacturer's name or trademark, model/part number and serial number or date of manufacture.

SECTION 685 is being expanded by the following new subarticle:

685-2.3 Power Distribution Unit (PDU): Provide the signal/ITS cabinets with a power distribution unit which supplies eight (8) 120 VAC outlets. The unit shall be fully compatible and interoperable with the UPS unit that the power manager system is integrated to. The unit must have the following features:

- The outlet panel must be remote controllable, per outlet, to allow operators to turn off/on individual power ports via manufacturer software or web interface via the Ethernet network.
- The unit shall support SNMP protocol. SNMP traps shall be repeatable on a user defined basis.
- Each outlet shall be labeled in the user interface to reflect the proper device is connected to the appropriate outlet.
- The outlet port for the local switch shall be configured to Safe Reboot mode.
- Temperature: -30 to 165 °F (-34 to 74 °C), +/- 0.5 °C

SUBARTICLE 685-3 is deleted and the following substituted:

685-3 Installation.

Install UPS and PDU assemblies in accordance with the manufacturer's recommendations. All equipment used to keep the intersection signalized must be backed up and protected by the UPS. Include a UPS and PDU operation and maintenance manual in the cabinet where the UPS is installed that includes cabinet wiring schematics, electrical interconnection drawings, parts layout and parts lists.

SUBARTICLE 685-4 is deleted and the following substituted:

685-4 Testing.

Provide a field acceptance test plan to the Engineer for approval at least 14 days prior to commencement of testing. After approval of the acceptance test plan, perform testing of the installed UPS and PDU equipment. Furnish all equipment, software, and supplies necessary for conducting the test.

SUBARTICLE 685-5 is deleted and the following substituted:

685-5 Warranty.

Ensure the UPS and PDU includes a manufacturer's warranty covering defects for a minimum of three years (5 years for the external batteries in accordance with 685-2.2.3) from the date of final acceptance in accordance with 5-11 and Section 608. The warranty must include provisions for providing a replacement UPS or PDU within 10 calendar days of notification for any device found to be defective during the warranty period at no cost to the FDOT or the maintaining agency.

SUBARTICLE 685-6 is deleted and the following substituted:

685-6 Method of Measurement.

The Contract unit price for each UPS or PDU, furnished and installed, will include furnishing, placement, and testing of all equipment and materials as specified in the Contract Documents, and all tools, labor, operational software packages and firmware, supplies, support, personnel training, shop drawings, documentation (including the field acceptance test plan), and incidentals necessary for a complete and accepted installation.

SUBARTICLE 685-7 is deleted and the following substituted:

685-7 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section. Payment will be made under:

Item No.	685- 1-	Uninterruptible Power Supply – each
Item No.	685- 5-	Power Distribution Unit – each

Appendix F: ITS Certification Memo

CONSULTANT LETTERHEAD

DATE: _____

TO: **FDOT Project Manager**

FROM: _____, Engineer of Record

COPY TO: District Construction Scheduling Specialist
Intelligent Transportation System (ITS) Manager

SUBJECT: Verification of Communication and/or ITS Cables
Financial Project ID: _____
Federal ID Number: _____
County: _____
SR. No.: _____
Project Limits: _____

Verification of Communication Cables, Wireless Communication, and ITS Devices:

I certify that I coordinated with the following personnel/agency to develop a plan of action to handle communication cables, wireless communication, or ITS devices as part of the project.

1.

2.

3.

Action Plan:

_____ No communication cables, wireless communication, or ITS devices were identified within the limits of the projects.

_____ Communication cables, wireless communication, or ITS devices were identified within the limits of the project. They will be handled as follows:

1.

2.

3.

Submitted by:

_____
Signature, Engineer of Record

_____
Print Name of Engineer of Record

_____
Print Name of Consultant Firm

Concurred by:

_____
District Traffic Operations Engineer

FLORIDA DEPARTMENT OF TRANSPORTATION

RON DESANTIS
GOVERNOR

KEVIN THIBAULT
SECRETARY

INTELLIGENT TRANSPORTATION SYSTEMS (ITS) CERTIFICIATION

Date: February 28, 2022

To: Heidi Trivett (Project Manager, TSM&O District Five)

From: Nathan Mozeleski, PE (Atkins North America, Inc.), Engineer of Record

Subject: Marion County ITS Network Communications Upgrade (FPID 436361-1)

I certify that I coordinated with the following personnel and/or agency to identify existing communications and/or ITS field devices, as well as develop a plan of action to maintain, replace, or remove each facility as appropriate within the project limits.

1. **Florida Department of Transportation – District Five**, Patrick White, (321) 257-7243, July 1, 2021
2. **Marion County Traffic Operations**, Don Watson, PhD, (352) 671-8686, July 1, 2021
3. **City of Ocala – Ocala Fiber Network (OFN)**, Billy Weakland, (352) 401-6912, November 4, 2021

The following communications and/or field devices were identified within the limits of the project and will be handled as detailed below:

1. **Florida Department of Transportation – District Five.** Existing fiber optic communications cables installed along US 301 / US 441 and I-75 will remain in place. Existing field devices within the project limits include Connected Vehicle (CV) roadside units (RSU), CCTV cameras, managed field Ethernet switches (MFES), and remote power management unit (RPMU) will remain in place. *No impacts to the existing ITS facilities are anticipated as part of the project.*
2. **Marion County Traffic Operations.** Existing fiber optic communications cables installed sporadically along CR 484, SR 200, and SR 464 will remain in place and be reutilized within minor modifications included as part of the project. Existing field devices within the project limits include traffic signal controllers, CCTV cameras, Bluetooth travel time readers, video vehicle detection systems, uninterruptible power supplies (UPS), arterial dynamic message signs (ADMS), managed field Ethernet switches (MFES), and wireless communications devices. The design will include the removal of

existing and installation of new switches, wireless radios, and uninterruptible power supplies, whilst all other existing field equipment is to remain in place,

3. **City of Ocala – Ocala Fiber Network (OFN).** Existing fiber optic communications cables installed along CR 484, SR 35 (Baseline Rd), SR 464 (Maricamp Rd), SR 200, and SE 25th Ave will remain in place. *No impacts to the existing ITS facilities are anticipated as part of the project.*

Submitted by:

_____

Nathan Mozeleski, PE

Atkins North America, Inc.

Concurred by:

_____

Jim Stroz, PE

District Traffic Operations Engineer

Appendix G: Sample Plans

STATE OF FLORIDA

DEPARTMENT OF TRANSPORTATION

CONTRACT PLANS

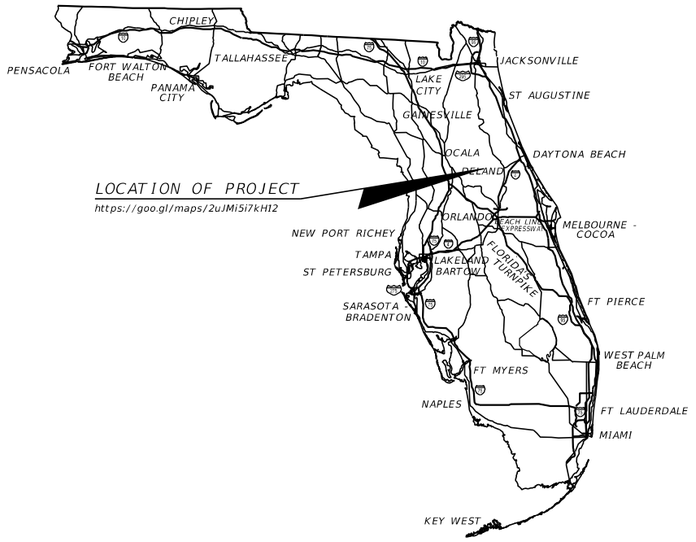
FINANCIAL PROJECT ID 437938-1-52-01

LAKE COUNTY (11100)

STATE ROAD NO. 19 (S. CENTRAL AVE)

SIGNALIZATION PLANS

INDEX OF SIGNALIZATION PLANS



THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY:

ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

SIGNALIZATION PLANS ENGINEER OF RECORD:
FDOT PROJECT MANAGER:

AYMAN A. MOHAMED, P.E., P.T.O.E.
P.E. NO.: 61777
FDOT DISTRICT 5 TRAFFIC DESIGN
719 S. WOODLAND BLVD.
DELAND, FL 32720

PLANS PREPARED BY:

FDOT DISTRICT 5 TRAFFIC DESIGN

CONSTRUCTION CONTRACT NO.	FISCAL YEAR	SHEET NO.
E51A8	22	T-1

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

THIS ITEM HAS BEEN DIGITALLY
SIGNED AND SEALED BY:

AYMAN A. MOHAMED
LICENSE
No 61777
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE
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FLORIDA DEPARTMENT OF TRANSPORTATION
719 S. WOODLAND BOULEVARD, DELAND, FL 32720
AYMAN A. MOHAMED, P.E. NO. 61777

THE ABOVE NAMED PROFESSIONAL ENGINEER SHALL BE RESPONSIBLE FOR THE FOLLOWING SHEETS IN ACCORDANCE WITH RULE 61G15-23.004, F.A.C.

SIGNALZITION PLANS

SHEET NO.	SHEET DESCRIPTION
T-1	KEY SHEET
T-2	SIGNATURE SHEET
T-3	TABULATION OF QUANTITIES
T-4	GENERAL NOTES
T-5 TO T-6	SIGNALIZATION PLANS
T-7	TRAFFIC COUNT STATION PLANS
T-8 TO T-9	SIGNAL SPECIAL DETAIL
T-10	GUIDESIGN WORKSHEET
T-11	MAST ARM TABULATION
T-13 TO T-14	DETECTOR CHART
T-15	WIRING DIAGRAM

THIS ITEM HAS BEEN DIGITALLY
SIGNED AND SEALED BY:

MARK T. TREBITZ
LICENSE
No 79402
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

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SIGNALZITION PLANS

SHEET NO.	SHEET DESCRIPTION
T-2	SIGNATURE SHEET
T-12	STANDARD MAST ARM ASSEMBLIES DATA TABLE

REVISIONS

DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Aymon A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

SIGNATURE SHEET

SHEET NO. T-2

TABULATION OF QUANTITIES

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS																GRAND TOTAL	
			T-5		T-6		T-7													
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL
630-2-11	CONDUIT, FURNISH & INSTALL, OPEN TRENCH	LF	45		380		10												435	
630-2-12	CONDUIT, FURNISH & INSTALL, DIRECTIONAL BORE	LF	180		285		70												535	
632-7-1	SIGNAL CABLE- NEW OR RECONST. INTERSECTION, F&I	PI			1														1	
632-7-2	SIGNAL CABLE- REPAIR/REPLACE/OTHER, F&I	LF	130																130	
632-7-6	SIGNAL CABLE- REMOVE INTERSECTION	PI			1														1	
635-2-11	PULL & SPLICE BOX, F&I, 13" x 24" COVER SIZE	EA	3		16		2												21	
635-2-13	PULL & SPLICE BOX, F&I, 36" ROUND COVER SIZE	EA			1														1	
635-3-12	JUNCTION BOX, FURNISH & INSTALL, MOUNTED	EA			1														1	
639-1-122	ELECTRICAL POWER SERVICE, F&I, UNDERGROUND, METER PURCHASED BY CONTRACTOR	AS			1														1	
639-1-610	ELECTRICAL POWER SERVICE, REMOVE OVERHEAD	AS			1														1	
639-2-1	ELECTRICAL SERVICE WIRE, FURNISH & INSTALL	LF			160														160	
639-2-6	ELECTRICAL SERVICE WIRE, REMOVE	LF			180														180	
641-2-12	PRESTRESSED CONCRETE POLE, F&I, TYPE P-II SERVICE POLE	EA			1														1	
641-2-70	PRESTRESSED CONCRETE POLE, SHALLOW POLE REMOVAL- POLE 30' AND GREATER	EA			2														2	
646-1-11	ALUMINUM SIGNALS POLE, F&I, PEDESTAL	EA	2		5														7	
646-1-40	ALUMINUM SIGNALS POLE, RELOCATE	EA	1		2														3	
646-1-60	ALUMINUM SIGNALS POLE, REMOVE	EA			1														1	
649-21-3	STEEL MAST ARM ASSEMBLY, FURNISH AND INSTALL, SINGLE ARM 40'	EA			2														2	
649-21-10	STEEL MAST ARM ASSEMBLY, FURNISH AND INSTALL, SINGLE ARM 60'	EA			1														1	
650-1-14	VEH. TRAFFIC SIGNAL, F&I, ALUMINUM, 3 SECTION, 1 WAY	AS			8														8	
650-1-16	VEH. TRAFFIC SIGNAL, F&I, ALUMINUM, 4 SECTION, 1 WAY	AS	2		2														4	
650-1-70	VEH. TRAFFIC SIGNAL, RELOCATE- INCLUDES REMOVAL AND REINSTALLATION	AS	4																4	
653-1-11	PEDESTRIAN SIGNAL, F&I, LED COUNTDOWN, 1 WAY	AS	4		5														9	
653-1-60	PEDESTRIAN SIGNAL, REMOVE PED SIGNAL- POLE/PEDESTAL TO REMAIN	AS	2																2	
660-1-600	LOOP DETECTOR INDUCTIVE, REMOVE- CABINET TO REMAIN	EA	4																4	
660-4-11	VEHICLE DETECTION SYSTEM- VIDEO, FURNISH & INSTALL CABINET EQUIPMENT	EA	1		1														2	
660-4-12	VEHICLE DETECTION SYSTEM- VIDEO, FURNISH & INSTALL ABOVE GROUND EQUIPMENT	EA	4		4														8	
660-9-11	TRAFFIC DATA DETECTION SYSTEM- VIDEO, FURNISH AND INSTALL, CABINET EQUIPMENT	EA			1														1	
660-9-12	TRAFFIC DATA DETECTION SYSTEM- VIDEO, FURNISH AND INSTALL, ABOVE GROUND EQUIPMENT	EA			1														1	
663-1-121	SIGNAL PRIORITY AND PREEMPTION SYSTEM, FURNISH AND INSTALL, GPS, CABINET ELECTRONICS	EA			1														1	
663-1-122	SIGNAL PRIORITY AND PREEMPTION SYSTEM, FURNISH AND INSTALL, GPS, DETECTOR	EA			1														1	
665-1-11	PEDESTRIAN DETECTOR, FURNISH & INSTALL, STANDARD	EA	2		5														7	
665-1-60	PEDESTRIAN DETECTOR, REMOVE- POLE/PEDESTAL TO REMAIN	EA	2																2	
670-5-111	TRAFFIC CONTROLLER ASSEMBLY, F&I, NEMA, 1 PREEMPTION	AS			1														1	
670-5-400	TRAFFIC CONTROLLER ASSEMBLY, MODIFY	AS	1																1	
670-5-600	TRAFFIC CONTROLLER ASSEMBLY, REMOVE CONTROLLER WITH CABINET	AS			1														1	
684-1-1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA			1														1	
684-5-1	MEDIA CONVERTER, FURNISH & INSTALL				2														2	
685-2-1	REMOTE POWER MANAGEMENT UNIT- RPMU, FURNISH AND INSTALL	EA			1														1	
695-1-1	TRAFFIC MONITORING SITE VEHICLE SENSOR-NON-WEIGHT, FURNISH & INSTALL	EA					4												4	
695-6-12	TRAFFIC MONITORING SITE INDUCTIVE LOOP ASSEMBLY, FURNISH & INSTALL, 2 LOOPS	EA					4												4	
695-7-162	TRAFFIC MONITORING SITE CABINET, F&I, TYPE 3, 2 PANE BACK, PEDESTAL MOUNT	EA					1												1	
695-7-600	TRAFFIC MONITORING SITE CABINET, REMOVE EXISTING CABINET	EA					1												1	
695-8-11	CELLULAR COMMUNICATIONS MODEM, FURNISH & INSTALL W/ ANTENNA	EA					1												1	
700-3-101	SIGN PANEL, FURNISH & INSTALL GROUND MOUNT, UP TO 12 SF	EA	6		3														9	
700-3-601	SIGN PANEL, REMOVE, UP TO 12 SF	EA	6		3														9	
700-5-21	INTERNALLY ILLUMINATED SIGN, FURNISH & INSTALL OVERHEAD MOUNT, UP TO 12 SF	EA			1														1	
700-5-22	INTERNALLY ILLUMINATED SIGN, FURNISH & INSTALL, OVERHEAD MOUNT, 12-18 SF	EA			2														2	
700-11-391	ELECTRONIC DISPLAY SIGN, F&i OVERHEAD MOUNT- AC POWERED, BLANK OUT SIGN, UP TO 12 SF	AS			4														4	

REVISIONS

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DISTRICT FIVE - DESIGN
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No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

TABULATION OF QUANTITIES

SHEET NO. T-3

GENERAL NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE MAINTAINING AGENCY, LAKE COUNTY TRAFFIC OPERATIONS, AT 352-742-1766, IN ADVANCE OF ALL PHASES OF CONSTRUCTION INCLUDING AND NOT LIMITED TO, INSTALLING SIGNAL POLES, GROUND RODS, UNDERGROUND CONDUIT, SIGNAL HEAD ASSEMBLIES, AND LOOP INSTALLATION SO THAT THESE OPERATIONS CAN BE OBSERVED.

2. ALL REMOVED EQUIPMENT SHALL BE DELIVERED TO LAKE COUNTY TRAFFIC OPERATIONS, 28127 C.R. 561, TAVARES, 352-742-1766, EXCEPT SIGNAL POLES, WHICH SHALL BE DISPOSED OF BY THE CONTRACTOR. CARE SHALL BE TAKEN NOT TO DAMAGE THE EQUIPMENT IN THE REMOVAL PROCESS.

3. THE CONTRACTOR SHALL FURNISH LAKE COUNTY TRAFFIC OPERATIONS, TWO COMPLETE SETS OF AS-BUILT PLANS THAT INCLUDE CONDUIT AND PULL BOX LOCATIONS, AT FINAL INSPECTION.

4. THESE PLANS REFLECT CONDITIONS KNOWN DURING PLAN DEVELOPMENT. IN THE EVENT ACTUAL PHYSICAL CONDITIONS PREVENT THE APPLICATION OR THE PROGRESS OF ANY WORK SPECIFIED IN THESE PLANS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY AND PRIOR TO ANY FURTHER ACTIVITY.

5. FIELD ADJUSTMENT OF ALL PROPOSED EQUIPMENT MAY BECOME NECESSARY TO ACCOMMODATE EXISTING FIELD CONDITIONS. VARIATIONS FROM THE PROPOSED LOCATION MUST BE PRE APPROVED BY THE MAINTAINING AGENCY.

6. APPROVAL OF SHOP DRAWINGS DOES NOT CONSTITUTE A WARRANTY THAT THE SIGNAL EQUIPMENT COMPLIES WITH THE STANDARDS OF THE MAINTAINING AGENCY. THE CONTRACTOR IS RESPONSIBLE FOR INSURING THAT THE PROPOSED SIGNAL EQUIPMENT MEETS THE REQUIREMENTS SPECIFIED IN THE CONTRACT, SPECIFICATIONS AND CONTRACT PLANS.

7. THE CONTRACTOR SHALL SUBMIT FOR APPROVAL TWO SETS OF SHOP DRAWINGS, MANUFACTURER'S DESCRIPTIVE LITERATURE AND TECHNICAL DATA FOR EACH EQUIPMENT ITEM PROPOSED ON THIS PROJECT TO THE EOR AND THE MAINTAINING AGENCY.

8. THE CONTRACTOR SHALL NOTIFY THE MAINTAINING AGENCY AT LEAST 72 HOURS BEFORE BEGINNING ANY RELATED TRAFFIC SIGNAL WORK. THE CONTRACTOR SHALL OBTAIN ALL CONSTRUCTION PERMITS REQUIRED FOR THE PROJECT FOR APPLICABLE CITIES, COUNTY AGENCIES, AND FDOT. APPROVAL OF PLANS BY THE MAINTAINING AGENCY DOES NOT CONSTITUTE A PERMIT.

9. PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL PROVIDE WRITTEN NOTICE OF COMMENCEMENT, VIA E-MAIL, TO MAINTAINING AGENCIES. NOTICE SHALL INCLUDE THE DATE OF COMMENCEMENT, LOCATION AND TYPE OF WORK & INFORMATION REGARDING ANY MALFUNCTIONING SIGNAL EQUIPMENT. THIS SHALL BE COMPLETED AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF WORK.

10. FINAL LOCATIONS OF ALL CABINETS SHALL BE APPROVED BY THE MAINTAINING AGENCY PRIOR TO PLACEMENT OF THE FOUNDATION.

11. IT IS THE CONTRACTOR'S RESPONSIBILITY TO REVIEW THE PLACEMENT OF THE VIDEO IMAGE DETECTION DEVICES AND COORDINATE WITH THE VENDOR TO DETERMINE THE MOST OPTIMAL LOCATION FOR THE INSTALLATION OF THE VIDEO IMAGE DETECTION DEVICES IN ORDER TO MEET THE PERFORMANCE REQUIREMENTS OF THE TECHNICAL SPECIFICATIONS.

