

District Five

Wrong Way Detection System



DESIGN GUIDANCE

FLORIDA DEPT. OF TRANSPORTATION
DISTRICT FIVE





Florida Department of Transportation, District Five

CREATED BY:

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

Document Revision History

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v2.0	Revision No. 1 – Updated pay item and design considerations; removed PPC references, multiple APL listed vendors; updated network diagrams.	Nathan Mozeleski Trent Masih	8/27/2021

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Section I – Objectives

This document is intended to provide guidance to all stakeholders responsible for the planning, design, construction, integration, operation, and maintenance of Wrong Way Detection Systems (WWDS) used to detect, alert, and notify both the motoring public and operational staff of potential wrong way driving events on limited-access facilities. The design guidance was developed specifically for the deployment of WWDS within projects for the Florida Department of Transportation (FDOT) District Five.

The following subsections will provide overarching guidance and reference information for the end-to-end design and implementation of WWDS, including background information, systems overview, design considerations, necessary design submittals, and more.

Background

Defined by the Federal Highway Administration (FHWA), a wrong way driving crash occurs when a vehicle traveling in a direction opposing the legal flow of traffic on a high-speed divided highway or access ramp collides with a vehicle(s) traveling on the same roadway in the proper direction. Historically, wrong way driving incidents occur randomly and less frequently than other crash types; however, the severity of these incidents are typically greater, often resulting in serious injury or fatalities. In the United State, 300 to 400 people are killed as a result of wrong way driving incident annually.

Dated July 3, 2019, the Department issued [Roadway Design Bulletin 19-03 – Wrong-way Driving Advanced Countermeasures at Interchange Exit Ramps](#) to introduce additional minimum requirements for limited-access facility exit ramps interchanges utilizing Intelligent Transportation Systems (ITS) to supplement static signing and pavement markings for increased safety. This statewide directive requires WWDS to be included in all design and construction project that either impact or include limited-access facility exit ramps and interchanges within the project limits. The deployment of technology-based solutions provides enhanced ability to detect wrong way driving events in real-time, notify motorists to correct their actions, and alert the appropriate operational staff of the event to mobilize the appropriate response.



Figure 1: Recent installation along Interstate 4 at Lake Mary Boulevard (Exit 98) in Seminole County, FL

Section II – Wrong Way Detection System Overview

The WWDS is comprised of three (3) basic subsystems: vehicle detection, motorist awareness, and centralized logic platform. Working as a complete system, each WWDS deployment will be capable of detecting wrong way events, providing local notification to motorists to enable corrective actions, and facilitate the appropriate response plan(s) by operational personnel.

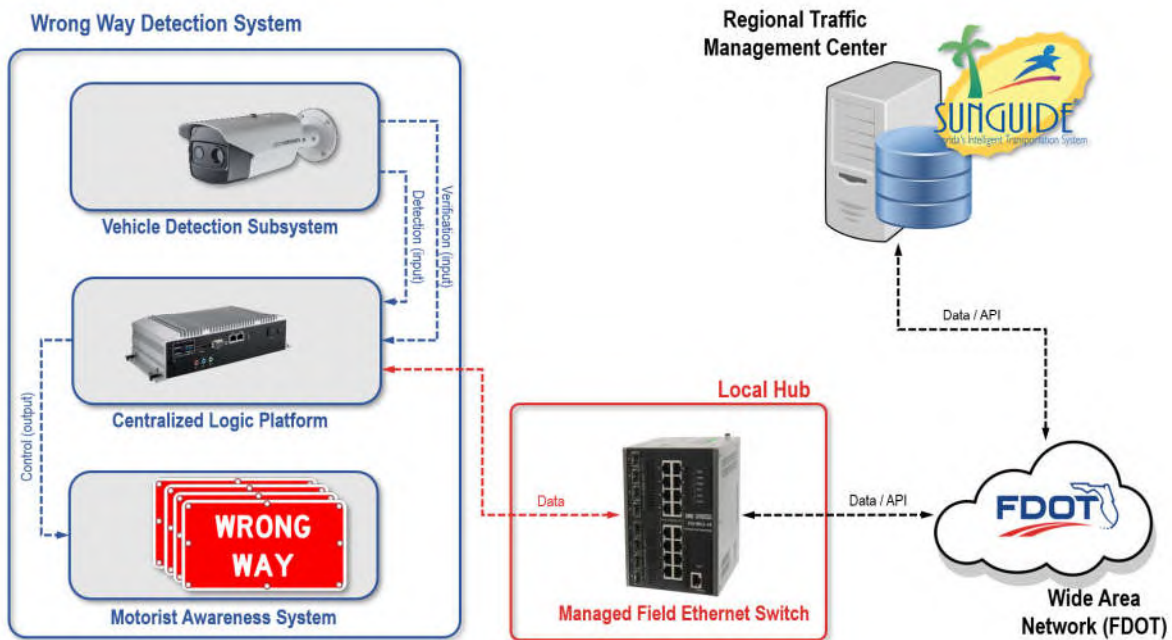


Figure 2: High-level architecture and data flow for WWDS.

In addition to the three primary subsystems, each WWDS installation will also include ancillary hardware and equipment necessary for the electrification and network connectivity of the system.

Vehicle Detection Subsystem

The vehicle detection subsystem is responsible for the identification of vehicles entering onto a limited-access facility in the improper direction to determine a potential wrong way driving event. Various technologies are available to achieve wrong-way driving detection, including in-pavement loops, wireless magnetometers, video analytics, thermal imaging, doppler radar, microwave radar, and more. To date, however, the Department has only approved the following manufacturer’s technology for deployment on state roadways, as identified on the [FDOT Approved Products List \(APL\)](#):

1. [TAPCO, Wrong-Way Alert System](#) (model no. varies)
2. [GovComm, Wrong-Way Vehicle Detection System](#) (model no. GC-WWVDS-Series)
3. [K&K Systems, Inc., Wrong Way Vehicle Detection System](#) (model no. WWVDS Series)

Each vehicle detection subsystem shall include all sensors, in-cabinet equipment, power supplies, surge protection, cabling, and hardware necessary to provide a complete installation capable of detecting wrong way vehicles for all lanes of the selected off-ramp.



Figure 3: Examples of WWDS in-cabinet assemblies: GovComm (left), TAPCO (right)

The vehicle detection subsystem shall be designed in accordance with the current requirements set forth in the [FDOT Standard Specifications for Road and Bridge Construction, Section 660 – Vehicle Detection System](#).

The following pay item(s) shall be included as part of the vehicle detection subsystem design for all WWDS installations:

- **660-7-AB** Vehicle Detection System – Wrong Way Detection for Exit Ramp, EA

Motorist Awareness Subsystem

The motorist awareness subsystem is responsible for alerting motorists who have entered in the wrong direction onto a limited-access ramp of the error in order to prompt quick and safe corrective actions. Numerous technologies are available on the market to serve as the motorist awareness subsystem for the WWDS, including standard flashing beacons, LED highlighted signs, rapid rectangular flashing beacons (RRFB), blank out signs, small-form dynamic message signs (DMS), audible sirens, Connected Vehicle Roadside Units (RSU), and more. The Department has standardized the utilization of highlighted signs for all deployments of WWDS along state roadways, per *Roadway Design Bulletin 19-03*. Highlighted signs are defined as static sign panels surrounded by LEDs to emphasize the sign's shape, color, or message by flashing to attract motorists' attention. Refer to the APL for available vendors and technologies.

The following pay item(s) shall be included as part of the motorist awareness subsystem design for all WWDS installations:

- **700-6-AB** Highlighted Sign, AS
- **700-13-AB** Retroreflective Sign Strop, EA

Centralized Logic Platform

Each WWDS shall include the necessary hardware and/or software capable of receiving real-time inputs from the vehicle detection subsystem (e.g., field sensors), activating the motorist awareness systems (e.g., LED highlighted signs) when a wrong way driving event is verified, and providing pertinent information to the District. WWDS shall be capable of providing an Application Programming Interface (API) feed from the field equipment into the SunGuide® central management software utilizing the District ITS wide area network (WAN). Cloud-hosted solutions are not an acceptable alternative. All WWDS shall be integrated with the SunGuide® platform for management, operations, and control. The centralized logic platform includes all in-cabinet equipment necessary to receive and process field sensor inputs, actuate localized responses (e.g., at the off-ramp), and alert operational staff located within the Regional Traffic Management Center (RTMC).

Ancillary Equipment

In addition to the three (3) key components that comprise the WWDS, each deployment will require additional infrastructure and equipment necessary for a complete installation. Ancillary equipment includes, but may not be limited to, conduit, pull boxes, cabinets, enclosures, poles, foundations, electrification hardware, communications equipment, grounding, and cabling.

The following pay item(s) may be included as part of the overall WWDS installation:

- **630-2-AB** Conduit, LF
- **633-1-ABC** Fiber Optic Cable, LF
- **633-2-AB** Fiber Optic Connection, EA
- **633-3-AB** Fiber Optic Hardware, EA
- **633-8-A** Multi-Conductor Communication Cable, LF
- **635-2-AB** Pull & Splice Box, EA
- **639-1-ABC** Electrical Power Service, AS
- **639-2-A** Electrical Service Wire, LF
- **639-3-AB** Electrical Service Disconnect, EA
- **639-6-A** Electrical Power Service Transformer, EA
- **641-2-AB** Prestressed Concrete Pole Standard Plan 641-010, EA
- **676-2-ABC** ITS Cabinet, EA
- **684-1-A** Managed Field Ethernet Switch, EA
- **685-1-AB** Uninterruptible Power Supply, EA
- **685-2-A** Remote Power Management Unit, EA

Section III – Design Considerations

The design of each WWDS will vary per location, dependent upon ramp geometry, physical conditions, existing infrastructure, and a litany of other factors. The Engineer shall be responsible for performing site-specific analysis and completing the design for each off-ramp location with proposed WWDS, in accordance with the latest versions of the *FDOT Design Manual*, *FDOT Standard Plans*, and *FDOT Standard Specifications for Road and Bridge Construction*.

Prior to initiating design activities, the Engineer shall coordinate a meeting with the following District Five personnel to determine the current state of technology, network topology, and integration requirements into the larger ITS system.

- Project Manager (*varies*)
- Intelligent Transportation Systems (*Jeremy Dilmore* – jeremy.dilmore@dot.state.fl.us)
- Integration Support (*Jovanny Varela* – jovanny.varela@dot.state.fl.us)
- SunGuide® Software Support (*Kyle Higgins* – kyle.higgins@dot.state.fl.us)
- Networking (*Shane Owens* – shane.owens@dot.state.fl.us)

The following sub-sections provide high-level guidance for the design of WWDS within District Five projects.

Field Review

Often the first step in the design process, the initial field review provides the Engineer a comprehensive understanding of the existing conditions and potential design constraints within which the proposed system must function. The Engineer shall conduct a field review inclusive of all interchange off-ramps and the necessary limits of the limited-access facility and intersecting arterial roadways. The Engineer shall be responsible for identification of the following items during the initial field review for each off-ramp terminal.

- **Roadway Geometry (Off-Ramp).** Verify the geometric conditions of each off-ramp to determine design considerations and limitations for the deployment of WWDS.
 - Total off-ramp length
 - Number of lanes
 - Potential wrong way driving entry points
 - Lane assignments and associated movements
 - Lane and shoulder widths
 - Horizontal / vertical curves
 - Proximity of other vehicular movements (e.g., adjacent on-ramp, frontage roads)
 - Posted speed limit
 - Superelevation
 - Shoulder slopes / drop-offs
 - Clear zone concerns
 - Horizontal offset protection (e.g., concrete barrier wall, non-mountable curb, guardrail)
- **Roadside Infrastructure.** Identify roadside infrastructure that may affect the proposed location of WWDS componentry, including physical space limitations and/or obstructed sight lines.
 - Mechanically stabilized earth (MSE) walls
 - Underground and/or overhead utilities
 - Signing (e.g., single post and multi-column assemblies)
 - Roadway lighting poles
 - Vegetation

- **Power and Communications.** Identify the existing communications infrastructure and owner, as well as locate potential connection points for network connectivity to the District Five ITS wide area network (WAN). Additionally, locate existing electrical utility service provider equipment to identify potential power service for the WWDS.
 - Fiber optic communications infrastructure (e.g., underground / overhead cabling, fiber optic route markers, pull boxes, splice vaults, local hubs)
 - Network communication equipment (e.g., type of network switch, number of available ports, availability of fiber optic patch panel bulkheads)
 - Electrical utility service provider infrastructure (e.g., pole numbers and location, meters, electrical service disconnect, availability of punchouts in disconnect for additional breakers, transformers, electrical pull boxes, risers)

Overall Site

The Engineer shall be responsible for the design of a fully functional system including all ancillary equipment and infrastructure necessary to provide power and communications to the WWDS—including but not limited to conduit, pull boxes, splice vaults, fiber optic cabling and hardware, electrical equipment, cabinets, in-cabinet equipment, grounding, and more.