12. ALL FIELD WIRING SHALL BE NEATLY BUNDLED AND CLEARLY IDENTIFIED WITH PERMANENT LEGIBLE, WEATHERPROOF TAGS THAT ARE SECURELY ATTACHED TO EACH CABLE. THE TAGGING SYSTEM PROPOSED SHALL BE SUBMITTED FOR APPROVAL WITH THE OTHER EQUIPMENT SUBMITTAL'S REQUIRED FOR THIS PROJECT.

GENERAL NOTES

1. SYSTEM DEVICE PAY ITEMS SHALL INCLUDE ALL WORK NECESSARY TO FURNISH AND INSTALL THE SYSTEM, SOFTWARE MODULES TO COMMUNICATE WITH MAINTAINING AGENCIES ATMS SOFTWARE AND FDOT DISTRICT 5 DISRICTWIDE ATPSM DATABASE CAPABLE OF ENHANCED DETECTION, HIGH RESOLUTION DATA LOGGING AND FUTURE CV EXPANSION EFFORT. THE WORK SHALL INCLUDE BUT NOT LIMITED TO PROCESSOR UNITS, MOUNTING ARMS, BRACKETS, WIRING, HARDWARE AND ALL ANCILLARY COMPONENTS AS WELL AS ALL DATA AND POWER CABLING REQUIRED TO TRANSMIT AND RECIEVE DATA AND POWER THE DEVICE FOR A COMPLETE DEPLOYMENT.

A. 660-4-11, 660-4-12: VEHICLE VIDEO DETECTION SYSTEM (VVDS) SHALL BE ITERIS VANTAGE NEXT VIDEO DETECTION CAMERA, OPTIMIZED FOR TRAFFIC VIDEO DETECTION AND DATE COLLECTION. SYSTEM SHALL INCLUDE THE DATA MODULE AND COMMUNICATION MODULE TO ENABLE LIVE VIDEO FEEDS.

B. 660-9-11, 660-9-12: SHALL BE CONFIGURED TO PROVIDE AN INTERSECTION MOVEMENT COUNT (IMC) CAMERA SYSTEM CAPABLE OF PERFROMING LANE BY LANE (INCLUDES LEFT, THRU AND RIGHT TURN LANES) VEHICLE TURNING MOVEMENT COUNTS FOR ALL APPROACHES OF THE INTERSECTION. THE SYSTEM SHALL INCLUDE THE DATA MODULE AND COMMUNICATION MODULE TO ENABLE LIVE VIDEO FEEDS.

C. 663-1-121, 663-1-122: EMERGENCY PREEMPTION SYSTEM SHALL BE GTT OPTICOM 3100 GPS RADIO UNIT W/ GPS RECIEVER & ANTENNA 2.4 GHZ TRANSCEIVER, 3101 GPS RADIO UNIT W/ GPS RECIEVER, 2.4 GHZ TRANSCEIVER, 1050 GPS/RADIO ANTENNA,1072 GPS CABLE ASSEMBLY, 764 MULTIMODE PHASE SELECTOR, OPTICOM 768 AUXILIARY INTERFACE PANEL, 1040 GPS CARD RACK OR OPTICOM MODEL 760 CARD RACK OR OPTICOM MODEL 770 CARD RACK, AND AUXILIARY INTERFACE PANEL (MODEL 1030).

D. 670-5-111: SHALL BE CUBIC / TRAFFICWARE WIRED CABINET ASSEMBLY, TS-2 SIZE 6, MODEL NO. 70006-TS2/FL W/ 64 CHANNEL AND THE CONTROLLER SHALL BE CUBIC / TRAFFICWARE COMMANDER ATC SHELF MOUNT W/ ETHERNET NEMA TS-2, TYPE 2 UNIT. ATC CONTORLLER SHALL BE COMPATIBLE WITH THE MAINTAINING AGENCY AND FDOT DISTRICT 5 ATMS SOFTWARE, CAPABLE OF HIGH-RESOLUTION DATA LOGGING AND ARE FORWARD COMPATIBLE WITH CV AND ICM EFFORTS. THIS PAY ITEM SHALL ALSO INCLUDE ALL MATERIALS AND WORK NECESSARY TO TRANSFER EXISTING SIGNAL TIMING AND PHASING INFORMATION INCLUDING, BUT NOT LIMITED TO, TIMING PLANS, DATABASES, CONFIGURATIONS FILES, AND MORE.

E. 684-1-1: SHALL BE HARDENED NETWORKS MODEL NO. ITS-8012-24+ (V3) MANAGED FIELD ETHERNET SWITCH.

F. 695-8-11: CELLULAR MODEM WITH ANTENNA SHALL BE MIOVISION SPECTRUM SMARTLINK.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Aymon A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

GENERAL NOTES

SHEET NO. T-4

10 LF	630-2-11
1 EA	646-1-11
1 AS	653-1-11
1 EA	665-1-11

PED. PEDESTAL-2, STA. 58+70, 65'LT

1 AS	653-1-11
1 AS	653-1-60
1 EA	665-1-60
1 EA	700-3-101
1 EA	700-3-601

EXISTING PED. PEDESTAL-1 TO REMAIN, REMOVE TWO-WAY PED. HEAD, REMOVE PHASE-2 PED. DETECTOR AND SIGN PANEL

EXIST. MAST ARM POLE-1 & OVERHEAD STREET NAME SIGNS TO REMAIN. INSTALL VIDEO DETEC. CAMERAS VC1, VC2 & IMC CAMETRA. USE EXISTING CONDUIT FROM CABINET TO POLE

2 EA	660-4-12
1 EA	660-9-12

REPLACE EXIST. SIGNAL CABINET

(4X10) 40 LF	630-2-11	663-1-122	1 EA
380 LF	632-7-2	670-5-111	1 AS
1 EA*	635-2-13	670-5-600	1 AS
1 EA	660-4-11	684-1-1	1 EA
1 EA	660-9-11	685-2-1	1 EA
1 EA	663-1-121	695-8-11	1 EA

*635-2-13 IS FOR FUTURE USE

EXIST. POWER PEDESTAL, DISCONNECT AND METER TO REMAIN

APPARENT R/W LINE

APPARENT R/W LINE

PEDESTRIAN SIGNAL HEAD DETAILS

P2 P4 P8

PED. SIGNAL COUNT-DOWN 1-SECT., 1-WAY

(A) SR 19

(B) Guerrant St

(C) Cassady St

EXISTING OVERHEAD STREET NAME SIGNS TO REMAIN

RELOCATE PED. PEDESTAL-3 TO STA. 59+16, 60.75'LT, REMOVE TWO-WAY PED. HEAD, REMOVE PHASE-4 PED. DETECTOR AND SIGN PANEL

630-2-11	5 LF
646-1-40	1 EA
653-1-11	1 AS
653-1-60	1 AS
665-1-60	1 EA
700-3-101	1 EA
700-3-601	1 EA

PED. PEDESTAL-4, STA. 59+24, 50.5'LT

630-2-11	30 LF
646-1-11	1 EA
653-1-11	1 AS
665-1-11	1 EA

PEDESTRIAN SIGN DETAIL

R10-3i 9"X15" 8 EA

(D) LEFT TURN YIELD ON FLASHING YELLOW ARROW

(FUTURE PANELS) FTP-85-13 3'0"X2'6" (2 EA)

0 10 40 Feet

HARRIS ST

GUERRANT ST (25 MPH)

DZ-8B

DZ-8A

2 RUNS @ 105 LF 1- VIDEO, 1-SPARE

105 LF 630-2-12

℄ SURVEY SR 19

IMC VC1

VC2

56 57 58 59 60 62

SR 19 (35 MPH)

DZ-1B DZ-6D DZ-6C

135' FROM STOP BAR (TYP.)

DZ-1A DZ-6B DZ-6A

DZ-2A DZ-2B DZ-5A

DZ-2C DZ-2D DZ-5B

SR 19 (35 MPH)

635-2-11 3 EA

2 RUNS @ 75 LF 1- VIDEO, 1-SPARE

630-2-12 75 LF

VC3 VC4

EXISTING PED. PEDESTAL-6 TO REMAIN

700-3-101	2 EA
700-3-601	2 EA

EXIST. MAST ARM POLE-2 & OVERHEAD STREET NAME SIGNS TO REMAIN. INSTALL VIDEO DETECTION CAMERAS VC3 & VC4

660-4-12 2 EA

EXISTING PED. PEDESTAL-5 TO REMAIN

700-3-101	2 EA
700-3-601	2 EA

APPARENT R/W LINE

APPARENT R/W LINE

APPARENT R/W LINE

CASSADY ST (25 MPH)

DZ-4A

DZ-4B

ORANGE LN

CENTRAL AV

S.O.P.-7

PHASE 1 PHASE 2 PHASE 3 PHASE 4

LEGEND:

IMC CAMERA (INTERSECTION MOVEMENT COUNTS)

VVDS (PRESENCE, ADVANCE, QUEUE)

CONTROLLER TIMINGS

TIMING FUNCTION									
MOVEMENT NUMBER		1	2	3	4	5	6	7	8
TIMING FUNCTION	MINIMUM GREEN	7	15		7	7	15		7
	EXTENSION	3.0	3.5		3.0	3.0	3.5		3.0
	MAXIMUM GREEN 1	15	45		20	15	45		20
	MAXIMUM GREEN 2	25	60		30	25	60		30
	YELLOW CLEARANCE	4	4		3.4	4	4		3.4
	ALL RED	3.3	2.0		3.3	2.7	2.0		3.3
	PEDESTRIAN WALK		7		7		7		7
	PED. CLEARANCE		10		26		12		26
	RECALL		MIN				MIN		

NOTES:

1. THE MAJOR STREET IS SR 19 (N. CENTRAL AVE). THE MINOR STREET IS GUERRANT ST/CASSADY ST.
2. THE POSTED SPEED LIMIT WITHIN THE INTERSECTION LIMITS ALONG SR 19 IS 35 MPH.
3. REPLACE ALL R10-3i PANELS. THE ARROWS ON SIGN R10-3i SHALL POINT IN THE DIRECTION OF THE CROSSING. THE SIGN PANELS SHALL BE PLACED DIRECTLY ABOVE THE INTENDED PUSH BUTTON.
4. ALL TIMINGS ARE PRELIMINARY AND MAY REQUIRE FIELD ADJUSTMENT AS DIRECTED BY THE MAINTAINING AGENCY.
5. MAINTAINING AGENCY TO DETERMINE THE OPERATION OF 4-SECTION SIGNAL HEADS FOR THE TIME OF DAY.
6. EXISTING LOOPS SHALL BE ABANDONED AND REMOVE ALL ABANDONED PULL BOXES.
7. EXISTING CONCRETE BASE SHALL BE USED FOR THE PROPOSED CABINET, WHERE NOT POSSIBLE, PRECAST BASE SLAB SHALL BE INSTALLED.

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ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

SIGNALIZATION PLAN

SHEET NO. T-5

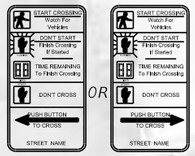
PEDESTRIAN SIGNAL HEAD DETAILS

P2 P4 P8

PED. SIGNAL COUNT-DOWN 1-SECT., 1-WAY

653-1-11 5 AS

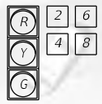
PEDESTRIAN SIGN DETAIL



R10-3i 9"X15" 8 EA

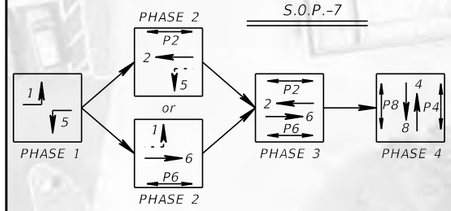
4-SECT., 1-WAY W/ BACK-PLATES 2 AS

650-1-16



3-SECT., 1-WAY W/ BACK-PLATES 8 AS

650-1-14



S.O.P.-7

REMOVAL ITEMS

632-7-6	1 PI
639-1-610	1 AS
639-2-6	180 LF
641-2-70	2 EA
670-5-600	1 EA

EXISTING PED. PEDESTAL-6 TO REMAIN

1 EA	700-3-101
1 EA	700-3-601

REPLCAE EXISTING PULL BOXES, INTERCEPT EXIST. CONDUIT

2 EA 635-2-11

3 RUNS @ 55 LF 2-SIGNAL

630-2-11 55 LF

MAST ARM POLE-4, ELEV. 96.87+0.5', STA. 76+23, 50'LT

630-2-11	4 RUNS @ 30 LF
635-3-12	1 EA
649-21-10	1 EA
660-4-12	2 EA
660-9-12	1 EA
684-5-1	1 EA

0 10 40 Feet

NOTES:

1. THE MAJOR STREET IS SR 19 (N. CENTRAL AVE). THE MINOR STREET IS W.OCALA ST/BULLDOG LN.
2. THE POSTED SPEED LIMIT WITHIN THE INTERSECTION LIMITS ALONG SR 19 IS 35 MPH.
3. REPLACE ALL R10-3i PANELS. THE ARROWS ON SIGN R10-3i SHALL POINT IN THE DIRECTION OF THE CROSSING. THE SIGN PANELS SHALL BE PLACED DIRECTLY ABOVE THE INTENDED PUSH BUTTON.
4. EXISTING TIMINGS TO REMAIN UNLESS NOTED IN THE PLANS. TIMINGS ARE PRELIMINARY AND MAY REQUIRE FIELD ADJUSTMENT AS DIRECTED BY THE MAINTAINING AGENCY.
5. MAINTAINING AGENCY TO DETERMINE THE OPERATION OF 4-SECTION SIGNAL HEADS FOR THE TIME OF DAY.
6. EXISTING LOOPS SHALL BE ABANDONED.
7. REMOVE ALL ABANDONED PULL BOXES.

630-2-11 2 RUNS (SIGNAL) @ 10 LF
646-1-11 1 EA
665-1-11 1 EA

PED. PEDESTAL-7 STA. 76+56, 37'LT

630-2-12 70 LF

6 RUNS @ 70 LF 2-SIGNAL,2-VIDEO, 2-SPARE

14 EA 635-2-11

PED. PEDESTAL-4 STA. 75+34, 37'LT
PED. PEDESTAL-5 STA. 75+62, 72'LT

2 RUNS (SIGNAL) @ 45 LF 630-2-11
2 EA 646-1-11
2 EA 665-1-11

6 RUNS @ 105 LF 2-SIGNAL,2-VIDEO,2-SPARE

105 LF 630-2-12

MAST ARM POLE-3, ELEV. 96.15'+0.5', STA. 75+22, 38'LT

4 RUNS @ 30 LF 630-2-11
1 EA 649-21-3
1 EA 660-4-12

ELEV. 96.33

ELEV. 96.83

ELEV. 96.22

1 EA 646-1-60 GAS LINE

UMATILLA BLVD (NOT PART OF SIGNALIZED INTERSECTION)

W OCALA ST (35 MPH)

SR 19 (35 MPH)

SURVEY SR 19

SCHOOL SCHOOL

135' FROM STOP BAR (TYP.)

(25 MPH) BULLDOG LN

HATFIELD DR

APPARENT R/W LINE

DZ-1A DZ-1B DZ-2A DZ-2B DZ-4A DZ-4B DZ-5A DZ-5B DZ-6A DZ-6B DZ-6C DZ-6D DZ-8A DZ-8B

POLE-5, ELEV. 97.35'+0.5', STA. 76+57, 35'RT

630-2-11	4 RUNS @ 10 LF
649-21-3	1 EA
660-4-12	1 EA

PED. PEDESTAL-8 STA. 76+52, 34'RT

630-2-11	2 RUNS (SIGNAL) @ 10 LF
646-1-11	1 EA
665-1-11	1 EA

RELOCATE PED. PEDESTAL-1 TO STA. 76+37, 36'RT

630-2-11	2 RUNS (SIGNAL) @ 10 LF
646-1-40	1 EA
700-3-101	1 EA
700-3-601	1 EA

630-2-11 (1-POWER) 90 LF
639-2-1 130 LF

POWER SOURCE- EXISTING UTILITY POLE W/ TRANSFORMER

APPARENT R/W LINE

PROPOSED CABINET

(8X10) 80 LF	630-2-11
1 PI	632-7-1
1 EA*	635-2-13
1 EA	660-4-11
1 EA	660-9-11
1 EA	663-1-121
1 EA	663-1-122
1 AS	670-5-111
1 EA	684-1-1
1 EA	684-5-1
1 EA	685-2-1
1 EA	695-8-11

*635-2-13 IS FOR FUTURE USE

PROPOSED POWER PEDESTAL

15 LF	630-2-11
1 AS	639-1-122
30 LF	639-2-1
1 EA	641-2-12

RELOCATE PED. PEDESTAL-2 TO STA. 75+62, 47.5'RT

2 RUNS (SIGNAL) @ 10 LF	630-2-11
1 EA	646-1-40
1 EA	700-3-101
1 EA	700-3-601

6 RUNS @ 110 LF 2-SIGNAL,2-VIDEO,2-SPARE

110 LF 630-2-12

PED. PEDESTAL-3 STA. 75+50, 50'RT

2 RUNS (SIGNAL) @ 15 LF	630-2-11
1 EA	646-1-11
1 EA	665-1-11

APPARENT R/W LINE

(D) LEFT TURN YIELD ON FLASHING YELLOW ARROW

(FUTURE PANELS) FTP-85-13 3'0"X2'6" (2 EA)

(S) YIELD TO

(BLANK-OUT SIGN) R1-5 (MOD) 3'0"X3'0" (4 EA)

700-11-391 1 AS

(P) FRONT: Bulldog Ln ← Ocala St / Bulldog Ln → Ocala St; BACK 7.5'X2.0' 1 EA

(Q) FRONT: Bulldog Ln → Ocala St / Bulldog Ln ← Ocala St; BACK 7.5'X2.0' 1 EA

(R) SR 19 6.0'X2.0' 1 EA

FREE SWINGING, DOUBLE SIDED, LED ILLUMINATED OVERHEAD SNS

700-5-21	1 EA
700-5-22	2 EA

LEGEND:

IMC CAMERA (INTERSECTION MOVEMENT COUNTS)

VVDS (PRESENCE, ADVANCE, QUEUE)

CONTROLLER TIMINGS

TIMING FUNCTION	MOVEMENT NUMBER	1	2	3	4	5	6	7	8
	MINIMUM GREEN								
	EXTENSION		3.5				3.5		
	MAXIMUM GREEN 1								
	MAXIMUM GREEN 2								
	YELLOW CLEARANCE	4	4		3.4	4	4		4
	ALL RED	3.8	2.4		3.5	2.6	2.3		2.5
	PEDESTRIAN WALK		7		7		7		7
	PED. CLEARANCE		12		16		16		22
	RECALL		MIN				MIN		

TIMING FUNCTION

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Aymon A. Mohomed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

SIGNALIZATION PLAN

SHEET NO. T-6

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

COUNT STATION NO. PTMS 115035
ROADWAY ID 11100, MP 4.380

0 10 40
Feet

STA. 49+65
1 EA 695-7-162

10 LF 630-2-11
2 EA 635-2-11

APPARENT R/W LINE

70 LF 630-2-12

SR 19 SB

49 50 ℄ SURVEY SR 19 51

SR 19 NB

1B 1A 2B 2A 3A 3B 4A 4B

APPARENT R/W LINE

695-6-12 4 EA

695-1-1 4 EA

NOTES:
1) CONTACT THE DISTRICT DATA COLLECTION MANAGER CHERYL BURKE AT LEAST TEN (10) WORKING DAYS PRIOR TO INSTALLATION (386)943-5380 TO CONFIRM LOCATIONS. ANY CHANGES MUST BE APPROVED BY THE DISTRICT TRAFFIC OPERATIONS OFFICE.

2) IMMEDIATELY AFTER COMPLETION OF INSTALLATION CONTACT THE DISTRICT DATA COLLECTIONS MANAGER AT 386-943-5380 TO SCHEDULE 48-HOUR INSPECTION COUNT AND PRIOR TO FINAL ACCEPTANCE.

3) SUBMIT FINAL TMS PLANS TO D5 TRAFFIC OPS.

4) COPY OF PRE-TESTED PIEZO READINGS AND WARRANTY SHALL BE LEFT IN CABINET.

COUNT STATION NO. ROAD TUBE 115036
ROADWAY ID 11100, MP 4.971

NOTES FOR TRAFFIC MONITORING SITE:
1. REMOVE ABANDONED PULL BOXES.