Each site shall include the WWDS, local hub cabinet assembly (w/ network connectivity and battery backup system), electrical systems, networking equipment, and physical infrastructure (e.g., conduit, boxes).



Figure 4: WWDS deployment w/ vehicle detection system, highlighted sign assembly, and local hub cabinet.

Local Hub

The local hub shall consist of either a pole-mounted Type 336S or ground mounted Type 332/334 cabinet assembly, in accordance with *FDOT Standard Specifications for Road and Bridge Construction, Section 676*. Ensure each local hub provides the means to power the overall system and establish communication between the WWDS field equipment and the District network.

At a minimum, each local hub shall include the following in-cabinet equipment:

- Fiber Optic Patch Panel
- Managed Field Ethernet Switch (MFES)
- Uninterruptible Power Supply (UPS) w/ Battery Backup System
- Remote Power Management Unit (RPMU)

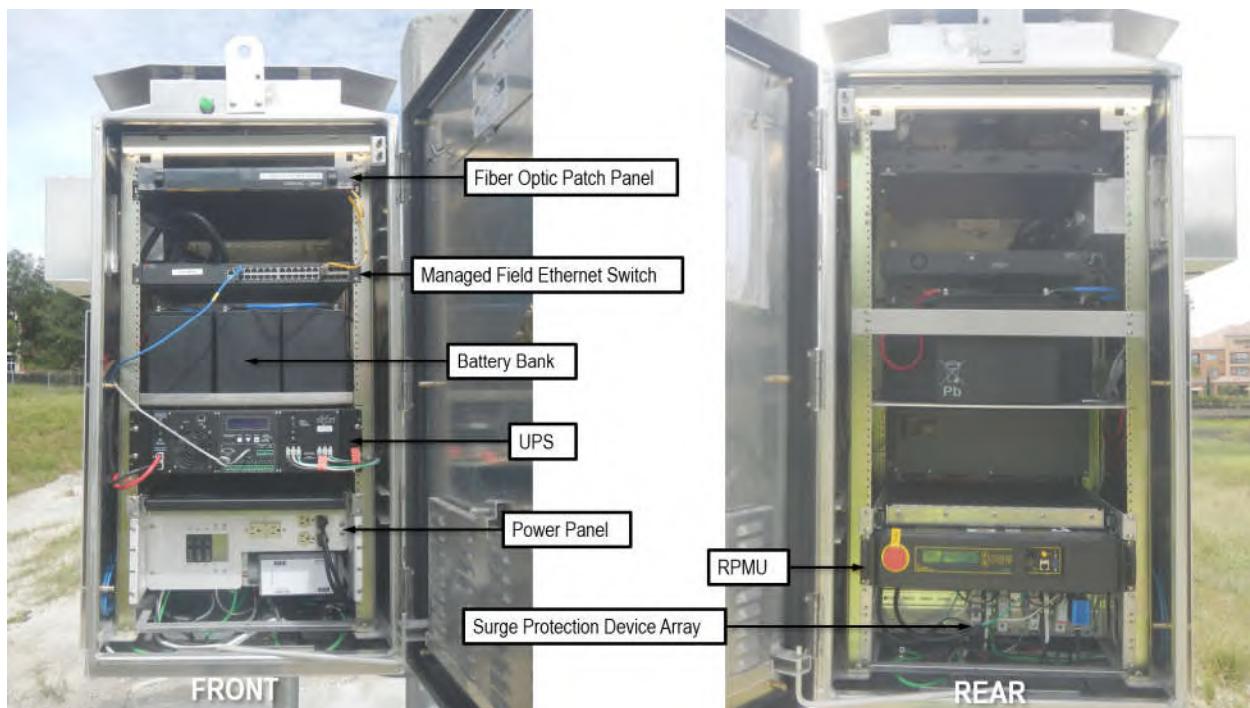


Figure 5: Example local hub cabinet assembly w/ in-cabinet equipment.

At a minimum, the design for the local hub cabinet assembly, the Engineer shall address the following considerations:

- Verify proposed cabinet location is positioned outside of clear zone and/or meets the lateral offset requirements (*FDM Section 215*).
- Verify proposed cabinet location is easily accessible by maintenance personnel. Where feasible, consider locations that provide opportunities for a maintenance vehicle.
- Verify proposed cabinet location allows for maintenance personnel to access the cabinet without having his/her back perpendicular to the direction of traffic.
- Verify proposed cabinet is provided a technician pad for both the front and rear access doors. Technician pad dimensions shall be at least as wide of the proposed cabinet and a minimum of 2'-6" deep (*FDOT Standard Plans, Index 676*).
- For pole-mounted cabinets, verify the bottom of the cabinet is not mounted higher than 48" above grade.

- Verify proposed cabinet assembly provide adequate physical space for all in-cabinet equipment.
- Verify sunshields are provided for all local hub cabinets.



Figure 6: Type 336S local hub w/ concrete pad (left) | Local hub informational placard (right).

- Verify the design accounts for replacement of the standard Type 2 Corbin lock with an electronic CyberLock® cylinder consistent with the existing systems utilized by District Five.
- Verify the design accounts for the installation of an informational placard with a white legend on a green background and adheres to the following format identified in **Figure 7**.

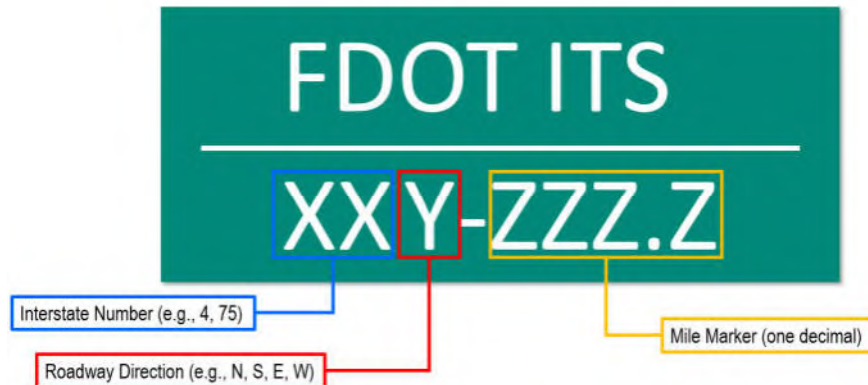


Figure 7: Informational placard for installation on local hub cabinet.

- Verify “modify/adjust” pay items are included for all work to revise existing in-cabinet equipment, as necessary. Ensure pay item notes are provided clearly defining the work to be performed.

Networking Equipment

Each WWDS shall include the necessary networking equipment to establish and maintain communications between the field systems and the existing ITS WAN. Fiber optic communications is the preference for new network connections within District Five. Additionally, the District prefers to minimize the number of new splices introduced to the existing fiber optic backbone. The Engineer shall determine the feasibility of establishing a fiber optic spur connection between the closest existing local hub communicating on the ITS WAN and the proposed local hub. If the project is unable to

accommodate fiber optics, the Engineer shall submit for approval a design exemption with the proposed alternative (e.g., cellular modem, point-to-point wireless bridge) to the Department Project Manager.

For each WWDS deployment, networking equipment may include, but is not limited to, the following:

- Fiber Optic Cable
- Fiber Optic Jumper
- Fiber Optic Patch Panel
- Fiber Optic Connector Panel
- Fiber Optic Splice Tray
- Fiber Optic Splice Enclosure
- Managed Field Ethernet Switch
- Ethernet Patch Cable (CAT-6)

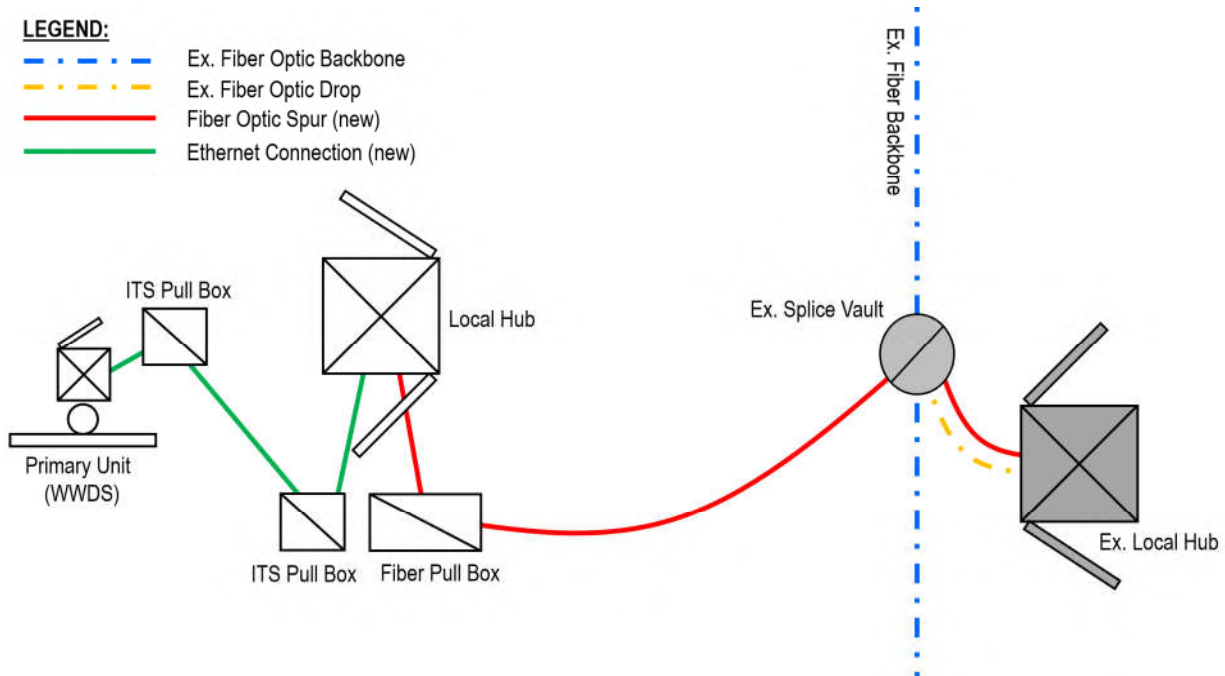


Figure 8: Proposed concept for fiber optic network connection.

The following outlines the minimum design considerations to be addressed by the Engineer related to the proposed networking equipment:

- Coordinate with the District to determine the existing network topology within the project limits, including existing splicing scheme, available fiber optic pairs, terminations, port utilization, and more.
- Verify the design includes a connection between the proposed local hub and the District Five ITS WAN using a fiber optic spur terminating within an existing ITS local hub with network connectivity. If an existing local hub is not available within the project area, coordinate with the District to identify potential alternatives (e.g., introduce new splice to the fiber optic backbone).
- Verify the existing local hub to be utilized as the network connection point has the necessary number of available ports in both the fiber optic patch panel and managed field Ethernet switch.

- Verify the design provides the necessary fiber optic hardware (e.g., patch panel, connector panels) to accommodate all new fiber optic spurs within the local hub(s), whether existing or proposed. Ensure the design provides sufficient detail to the Contractor on the type of equipment necessary (e.g., connector type).
- In scenarios where the number of available fiber optic ports (e.g., SFP) within the existing managed field Ethernet switch at the local hub is less than the number of proposed fiber optic spurs, the Engineer may either
 - (1) Remove the existing switch and replace with a new switch with additional fiber optic ports; or
 - (2) Provide a second switch of the same make and model and connect the two via a CAT-6 patch cable using the uplink port.

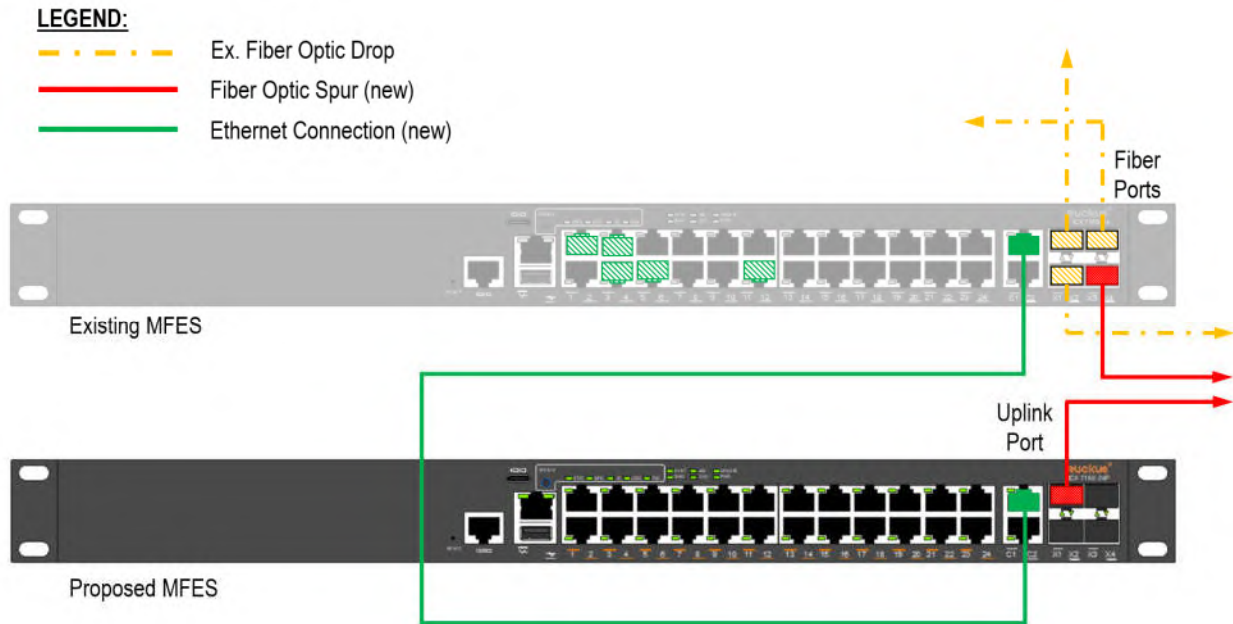


Figure 9: Typical configuration for linking multiple MFES via the uplink port.

- Verify all managed field Ethernet switches proposed within the project are Layer 3 models consistent with the specifications and requirements of the District. If an existing switch within the project limits is not Layer 3 compliant, the Engineer shall coordinate with the District to replace the switch as part of the project. Ensure the proposed switches are of the same manufacturer and model for compatibility, including the development of a Proprietary Product Certification (PPC), as required.
- Verify an Ethernet-based connection (e.g., CAT-6) is provided between the local hub and primary.
- In scenarios where the WWDS includes both a primary and secondary unit, ensure an Ethernet-based connection (e.g., CAT-6) is provided between the primary unit and secondary unit.
- Verify all applicable in-cabinet equipment is connected to the network, including WWDS, UPS, RPMU, and more.
- Verify “modify/adjust” pay items are included for existing infrastructure where work is performed. Ensure pay item notes are provided clearly defining the work to be performed.

Electrical Systems

The Engineer shall be responsible for the identification, coordination, and design of the electrical utility service and all infrastructure necessary to provide power to the overall WWDS site. Where feasible, the District preference is to leverage an existing metered electrical service utilized for ITS field devices. If this option is unavailable, the Engineer

shall coordinate alternatives with the Department. Each WWDS site shall be provided direct-line power; solar powered systems will not be accepted. The following identifies available options and order of preference for obtaining electrical service for new WWDS sites:

- PREFERENCE
1. **Existing electrical service (ITS).** Install new circuits to an existing metered electrical service providing power to ITS field devices and paid for by the Department. Connections may be tapped into either existing main electrical service disconnect at the service location or distribution disconnects at the existing local hubs.
 2. **Existing electrical service (lighting).** Install new circuits to an existing metered electrical service providing power to roadway lighting fixtures and paid for by the Department. Connections may be tapped into existing main electrical service disconnect at the service location.
 3. **Existing electrical service (traffic signals).** Install new circuits to an existing metered electrical service providing power to nearby signalized intersections at the ramp terminals and paid for by the local maintaining agency (e.g., City of Orlando). Connections may be tapped into existing main electrical service disconnect at the service location. Ensure coordination with the local maintaining agency is completed.
 4. **New electrical service (ITS).** Install a completely new metered electrical service from the utility service provider. Coordinate with the utility service provider to determine the appropriate pole location and service voltage and design meter, main disconnect, and electrical circuits.

For each WWDS deployment, electrical service hardware may include, but is not limited to, the following:

- Electrical meter
- Electrical service disconnect
- Electrical power service transformer
- Remote power management unit (RPMU)
- Uninterruptible Power Supply (UPS)
- Automatic Transfer Switch (ATS)
- Batteries
- Electrical conductors

The following outlines the minimum design considerations to be addressed by the Engineer related to the proposed electrical systems equipment:

- Verify the local hub cabinet assembly is provide an uninterruptible power supply (UPS), automatic transfer switch (ATS), and remote power management unit (RPMU). Ensure the system is capable of automatically switching operations between direct line-in, battery, and generator power without manual intervention. Note, generators are not to be included as part of the design; however, generator hookups shall be included.
- Verify electrical conductors are sized appropriately for each primary electrical circuit between the utility service and local hub based on a maximum 3.0-percent voltage drop.
- Verify direct-in power is provided from the local hub to each highlighted sign assembly (WWDS) and connected directly to a plug within the RPMU.
- Verify the electrical conductors are sized appropriately for runs between the primary, secondary, and remote units of the WWDS. Ensure each electrical circuit to the primary, secondary, and remote units includes an appropriately sized circuit breaker.
- Verify circuit breakers are sized appropriately within the local hub cabinet power panel, primary unit, and all electrical service disconnects.

- Verify if electrical transformers are needed for the system. Ensure the type (e.g., step-up, step-down), size, and location of each transformer is appropriately detailed. Ensure a Technical Special Provision (TSP) is approved for all projects with proposed transformers.
- Verify the proposed battery backup system (UPS) is appropriately sized to provide a minimum of two (2) hours run time in the case of power loss.
- Verify either the UPS or RPMU is wired to monitor battery temperature, as well as front and rear door status through the contact closure I/O terminals for remote monitoring.
- The Engineer shall provide power draw calculations for each existing and proposed local hub cabinet impacted within the project limits. The Engineer shall coordinate with Kristen Johnson (kristen.johnson@dot.state.fl.us) of the Department to obtain the latest six (6) or twelve-month meter readings and peak usage for existing local hubs to be used in power draw calculations. The Engineer shall provide the existing meter service identification number.
- The Engineer shall provide voltage drop calculations for each existing and proposed circuit impacted within the project limits. Ensure circuits do not exceed a maximum voltage drop of 3.0 percent.

Physical Infrastructure

The Engineer shall be responsible for the design of the physical infrastructure for each WWDS site, including conduit, pull boxes, foundations, poles, and grounding in accordance with the latest versions of the *FDOT Design Manual*, *FDOT Standard Plans*, and *FDOT Standard Specifications for Road and Bridge Construction*.

The following outlines the minimum design considerations to be addressed by the Engineer related to the proposed physical infrastructure:

- Verify physically separate pathways are provided for high-voltage (120VAC), low-voltage (12-48VDC), and fiber optic communications cabling, including conduits, boxes, and foundation sweeps.
- Verify each highlighted sign assembly is provided a minimum of one (1) conduit sweep into the foundation for cabling access.
- Verify each highlighted sign assembly is provided pull box(es) in close vicinity to the foundation for conduit sweep and cabling access. Conduits directly into the foundations for highlight sign assemblies is not acceptable.
- Verify pull boxes and splice vaults are provided a concrete apron with 12" clearance on all sides, per *FDOT Standard Plans, Index 635*. Where multiple pull boxes are to be installed in a single location, arrange the pull boxes to minimize the overall dimensions of the concrete pad.
- Verify pull box and splice vault lids are appropriately labeled based on utilization (e.g., "FDOT ELECTRICAL" for high-voltage cabling; "FDOT ITS" for low-voltage cabling; and "FDOT FIBER OPTICS" for fiber optic communications).
- Verify the system is grounded in accordance with *Section 620*. Ensure ground rods are installed in pull boxes within 36" of each highlighted sign assembly, local hub cabinet, and electrical service disconnect. Ensure ground wire is appropriately sized and detailed.
- Verify all infrastructure with vertical obstruction is located outside of the clear zone and/or meets the lateral offset requirements (*FDM Section 215*), including highlighted sign assemblies, cabinets, electrical service equipment. Ensure frangible components (e.g., highlighted sign assemblies with transformer bases) remain in a breakaway state and avoid adding rigid structural elements, such as vertical conduit risers.

Wrong Way Detection System

The Engineer shall design one (1) WWDS at all limited-access facility interchanges with exit ramps onto arterial roadways. System-to-system type interchanges do not require the deployment of WWDS, unless otherwise determined by the Engineer. The District Five standard deployment includes a total of four (4) LED highlighted sign assemblies, one (1) vehicle detection subsystem, and one (1) local hub cabinet equipped with network and electrification equipment at all off-ramp locations, regardless of ramp geometry or configuration. If the Engineer elects to deviate from the established standard an approved exemption will be required from the District Project Manager.



Figure 10: Primary unit (left) | Remote unit (right).

Each ramp shall consist of four (4) LED highlighted sign assemblies arranged into two (2) sets of signs positioned evenly on either side of the off-ramp. Dependent upon the manufacturer and ramp geometry, the system configuration will include a combination of primary, secondary, and remote units.

- **Primary** – Unit with direct communication interface to all secondary and primary units, as well as the local hub for network connectivity with District Five. This unit will include one (1) LED highlighted sign assembly, as well as the necessary componentry for the vehicle detection subsystem and the centralized logic platform. This unit will include interconnection equipment to interface with both the secondary and remote units to receive detection inputs and provide control commands (e.g., activate LED sequence), respectively.
- **Secondary** – Unit with direct communication interface with the primary unit providing supplemental detection inputs to the centralized logic platform. This is an optional unit typically deployed in scenarios where the primary unit is unable to adequately provide detection zone coverage. This unit will include one (1) LED highlight sign assembly, as well as the necessary componentry for the vehicle detection subsystem and interconnection equipment.

- Remote** – Unit with direct communication interface with the primary unit receiving control commands (e.g., activate LED sequence). This unit will include one (1) LED highlighted sign assembly and interconnection equipment.

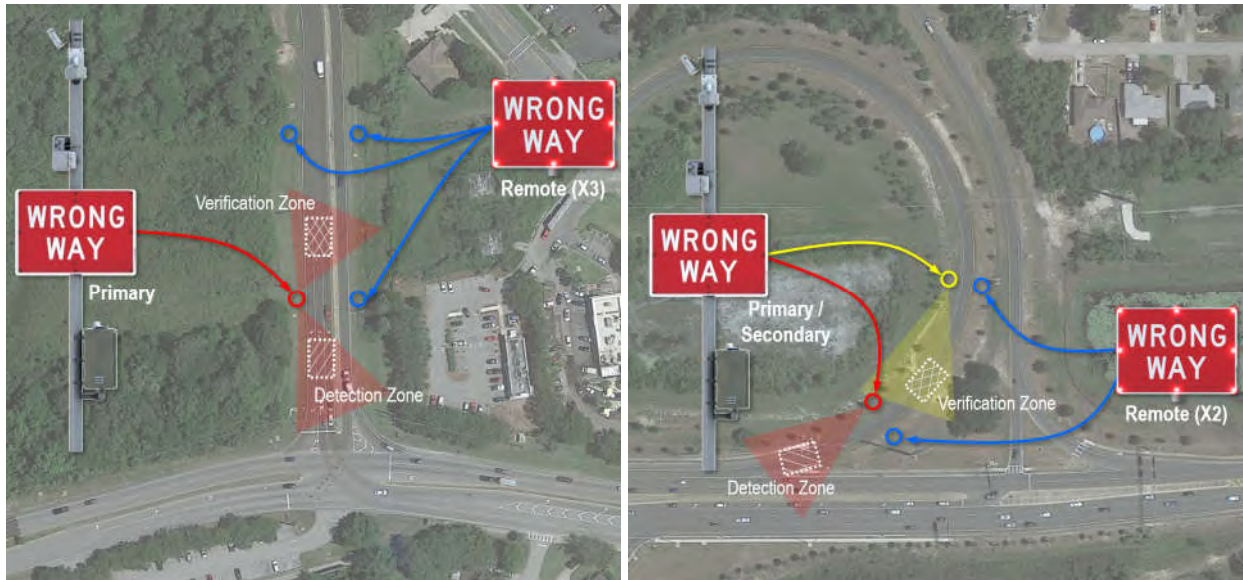


Figure 11: Example configurations of wrong way detection systems.

Vehicle Detection Subsystem

The Engineer shall design a redundant system capable of detecting and verifying wrong way driving events in real-time. At a minimum, the system shall include a forward “detection zone” and a subsequent “verification” zone capable of identifying vehicles traveling in the improper direction for all lanes of the off-ramp. Each system provides unique functionality and constraints inherent to the specific technology and vendor. The Engineer shall be responsible for identifying the APL-listed technology or technologies that is best suited for conditions and constraints of each deployment location.