0 10 40
Feet

APPARENT R/W LINE

SCHOOL

80 81 ℄ SURVEY SR 19 SR 19 SB 82

SR 19 NB

APPARENT R/W LINE

REMOVE EXIST. TMS CABINET
695-7-600 1 EA

REVISIONS			
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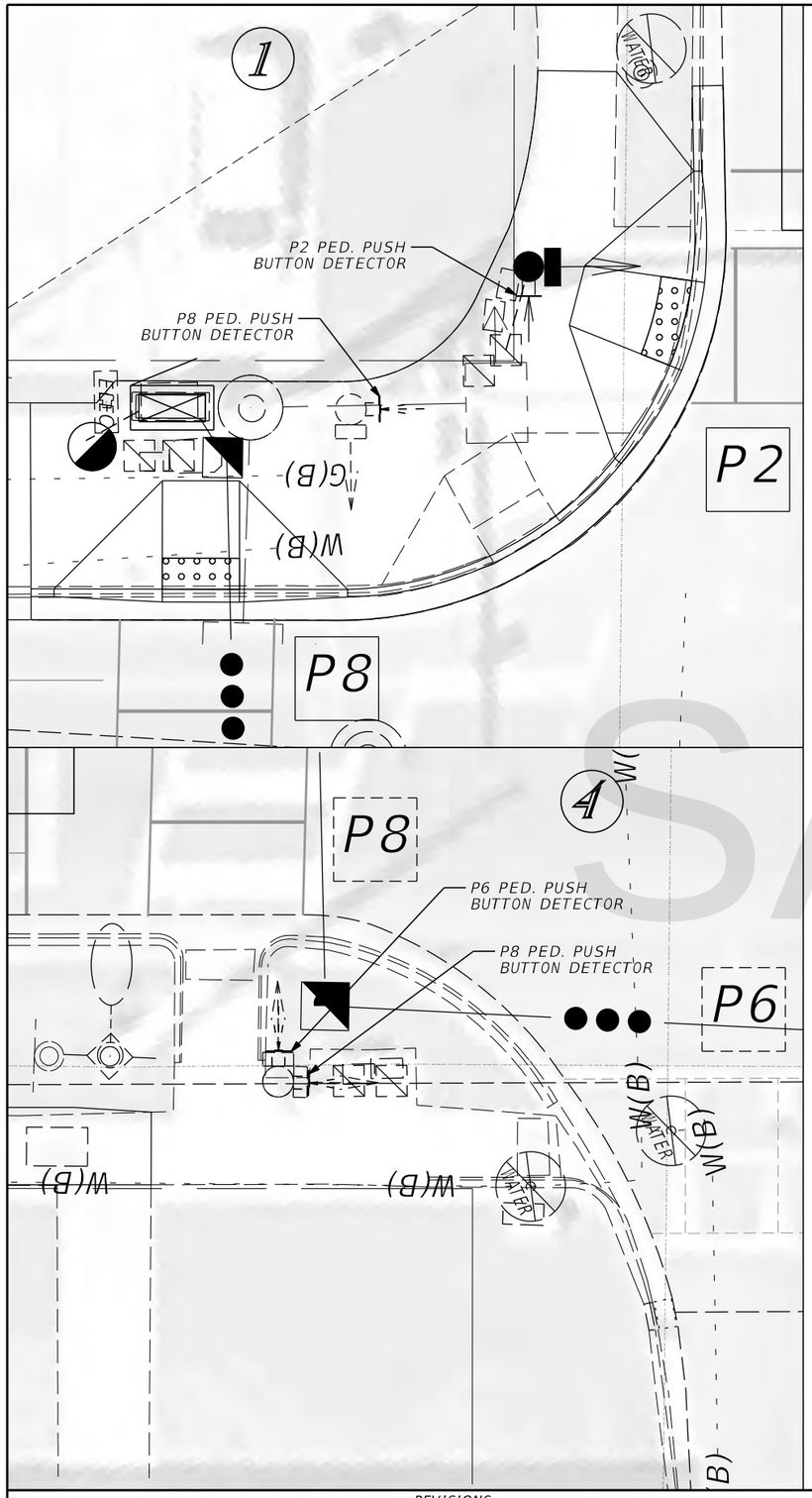
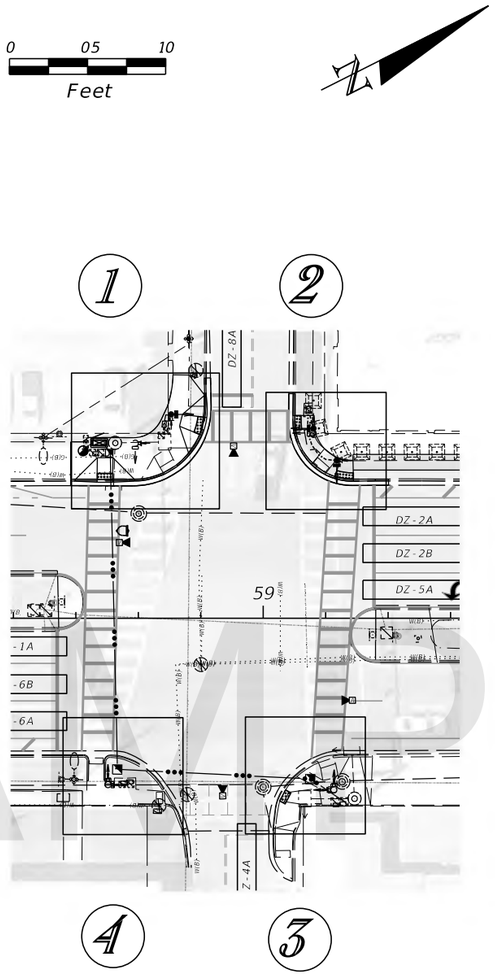
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

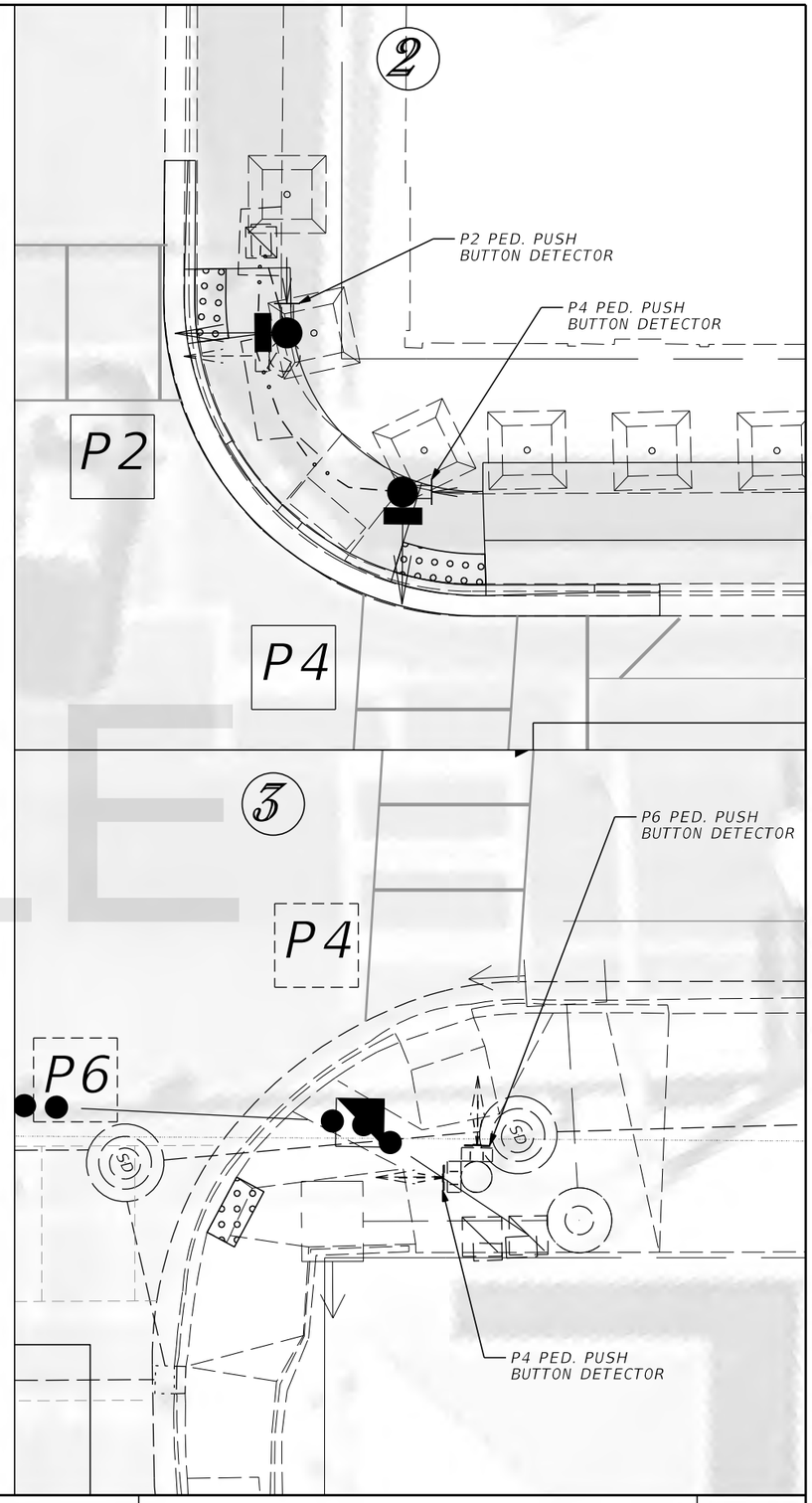
TRAFFIC COUNT STATION PLAN

SHEET NO. T-7





SR 19 @ CASSADY ST / GUERRANT ST



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
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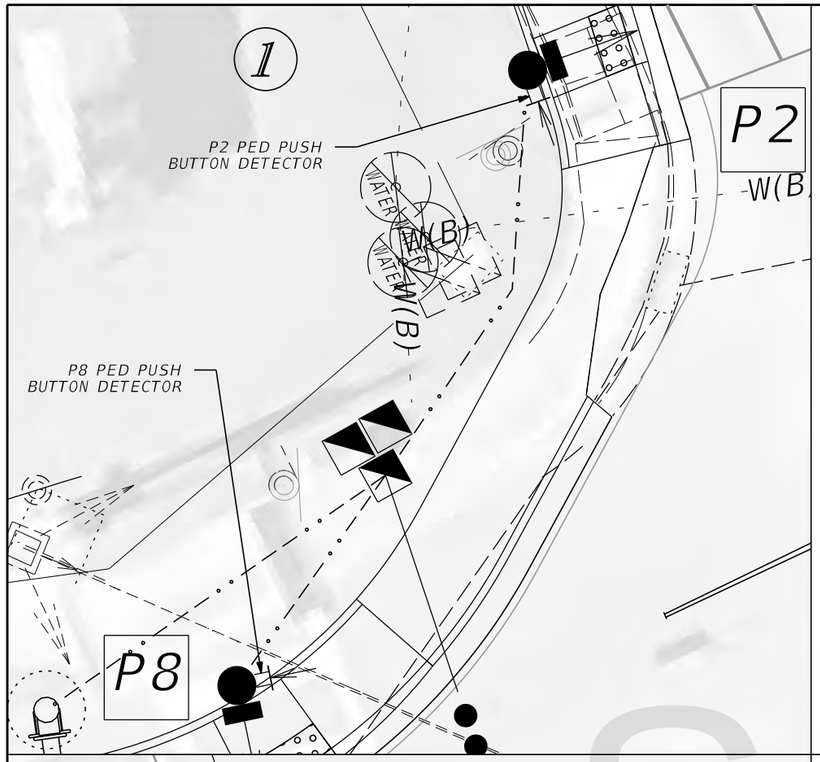
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

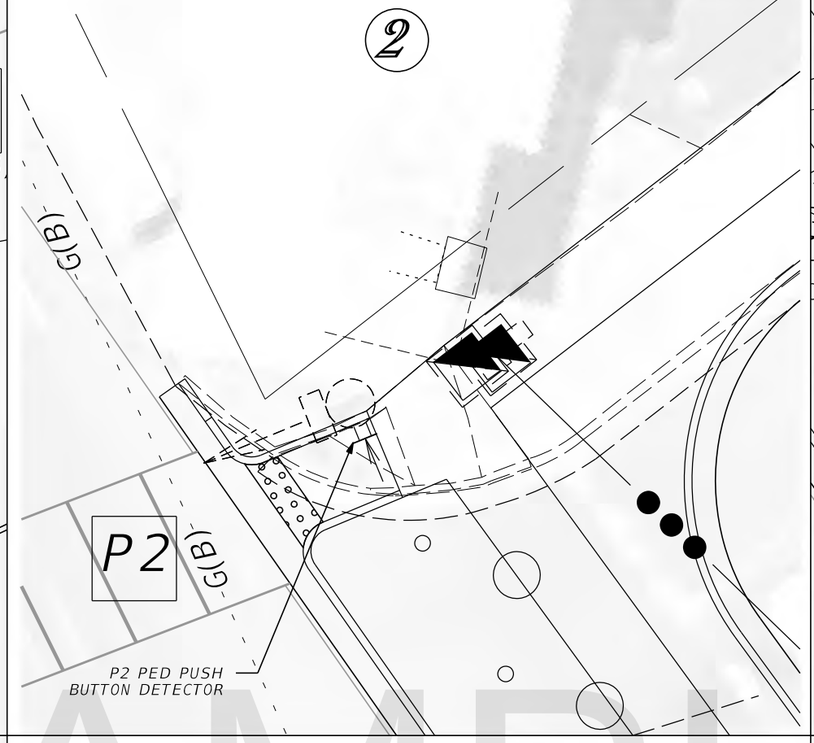
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

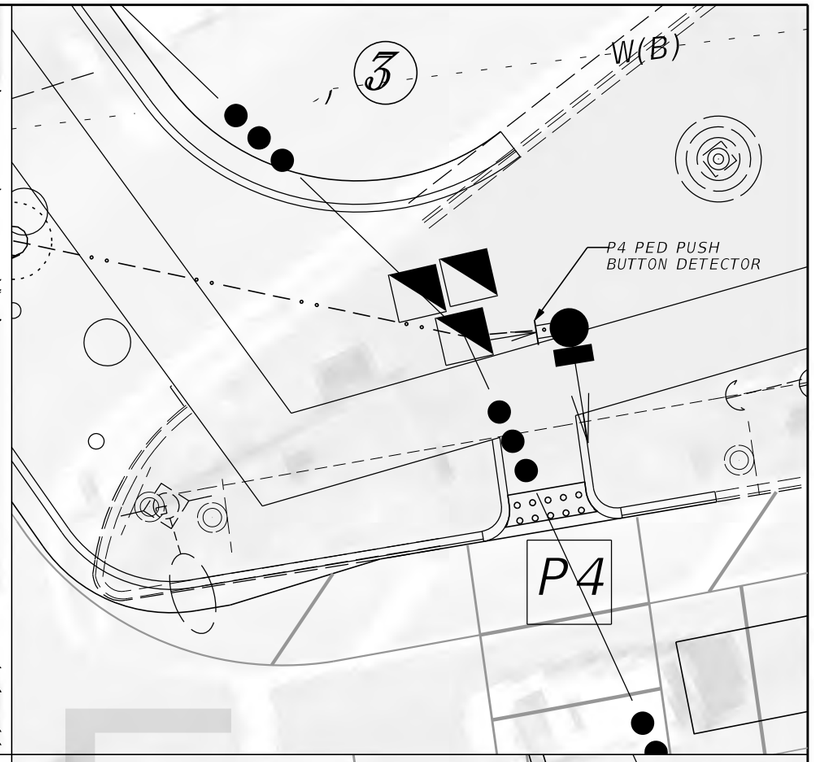
SIGNAL SPECIAL DETAIL

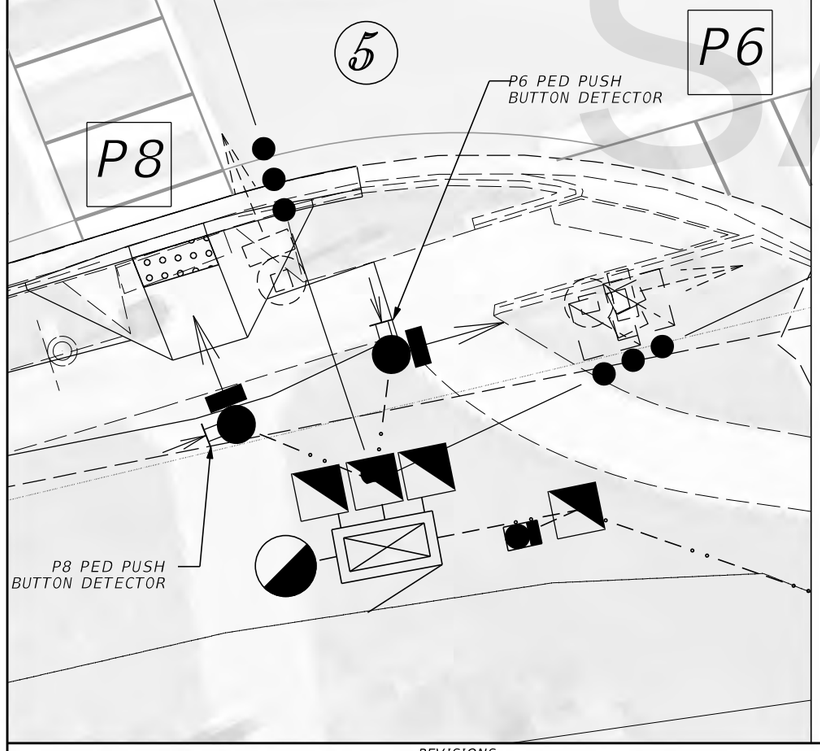
SHEET NO.
T-8

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



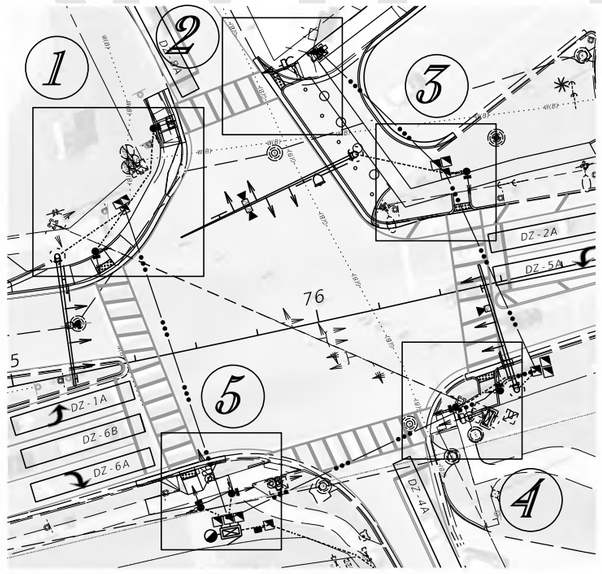


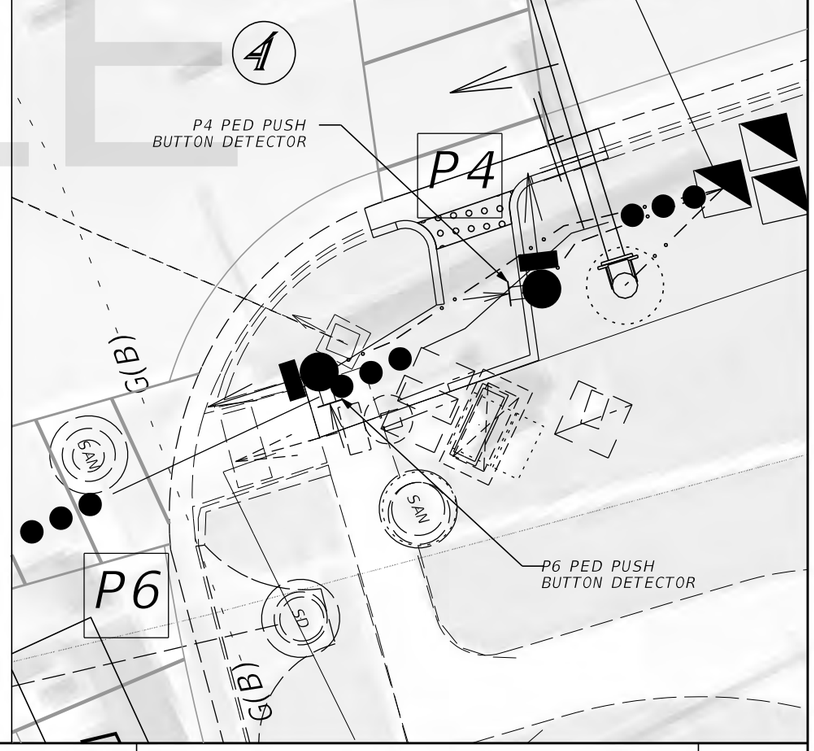




0 05 10
Feet

SR 19 AT W.OCALA ST / BULLDOG LN





REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Aymon A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

SIGNAL SPECIAL DETAIL

SHEET NO.
T-9

SIGN NAME	P		QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER				
WIDTH	7'-6"	WIDTH	1"			
HEIGHT	2'-0"	RADII	1.5"			
LEGEND	White	COLOR	White			
COLOR	Green					

SYMBOL(S)	ANGLE	X	Y	WID	HT
AR_Type D	270	8	13	8	12
AR_Type D	90	70	3	8	12	

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

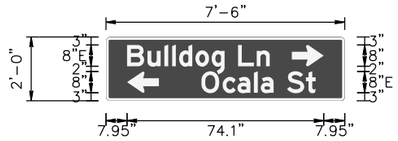
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		B	u	l	l	d	o	g		L	n		L									
SPACE	28.2	7.7	6.4	2.9	2.6	6.2	6.1	5	5	7	5	8	53.8									
COPY		O	c	a	l	a		S	t		L											
SPACE	8	8	5.6	6.2	2.6	4.9	5	7.1	3.7	39	43.1											
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						