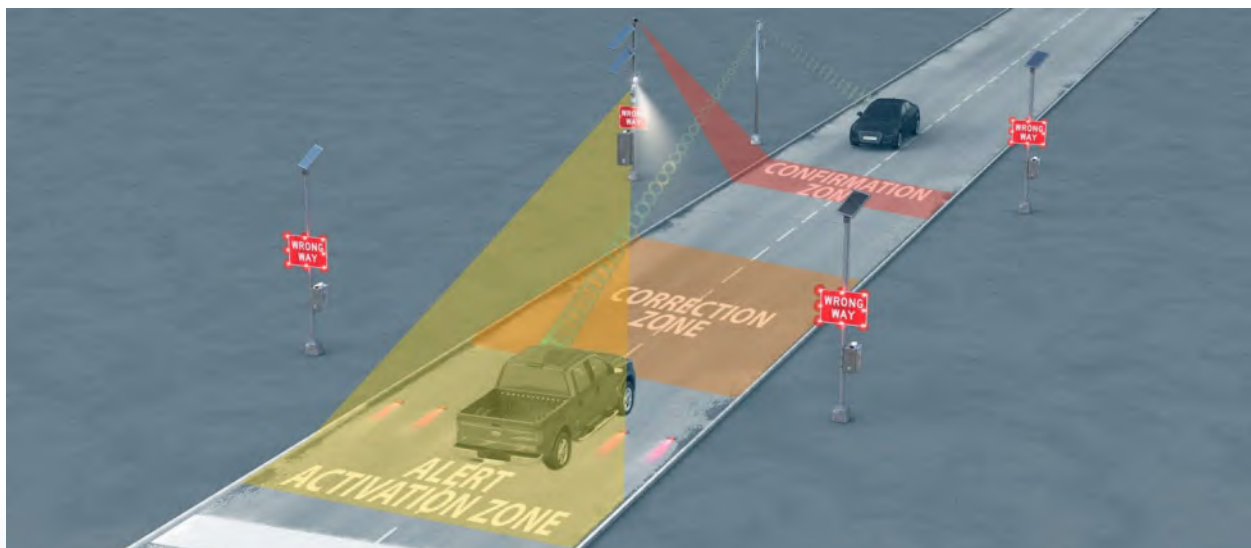


Figure 12: WWDS utilize multiple zones to identify and validate wrong way driving events (Source: TAPCO)

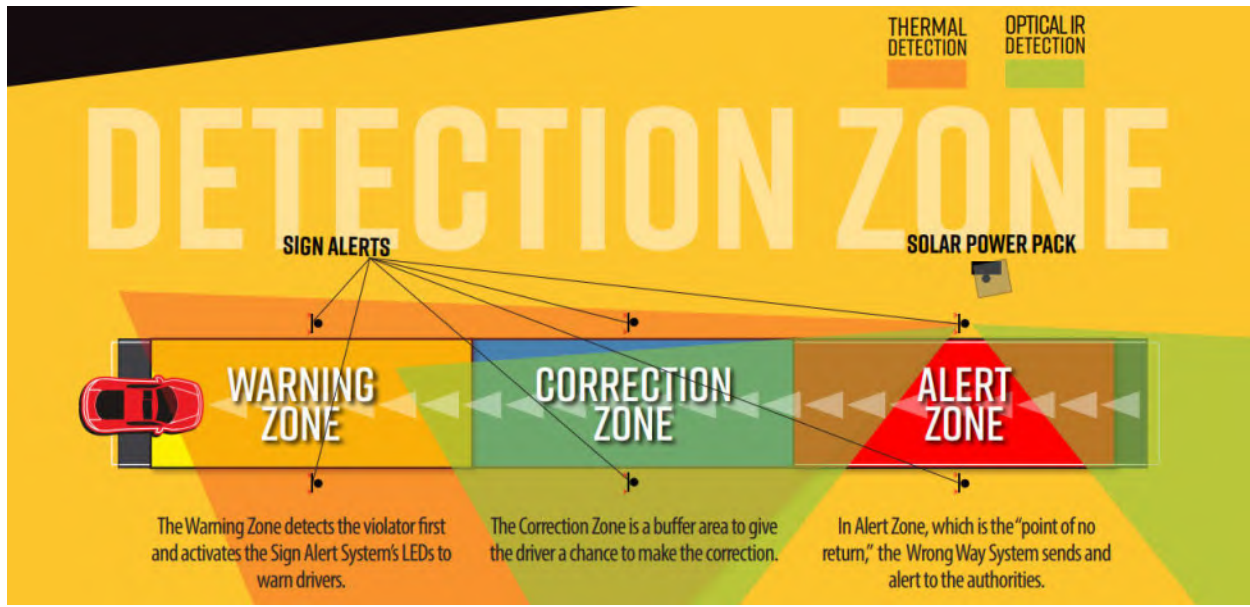


Figure 13: Redundant detection and verification zones using multiple technologies. (Source: K&K Systems)

The following outlines the minimum design considerations to be addressed by the Engineer related to the proposed vehicle detection subsystem:

- Verify the subsystem includes sensors capable of creating unique "detection" and "verification" zones.
- Verify the proposed location of sensors provides sufficient vehicle detection coverage for all lanes and shoulders of the off-ramp, including slip ramps.
- Verify sensor mounting height is sufficient to provide the necessary vehicle detection coverage. Ensure sensor is capable of capturing both "detection" and "verification" zones for all lanes and shoulders.
- For straightaway off-ramps position the start of the "detection" zone no less than 25' upstream of the stop bar.
- For ramps that include right turn lane(s) and islands position the start of the "detection" zone at the island gore point or tangent begin.
- Verify detection zones are positioned to eliminate false calls from opposing or right-way traffic on adjacent roadways and on-ramps.
- Verify sight lines are clear from obstruction, including highway signing, lighting poles, vegetations, barrier walls, and other physical features.
- Verify the vehicle detection subsystem is capable of functioning in all weather and lighting conditions. Ensure any additional hardware or equipment (e.g., illuminators) is provided as part of the system, as necessary.
- Verify the necessary configuration of the vehicle detection subsystem (e.g., primary and remote; primary, secondary, and remote) based on the roadway geometry and physical constraints of the proposed location.

It is recommended that the Engineer coordinate with the manufacturers for the APL-listed vehicle detection subsystem technologies to determine the properties of each system. Often times vendors will provide design-aid tools to assist in the decision process to select the correct equipment based on various parameters—such as lens type, mounting height, detection area, field of view angle, and more. One example is the Raven – Site Planning Tool powered by Teledyne FLIR, the vendor for the TAPCO Wrong-Way Alert System (<https://www.flir.com/security/raven-site-planning-tool/>) which allows users to toggle multiple sensor models and determine the right solutions for the proposed location.

Motorist Awareness Subsystem

The Engineer shall design the motorist awareness subsystem capable of providing localized notifications to drivers when a wrong way driving event is determined. Each system shall consist of the LED highlight sign assemblies, including sign panels, LED arrays, breakaway pole supports, and foundations necessary for a complete installation at each off-ramp.

The following outlines the minimum design considerations to be addressed by the Engineer related to the proposed motorist awareness subsystem:

- Verify “WRONG WAY” (R5-1a) sign panel included in the highlighted sign assembly meets the “Oversized” dimensions of the *Manual on Uniform Traffic Control Devices (MUTCD)* (e.g., 42”W X 30”H).
- Verify the bottom of the “WRONG WAY” (R5-1a) sign panel of the highlighted sign assembly is mounted 4’-0” above the roadway grade.
- Verify each highlighted sign assembly is provided a red retroreflective strip minimum 2’-0” in length. Ensure the appropriate pay item is included.
- Verify all highlighted signs are wired to actuate simultaneously and maintain a constant LED flash pattern without drifting or becoming un-sequenced.

Additional Considerations

In addition to the design of the Intelligent Transportation System (ITS) components, the Engineer shall also be responsible for ensuring the design complies with all requirements of the Department, including the following considerations:

- **Constructability.** The Engineer shall review the design to ensure the proposed system(s) are constructable, including adequate space for bore pits; available construction vehicle ingress/egress points; material laydown locations; avoidance of low-lying areas for construction (e.g., retention areas); and more.
- **Right-of-Way.** The Engineer shall identify existing and proposed right-of-way lines and ensure all elements of the project are located within Department right-of-way. In scenarios where work is proposed outside of the right-of-way, the Engineer shall coordinate with the District to obtain access permits, construction easements, or parcel takes prior to construction.
- **Utilities.** The Engineer shall be responsible for identification of all utility agency owners (UAOs) within the project limits, including facilities owned and maintained by the Department (e.g., ITS, lighting, irrigation). The Engineer shall locate underground and overhead utilities and verify that the proposed work is not in conflict. The Engineer may be required to submit Utilities Verification Sheets and/or Utility Adjustment Sheets, as necessary.
- **Environmental.** The Engineer shall review the project limits to determine the existence of any environmental concerns, including wetlands; threatened or endangered species habitats; state and federal waters; and historical and cultural landmarks. The Engineer shall coordinate with the District to identify potential concerns, as well as minimize impacts. The Engineer may need to provide a Stormwater Pollution Prevention Plan (SWPPP), as necessary.
- **Maintenance of Traffic.** The Engineer shall provide consideration for maintenance of traffic (MOT) to account for the construction, integration, and testing of the system(s). This may require shoulder and ramp closures and potential detour routes to be designed. The Engineer may need to provide Temporary Traffic Control Plans (TTCP), as necessary.

Section IV – Schedule of Deliverables

The following sub-sections describe the typical deliverables associated with a project including WWDS deployment.

Table 1: Schedule of Deliverables.

INTELLIGENT TRANSPORTATION SYSTEM (ITS) SUBMITTALS				
DELIVERABLE(S):		PHASE II	PHASE III	PHASE IV
1	Intelligent Transportation Systems (ITS) Plans			
	Key Sheet	P	C	F
	General Notes	P	C	F
	Project Layout	P	C	F
	Plan Sheets	P	C	F
	Logical Network Diagram	P	C	F
	Fiber Optic Splice Diagram	P	C	F
	Wiring Diagram	P	C	F
	Managed Field Ethernet Switch Detail	P	C	F
	Electrical Service Detail	P	C	F
	Installation Details / Mounting Detail	P	C	F
	Detection Coverage Detail	P	C	F
	Cabinet Detail	P	C	F
	Concrete Pad Detail	P	C	F
	Conduit and Route Marker Detail	P	C	F
	Maintenance of Communication (MOC) Plan		P	F
	Cross Sections		P	F
	Stormwater Pollution Prevention Plan (SWPPP)		P	F
	Temporary Traffic Control Plan (TTCP)		P	F
2	Estimated Quantities Report (EQR)	P	C	F
3	Technical Special Provisions (TSP)	P	C	F
4	Modified Special Provisions (MSP)	P	C	F
5	Proprietary Product Certification (PPC)	P	C	F

P = Preliminary

C = Complete, but subject to change

F = Final

Intelligent Transportation Systems (ITS) Plans

Ensure all Intelligent Transportation Systems (ITS) Plans are developed to meet the requirements set forth in latest version of *FDOT Standard Plans*, *FDOT Standard Specifications for Road and Bridge Construction*, and the District Five *ITS Design Review Checklist* located on cfsmartroads.com. The following provides general guidance for the development of plan sheets and details. The. Refer to **Appendix A – Sample Plans** for specific examples.

Key Sheet – Develop Key Sheet in accordance with *FDM Section 328.2*. 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 328.5*. Engineer shall ensure the provided notes are sufficient to cover all aspects of the project. 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 (e.g., conduit color scheme, composite cable construction), as well as all adjust/modify pay item numbers.

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
- ITS 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 ITS Plan Sheets in accordance with *FDM Section 328.6*. Plan Sheets shall be developed at either 1" = 40' or 1" = 100' scale. Ensure Plan Sheets clearly depict the existing and proposed ITS infrastructure including field devices, structures, cabinets, conduits, pull boxes, splice vaults, 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. Ensure all ITS devices—including existing and proposed—are properly identified with the corresponding device 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 ITS device. Callouts shall clearly identify the unique components of the WWDS—including clear designations of the primary, secondary, and remote sites, as appropriate. If areas within the plan sheet are heavily congested or require additional clarity, provide an inset with a higher level of detail and an increased scale (e.g., 1" = 10')

Logical Network Diagram – Develop Logical Network Diagram to illustrate the end-to-end communications schema for all ITS devices within the project limits. Clearly identify the appropriate network nodes (e.g., local hubs), master hubs, firewalls, cloud-hosted and/or on-premises servers, and communication mediums (e.g., fiber optics, cellular) necessary to connect each field device with the appropriate operational system.

Fiber Optic Splice Diagram – Develop Fiber Optic Splice Diagram to denote the existing and proposed physical connections of the fiber optic communications network in the field. These diagrams shall clearly illustrate the type of connection (e.g., splice, termination, unterminated, express) for each fiber strand within the cables impacted by the project. Additional information to be included within this detail includes cable information (e.g., fiber count, single mode versus multi-mode, origin-destination); individual fiber numbering; fiber and buffer tube color; connector type (e.g., LC, SC, ST); identification of networking equipment (e.g., splice enclosure, patch panel); stationing or physical location of splice and/or termination connection.

Wiring Diagram – Develop Wiring Diagrams to clearly depict the physical connections of field devices and in-cabinet equipment necessary to provide network communications to each system. This schematic shall illustrate power and communications connections between all field devices and in-cabinet equipment with labels for each type of wiring (e.g., 120VAC, 12-24VDC, CAT-6 (Ethernet), RS-422). Ensure the type of port (e.g., RJ-45, Db-9) is identified for each connection to in-cabinet equipment. Ensure grounding and surge protection equipment is depicted. Ensure the complete configuration for power and communications is clearly illustrated at the field level for each system comprised of multiple discrete components. Systems that are furnished as complete assemblies (e.g., WWDS) do not require detailed wiring diagrams and will only need to depict how network connectivity and power will be provided to the overall system. Unique wiring diagrams are not required for each cabinet. If multiple cabinets will be arranged similarly, typical diagrams may be developed. Ensure the specific project locations are identified for each typical diagram, as appropriate.