SIGN NAME	Q		QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER				
WIDTH	7'-6"	WIDTH	1"			
HEIGHT	2'-0"	RADII	1.5"			
LEGEND	White	COLOR	White			
COLOR	Green					

SYMBOL(S)	ANGLE	X	Y	WID	HT
AR_Type D	270	70	13	8	12
AR_Type D	90	8	3	8	12	

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



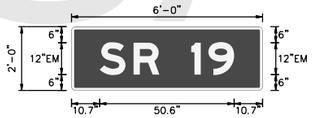
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		B	u	l	l	d	o	g		L	n		L									
SPACE	8	7.7	6.4	2.9	2.6	6.2	6.1	5	5	7	5	28.2	53.8									
COPY		O	c	a	l	a		S	t		L											
SPACE	36	8	5.6	6.2	2.6	4.9	5	7.1	3.7	11	43.1											
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						

SIGN NAME	R		QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER				
WIDTH	6'-0"	WIDTH	1"			
HEIGHT	2'-0"	RADII	1.5"			
LEGEND	White	COLOR	White			
COLOR	Green					

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		S	R		1	9		L														
SPACE	10.7	12.7	9.7	12	6.5	9.7	10.7	50.6														
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						

SIGN NAME		QTY		SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH		WIDTH			
HEIGHT		RADII			
LEGEND		COLOR			
COLOR					

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
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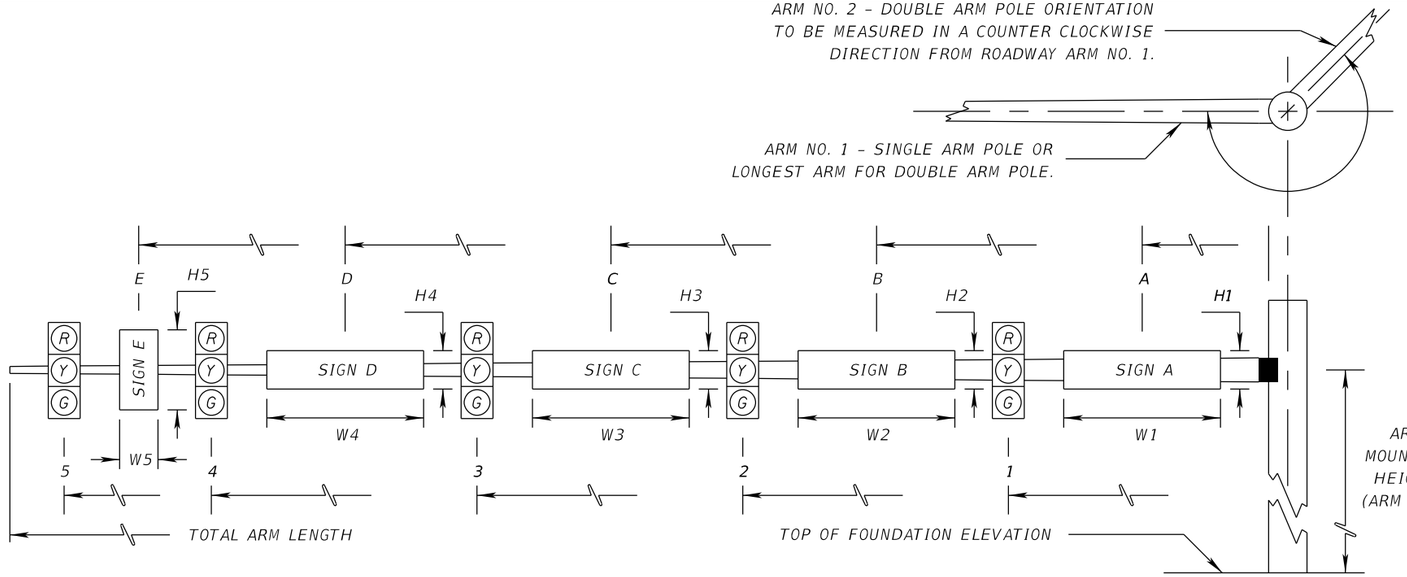
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

GUIDESIGN WORKSHEET

SHEET NO. T-10



ALL VALUES SHOWN ARE FROM AS-BUILT PLANS EXCEPT UNDERLINED VALUES SHOWING RELOCATED DEVICE LOCATIONS.
* DENOTES NUMBER OF SECTIONS IN SIGNAL HEAD ASSEMBLY
** FUTURE PANELS (SHOWN FOR LOAD CALCULATIONS)
[X] NEW SIGNAL HEADS TO BE INSTALLED
SIGNAL HEADS AND SIGNS ON POLE 3,4 & 5 ARE ALL NEW AS IDENTIFIED.

					SIGNAL DATA																SIGN DATA												
								DISTANCE FROM POLE													DISTANCE FROM POLE / HEIGHT AND WIDTH OF SIGN														
ID NO.	SHEET NO.	LOCATION BY STA.	TOP OF FOUND. ELEVATION	RDWY ARM NO.	CROWN ELEV.	SIGNAL V/H	BACK PLATES Y/N	PED. SIGNAL Y/N	1	*	2	*	3	*	4	*	5	*	TOTAL ARM LENGTH	ARM M.H.	ANGLE BETWEEN DUAL ARMS 90/270	A	H1	W1	B	H2	W2	C	H3	W3	CAM1	CAM2	CAM3	PAINT COLOR
1	T-5	EXIST., STA. 58+53,LT	500.33	1	499.48	V	Y	N	44.0	3	56.0	3							60	21.5	270	10	2	6										
				2	500.36	V	Y	N	27.0	3	38.0	3	48.0	[4]					52	21.5		9	2	9				51**	2.5	2				
2	T-5	EXIST., STA. 59+30,RT	499.74	1	500.35	V	Y	N	28.0	3	39.0	3	49.0	[4]					53	22.0	90	10	2	9				52**	2.5	2				
				2	499.51	V	Y	N	39.0	3	49.0	3							53	22.0		18	2	6										
3	T-6	STA. 75+22, 38'LT	96.65	1	96.22	V	Y	N	17.0	3	28.0	3	36.0	4					40	20.5		8	2	7.5	12	3	3	39**	2.5	2	22.5			
				2																														
4	T-6	STA. 76+23, 50'LT	97.37	1	96.33	V	Y	N	24.0	3	32.0	3	35.0	3	43.0	3			60	20.0		8	2	6	19	3	3	48	3	3	14.0	39.0	39.0	
				2																														
5	T-6	STA. 76+57, 35'RT	97.85	1	96.83	V	Y	N	15.0	3	23.0	3	38.0	4					40	20.0		8	2	7.5	10	3	3	35**	2.5	2	28.0			
				2																														

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

MAST ARM TABULATION

SHEET NO. T-11

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

SIGNAL ID	BIU NO.	CARD NO.	CHANNEL NO.	DETECTOR ID	DETECTOR	DIRECTION	MOVEMENT TYPE	APP. SPEED MPH	PROTECTED PHASE	PERMISSIVE PHASE	OVERLAP	DELAY SEC.	CAMERA ID	DETECTOR SYSTEM	ZONE SIZE	DISTANCE TO STOP BAR	DETECTOR TYPE	LANE TYPE	LANE NO.
			1	XXXXX01	DZ-1A	NB	L	35	1			5	V3	VIDEO	45'X8'	0	PD	V	*
		1	2	XXXXX02	DZ-1B	NB	L	35	1				V3	VIDEO	10'X8'	130	AD, QD	V	*
			3	XXXXX03	DZ-2A	SB	TR	35	2	5		5	V1	VIDEO	45'X8'	0	PD	V	*
		2	4	XXXXX04	DZ-2B	SB	T	35	2	5			V1	VIDEO	45'X8'	0	PD	V	*
			5	XXXXX05	DZ-2C	SB	TR	35	2	5			V1	VIDEO	10'X8'	130	AD	V	*
		3	6	XXXXX06	DZ-2D	SB	T	35	2	5			V1	VIDEO	10'X8'	130	AD	V	*
			7	XXXXX07	DZ-4A	WB	LTR	25	4			5	V2	VIDEO	45'X8'	0	PD	V	*
	1	4	8	XXXXX08	DZ-4B	WB	LTR	25	4				V2	VIDEO	10'X8'	100	AD	V	*
			9	XXXXX09	DZ-5A	SB	L	35	5			5	V1	VIDEO	45'X8'	0	PD	V	*
		5	10	XXXXX10	DZ-5B	SB	L	35	5				V1	VIDEO	10'X8'	130	AD, QD	V	*
			11	XXXXX11	DZ-6A	NB	TR	35	6	1		5	V3	VIDEO	45'X8'	0	PD	V	*
		6	12	XXXXX12	DZ-6B	NB	T	35	6	1			V3	VIDEO	45'X8'	0	PD	V	*
			13	XXXXX13	DZ-6C	NB	TR	35	6	1			V3	VIDEO	10'X8'	130	AD	V	*
		7	14	XXXXX14	DZ-6D	NB	T	35	6	1			V3	VIDEO	10'X8'	130	AD	V	*
			15	XXXXX15	DZ-8A	EB	LTR	25	8			5	V4	VIDEO	45'X8'	0	PD	V	*
		8	16	XXXXX16	DZ-8B	EB	LTR	25	8				V4	VIDEO	10'X8'	100	AD	V	*
			17	XXXXX17	SPARE														
		9	18	XXXXX18	SPARE														
			19	XXXXX19	SPARE														
		10	20	XXXXX20	SPARE														
			21	XXXXX21	SPARE														
		11	22	XXXXX22	SPARE														
			23	XXXXX23	SPARE														
XXXXX	2	12	24	XXXXX24	SPARE														
			25	XXXXX25	SPARE														
		13	26	XXXXX26	SPARE														
			27	XXXXX27	SPARE														
		14	28	XXXXX28	SPARE														
			29	XXXXX29	SPARE														
		15	30	XXXXX30	SPARE														
			31	XXXXX31	SPARE														
		16	32	XXXXX32	SPARE														
			33	XXXXX33	SPARE														
		17	34	XXXXX34	SPARE														
			35	XXXXX35	SPARE														
		18	36	XXXXX36	SPARE														
			37	XXXXX37	SPARE														
		19	38	XXXXX38	SPARE														
			39	XXXXX39	SPARE														
	3	20	40	XXXXX40	SPARE														
			41	XXXXX41	SPARE														
		21	42	XXXXX42	SPARE														
			43	XXXXX43	SPARE														
		22	44	XXXXX44	SPARE														
			45	XXXXX45	SPARE														
		23	46	XXXXX46	SPARE														
			47	XXXXX47	SPARE														
		24	48	XXXXX48	SPARE														

LEGEND:
PD - PRESENCE DETECTION
AD - ADVANCE DETECTION
V - VEHICLE, B - BIKE
LTR - LEFT-THRU-RIGHT
QD - QUEUE DETECTION
L - LEFT, T - THRU, R - RIGHT
TL - LEFT-THRU, TR - THRU-RIGHT

* CONFIRM THE LANE NUMBER VALUES WITH LAKE COUNTY ENGINEERING DEPT DURING CONSTRUCTION.

SR 19 AT CASSADY ST / GUERRANT ST

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Ayman A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

DETECTOR CHART (1)

SHEET NO. T-13

SIGNAL ID	BIU NO.	CARD NO.	CHANNEL NO.	DETECTOR ID	DETECTOR	DIRECTION	MOVEMENT TYPE	APP. SPEED MPH	PROTECTED PHASE	PERMISSIVE PHASE	OVERLAP	DELAY SEC.	CAMERA ID	DETECTOR SYSTEM	ZONE SIZE	DISTANCE TO STOP BAR	DETECTOR TYPE	LANE TYPE	LANE NO.
			1	XXXXX01	DZ-1A	NB	L	35	1			5	V3	VIDEO	45'X8'	0	PD	V	*
		1	2	XXXXX02	DZ-1B	NB	L	35	1				V3	VIDEO	10'X8'	130	AD	V	*
			3	XXXXX03	DZ-2A	SB	TR	35	2	5		5	V1	VIDEO	45'X8'	0	PD	V	*
		2	4	XXXXX04	DZ-2B	SB	TR	35	2	5			V1	VIDEO	10'X8'	130	AD	V	*
			5	XXXXX05	DZ-4A	WB	LTR	25	4			5	V2	VIDEO	45'X8'	0	PD	V	*
		3	6	XXXXX06	DZ-4B	WB	LTR	25	4				V2	VIDEO	10'X8'	100	AD	V	*
			7	XXXXX07	DZ-5A	SB	L	35	5			5	V1	VIDEO	45'X8'	0	PD	V	*
	1	4	8	XXXXX08	DZ-5B	SB	L	35	5				V1	VIDEO	10'X8'	130	AD	V	*
			9	XXXXX09	DZ-6A	NB	R	35	6	1		5	V3	VIDEO	45'X8'	0	PD	V	*
		5	10	XXXXX10	DZ-6B	NB	T	35	6	1			V3	VIDEO	45'X8'	0	PD	V	*
			11	XXXXX11	DZ-6C	NB	R	35	6	1			V3	VIDEO	10'X8'	130	AD	V	*
		6	12	XXXXX12	DZ-6D	NB	T	35	6	1			V3	VIDEO	10'X8'	130	AD	V	*
			13	XXXXX13	DZ-8A	EB	LTR	35	8			5	V4	VIDEO	45'X8'	0	PD	V	*
		7	14	XXXXX14	DZ-8B	EB	LTR	35	8				V4	VIDEO	10'X8'	100	AD	V	*
			15	XXXXX15	SPARE														
		8	16	XXXXX16	SPARE														
			17	XXXXX17	SPARE														
		9	18	XXXXX18	SPARE														
			19	XXXXX19	SPARE														
		10	20	XXXXX20	SPARE														
			21	XXXXX21	SPARE														
		11	22	XXXXX22	SPARE														
			23	XXXXX23	SPARE														
XXXXX	2	12	24	XXXXX24	SPARE														
			25	XXXXX25	SPARE														
		13	26	XXXXX26	SPARE														
			27	XXXXX27	SPARE														
		14	28	XXXXX28	SPARE														
			29	XXXXX29	SPARE														
		15	30	XXXXX30	SPARE														
			31	XXXXX31	SPARE														
		16	32	XXXXX32	SPARE														
			33	XXXXX33	SPARE														
		17	34	XXXXX34	SPARE														
			35	XXXXX35	SPARE														
		18	36	XXXXX36	SPARE														
			37	XXXXX37	SPARE														
		19	38	XXXXX38	SPARE														
			39	XXXXX39	SPARE														
	3	20	40	XXXXX40	SPARE														
			41	XXXXX41	SPARE														
		21	42	XXXXX42	SPARE														
			43	XXXXX43	SPARE														
		22	44	XXXXX44	SPARE														
			45	XXXXX45	SPARE														
		23	46	XXXXX46	SPARE														
			47	XXXXX47	SPARE														
		24	48	XXXXX48	SPARE														

LEGEND:
PD - PRESENCE DETECTION
AD - ADVANCE DETECTION
V - VEHICLE, B - BIKE
LTR - LEFT-THRU-RIGHT

QD - QUEUE DETECTION
L - LEFT, T - THRU, R - RIGHT
TL - LEFT-THRU, TR - THRU-RIGHT

* CONFIRM THE LANE NUMBER VALUES WITH LAKE COUNTY ENGINEERING DEPT DURING CONSTRUCTION.

SR 19 AT W.OCALA ST / BULLDOG LN

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

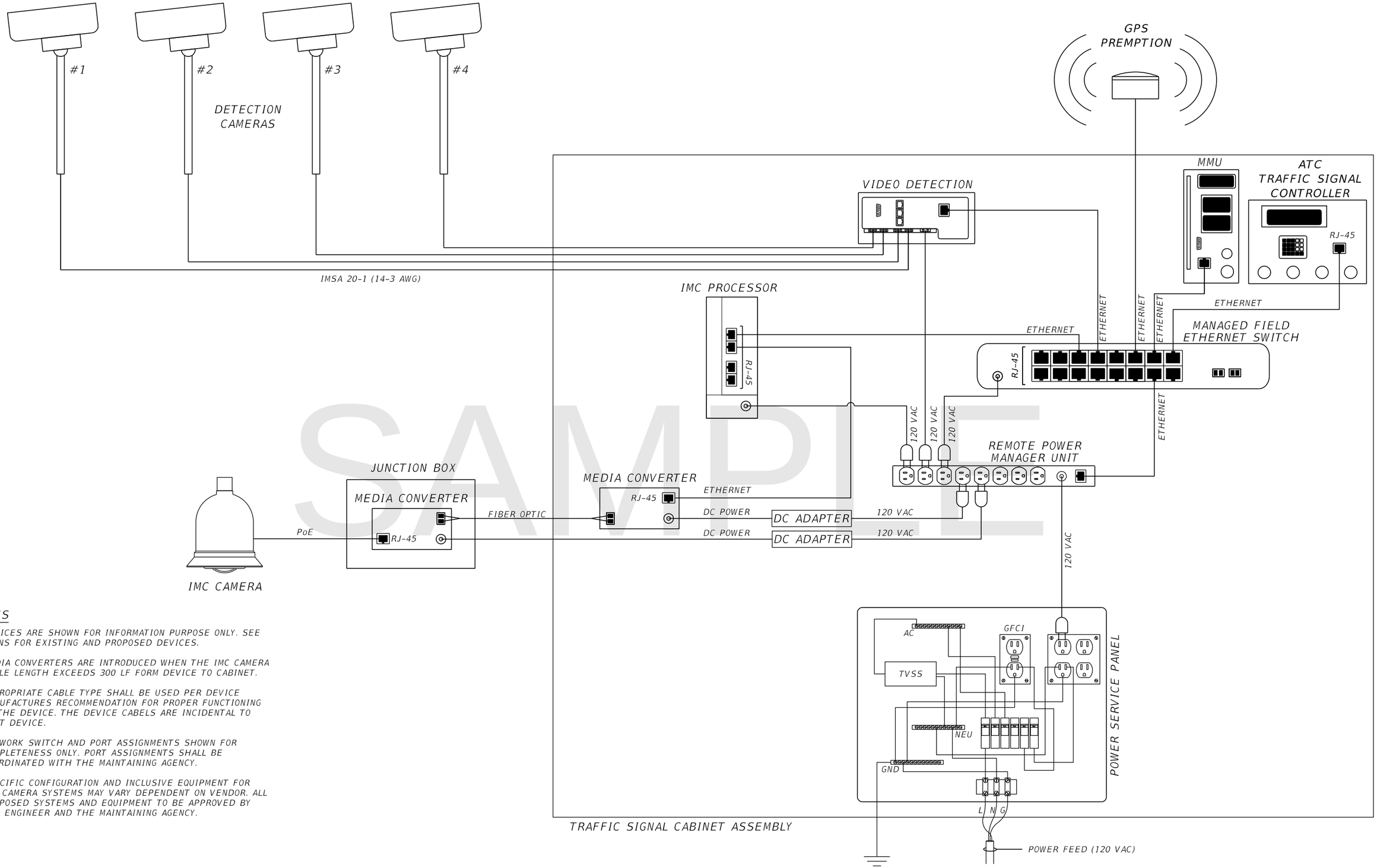
DISTRICT FIVE - DESIGN
Ayman A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

DETECTOR CHART (2)

SHEET NO. T-14



NOTES

1. DEVICES ARE SHOWN FOR INFORMATION PURPOSE ONLY. SEE PLANS FOR EXISTING AND PROPOSED DEVICES.
2. MEDIA CONVERTERS ARE INTRODUCED WHEN THE IMC CAMERA CABLE LENGTH EXCEEDS 300 LF FORM DEVICE TO CABINET.
3. APPROPRIATE CABLE TYPE SHALL BE USED PER DEVICE MANUFACTURES RECOMMENDATION FOR PROPER FUNCTIONING OF THE DEVICE. THE DEVICE CABELS ARE INCIDENTAL TO THAT DEVICE.
4. NETWORK SWITCH AND PORT ASSIGNMENTS SHOWN FOR COMPLETENESS ONLY. PORT ASSIGNMENTS SHALL BE COORDINATED WITH THE MAINTAINING AGENCY.
5. SPECIFIC CONFIGURATION AND INCLUSIVE EQUIPMENT FOR IMC CAMERA SYSTEMS MAY VARY DEPENDENT ON VENDOR. ALL PROPOSED SYSTEMS AND EQUIPMENT TO BE APPROVED BY THE ENGINEER AND THE MAINTAINING AGENCY.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Aymon A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 19	LAKE	437938-1-52-01

WIRING DIAGRAM

SHEET NO. T-15

STATE OF FLORIDA

DEPARTMENT OF TRANSPORTATION

CONTRACT PLANS

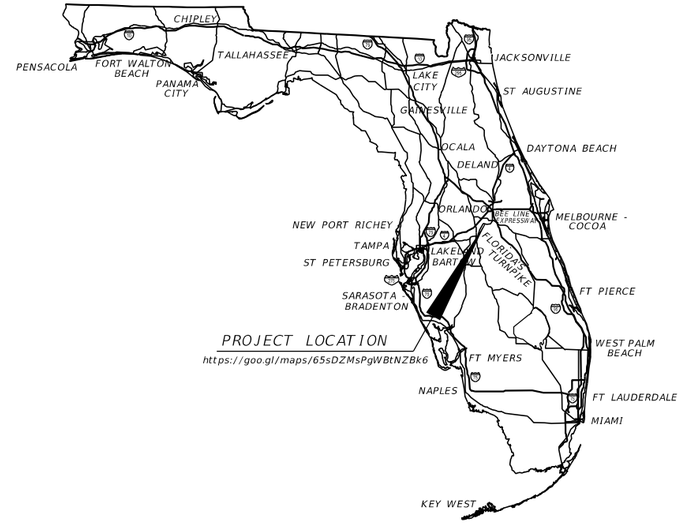
FINANCIAL PROJECT ID 445210-1-52-01

OSCEOLA COUNTY (92010-000)

STATE ROAD NO. 600/500

(S. JOHN YOUNG PARKWAY)

SIGNALIZATION PLANS



INDEX OF SIGNALIZATION PLANS

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T-2	GENERAL NOTES
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T-6	TRAFFIC COUNT STATION PLAN
T-7 TO T-9	DETECTOR CHART
T-10	SPLICING DIAGRAM
T-11	WIRING DIAGRAM
T-12	DEVICE MOUNTING DETAIL

AYMAN A. MOHAMED
LICENSE
No 61777
STATE OF FLORIDA
PROFESSIONAL ENGINEER

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY:

ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

SIGNALIZATION PLANS ENGINEER OF RECORD:

AYMAN A. MOHAMED, P.E.
P.E. NO.: 61777
FDOT DISTRICT 5 TRAFFIC DESIGN
719 S. WOODLAND BLVD.
DELAND, FL 32720

FDOT PROJECT MANAGER:

NAZIRU M. ISAAC, P.E.