Managed Field Ethernet Switch Detail – Develop Managed Field Ethernet Switch Detail to illustrate the standard arrangement of field devices and in-cabinet equipment within the switch. Ensure all ports within the switch are appropriately numbered and the port type and status (e.g. occupied, open) is clearly identified. Ensure the end device connected to each port is depicted.

Electrical Service Detail – Develop Electrical Service Detail to depict the complete circuitry for local hubs from the utility service point to the final cabinet power panel for each circuit. This detail shall include the hardware (e.g., service meter, electrical disconnect, transformer, power panel), wiring, and connections necessary for a complete electrical circuit. Ensure each Electrical Service Detail includes the following information:

- Utility Service Provider and Pole No.
- Electrical Service Provider Voltage (incoming)
- Service Voltage (per conductor run)
- Circuitry Pathway (e.g., live, neutral, ground)
- Physical Connection Locations (e.g., termination, splice)
- Conductor Schedule (w/ size (AWG) and quantity of each run)
- Disconnect Size
- Transformer Type (e.g., step-up, step-down) and Size

Installation Detail / Mounting Detail – Develop Installation / Mounting Detail to identify the infrastructure necessary for a complete deployment of any field devices and/or systems (e.g., WWDS). Ensure these details clearly identify the location, quantity, material, and hardware necessary for the installation of individual components of a system. Ensure this detail provides the information necessary for the Contractor to assemble the discrete components into a complete system—including routing of individual conduit runs and sweeps into pull boxes, cabinets, and foundations; fastening of pole mounted enclosures, devices, and signs; mounting heights; and more.

Detection Coverage Detail – Develop Detection Coverage Detail to clearly denote the proposed detection zone(s) for each off-ramp facility depicting the minimum areas of coverage to identify wrong way driving events. Ensure two (2) distinct coverage areas are depicted for each ramp—detection zone and verification zone.

Cabinet Detail – Develop Cabinet Detail to identify the location, arrangement, size, and quantity of all in-cabinet equipment. Ensure this detail is to scale (relative) with each component and cabinet assembly drawn with accurate dimensions. Ensure the detail clearly denotes the total amount of rack units (RU) for the cabinet and identifies whether in-cabinet equipment is rack or shelf mounted. Ensure the Cabinet Detail include views both the front and back of the cabinet.

Concrete Pad Detail – Develop Concrete Pad Detail in accordance with *FDOT Standard Plans, Index 630*. Detail shall illustrate the size and arrangement of concrete pads for pull box (e.g., apron) and cabinet (e.g. technician pad) installations. Ensure the detail includes the total concrete pad dimensions, type and dimensions of pull boxes, minimum spacing between boxes, and thickness of concrete.

Conduit and Route Marker Detail – Develop Conduit and Route Marker Detail in accordance with *FDOT Standard Plans, Index 630*. Detail shall identify the specific information (e.g., phone number) and dimensions for the route marker cover, as well as installation requirements.

Maintenance of Communications Plans – Develop Maintenance of Communications (MOC) Plans depicting the work necessary to identify and protect in-place existing ITS communications and/or mitigate potential impacts within the project limits to maintain network uptime. Coordinate these plans with the Temporary Traffic Control Plans (TTCP) to identify the appropriate phase of construction for the work to be completed, as applicable. Ensure plans identify the area(s) impacted by construction, provide step-by-step directions to disconnect and re-establish communications, identify appropriate Department contact information, and detail maximum network downtime requirements. This information is acceptable in either text or plan sheet format.

The following items may not be required for inclusion within the Intelligent Transportation System (ITS) Plans set dependent upon if the ITS design is the lead or a component set. In the event the ITS design is a component set, all pertinent information shall be coordinated with the Engineer of Record for the Roadway plan set.

- **Cross Sections** – Develop Cross Sections in accordance with *FDM Section 319*.
- **Stormwater Pollution Prevention Plan** – Develop Stormwater Pollution Prevent Plan (SWPPP) in accordance with *FDM Section 320*.
- **Temporary Traffic Control Plan** – Develop Temporary Traffic Control Plan (TTCP) in accordance with *FDM Section 321*.

Estimated Quantities Report (EQR)

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

Modified Special Provision (MSP)

Modified Special Provisions (MSP) shall be required when an implemented Specification (e.g., Section 630) 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.

The following identifies potential MSPs that may be necessary for projects inclusive of WWDS:

- Section 660 – Vehicle Detection System
- Section 676 – Traffic Cabinets
- Section 684 – Managed Field Ethernet Switch

For previously approved examples refer to **Appendix B** – Sample MSPs.

Technical Special Provision (TSP)

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

The following identifies potential TSPs that may be necessary for projects inclusive of WWDS:

- Section T612 – Device Integration and Testing
- Section T633 – Multi-Conductor Communication Cable
- Section T639 – Electrical Power Service Transformer

For previously approved examples refer to **Appendix B** – Sample MSPs.

Proprietary Product Certification (PPC)

Based on the distinct needs of the District, 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 or unique functionality. 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 cflsmartroads.com.

The following identifies potential PPCs that may be necessary for projects inclusive of WWDS:

- **CyberLock®** – Electronic Cylinders (Cabinet Locks)
- **Alpha® FXM** – Uninterruptible Power Supply (UPS)

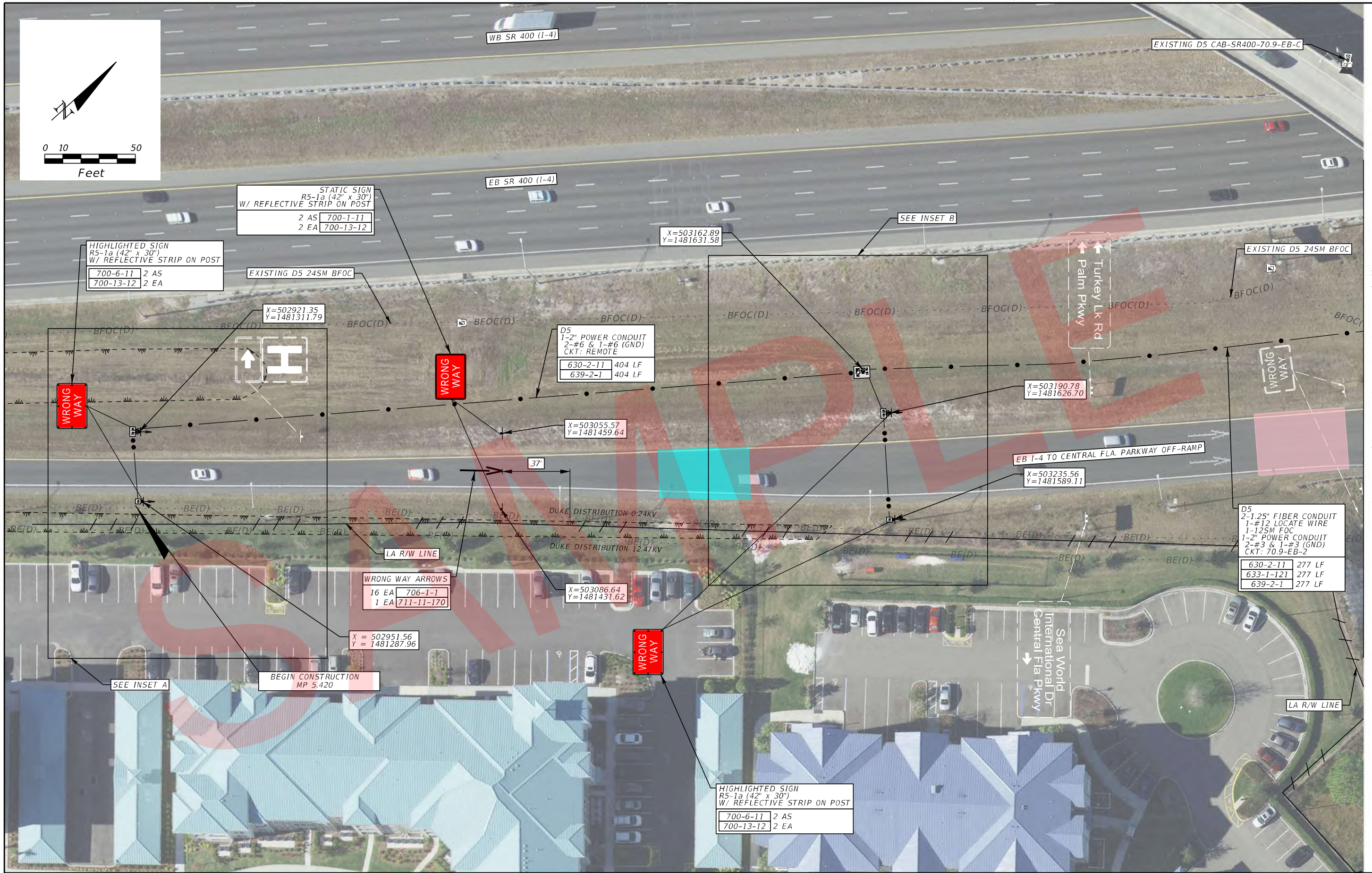
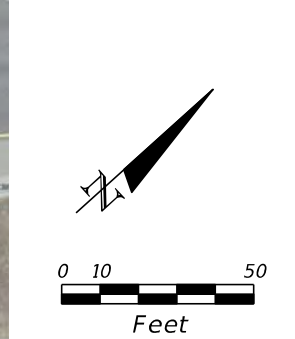
For previously approved examples refer to **Appendix D** – Example PPCs.

Section V – References

1. FDOT Design Bulletin 19-03, *Wrong-way Driving Advanced Countermeasures at Interchange Exit Ramps*, dated July 3, 2019. ([LINK](#))
2. *SunGuide® Software System Wrong-Way Driving Concept of Operations*, latest version.
3. *FDOT District Five – ITS Plans Review Checklist*, latest version. ([LINK](#))
4. *FDOT Design Manual (FDM)*, latest version.
5. *FDOT Standard Plans*, latest version.
6. *FDOT Standard Specifications for Road and Bridge Construction*, latest version.
7. *Manual on Uniform Traffic Control Devices (MUTCD)*, 2009 Edition w/ Revisions 1 and 2.

Appendix A – Sample Plans





STATIC SIGN
R5-1a (42" x 30")
W/ REFLECTIVE STRIP ON POST
2 AS 700-1-11
2 EA 700-13-12

HIGHLIGHTED SIGN
R5-1a (42" x 30")
W/ REFLECTIVE STRIP ON POST
700-6-11 2 AS
700-13-12 2 EA

D5
1-2" POWER CONDUIT
2-#6 & 1-#6 (GND)
CKT: REMOTE
630-2-11 404 LF
639-2-1 404 LF

D5
2-1.25" FIBER CONDUIT
1-#12 LOCATE WIRE
1-125M FOC
1-2" POWER CONDUIT
2-#3 & 1-#3 (GND)
CKT: 70.9-EB-2
630-2-11 277 LF
633-1-121 277 LF
639-2-1 277 LF

WRONG WAY ARROWS
16 EA 706-1-1
1 EA 711-11-170

HIGHLIGHTED SIGN
R5-1a (42" x 30")
W/ REFLECTIVE STRIP ON POST
700-6-11 2 AS
700-13-12 2 EA

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ALEXANDER TEAL MIMS, P.E. PE No. 77095
Traffic Engineering Data Solutions, Inc.
80 Spring Vista Drive Phone: 386.753.0558
DeBary, FL 32713 Fax: 386.753.0778