PLANS PREPARED BY:

FDOT DISTRICT 5 TRAFFIC DESIGN

PHASE III PLANS
PERLIMINARY

CONSTRUCTION CONTRACT NO.	FISCAL YEAR	SHEET NO.
TBD	22	T-1

7/30/2021 11:59:17 AM KNHNTSV
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GENERAL NOTES

1. THE CONTRACTOR SHALL COORDINATE WITH THE FOLLOWING MAINTINING AGENCY FOR THE SIGNALS ALONG JOHN YOUNG PARKWAY AT:

A. PLEASANT HILL RD/ HOAGLAND BLVD	OSCEOLA COUNTY TRAFFIC OPERATIONS KATHY LEE (407)- 742 0553 Kathy.lee@osceola.org
B. THE OAKS BLVD C. OSCEOLA PARK RD/ HACIENDA CIR	CITY OF KISSIMMIEE TRAFFIC ENGINEERING & OPERATION NABIL MUHAISEN (407)- 518 2275 nabil.muhaisen@kissimmee.gov

2. THESE PLANS REFLECT CONDITIONS KNOWN DURING PLAN DEVELOPMENT. IN THE EVENT ACTUAL PHYSICAL CONDITIONS PREVENT THE APPLICATION OR THE PROGRESS OF ANY WORK SPECIFIED IN THESE PLANS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY AND PRIOR TO ANY FURTHER ACTIVITY.

3. APPROVAL OF SHOP DRAWINGS DOES NOT CONSTITUTE A WARRANTY THAT THE SIGNAL EQUIPMENT COMPLIES WITH THE STANDARDS OF THE MAINTAINING AGENCY. THE CONTRACTOR IS RESPONSIBLE FOR INSURING THAT THE PROPOSED SIGNAL EQUIPMENT MEETS THE REQUIREMENTS SPECIFIED IN THE CONTRACT, SPECIFICATIONS AND CONTRACT PLANS.

4. THE CONTRACTOR SHALL SUBMIT FOR APPROVAL TWO SETS OF SHOP DRAWINGS, MANUFACTURER'S DESCRIPTIVE LITERATURE AND TECHNICAL DATA FOR EACH EQUIPMENT ITEM PROPOSED ON THIS PROJECT TO THE EOR AND THE MAINTAINING AGENCY.

5. THE MAINTAINING AGENCY IS OSCEOLA COUNTY. A RIGHT OF WAY UTILIZATION PERMIT IS REQUIRED. THE CONTRACTOR SHALL NOTIFY THE MAINTAINING AGENCY AT LEAST 72 HOURS BEFORE BEGINNING ANY RELATED TRAFFIC SIGNAL WORK. THE CONTRACTOR SHALL OBTAIN ALL CONSTRUCTION PERMITS REQUIRED FOR THE PROJECT FOR APPLICABLE CITIES, COUNTY AGENCIES, AND FOOT. APPROVAL OF PLANS BY OSCEOLA COUNTY DOES NOT CONSTITUTE A PERMIT.

6. EQUIPMENT WARRANTY SHALL BE ONE YEAR, MANUFACTURERS PROVIDED OR PER FOOT STANDARD SPECIFICATIONS (LATEST EDITION), WHICHEVER IS LONGER.

7. PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL PROVIDE WRITTEN NOTICE OF COMMENCEMENT, VIA E-MAIL, TO MAINTAINING AGENCIES. NOTICE SHALL INCLUDE THE DATE OF COMMENCEMENT, LOCATION AND TYPE OF WORK & INFORMATION REGARDING ANY MALFUNCTIONING SIGNAL EQUIPMENT. THIS SHALL BE COMPLETED AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF WORK.

8. THE CONTRACTOR SHALL NOTIFY KEVIN KRUG (SIGNAL PROJECT MANAGER) AT (407) 738-9405 AT LEAST TWO FULL BUSINESS DAYS IN ADVANCE OF INSTALLING GROUND RODS, UNDERGROUND CONDUIT, OR SETTING POLES SO THAT THESE OPERATIONS CAN BE OBSERVED. CONTRACTOR SHALL PROVIDE TO THE COUNTY AN UPDATED CONSTRUCTION SCHEDULE IN THE FORM OF A TWO WEEK LOOK AHEAD ON A BI-WEEKLY BASIS.

9. FINAL LOCATIONS OF ALL CABINETS SHALL BE APPROVED BY THE MAINTAINING AGENCY PRIOR TO PLACEMENT OF THE FOUNDATION.

10. FIELD ADJUSTMENT OF ALL PROPOSED EQUIPMENT MAY BECOME NECESSARY TO ACCOMMODATE EXISTING FIELD CONDITIONS. VARIATIONS FROM THE PROPOSED LOCATION MUST BE PRE APPROVED BY THE MAINTAINING AGENCY.

11. THESE PLANS REFLECT CONDITIONS KNOWN DURING PLAN DEVELOPMENT. IN THE EVENT ACTUAL PHYSICAL CONDITIONS PREVENT THE APPLICATION OR THE PROGRESS OF ANY WORK SPECIFIED IN THESE PLANS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO ANY FURTHER WORK ACTIVITY.

12. IT IS THE CONTRACTOR'S RESPONSIBILITY TO REVIEW THE PLACEMENT OF THE VIDEO IMAGE DETECTION DEVICES AND COORDINATE WITH THE VENDOR TO DETERMINE THE MOST OPTIMAL LOCATION FOR THE INSTALLATION OF THE VIDEO IMAGE DETECTION DEVICES IN ORDER TO MEET THE PERFORMANCE REQUIREMENTS OF THE TECHNICAL SPECIFICATIONS.

13. THE USE OF "JONES" PLUGS SHALL BE PROHIBITED.

14. CIRCULAR DRIP LOOPS (MINIMUM ONE CIRCLE) ARE TO BE PROVIDED AT ALL AERIALS DISCONNECT HANGER, INTERCONNECT JUNCTION BOX, ELECTRICAL SIGN AND POLE LOCATIONS.

15. SIX FEET OF ADDITIONAL SIGNAL CABLE SLACK SHALL BE PRESENT IN THE UPRIGHT SUCH THAT THE TERMINAL BLOCK CAN BE REMOVED FROM THE UPRIGHT TO ALLOW FOR TROUBLE SHOOTING.

16. CABLE GRIPS SHALL BE OF SUFFICIENT SIZE TO NOT COMPROMISE THE INSULATION ON THE SIGNAL CABLE. CONTRACTOR SHALL VERIFY COLOR CODES FOR BOTH SIGNAL AND INTERCONNECT CABLE WITH THE MAINTAINING AGENCY ORDERING. WIRING DIAGRAMS SHALL BE IN ACCORDANCE WITH OSCEOLA COUNTY SPECIFICATIONS.

17. ALL FIELD WIRING SHALL BE NEATLY BUNDLED AND CLEARLY IDENTIFIED WITH PERMANENT LEGIBLE, WEATHERPROOF TAGS THAT ARE SECURELY ATTACHED TO EACH CABLE. THE TAGGING SYSTEM PROPOSED SHALL BE SUBMITTED FOR APPROVAL WITH THE OTHER EQUIPMENT SUBMITTAL'S REQUIRED FOR THIS PROJECT.

18. THREE SPARE CONDUCTORS SHALL BE INSTALLED PER VEHICLE PHASE. SPARES SHALL BE BOUND AND GROUNDED IN CABINET.

19. IF THERE IS FIBER OPTIC CABLE WITHIN YOUR PROJECT LIMITS OR WITHIN 1500 FEET OF PROJECT LIMITS, CONTACT LINDSEY.GIOVINAZZO@OSCEOLA.ORG, (407) 742-9166 OR KEVIN KRUG AT (407) 738- 9405.

20. WHEN COMMUNICATIONS TO AN INTERSECTION MUST BE DISRUPTED BY A CONTRACTOR TO PERFORM WORK, THE CONTRACTOR SHALL PROVIDE TWO DAYS ADVANCE NOTICE IN WRITING TO THE MAINTAINING AGENCIES. NOTIFICATION SHALL INCLUDE CONTACT PERSON, TELEPHONE NUMBER, PURPOSE, LOCATION AND DURATION. THE DISRUPTION SHALL LAST FOR NO MORE THAN THREE CONSECUTIVE BUSINESS DAYS. WHERE POSSIBLE, THE DISRUPTION SHALL BE DURING OFF PEAK HOURS BEGINNING AT 9:00 AM AND ENDING AT 3:00 PM OR FROM 6:00 PM TO 7:00 AM.

PAY ITEM NOTES

1. SYSTEM DEVICE PAY ITEMS SHALL INCLUDE ALL WORK NECESSARY TO FURNISH AND INSTALL THE SYSTEM, SOFTWARE MODULES TO COMMUNICATE WITH MAINTAINING AGENCIES ATMS SOFTWARE AND FDOT DISTRICT 5 DISRICTWIDE ATSPM DATABASE CAPABLE OF ENHANCED DETECTION, HIGH RESOLUTION DATA LOGGING AND FUTURE CV EXPANSION EFFORT. THE WORK SHALL INCLUDE BUT NOT LIMITED TO PROCESSOR UNITS, MOUNTING ARMS, BRACKETS, WIRING, HARDWARE AND ALL ANCILLARY COMPONENTS AS WELL AS ALL DATA AND POWER CABLING REQUIRED TO TRANSMIT AND RECEIVE DATA AND POWER THE DEVICE FOR A COMPLETE DEPLOYMENT.

   A. 660-4-11, 660-4-12: VEHICLE VIDEO DETECTION SYSTEM (VVDS) SHALL BE iTERIS RZ-4™ ADVANCED WDR (RZ-4 AWDR) PREMIUM VIDEO DETECTION CAMERA, OPTIMIZED FOR TRAFFIC VIDEO DETECTION AND DATA COLLECTION. SYSTEM SHALL INCLUDE THE DATA MODULE AND COMMUNICATION MODULE TO ENABLE LIVE VIDEO FEEDS.

   B. 660-6-121, 660-6-122: AUTOMATIC VEHICLE IDENTIFICATION (AVI) BLUETOOTH DEVICE SHALL BE iTERIS VANTAGE VELOCITY RACK-MOUNT FIELD UNIT W/ ETHERNET CONNECTION, VANTAGE VELOCITY ANTENNA W/ 9" BRACKET 800-2700 MHZ (3-5DBI) & 2400-2485 MHZ (5DBI).

   C. 660-9-11, 660-9-12: SHALL BE CONFIGURED TO PROVIDE AN INTERSECTION MOVEMENT COUNT (IMC) CAMERA SYSTEM CAPABLE OF PERFROMING LANE BY LANE (INCLUDES LEFT, THRU AND RIGHT TURN LANES) VEHICLE TURNING MOVEMENT COUNTS FOR ALL APPROACHES OF THE INTERSECTION. GRIDSMART SYSTEM SHALL INCLUDE THE DATA MODULE AND COMMUNICATION MODULE TO ENABLE LIVE VIDEO FEEDS.

   D. 663-1-121, 663-1-122: EMERGENCY PREEMPTION SYSTEM SHALL BE GTT OPTICOM 3100 GPS RADIO UNIT W/ GPS RECIEVER & ANTENNA 2.4 GHZ TRANSCEIVER, 3101 GPS RADIO UNIT W/ GPS RECIEVER, 2.4 GHZ TRANSCEIVER, 1050 GPS/RADIO ANTENNA,1072 GPS CABLE ASSEMBLY, 764 MULTIMODE PHASE SELECTOR, OPTICOM 768 AUXILIARY INTERFACE PANEL, 1040 GPS CARD RACK OR OPTICOM MODEL 760 CARD RACK OR OPTICOM MODEL 770 CARD RACK, AND AUXILIARY INTERFACE PANEL (MODEL 1030).

   E. 670-5-111: SHALL BE ECONOLITE NEMA TS 2, SIZE 7 W/ 64 CHANNEL WIRED CABINET ASSEMBLY. THE CONTROLLER SHALL BE ECONOLITE COBALT NEMA TS2, TYPE 1 ATC CONTROLLER W/ ETHERNET. ATC CONTORLLER SHALL BE COMPATIBLE WITH THE MAINTAINING AGENCY AND FDOT DISTRICT 5 ATMS SOFTWARE, CAPABLE OF HIGH-RESOLUTION DATA LOGGING AND ARE FORWARD COMPATIBLE WITH CV AND ICM EFFORTS. THIS PAY ITEM SHALL ALSO INCLUDE ALL MATERIALS AND WORK NECESSARY TO TRANSFER EXISTING SIGNAL TIMING AND PHASING INFORMATION INCLUDING, BUT NOT LIMITED TO, TIMING PLANS, DATABASES, CONFIGURATIONS FILES, AND MORE.

   F. 682-1-143: CCTV CAMERA SHALL BE TKH SIQURA PD910 3-MEGAPIXEL /N HIGH-SPEED PTZ DOMELESS CAMERA, IP, OUTDOOR, SD, 40X OPT. 10X DIGITAL ZOOM, MULTI-CODEC, NTSC, H.264, INCLUDES POE SURGE, CITEL DS220S-24DC AC/DC SURGE, PA 02 US POWER SUPPLY W/ FIVE (FDOT 1387A), CANDY CANE POLE MOUNT BRACKET WITH ASTRO BRACKET, PD110XPD9XX ADAPTER AND PTM02 BRACKET.

   G. 684-1-1: MANAGED FIELD ETHERNET SWITCH SHALL BE ITS-8012-24-V3-KIT 4 USFP+ PORTS 100MB/1000MB/2.5GB/10GB (ULTRA SFP+ PORTS) 4 ESFP PORTS 100MB/1000MB/2.5GB (ENHANCED SFP PORTS) 16 COPPER PORTS 10MB/100MB/ 1000MB TX INCLUDES PS80 POWER SUPPLY, QTY 2 LX10 OPTICS AND DIN RAIL.

   H. 685-1-13: SHALL INCLUDE UPS ASSEMBLEY WITH AN EXTERNAL PIGGYBACK CABINET ATTACHED TO SIGNAL CABINET.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Ayman A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445210-1-52-01

GENERAL NOTES

SHEET NO. T-2

7/30/2021 11:59:21 AM KHHNTSV
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NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

PEDESTRIAN SIGNAL HEAD DETAILS

P2 P4 P6 P8

PED. SIGNAL COUNT-DOWN 1-SECT., 1-WAY 8 AS

PEDESTRIAN SIGN DETAIL

R10-3i 9"X15" 8 EA

3-SECT., 1-WAY EXIST. TO REMAIN 7 AS

3-SECT., 1-WAY EXIST. TO REMAIN 3 AS

3-SECT., 2-WAY EXIST. TO REMAIN 1 AS

3-SECT., 1-WAY RELOCATE 1 AS — 650-1-70

3-SECT., 2-WAY 1 AS — 650-1-15

3-SECT., 1-WAY REMOVE 1 AS — 650-1-60

A — 30"X30" "BLANK-OUT" SIGN TO REMAIN

B — 30"X30" SIGN PANEL TO REMAIN

OSCEOLA COUNTY ATMS PULL BOX TO REMAIN

EXIST. SIGNAL CABINET (ID- 20602) W/ATTACHED UPS CABINET TO REMAIN

1 PI	632-7-1	670-5-400	1 AS
12 EA	660-1-109	684-1-1	1 EA
3 EA	660-1-110	684-1-6	1 EA
1 EA	660-4-11	684-5-1	1 EA
1 EA	660-9-11	685-2-1	1 EA
1 EA	663-1-121		

EXIST. STEEL STRAIN POLE-1 TO REMAIN, EXIST. CCTV ON POLE TO REMAIN (NO DOWN TIME ALLOWED), EXIST. POWER METER AND DISCONNECT TO REMAIN

2 EA	660-4-12
1 EA	660-9-12
1 EA	663-1-122
1 EA (15' ARM ONLY)	715-5-31

EXIST. OSCEOLA COUNTY ATMS PULL BOX W/ SPLICE ENCLOSURE TO REMAIN, REPLACE SPLICE TRAY, RESPLICE FIBER RUNNING SOUTH ALONG PLEASANT HILL RD

4 EA	633-2-31
1 EA	633-3-12
1 EA	633-3-51

NOTES:

1. THE MAJOR STREET IS JOHN YOUNG PKWY. THE MINOR STREET IS PLEASANT HILL RD.
2. THE POSTED SPEED LIMIT WITHIN THE INTERSECTION LIMITS ALONG JOHN YOUNG PKWY IS 45 MPH.
3. THE ARROWS ON SIGN R10-3i SHALL POINT IN THE DIRECTION OF THE CROSSING. THE SIGN PANELS SHALL BE PLACED DIRECTLY ABOVE THE INTENDED PUSH BUTTON.
4. EXISTING TIMINGS TO REMAIN UNLESS NOTED IN THE PLANS.
5. EXISTING DIAGONAL SPAN WIRE (CATINARY AND MESSENGER) STEEL STRAIN POLE SYSTEM TO REMAIN.
6. EXISTING REDLIGHT RUNNING BLUE LIGHT SYSTEM ON SPAN WIRE TO REMAIN.
7. EXISTING iTERIS VELOCITY IN-CABINET AND ON-CABINET BLUETOOTH DEVICE TO REMAIN.
8. ALL EXISTING AND PROPOSED SIGNAL HEADS ARE WITHOUT BACK PLATES.
9. CONTRACTOR TO USE BURIED CONDUITS TO RUN CABLE TO ABOVE GROUND DEVICES WITH OUT ADDING ADDITIONAL LOAD TO THE DIAGONAL SPAN SYSTEM WHERE POSSIBLE.
10. TWO QUEUE DETECTORS AT STA. 372+65 SHALL BE CONNECTED TO PLEASANT HILL RD SIGNAL CABINET. SOUTHBOUND THROUGH SIGNAL PHASE-6 AT THE OAKS INTERSECTION SHALL DWELL WHEN THE QUEUE DETECTOR IS ACTIVATED. SIMULTANEOUSLY SOUTHBOUND LEFT SIGNAL PHASE-1 AT PLEASANT HILL RD INTERSECTION SHALL BECOME ACTIVE USING SIGNAL COORDINATION.
11. PROGRAMING AND TIMING COORDINATION OF THE QUEUE DETECTOR SHALL BE COMPLETED OUTSIDE THIS PROJECT.