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 400	ORANGE	446159-1-52-01

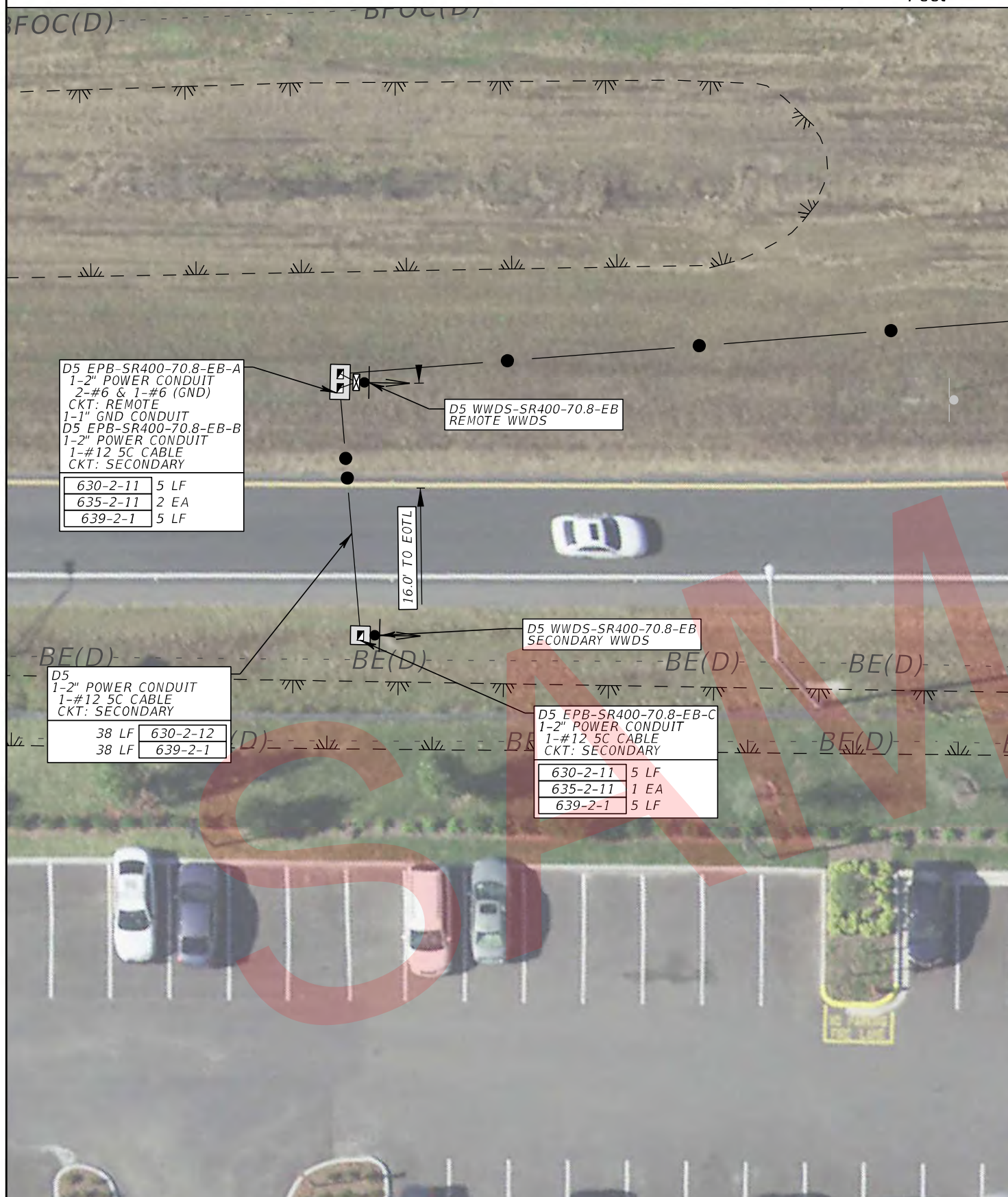
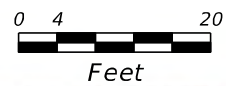
ITS PLAN SHEET (1)
I-4 EB AT EXIT 71
(CENTRAL FL. PKWY)

SHEET NO.
IT-16

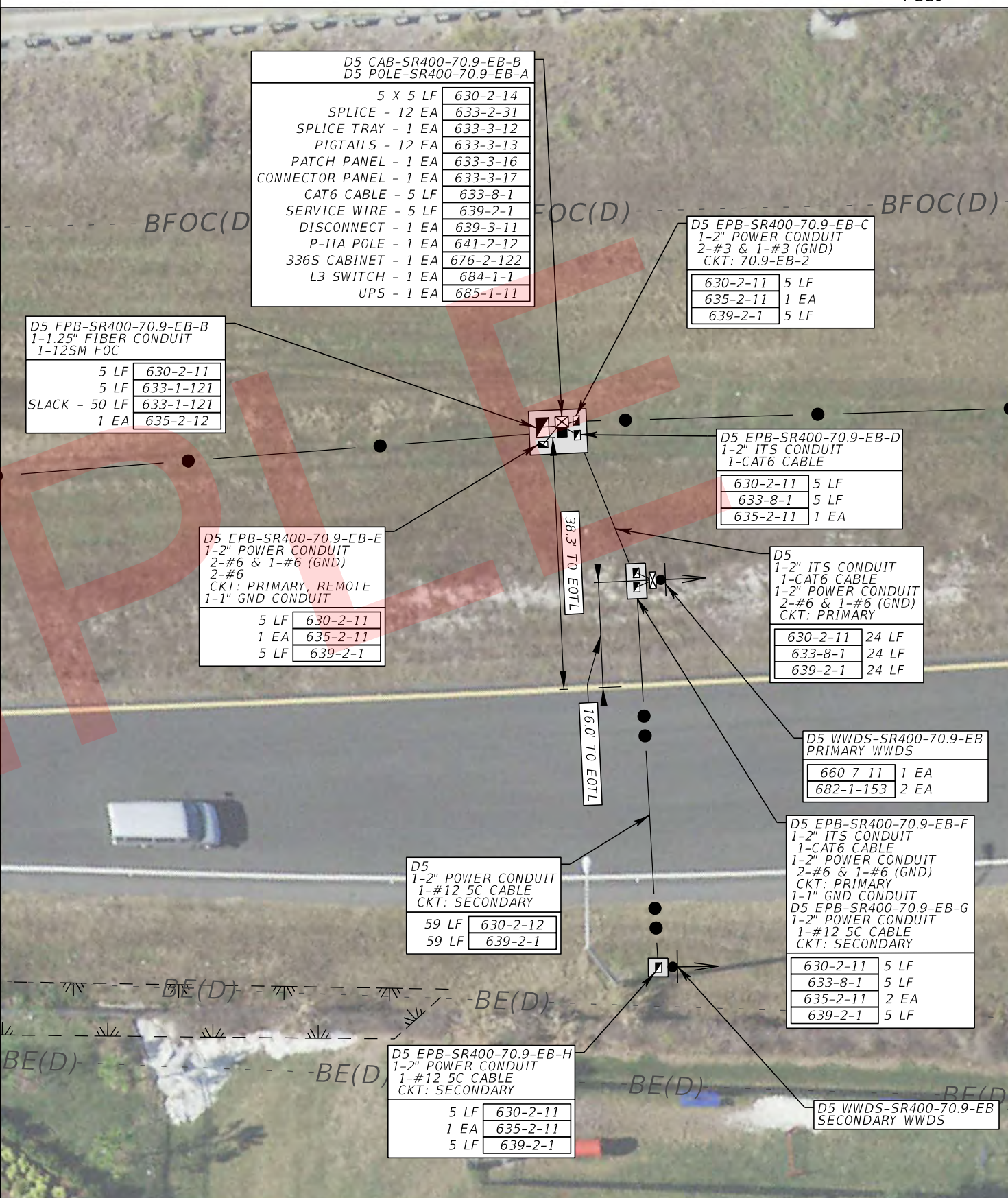
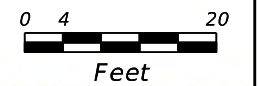
MATCHLINE (SEE ITS PLAN SHEET (3))