1-LOOP 630-2-11 225 LF

4 RUNS @ 190 LF 1-SIGNAL, 2-SPARE, 1-LOOP 630-2-12 190 LF

2 RUNS @ 80 LF 1-SIGNAL, 1-SPARE 630-2-12 80 LF

1-LOOP 630-2-11 330 LF

EXIST. OSCEOLA COUNTY ATMS 72 SM FIBER TO REMAIN

EXISTING TO REMAIN

PHOTO ENFORCED

SEE SHEET T-4 FOR QUEUE LOOPS

R/W

EXIST. OSCEOLA COUNTY ATMS 72 SM FIBER TO REMAIN

PED. POLE-1

PED. POLE-2

PED. POLE-3

PED. POLE-4

PED. POLE-5

PED. POLE-6

PED. POLE-7

PED. POLE-8

HOAGLAND BLVD (45 MPH)

PLEASANT HILL RD (45 MPH)

SOUTHBOUND SR 600/500 (JOHN YOUNG PARKWAY) (45 MPH)

NORTHBOUND SR 600/500 (JOHN YOUNG PARKWAY) (45 MPH)

27 AS 660-2-102

330' FROM STOP BAR (TYP)

150' FROM STOP BAR (TYP)

8 RUNS @ 175 LF 2-SIGNAL, 2-VIDEO, 2-LOOP, 2-SPARE 630-2-12 175 LF

8 RUNS @ 155 LF 2-SIGNAL, 2-VIDEO, 2-LOOP, 2-SPARE 155' LF 630-2-12

1 EA 646-1-60

RELOCATED BY OTHERS, SEE ROADWAY PLANS

1-LOOP 240 LF 630-2-11

20 EA 635-2-11

2 RUNS @ 60 LF 1-LOOP, 1-SPARE 60 LF 630-2-12

INTERCEPT EXIST. FIBER COUNDIT AND RUN NEW CONDUIT TO PROPOSED FOBP

60 LF 630-2-11

INTERCEPT EXIST. OSCEOLA COUNTY ATMS FIBER OPTIC CONDUIT AND INSTALL NEW FOPB. PULL BACK 72 SM FIBER FROM THE NEAREST SPLICE ENCLOSURE (NW CORNER) AND RUN IT BACK TO THE SAME SPLICE ENCLOSURE USING THE NEW CONDUIT. RESTORE EXISTING SLACK IN THE NEW PULL BOX.

350 LF 633-1-410

1 EA 635-2-13

EXIST. OSCEOLA COUNTY ATMS 72 SM FIBER TO REMAIN

1-LOOP 630-2-11 345 LF

EXIST. STEEL STRAIN POLE-2 TO REMAIN, EXIST. CCTV ON POLE TO REMAIN (NO DOWN TIME ALLOWED), REMOVE PED. HEAD & PUSH BUTTON

635-3-11	1 EA
653-1-60	1 EA
660-4-12	2 EA
660-9-12	1 EA
663-1-122	1 EA
665-1-60	1 EA
684-5-1	1 EA
715-5-31	1 EA (15' ARM ONLY)

PED. POLE-1 STA. 365+47, 91'LT
PED. POLE-2 STA. 364+50, 38'LT
PED. POLE-3 STA. 364+45, 99'RT
PED. POLE-4 STA. 364+49, 107'RT
PED. POLE-5 STA. 365+49, 145'RT
PED. POLE-6 STA. 366+29, 99'RT
PED. POLE-7 STA. 366+38, 30'LT
PED. POLE-8 STA. 366+26, 34'LT

630-2-11	2 RUNS (SIGNAL) @ 270 LF
646-1-11	8 EA
653-1-11	8 AS
665-1-11	8 EA

CONTROLLER TIMINGS

TIMING FUNCTION									
MOVEMENT NUMBER		1	2	3	4	5	6	7	8
TIMING FUNCTION	MINIMUM GREEN								
	EXTENSION								
	MAXIMUM GREEN 1								
	MAXIMUM GREEN 2								
	YELLOW CLEARANCE	4.0	4.8	3.4	4.8	4.0	4.8	3.4	4.8
	ALL RED	3.1	2.0	3.1	2.4	2.4	2.0	2.9	2.1
	PEDESTRIAN WALK		7		7		7		7
	PED. CLEARANCE		27		36		23		31
	RECALL								

SOP-10

PHASE 1 — PHASE 2 — PHASE 3 — PHASE 4 — PHASE 5 — PHASE 6

LEGEND:

- IMC CAMERA (INTERSECTION MOVEMENT COUNTS)
- TRAFFIC DATA VVDS (PRESENCE)
- CCTV CAMERA
- BLUETOOTH DETECTOR (TRAVEL TIME)

ALL SIGNALS HEADS ARE 3-SECTION 1-WAY UNLESS NOTED.
ALL EXISTING SIGNAL HEADS TO REMAIN UNLESS NOTED.
EXISTING STEEL STRAIN POLE-1 (NW CORNER)
EXISTING SIGN PANEL TO REMAIN
EXISTING STEEL STRAIN POLE-2 (SE CORNER)
EXISTING BLANK-OUT SIGN TO REMAIN
EXISTING 3-SEC 1-WAY AT 137.20' TO BE RELOCATED TO 133.41'
REPLACE 3-SEC 1-WAY WITH 3-SEC 2-WAY (146.02')

NW CORNER

FACE OF P6 PUSH BUTTON

FACE OF P4 PUSH BUTTON

SW CORNER

FACE OF P4 PUSH BUTTON

FACE OF P2 PUSH BUTTON

SE CORNER

FACE OF P8 PUSH BUTTON

FACE OF P2 PUSH BUTTON

NE CORNER

FACE OF P6 PUSH BUTTON

FACE OF P8 PUSH BUTTON

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

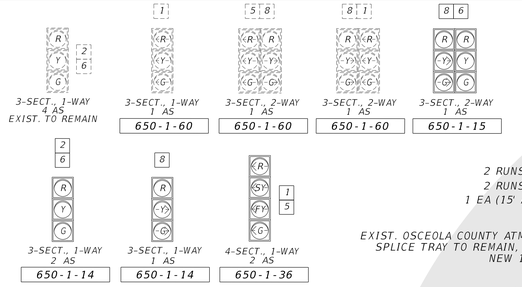
DISTRICT FIVE - DESIGN
Agnes A. Williams, P.E. No.- 62777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445210-1-52-01

SIGNALIZATION PLAN SHEET

SHEET NO. T-3



630-2-11	90 LF (9 X10 LF)
632-7-1	1 PI
633-1-121	20+50 LF (SLACK) 12 SM DROP
633-2-31	4 EA
633-3-12	1 EA
633-3-16	1 EA
635-2-13	1 EA
660-1-109	8 EA
660-1-110	4 EA
660-4-11	1 EA
660-6-121	1 EA
660-6-122	1 EA
660-9-11	1 EA
663-1-400	1 EA (COMPLETE SYSTEM)
670-5-111	1 AS
684-1-1	1 EA
685-1-13	1 EA
685-2-1	1 EA

NOTES:

1. *THE MAJOR STREET IS JOHN YOUNG PKWY. THE MINOR STREET IS "THE OAKS BLVD".*
2. *THE POSTED SPEED LIMIT WITHIN THE INTERSECTION LIMITS ALONG JOHN YOUNG PKWY IS 45 MPH.*
3. *THE ARROWS ON SIGN R10-3i SHALL POINT IN THE DIRECTION OF THE CROSSING. THE SIGN PANELS SHALL BE PLACED DIRECTLY ABOVE THE INTENDED PUSH BUTTON.*
4. *EXISTING TIMINGS TO REMAIN UNLESS NOTED IN THE PLANS.*
5. *EXISTING DIAGONAL SPAN WIRE (CATINARY AND MESSENGER) CONCRETE STRAIN POLE SYSTEM TO REMAIN.*
6. *EXISTING REDLIGHT RUNNING BLUE LIGHT SYSTEM ON SPAN WIRE TO REMAIN.*
7. *CONTRACTOR TO USE EXISTING PULL BOXES AND CONDUITS WHERE POSSIBLE TO RUN LOOP LEAD-INS TO THE EXISTING CABINET.*
8. *ALL EXISTING AND PROPOSED SIGNAL HEADS ARE WITHOUT BACK PLATES.*
9. *CONTRACTOR TO USE BURIED CONDUITS TO RUN CABLE TO ABOVE GROUND DEVICES WITH OUT ADDING ADDITIONAL LOAD TO THE DIAGONAL SPAN SYSTEM WHERE POSSIBLE.*
10. *TWO QUEUE DETECTORS AT STA. 372+65 SHALL BE CONNECTED TO PLEASANT HILL RD SIGNAL CABINET. SOUTHBOUND THROUGH SIGNAL PHASE-6 AT THE OAKS INTERSECTION SHALL DWELL WHEN THE QUEUE DETECTOR IS ACTIVATED. SIMULTANEOUSLY SOUTHBOUND LEFT SIGNAL PHASE-1 AT PLEASANT HILL RD INTERSECTION SHALL BECOME ACTIVE USING SIGNAL COORDINATION.*
11. *PROGRAMING AND TIMING COORDINATION OF THE QUEUE DETECTOR SHALL BE COMPLETED OUTSIDE THIS PROJECT SCOPE.*
12. *FIBER OPTIC DROP CABLE SHALL BE PLACED IN THE SAME ACCESS PORT WITH NEW GROMMET. ALL CONNECTORS SHALL BE "ST".*

REMOVAL ITEMS:

632-7-6	1 PI
633-1-620	125 LF DROP
639-1-620	1 AS
639-2-6	150 LF
641-2-60	1 EA
670-5-600	1 AS

A	US 17 - 92	2 EA
B	The Oaks Blvd	2 EA

EXIST. OVERHEAD SNS TO REMAIN

CONTROLLER TIMINGS								
TIMING FUNCTION								
MOVEMENT NUMBER	1	2		P4	5	6		8
TIMING FUNCTION: MINIMUM GREEN								
EXTENSION								
MAXIMUM GREEN 1								
MAXIMUM GREEN 2								
YELLOW CLEARANCE	3.4	4.8			3.4	4.8		3.4
ALL RED	2.9	2.0			3.3	2.0		2.0
PEDESTRIAN WALK		7		7		7		7
PED. CLEARANCE		31		40		16		37
RECALL								

PED. POLE-1 STA. 373+37, 52'LT
PED. POLE-2 STA. 372+94, 42'LT
PED. POLE-3 STA. 372+95, 113'RT
PED. POLE-4 STA. 373+12, 117'RT
PED. POLE-5 STA. 374+18, 109'RT
PED. POLE-6 STA. 374+56, 101'RT
PED. POLE-7 STA. 374+45, 45'LT
PED. POLE-8 STA. 374+10, 53'LT

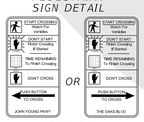
630-2-11	2 RUNS (SIGNAL) @ 190 LF
646-1-11	8 EA
653-1-11	8 AS
665-1-11	8 EA

PEDESTRIAN SIGNAL HEAD DETAILS

P2 P4 P6 P8

PED. SIGNAL COUNT-DOWN 1-SECT., 1-WAY 8 AS

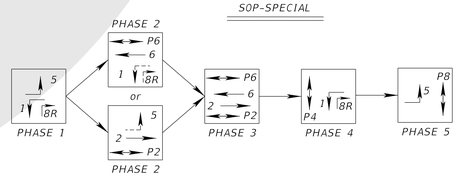
PEDESTRIAN SIGN DETAIL



OR

R10-3i 9"X15" 8 EA

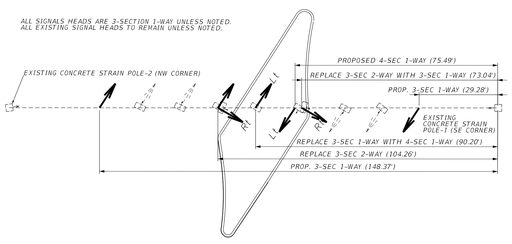
SOP-SPECIAL



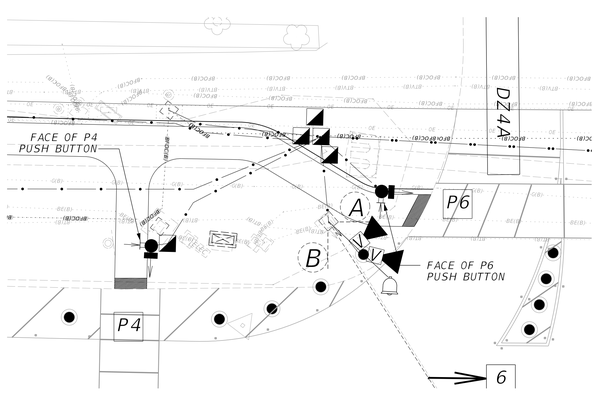
LEGEND:

- *IMC CAMERA (INTERSECTION MOVEMENT COUNTS)*
- *TRAFFIC DATA VVDS (PRESENCE)*
- *CCTV CAMERA*
- *BLUETOOTH DETECTOR (TRAVEL TIME)*

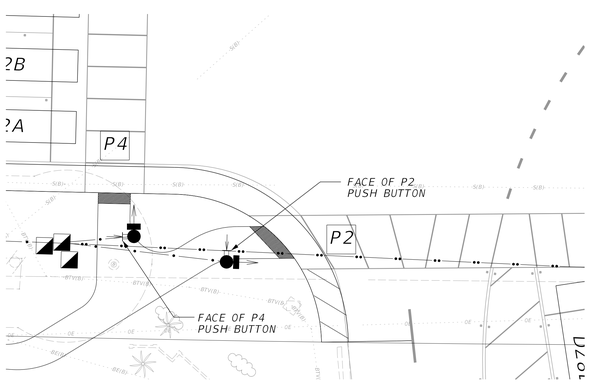
ALL SIGNALS HEADS ARE 3-SECTION 1-WAY UNLESS NOTED. ALL EXISTING SIGNAL HEADS TO REMAIN UNLESS NOTED.



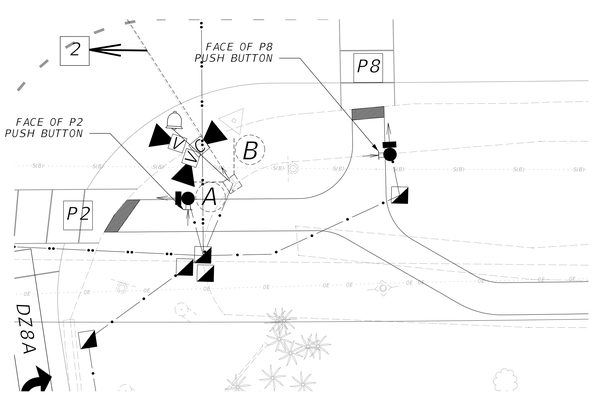
NW CORNER



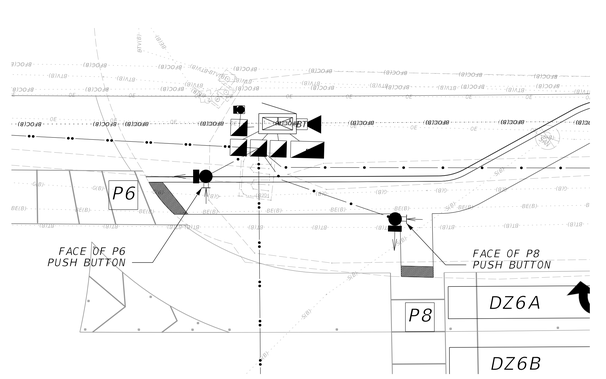
SW CORNER



SE CORNER



NE CORNER



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DISTRICT FIVE - DESIGN
Aaron A. Whitehall, P.E. No. 69777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445201-1-52-01

SIGNALIZATION PLAN SHEET

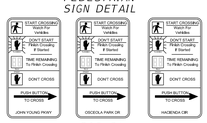
SHEET NO. T-4

PEDESTRIAN SIGNAL HEAD DETAILS

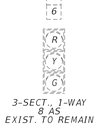
P2 P4 P6 P8

PED. SIGNAL COUNT-DOWN 1-SECT., 1-WAY 8 AS

PEDESTRIAN SIGN DETAIL



R10-3i 9"X15" 8 EA



3-SECT., 1-WAY 8 AS EXIST. TO REMAIN

3-SECT., 1-WAY 2 AS EXIST. TO REMAIN

REMOVAL ITEMS:

646-1-60	4 EA

EXIST. CONCRETE STRAIN POLE-3 TO REMAIN

635-3-11	1 EA
660-4-12	1 EA
684-5-1	1 EA
715-5-31	1 EA (15' ARM ONLY)

EXIST. OSCEOLA COUNTY ATMS 72 SM FIBER TO REMAIN

EXIST. CONCRETE STRAIN POLE-4 TO REMAIN

660-4-12	1 EA
660-9-12	1 EA
715-5-31	1 EA (15' ARM ONLY)

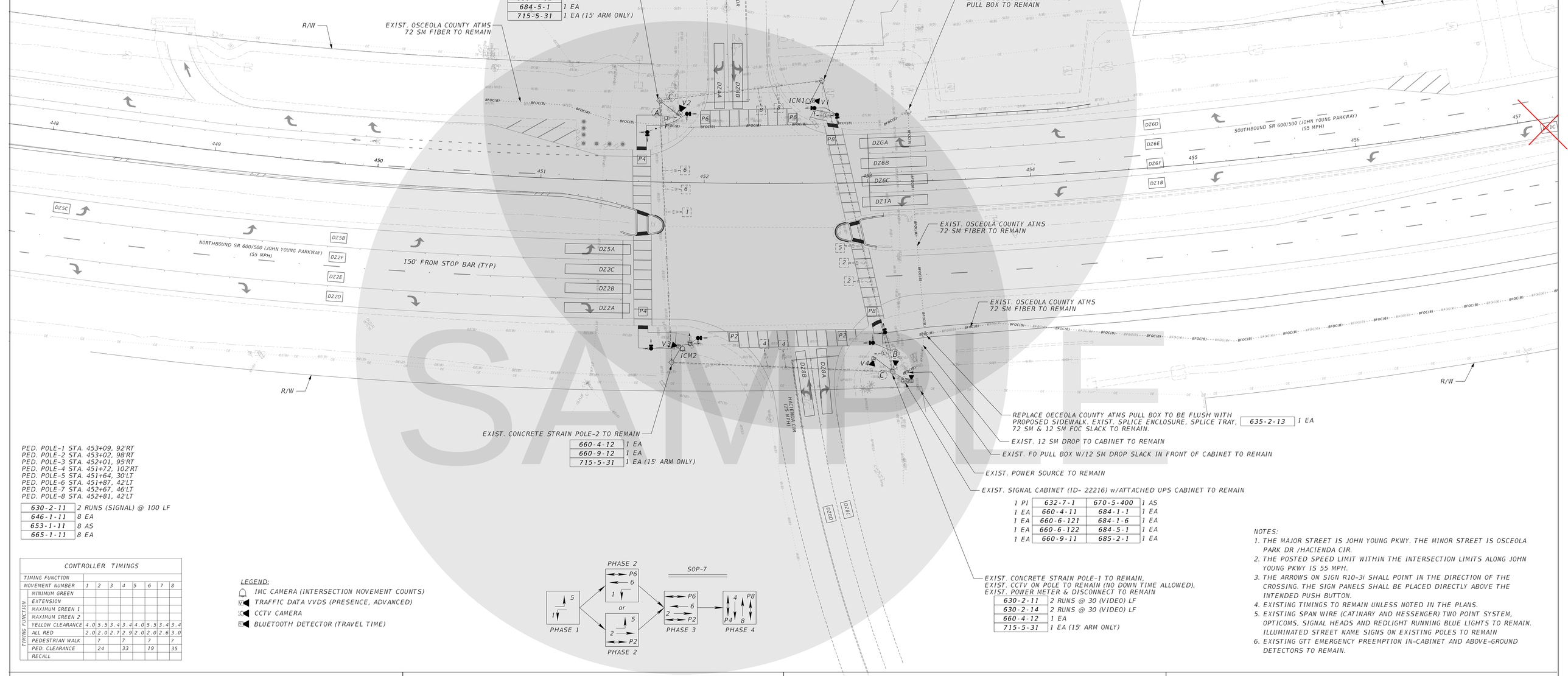
EXIST. OECEOLA COUNTY ATMS PULL BOX TO REMAIN

EXIST. CONCRETE STRAIN POLE-2 TO REMAIN

660-4-12	1 EA
660-9-12	1 EA
715-5-31	1 EA (15' ARM ONLY)

A	Osceola Park DRIVE	1 EA
B	Hacienda CIRCLE	1 EA
C	John Young PARKWAY	2 EA

EXIST. OVERHEAD SNS TO REMAIN



EXIST. OSCEOLA COUNTY ATMS 72 SM FIBER TO REMAIN

EXIST. OSCEOLA COUNTY ATMS 72 SM FIBER TO REMAIN

EXIST. OSCEOLA COUNTY ATMS 72 SM FIBER TO REMAIN

REPLACE OECEOLA COUNTY ATMS PULL BOX TO BE FLUSH WITH PROPOSED SIDEWALK. EXIST. SPLICE ENCLOSURE, SPLICE TRAY, 72 SM & 12 SM FOC SLACK TO REMAIN. | 635-2-13 | 1 EA

EXIST. 12 SM DROP TO CABINET TO REMAIN

EXIST. FO PULL BOX W/12 SM DROP SLACK IN FRONT OF CABINET TO REMAIN

EXIST. POWER SOURCE TO REMAIN

EXIST. SIGNAL CABINET (ID- 22216) w/ATTACHED UPS CABINET TO REMAIN

1 PI	632-7-1	670-5-400 1 AS
1 EA	660-4-11	684-1-1 1 EA
1 EA	660-6-121	684-1-6 1 EA
1 EA	660-6-122	684-5-1 1 EA
1 EA	660-9-11	685-2-1 1 EA

EXIST. CONCRETE STRAIN POLE-1 TO REMAIN, EXIST. CCTV ON POLE TO REMAIN (NO DOWN TIME ALLOWED), EXIST. POWER METER & DISCONNECT TO REMAIN

630-2-11	2 RUNS @ 30 (VIDEO) LF
630-2-14	2 RUNS @ 30 (VIDEO) LF
660-4-12	1 EA
715-5-31	1 EA (15' ARM ONLY)

PED. POLE-1 STA. 453+09, 92'RT
PED. POLE-2 STA. 453+02, 98'RT
PED. POLE-3 STA. 452+01, 95'RT
PED. POLE-4 STA. 451+72, 102'RT
PED. POLE-5 STA. 451+64, 30'LT
PED. POLE-6 STA. 451+87, 42'LT
PED. POLE-7 STA. 452+67, 46'LT
PED. POLE-8 STA. 452+81, 46'LT

630-2-11	2 RUNS (SIGNAL) @ 100 LF
646-1-11	8 EA
653-1-11	8 AS
665-1-11	8 EA

CONTROLLER TIMINGS								
TIMING FUNCTION								
MOVEMENT NUMBER	1	2	3	4	5	6	7	8
MINIMUM GREEN								
EXTENSION								
MAXIMUM GREEN 1								
MAXIMUM GREEN 2								
YELLOW CLEARANCE	4.0	5.5	3.4	3.4	4.0	5.5	3.4	3.4
ALL RED	2.0	2.0	2.7	2.9	2.0	2.0	2.6	3.0
PEDESTRIAN WALK		7		7		7		7
PED. CLEARANCE		24		33		19		35
RECALL								

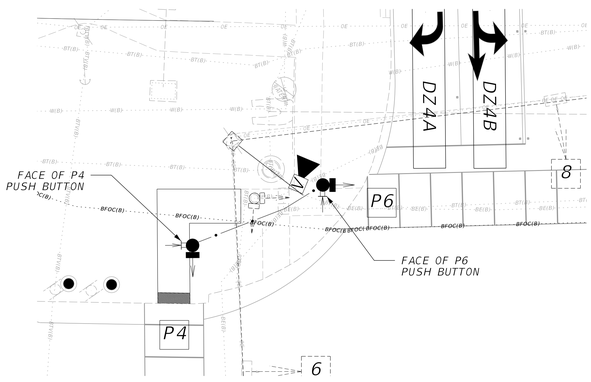
LEGEND:

- IMC CAMERA (INTERSECTION MOVEMENT COUNTS)
- TRAFFIC DATA VVDS (PRESENCE, ADVANCED)
- CCTV CAMERA
- BLUETOOTH DETECTOR (TRAVEL TIME)

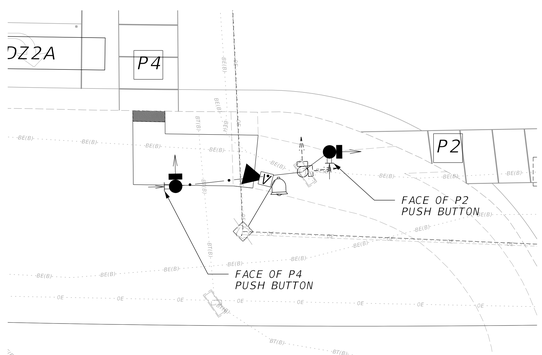
NOTES:

1. THE MAJOR STREET IS JOHN YOUNG PKWY. THE MINOR STREET IS OSCEOLA PARK DR /HACIENDA CIR.
2. THE POSTED SPEED LIMIT WITHIN THE INTERSECTION LIMITS ALONG JOHN YOUNG PKWY IS 55 MPH.
3. THE ARROWS ON SIGN R10-3i SHALL POINT IN THE DIRECTION OF THE CROSSING. THE SIGN PANELS SHALL BE PLACED DIRECTLY ABOVE THE INTENDED PUSH BUTTON.
4. EXISTING TIMINGS TO REMAIN UNLESS NOTED IN THE PLANS.
5. EXISTING SPAN WIRE (CATINARY AND MESSENGER) TWO POINT SYSTEM, OPTICOMS, SIGNAL HEADS AND REDLIGHT RUNNING BLUE LIGHTS TO REMAIN. ILLUMINATED STREET NAME SIGNS ON EXISTING POLES TO REMAIN
6. EXISTING GTT EMERGENCY PREEMPTION IN-CABINET AND ABOVE-GROUND DETECTORS TO REMAIN.

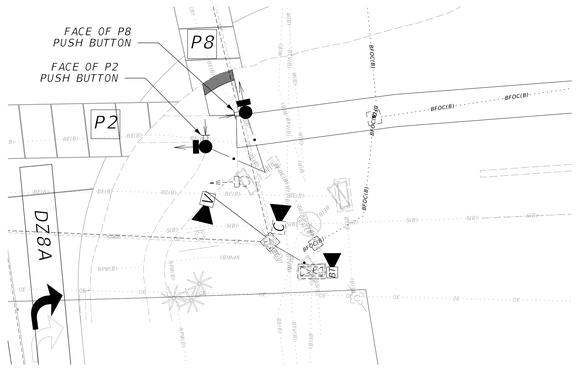
NW CORNER



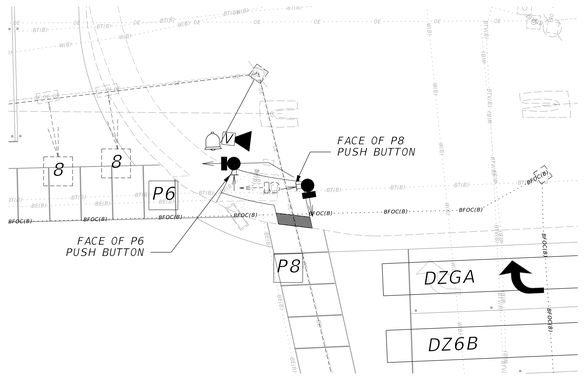
SW CORNER



SE CORNER



NE CORNER



THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 60G5-23.004, F.A.C.

DISTRICT FIVE - DESIGN
Kevin J. Whitehead, P.E. No.: 67777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445210-1-52-01

SIGNALIZATION PLAN SHEET

SHEET NO. T-5

NOTES:

1) CONTACT THE DISTRICT DATA COLLECTION MANAGER CHERYL BURKE PRIOR TO INSTALLATION (386)943-5380 TO CONFIRM LOCATIONS. ANY CHANGES MUST BE APPROVED BY THE DISTRICT TRAFFIC OPERATIONS OFFICE.

2) IMMEDIATELY AFTER COMPLETION OF INSTALLATION CONTACT THE DISTRICT DATA COLLECTIONS MANAGER AT 386-943-5380 TO SCHEDULE 48-HOUR INSPECTION COUNT AND PRIOR TO FINAL ACCEPTANCE.

3) SUBMIT FINAL TMS PLANS TO D5 TRAFFIC OPS.

4) COPY OF PRE-TESTED PIEZO READINGS AND WARRANTY SHALL BE LEFT IN CABINET.

SIGNAL ID	BIU NO.	CARD NO.	CHANNEL NO.	DETECTOR ID	DETECTOR	DIRECTION	MOVEMENT TYPE	APP. SPEED MPH	PROTECTED PHASE	OVERLAP	DELAY SEC.	CAMERA ID	DETECTOR SYSTEM	LOOP TYPE	DISTANCE TO STOP BAR	DETECTOR TYPE	LANE TYPE	LANE NO.
			1	2060201	DZ-1A	WB	L	45	1	8R		V2	VIDEO		0	PD	V	*
		1	2	2060202	DZ-1B	WB	L	45	1	8R		V2	VIDEO		0	PD	V	*
			3	2060203	L-1C	WB	L	45	1	8R			LOOP	B	150	AD	V	*
		2	4	2060204	L-1D	WB	L	45	1	8R			LOOP	B	150	AD	V	*
			5	2060205	L-1E	WB	L	45	1	8R	5		LOOP	B	END OF LANE	QD	V	*
		3	6	2060206	L-1F	WB	L	45	1	8R	5		LOOP	B	END OF LANE	QD	V	*
			7	2060207	DZ-2A	EB	R	45	2			V3	VIDEO		0	PD	V	*
	1	4	8	2060208	DZ-2B	EB	T	45	2			V3	VIDEO		0	PD	V	*
			9	2060209	DZ-2C	EB	T	45	2			V3	VIDEO		0	PD	V	*
		5	10	2060210	DZ-2D	EB	T	45	2			V3	VIDEO		0	PD	V	*
			11	2060211	L-2E	EB	R	45	2				LOOP	B	150	AD	V	*
		6	12	2060212	L-2F	EB	T	45	2				LOOP	B	150	AD	V	*
			13	2060213	L-2G	EB	T	45	2				LOOP	B	150	AD	V	*
		7	14	2060214	L-2H	EB	T	45	2				LOOP	B	150	AD	V	*
			15	2060215	L-2I	EB	T	45	2				LOOP	B	330	AD	V	*
		8	16	2060216	L-2J	EB	T	45	2				LOOP	B	330	AD	V	*
			17	2060217	L-2K	EB	T	45	2				LOOP	B	330	AD	V	*
		9	18	2060218	DZ-3A	NB	L	45	3			V4	VIDEO		0	PD	V	*
			19	2060219	L-3B	NB	L	45	3				LOOP	B	150	AD	V	*
		10	20	2060220	L-3C	NB	L	45	3		5		LOOP	B	END OF LANE	QD	V	*
			21	2060221	DZ-4A	SB	R	45	4		5	V1	VIDEO		0	PD	V	*
		11	22	2060222	DZ-4B	SB	T	45	4			V1	VIDEO		0	PD	V/B	*
			23	2060223	DZ-4C	SB	T	45	4			V1	VIDEO		0	PD	V	*
	2	12	24	2060224	L-4D	SB	R	45	4				LOOP	B	150	AD	V	*
			25	2060225	L-4E	SB	T	45	4				LOOP	B	150	AD	V	*
		13	26	2060226	L-4F	SB	T	45	4				LOOP	B	150	AD	V	*
			27	2060227	DZ-5A	EB	L	45	5			V3	VIDEO		0	PD	V	*
		14	28	2060228	L-5B	EB	L	45	5				LOOP	B	150	AD	V	*
			29	2060229	L-5C	EB	L	45	5		5		LOOP	B	END OF LANE	QD	V	*
		15	30	2060230	DZ-6A	WB	R	45	6			V2	VIDEO		0	PD	V	*
			31	2060231	DZ-6B	WB	T	45	6			V2	VIDEO		0	PD	V	*
20602		16	32	2060232	DZ-6C	WB	T	45	6			V2	VIDEO		0	PD	V	*
			33	2060233	L-6D	WB	R	45	6				LOOP	B	150	AD, QD	V	*
		17	34	2060234	L-6E	WB	T	45	6				LOOP	B	150	AD, QD	V	*
			35	2060235	L-6F	WB	T	45	6				LOOP	B	150	AD, QD	V	*
		18	36	2060236	L-6G	WB	T	45	6				LOOP	B	330	AD, QD	V	*
			37	2060237	L-6H	WB	T	45	6				LOOP	B	330	AD, QD	V	*
		19	38	2060238	DZ-7A	SB	L	45	7			V1	VIDEO		0	PD	V	*
			39	2060239	L-7B	SB	L	45	7				LOOP	B	150	AD	V	*
	3	20	40	2060240	L-7C	SB	L	45	7		5		LOOP	B	END OF LANE	QD	V	*
			41	2060241	DZ-8A	NB	R	45	8			V4	VIDEO		0	PD	V	*
		21	42	2060242	DZ-8B	NB	R	45	8			V4	VIDEO		0	PD	V	*
			43	2060243	DZ-8C	NB	T	45	8			V4	VIDEO		0	PD	V	*
		22	44	2060244	DZ-8D	NB	T	45	8			V4	VIDEO		0	PD	V	*
			45	2060245	L-8E	NB	R	45	8				LOOP	B	150	AD	V	*
		23	46	2060246	L-8F	NB	R	45	8				LOOP	B	150	AD	V	*
			47	2060247	L-8G	NB	T	45	8				LOOP	B	150	AD	V	*
		24	48	2060248	L-8H	NB	T	45	8				LOOP	B	150	AD	V	*
			33	2060249	SPARE													
		17	34	2060250	SPARE													
			35	2060251	SPARE													
		18	36	2060252	SPARE													
			37	2060253	SPARE													
		19	38	2060254	SPARE													
			39	2060255	SPARE													
	4	20	40	2060256	SPARE													
			41	2060257	SPARE													
		21	42	2060258	SPARE													
			43	2060259	SPARE													
		22	44	2060260	SPARE													
			45	2060261	SPARE													
		23	46	2060262	SPARE													
			47	2060263	SPARE													
		24	48	2060264	SPARE													

LEGEND:
PD – PRESENCE DETECTION
AD – ADVANCE DETECTION
V – VEHICLE, B – BIKE
QD – QUEUE DETECTION
L – LEFT, T – THRU, R – RIGHT
TL – THRU-LEFT, TR – THRU-RIGHT

* CONFIRM THE LANE NUMBER VALUES WITH OSCEOLA COUNTY ENGINEERING DEPT DURING CONSTRUCTION.

US 17/92 (JYP) AT PLEASANT HILL RD/ HOAGLAND BLVD

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Aymon A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445210-1-52-01

DETECTOR CHART (1)
US 17/92 (JYP) AT PLEASANT HILL RD / HOAGLAND BLVD

SHEET NO. T-7

7/30/2021 11:59:37 AM KNHNTSV
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SIGNAL ID	BIU NO.	CARD NO.	CHANNEL NO.	DETECTOR ID	DETECTOR	DIRECTION	MOVEMENT TYPE	APP. SPEED MPH	PROTECTED PHASE	OVERLAP	DELAY SEC.	CAMERA ID	DETECTOR SYSTEM	LOOP TYPE	DISTANCE TO STOP BAR	DETECTOR TYPE	LANE TYPE	LANE NO.
			1	2206601	DZ-1A	WB	L	45	1	8	5	V2	VIDEO		0	PD	V	*
		1	2	2206602	L-1B	WB	L	45	1	8			LOOP	B	150	AD	V	*
			3	2206603	L-1C	WB	L	45	1	8	5		LOOP	B	END OF LANE	QD	V	*
		2	4	2206604	DZ-2A	EB	R	45	2		5	V3	VIDEO		0	PD	V	*
			5	2206605	DZ-2B	EB	T	45	2			V3	VIDEO		0	PD	V	*
		3	6	2206606	DZ-2C	EB	T	45	2			V3	VIDEO		0	PD	V	*
			7	2206607	DZ-2D	EB	T	45	2			V3	VIDEO		0	PD	V	*
	1	4	8	2206608	L-2E	EB	R	45	2				LOOP	B	150	AD	V	*
			9	2206609	L-2F	EB	T	45	2				LOOP	B	150	AD	V	*
		5	10	2206610	L-2G	EB	T	45	2				LOOP	B	150	AD	V	*
			11	2206611	L-2H	EB	T	45	2				LOOP	B	150	AD	V	*
		6	12	2206612	L-2I	EB	T	45	2				LOOP	B	330	AD	V	*
			13	2206613	L-2J	EB	T	45	2				LOOP	B	330	AD	V	*
		7	14	2206614	L-2K	EB	T	45	2				LOOP	B	330	AD	V	*
			15	2206615	DZ-4A	SB	R	25	Stop controlled			V1	VIDEO		0	LBLC	V	*
		8	16	2206616	DZ-5A	EB	L	45	5		5	V3	VIDEO		0	PD	V	*
			17	2206617	L-5B	EB	L	45	5		5		LOOP	B	END OF LANE	QD	V	*
		9	18	2206618	DZ-6A	WB	R	45	6		5	V2	VIDEO		0	PD	V	*
			19	2206619	DZ-6B	WB	T	45	6			V2	VIDEO		0	PD	V	*
		10	20	2206620	DZ-6C	WB	T	45	6			V2	VIDEO		0	PD	V	*
			21	2206621	DZ-6D	WB	T	45	6			V2	VIDEO		0	PD	V	*
		11	22	2206622	DZ-6E	WB	T	45	6			V2	VIDEO		0	PD	V	*
			23	2206623	L-6F	WB	R	45	6				LOOP	B	150	AD	V	*
	2	12	24	2206624	L-6G	WB	T	45	6				LOOP	B	150	AD	V	*
			25	2206625	L-6H	WB	T	45	6				LOOP	B	150	AD	V	*
		13	26	2206626	L-6I	WB	T	45	6				LOOP	B	150	AD	V	*
			27	2206627	L-6J	WB	T	45	6				LOOP	B	150	AD	V	*
		14	28	2206628	L-6K	WB	T	45	6				LOOP	B	330	AD	V	*
			29	2206629	L-6L	WB	T	45	6				LOOP	B	330	AD	V	*
		15	30	2206630	L-6M	WB	T	45	6				LOOP	B	330	AD	V	*
			31	2206631	L-6N	WB	T	45	6				LOOP	B	330	AD	V	*
22066		16	32	2206632	DZ-8A	NB	R	25	8	1	5	V4	VIDEO		0	PD	V	*
			33	2206633	DZ-8B	NB	R	25	8	1		V4	VIDEO		0	PD	V	*
		17	34	2206634	L-8C	NB	R	25	8				LOOP	B	100	AD	V	*
			35	2206635	L-8D	NB	R	25	8				LOOP	B	100	AD	V	*
		18	36	2206636	SPARE													
			37	2206637	SPARE													
		19	38	2206638	SPARE													
			39	2206639	SPARE													
	3	20	40	2206640	SPARE													
			41	2206641	SPARE													
		21	42	2206642	SPARE													
			43	2206643	SPARE													
		22	44	2206644	SPARE													
			45	2206645	SPARE													
		23	46	2206646	SPARE													
			47	2206647	SPARE													
		24	48	2206648	SPARE													
			33	2206649	SPARE													
		17	34	2206650	SPARE													
			35	2206651	SPARE													
		18	36	2206652	SPARE													
			37	2206653	SPARE													
		19	38	2206654	SPARE													
			39	2206655	SPARE													
	4	20	40	2206656	SPARE													
			41	2206657	SPARE													
		21	42	2206658	SPARE													
			43	2206659	SPARE													
		22	44	2206660	SPARE													
			45	2206661	SPARE													
		23	46	2206662	SPARE													
			47	2206663	SPARE													
		24	48	2206664	SPARE													

LEGEND:
PD - PRESENCE DETECTION
AD - ADVANCE DETECTION
V - VEHICLE, B - BIKE
QD - QUEUE DETECTION
L - LEFT, T - THRU, R - RIGHT
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* CONFIRM THE LANE NUMBER VALUES WITH OSCEOLA COUNTY ENGINEERING DEPT DURING CONSTRUCTION.