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INSET A



INSET B



REVISIONS				ALEXANDER TEAL MIMS, P.E. PE No. 77095 Traffic Engineering Data Solutions, Inc. 80 Spring Vista Drive Phone: 386.753.0558 DeBary, FL 32713 Fax: 386.753.0778	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			ITS PLAN SHEET (2) I-4 EB AT EXIT 71 (CENTRAL FL. PKWY.)	SHEET NO. IT-17
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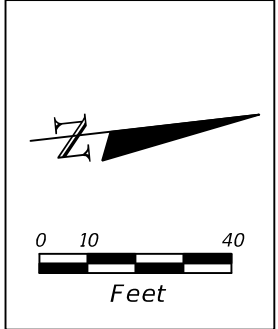
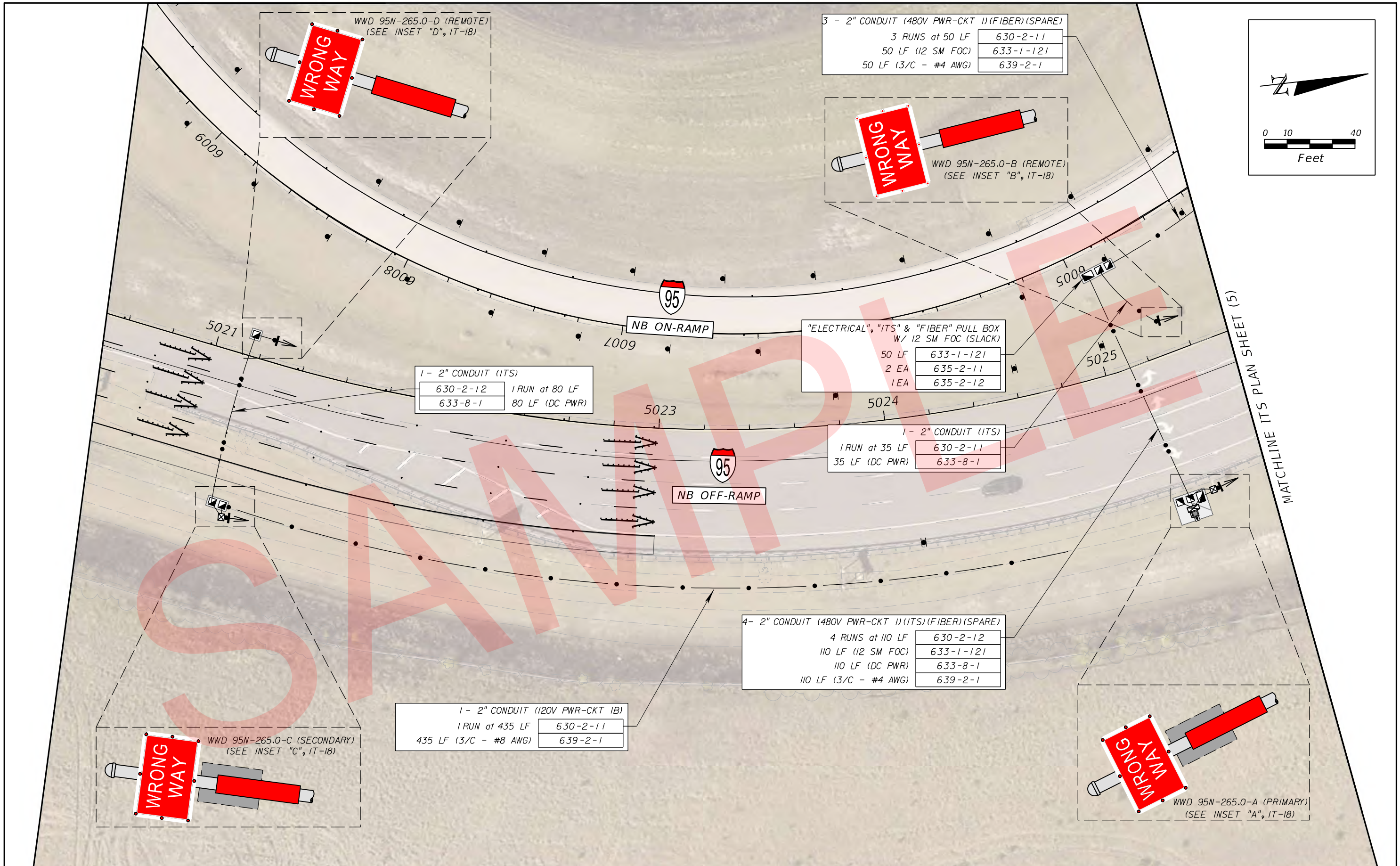
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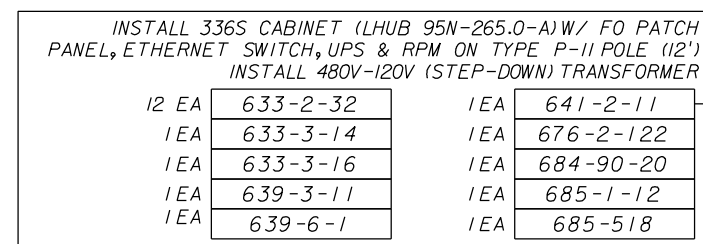
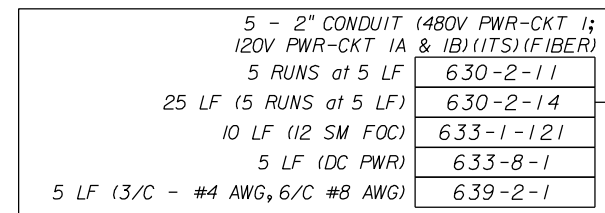
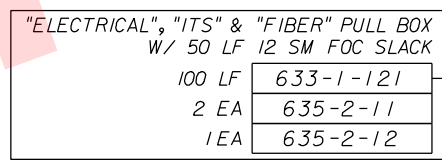
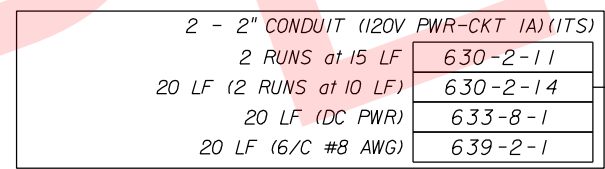
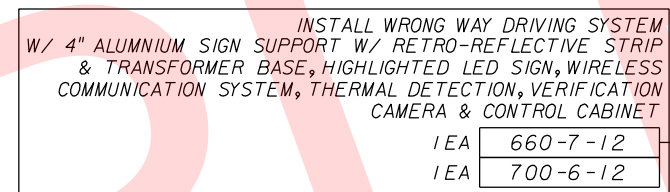
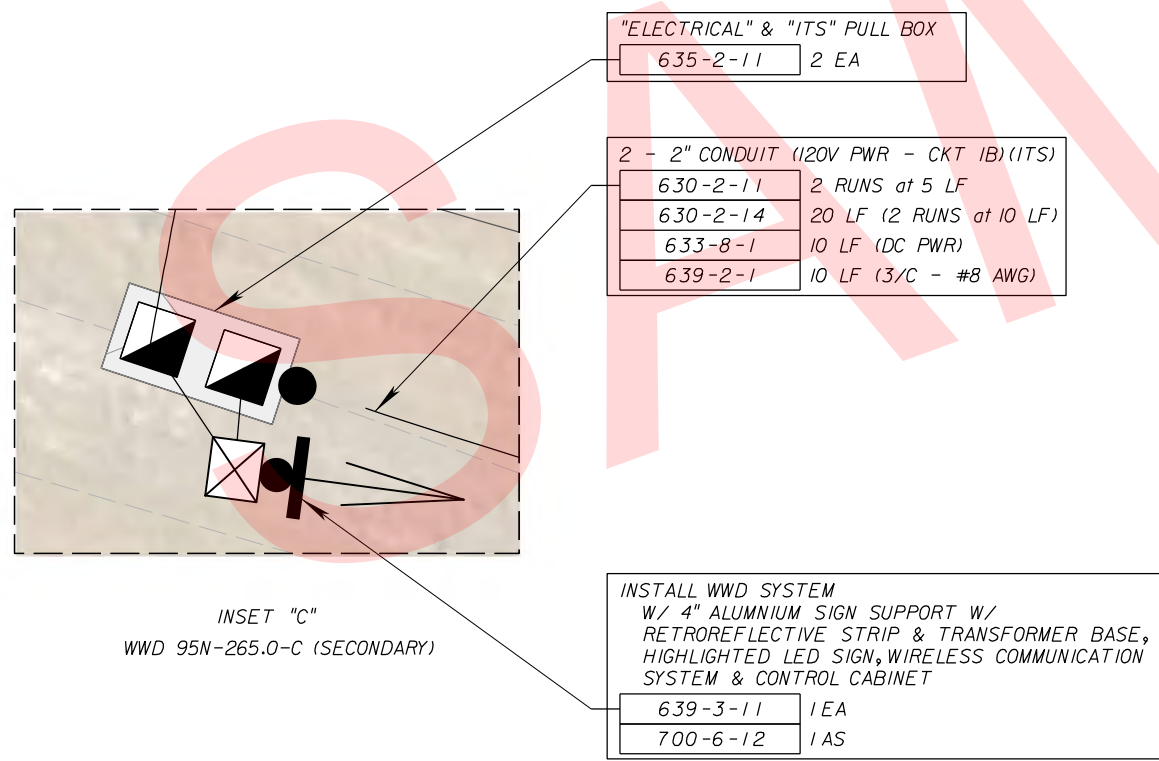
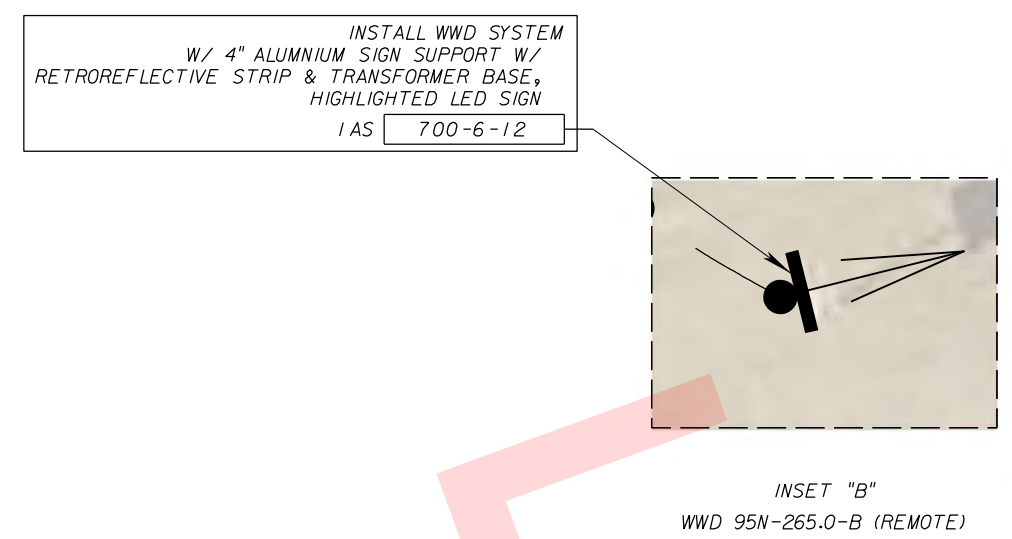
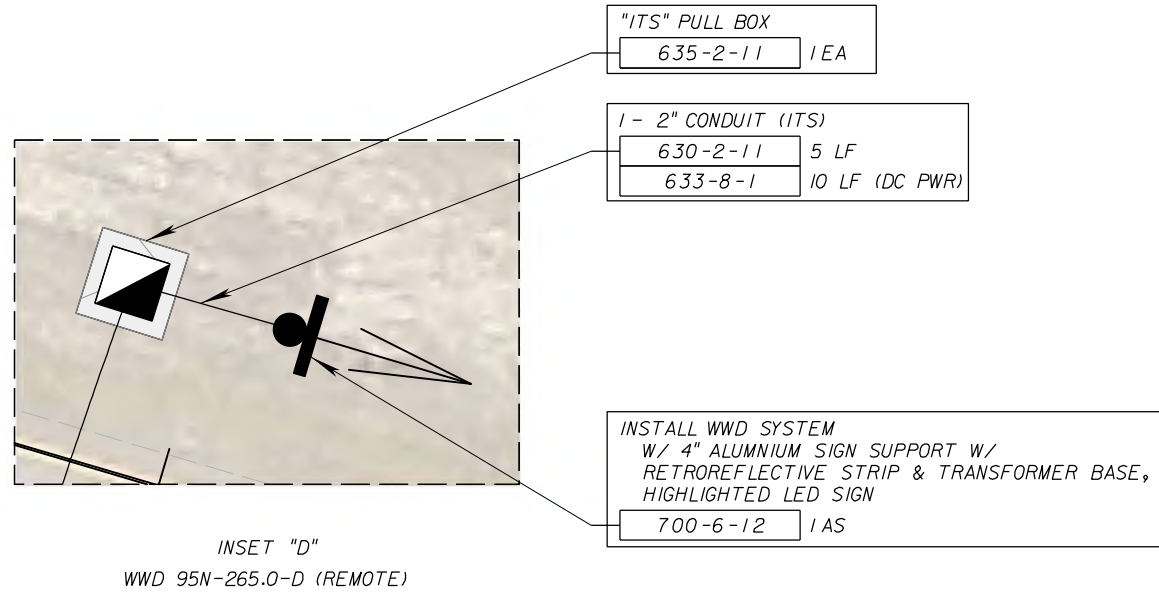
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DATE	DESCRIPTION	DATE	DESCRIPTION	ROAD NO.	COUNTY	FINANCIAL PROJECT ID	

ALEXANDER TEAL MIMS, P.E. PE No. 77095
 Traffic Engineering Data Solutions, Inc.
 80 Spring Vista Drive Phone: 386.753.0558
 DeBary, FL 32713 Fax: 386.753.0778

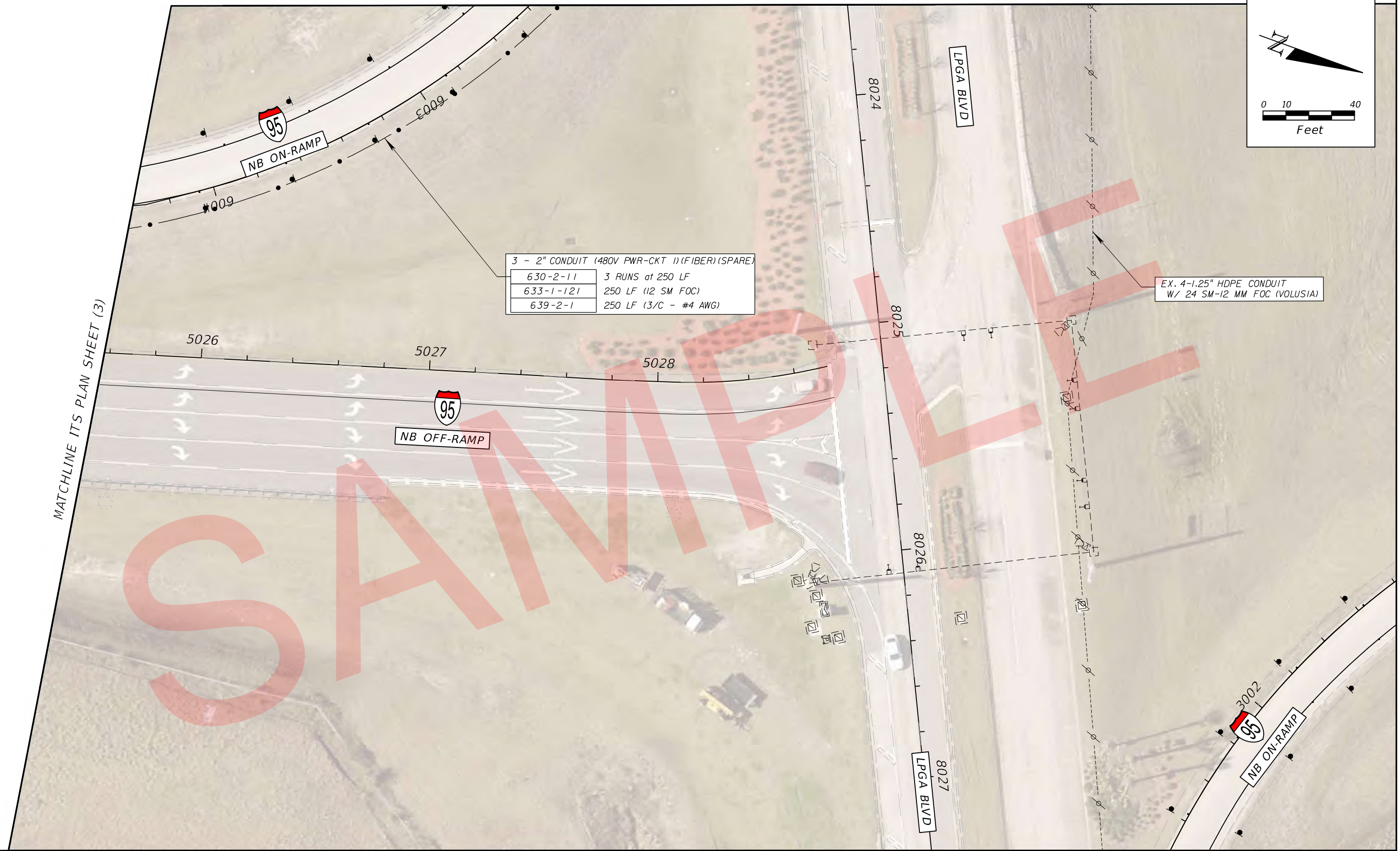
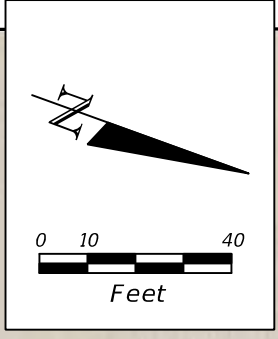


REVISIONS				FLORIDA DEPARTMENT OF TRANSPORTATION 719 SOUTH WOODLAND BLVD DELAND, FLORIDA 32720 (386) 943-5000 JEREMY H. DILMORE, P.E. #67510	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			ITS PLAN SHEET (3)	SHEET NO. IT-17
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 9	VOLUSIA	441133-1-52-01		

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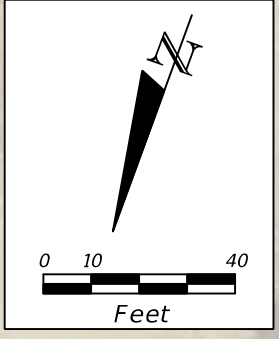
3 - 2" CONDUIT (480V PWR-CKT 1) (FIBER) (SPARE)	
630-2-11	3 RUNS at 250 LF
633-1-121	250 LF (12 SM FOC)
639-2-1	250 LF (3/C - #4 AWG)

EX. 4-1.25" HDPE CONDUIT
W/ 24 SM-12 MM FOC (VOLUSIA)