US 17/92 (JYP) AT THE OAKS BLVD

REVISIONS

DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Aymon A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445210-1-52-01

DETECTOR CHART (2)
US 17/92 (JYP) AT THE OAKS BLVD

SHEET NO. T-8

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

7/30/2021 11:59:41 AM KNHNTSV
C:\Projects\445210\Signal\VHLPSG01.dgn

SIGNAL ID	BIU NO.	CARD NO.	CHANNEL NO.	DETECTOR ID	DETECTOR	DIRECTION	MOVEMENT TYPE	APP. SPEED MPH	PROTECTED PHASE	OVERLAP	DELAY SEC.	CAMERA ID	DETECTOR SYSTEM	LOOP TYPE	DISTANCE TO STOP BAR	DETECTOR TYPE	LANE TYPE	LANE NO.
			1	2221601	DZ-1A	WB	L	55	1			V1	VIDEO		0	PD	V	*
		1	2	2221602	DZ-1B	WB	L	55	1			V1	VIDEO		180	AD	V	*
			3	2221603	DZ-1C	WB	L	55	1		5	V1	VIDEO		END OF LANE	QD	V	*
		2	4	2221604	DZ-2A	EB	R	55	2			V3	VIDEO		0	PD	V	*
			5	2221605	DZ-2B	EB	T	55	2			V3	VIDEO		0	PD	V	*
		3	6	2221606	DZ-2C	EB	T	55	2			V3	VIDEO		0	PD	V	*
			7	2221607	DZ-2D	EB	R	55	2			V3	VIDEO		180	AD	V	*
	1	4	8	2221608	DZ-2E	EB	T	55	2			V3	VIDEO		180	AD	V	*
			9	2221609	DZ-2F	EB	T	55	2			V3	VIDEO		180	AD	V	*
		5	10	2221610	DZ-4A	SB	R	25	4		5	V2	VIDEO		0	PD	V	*
			11	2221611	DZ-4B	SB	TL	25	4			V2	VIDEO		0	PD	V	*
		6	12	2221612	DZ-4C	SB	R	25	4			V2	VIDEO		100	AD	V	*
			13	2221613	DZ-4D	SB	TL	25	4			V2	VIDEO		100	AD	V	*
		7	14	2221614	DZ-5A	EB	L	55	5			V3	VIDEO		0	PD	V	*
			15	2221615	DZ-5B	EB	L	55	5			V3	VIDEO		180	AD	V	*
		8	16	2221616	DZ-5C	EB	L	55	5		5	V3	VIDEO		END OF LANE	QD	V	*
			17	2221617	DZ-6A	WB	R	55	6		5	V1	VIDEO		0	PD	V	*
		9	18	2221618	DZ-6B	WB	T	55	6			V1	VIDEO		0	PD	V	*
			19	2221619	DZ-6C	WB	T	55	6			V1	VIDEO		0	PD	V	*
		10	20	2221620	DZ-6D	WB	R	55	6			V1	VIDEO		180	AD	V	*
			21	2221621	DZ-6E	WB	T	55	6			V1	VIDEO		180	AD	V	*
		11	22	2221622	DZ-6F	WB	T	55	6			V1	VIDEO		180	AD	V	*
			23	2221623	DZ-8A	NB	R	25	8		5	V4	VIDEO		0	PD	V	*
	2	12	24	2221624	DZ-8B	NB	TL	25	8			V4	VIDEO		0	PD	V	*
			25	2221625	DZ-8C	NB	R	25	8			V4	VIDEO		100	AD	V	*
		13	26	2221626	DZ-8D	NB	TL	25	8			V4	VIDEO		100	AD	V	*
			27	2221627	SPARE													
		14	28	2221628	SPARE													
			29	2221629	SPARE													
		15	30	2221630	SPARE													
			31	2221631	SPARE													
22216		16	32	2221632	SPARE													
			33	2221633	SPARE													
		17	34	2221634	SPARE													
			35	2221635	SPARE													
		18	36	2221636	SPARE													
			37	2221637	SPARE													
		19	38	2221638	SPARE													
			39	2221639	SPARE													
	3	20	40	2221640	SPARE													
			41	2221641	SPARE													
		21	42	2221642	SPARE													
			43	2221643	SPARE													
		22	44	2221644	SPARE													
			45	2221645	SPARE													
		23	46	2221646	SPARE													
			47	2221647	SPARE													
		24	48	2221648	SPARE													
			33	2221649	SPARE													
		17	34	2221651	SPARE													
			35	2221652	SPARE													
		18	36	2221653	SPARE													
			37	2221654	SPARE													
		19	38	2221655	SPARE													
			39	2221656	SPARE													
	4	20	40	2221657	SPARE													
			41	2221658	SPARE													
		21	42	2221659	SPARE													
			43	2221660	SPARE													
		22	44	2221661	SPARE													
			45	2221662	SPARE													
		23	46	2221663	SPARE													
			47	2221664	SPARE													
		24	48	2221664	SPARE													

LEGEND:
PD – PRESENCE DETECTION
AD – ADVANCE DETECTION
V – VEHICLE, B – BIKE
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L – LEFT, T – THRU, R – RIGHT
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* CONFIRM THE LANE NUMBER VALUES WITH OSCEOLA COUNTY ENGINEERING DEPT DURING CONSTRUCTION.

US 17/92 (JYP) AT OSCEOLA PARK RD / HACIENDA CIR

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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Ayman A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

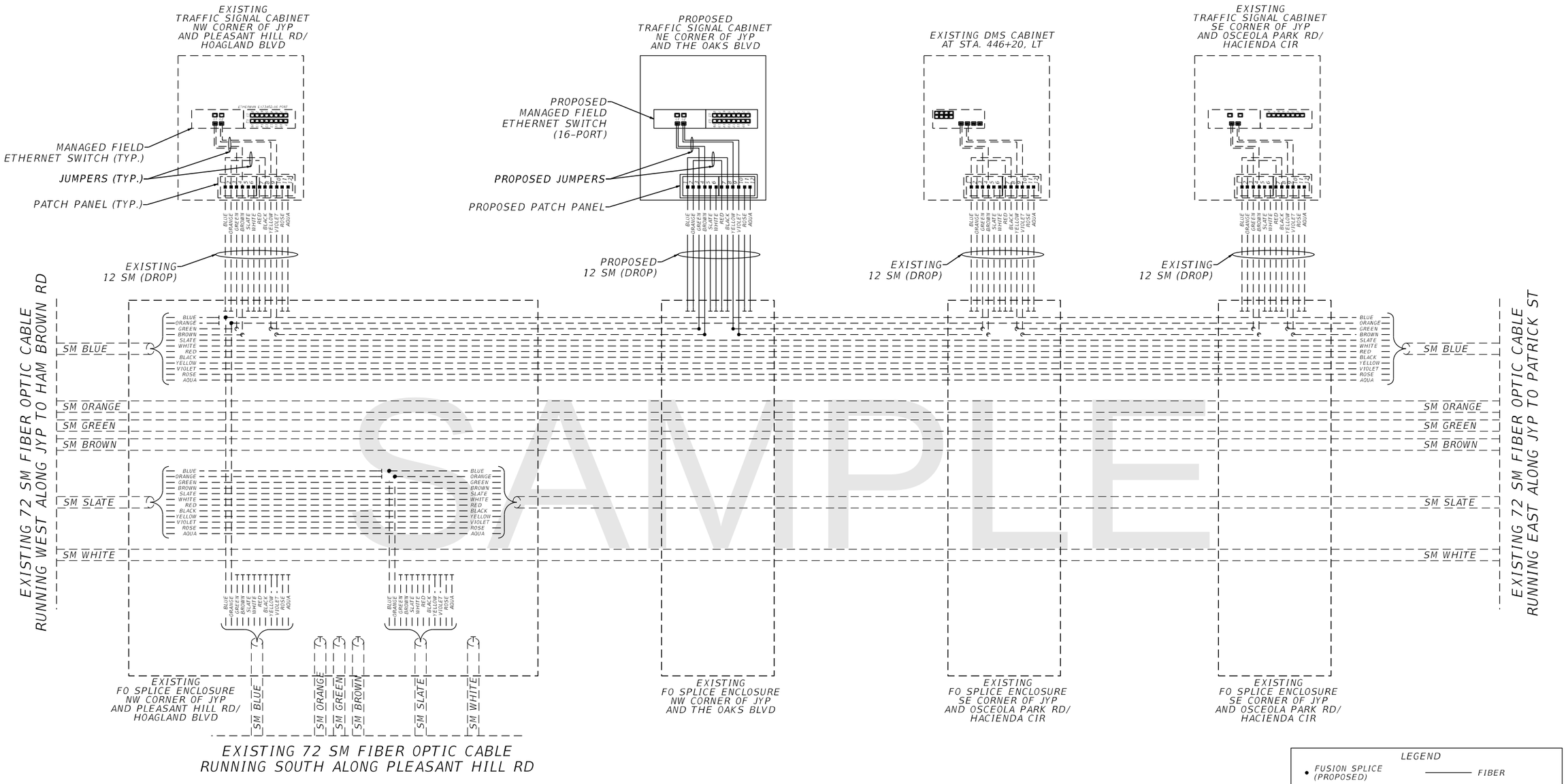
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445210-1-52-01

DETECTOR CHART (3)
US 17/92 (JYP) AT OSCEOLA PARK RD / HACIENDA CIR

SHEET NO.
T-9

7/30/2021 11:59:45 AM KHHNTSV
C:\Projects\445210\signal\VHLPS601.dgn



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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Aymon A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

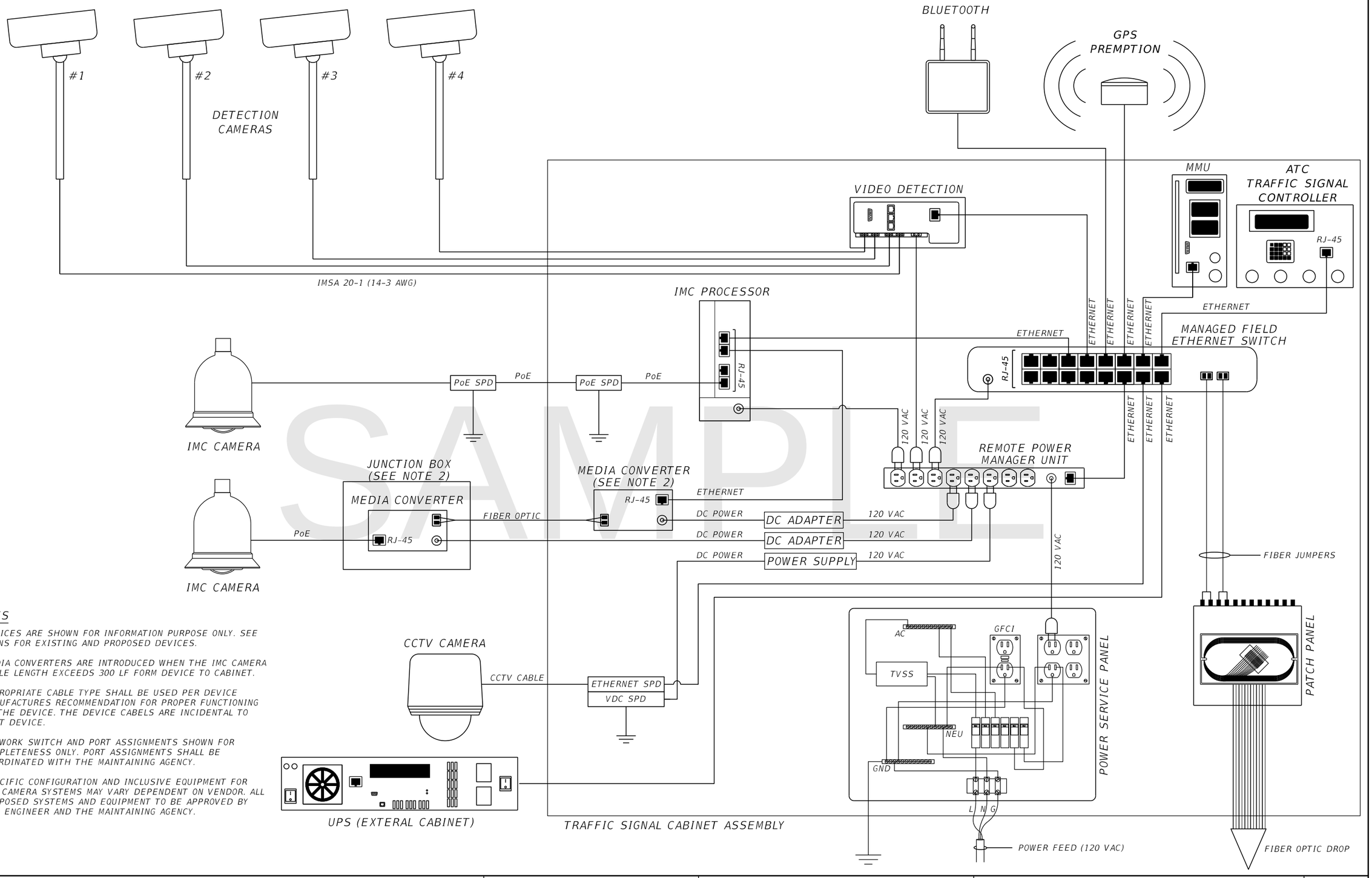
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445210-1-52-01

SPLICING DIAGRAM

SHEET NO.
T-10

7/30/2021 11:59:48 AM KHHNTSV
C:\Projects\445210\1\signal\SPDT5G01.dgn



SAMPLE

NOTES

1. DEVICES ARE SHOWN FOR INFORMATION PURPOSE ONLY. SEE PLANS FOR EXISTING AND PROPOSED DEVICES.
2. MEDIA CONVERTERS ARE INTRODUCED WHEN THE IMC CAMERA CABLE LENGTH EXCEEDS 300 LF FORM DEVICE TO CABINET.
3. APPROPRIATE CABLE TYPE SHALL BE USED PER DEVICE MANUFACTURES RECOMMENDATION FOR PROPER FUNCTIONING OF THE DEVICE. THE DEVICE CABELS ARE INCIDENTAL TO THAT DEVICE.
4. NETWORK SWITCH AND PORT ASSIGNMENTS SHOWN FOR COMPLETENESS ONLY. PORT ASSIGNMENTS SHALL BE COORDINATED WITH THE MAINTAINING AGENCY.
5. SPECIFIC CONFIGURATION AND INCLUSIVE EQUIPMENT FOR IMC CAMERA SYSTEMS MAY VARY DEPENDENT ON VENDOR. ALL PROPOSED SYSTEMS AND EQUIPMENT TO BE APPROVED BY THE ENGINEER AND THE MAINTAINING AGENCY.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN

Aymon A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445210-1-52-01

WIRING DIADRAM

SHEET NO. T-11

7/30/2021 11:59:51 AM KHHNTSV
C:\Projects\445210\1\signal\SSDT5G01.dgn

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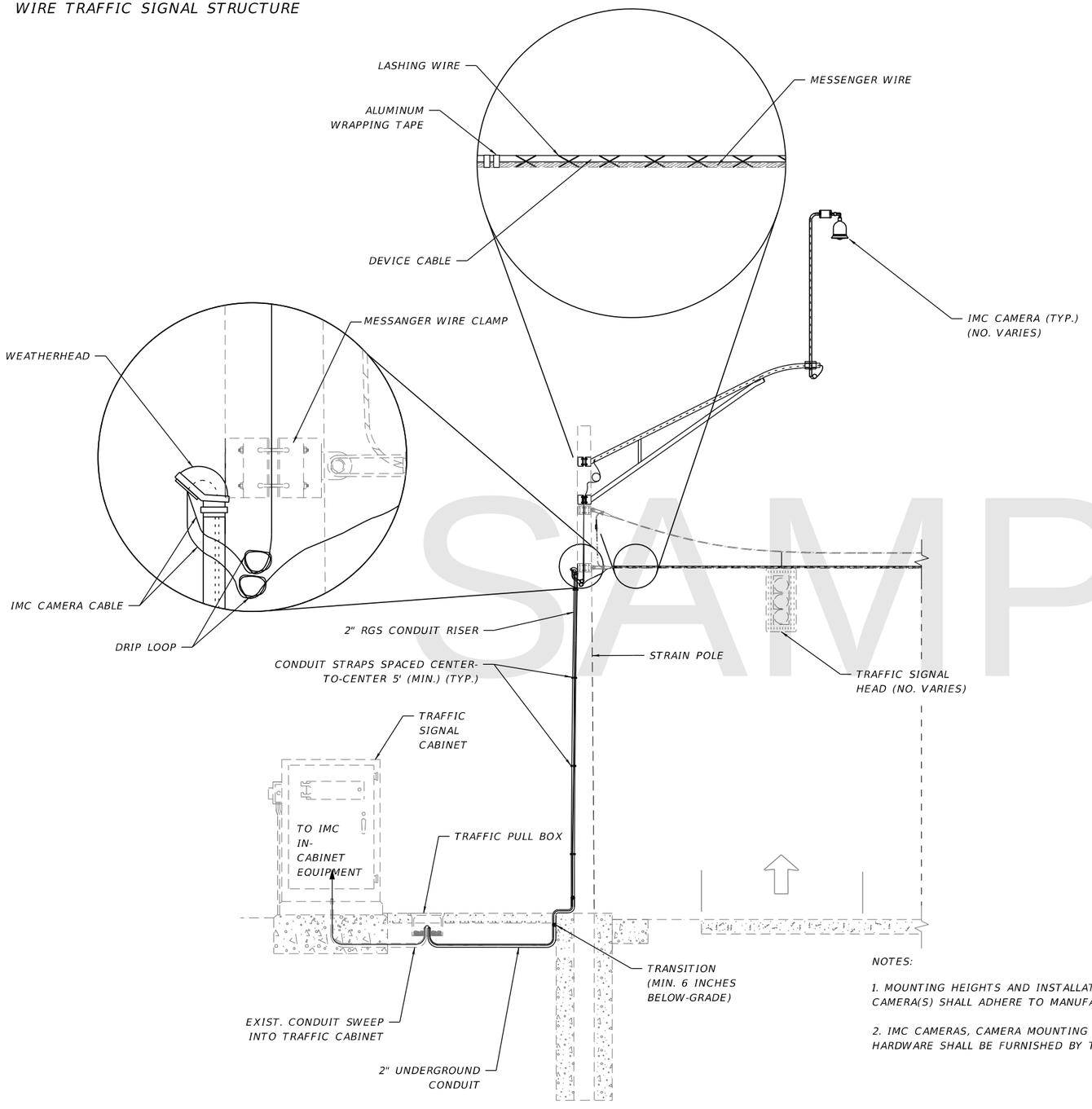
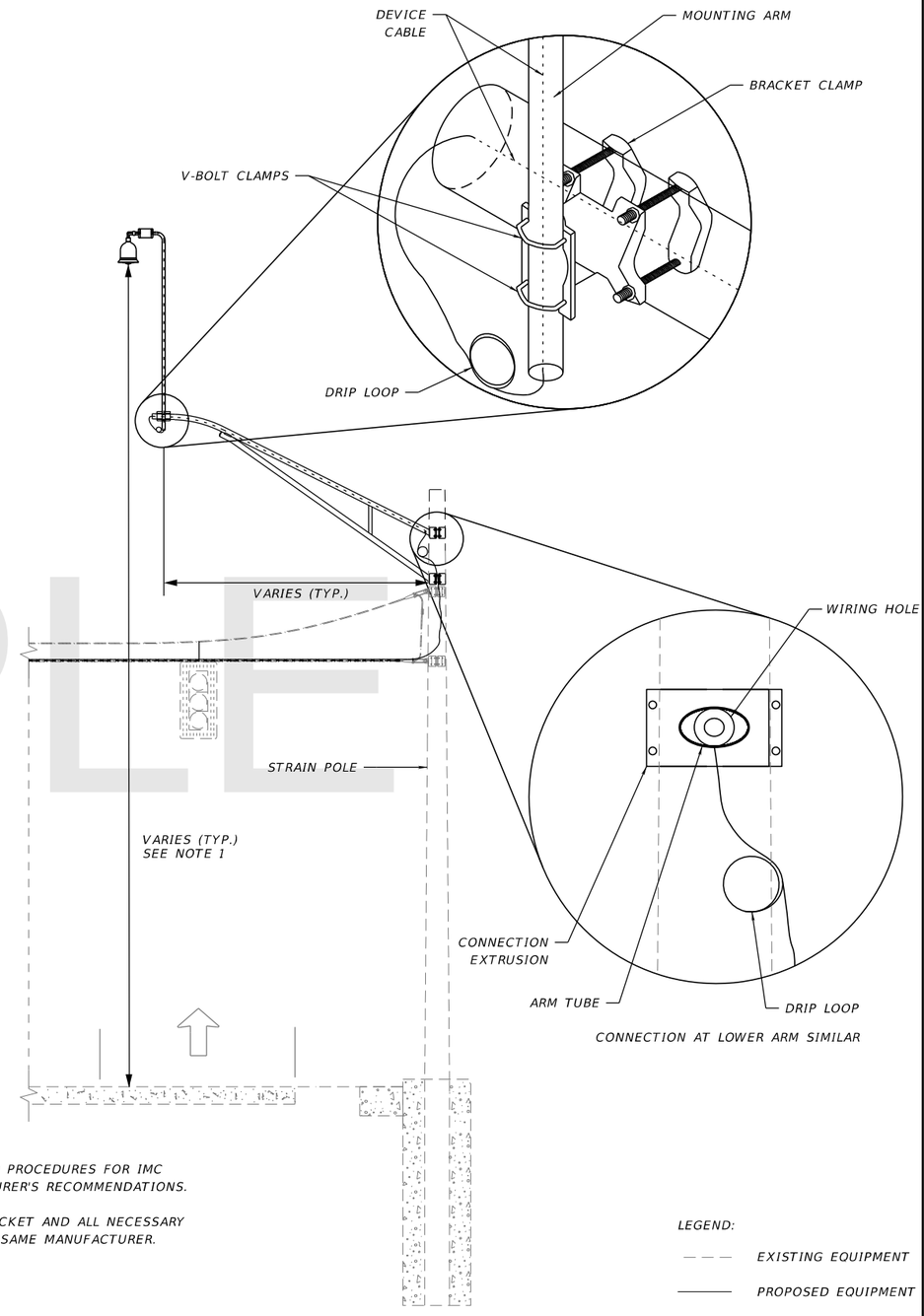
IMC CAMERA(S) MOUNTED ON EXISTING SPAN WIRE TRAFFIC SIGNAL STRUCTURE



IMC CAMERA MOUNTING BRACKET CABLE MOUNT DETAIL

N.T.S



NOTES:

1. MOUNTING HEIGHTS AND INSTALLATION PROCEDURES FOR IMC CAMERA(S) SHALL ADHERE TO MANUFACTURER'S RECOMMENDATIONS.

2. IMC CAMERAS, CAMERA MOUNTING BRACKET AND ALL NECESSARY HARDWARE SHALL BE FURNISHED BY THE SAME MANUFACTURER.

LEGEND:

- – – – EXISTING EQUIPMENT
- ——— PROPOSED EQUIPMENT

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

DISTRICT FIVE - DESIGN
Ayman A. Mohamed, P.E., P.T.O.E.
No.: 61777
719 South Woodland Blvd.
DeLand, Florida 32720

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
500/600	OSCEOLA	445210-1-52-01

DEVICE MOUNTING DETAIL

SHEET NO. T-12

7/30/2021 11:59:51 AM KHHNTSV
C:\Projects\4452101\signal\SSDTS601.dgn