MATCHLINE ITS PLAN SHEET (3)

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DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID	
					SR 9	VOLUSIA	441133-1-52-01	ITS PLAN SHEET (5)



3 - 2" CONDUIT (480V PWR-CKT 1)(FIBER)(SPARE)		
3 RUNS at 342 LF	630-2-11	
342 LF (12 SM FOC)	633-1-121	
342 LF (3/C - #4 AWG)	639-2-1	

3 - 2" CONDUIT (480V PWR-CKT 1)(FIBER)(SPARE)		
630-2-12	3 RUNS at 141 LF	
633-1-121	141 LF (12 SM FOC)	
639-2-1	141 LF (3/C - #4 AWG)	

"ELECTRICAL" & "FIBER" PULL BOX W/ 12 SM FOC (SLACK)	
633-1-121	50 LF
635-2-11	1 EA
635-2-12	1 EA

3 - 2" CONDUIT (480V PWR-CKT 1)(FIBER)(SPARE)		
3 RUNS at 156 LF	630-2-11	
156 LF (12 SM FOC)	633-1-121	
156 LF (3/C - #4 AWG)	639-2-1	

"ELECTRICAL" & "FIBER" PULL BOX W/ 12 SM FOC (SLACK)	
50 LF	633-1-121
1 EA	635-2-11
1 EA	635-2-12

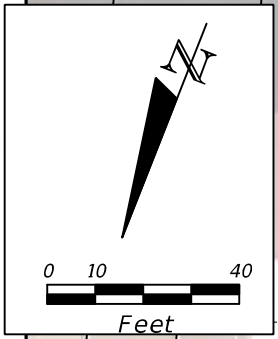
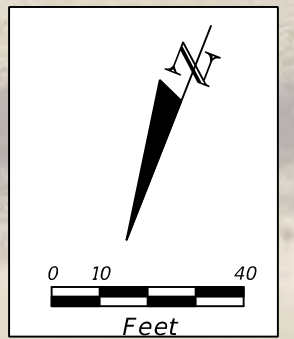
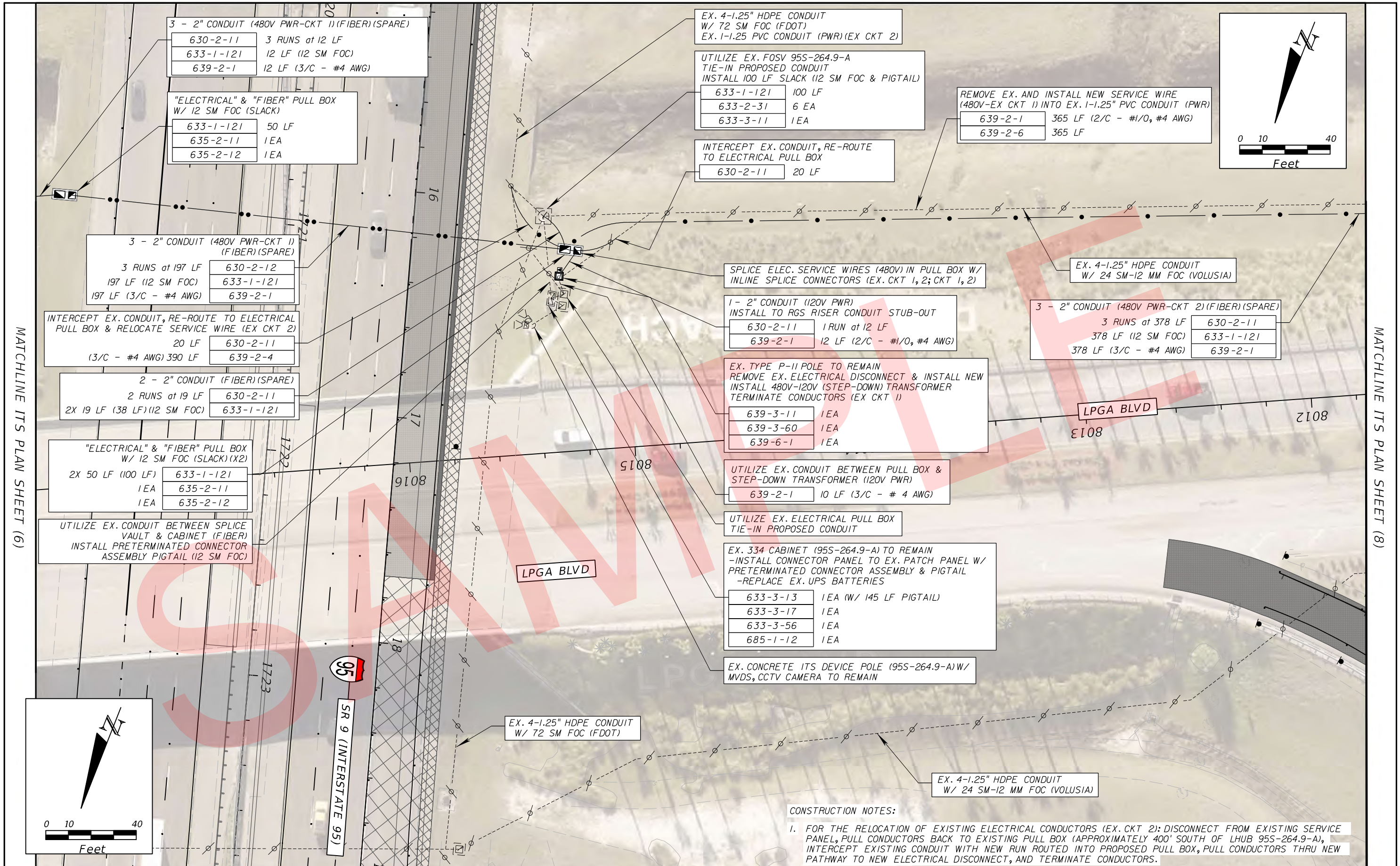
EX. 4-1.25" HDPE CONDUIT
W/ 24 SM-12 MM FOC (VOLUSIA)

MATCH LINE ITS PLAN SHEET (5)

MATCH LINE ITS PLAN SHEET (7)

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DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 9	VOLUSIA	441133-1-52-01		



MATCHLINE ITS PLAN SHEET (6)

MATCHLINE ITS PLAN SHEET (8)

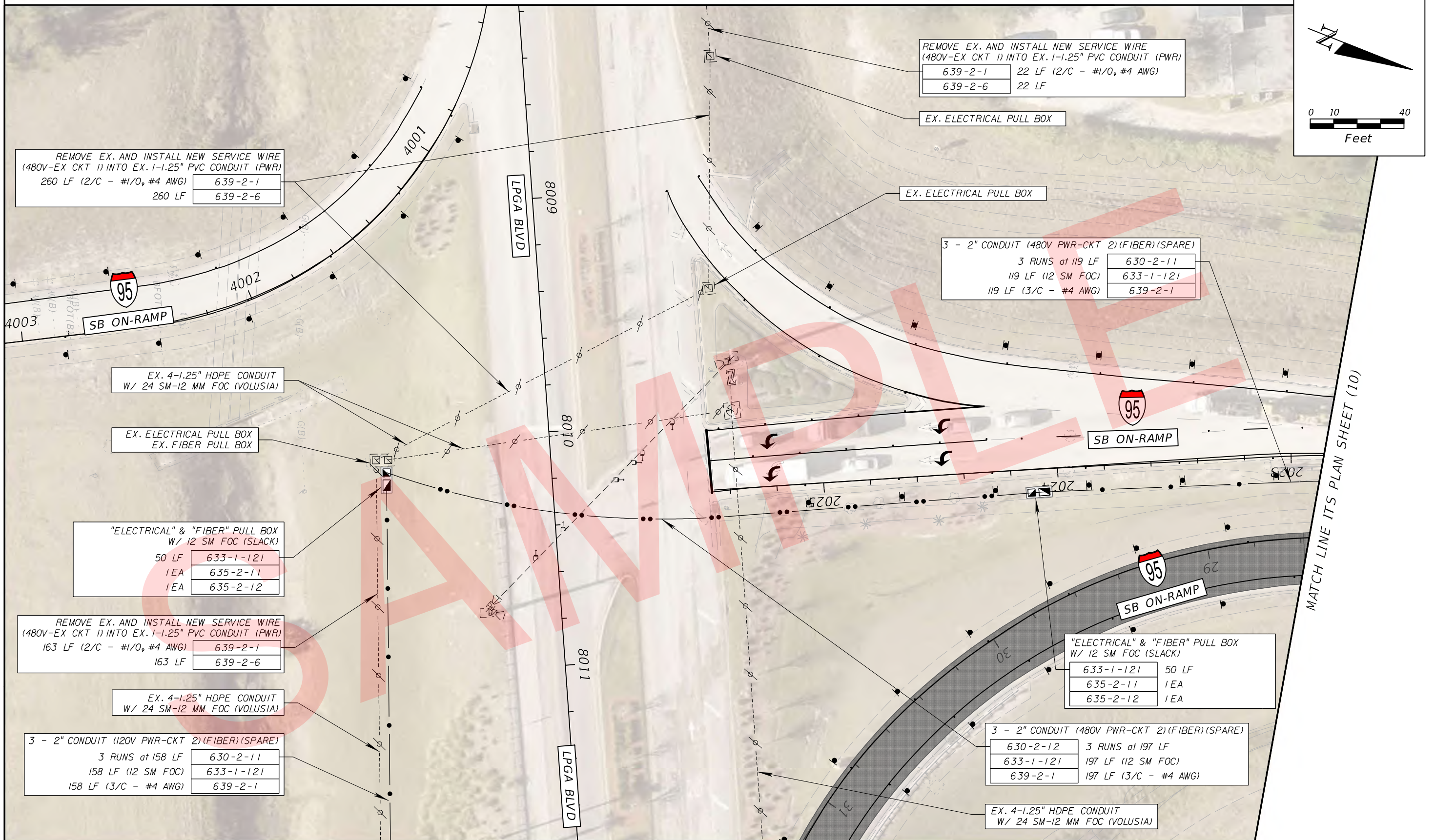
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CONSTRUCTION NOTES:

- FOR THE RELOCATION OF EXISTING ELECTRICAL CONDUCTORS (EX. CKT 2): DISCONNECT FROM EXISTING SERVICE PANEL, PULL CONDUCTORS BACK TO EXISTING PULL BOX (APPROXIMATELY 400' SOUTH OF LHUB 95S-264.9-A), INTERCEPT EXISTING CONDUIT WITH NEW RUN ROUTED INTO PROPOSED PULL BOX, PULL CONDUCTORS THRU NEW PATHWAY TO NEW ELECTRICAL DISCONNECT, AND TERMINATE CONDUCTORS.

REVISIONS				FLORIDA DEPARTMENT OF TRANSPORTATION 719 SOUTH WOODLAND BLVD DELAND, FLORIDA 32720 (386) 943-5000 JEREMY H. DILMORE, P.E. #67510	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SHEET NO. IT-21
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID	
					SR 9	VOLUSIA	441133-1-52-01	

ITS PLAN SHEET (7)



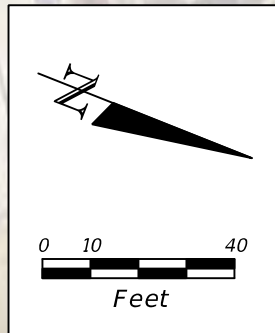
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

FLORIDA DEPARTMENT OF TRANSPORTATION
 719 SOUTH WOODLAND BLVD
 DELAND, FLORIDA 32720
 (386) 943-5000
 JEREMY H. DILMORE, P.E. #67510

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	VOLUSIA	441133-1-52-01

PLAN SHEET (8)

SHEET NO.
IT-22



N TOMOKA FARMS RD

EX. POWER SERVICE LOCATION (120/240V)

EX. TYPE P-II POLE W/ ELECTRICAL METER TO REMAIN
 REMOVE EX. & INSTALL NEW ELECTRICAL DISCONNECT
 INSTALL 120/240V-480V (STEP-UP) TRANSFORMER
 TERMINATE CONDUCTORS (EX CKT 1)

1 EA	639-3-11
1 EA	639-3-60
1 EA	639-6-1

EX. ELECTRICAL PULL BOX

REMOVE EX. AND INSTALL NEW SERVICE WIRE
 (480V-EX CKT 1) INTO EX. 1-1.25" PVC CONDUIT (PWR)

69 LF (2/C - #1/0, #4 AWG)	639-2-1
69 LF	639-2-6

EX. ELECTRICAL PULL BOX

REMOVE EX. AND INSTALL NEW SERVICE WIRE
 (480V-EX CKT 1) INTO EX. 1-1.25" PVC CONDUIT (PWR)

281 LF (2/C - #1/0, #4 AWG)	639-2-1
281 LF	639-2-6

8003

8004

8005

8006

8007

8008

LPGA BLVD

4000

MATCH LINE ITS PLAN SHEET (8)

SAMPLE

REVISIONS			
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 719 SOUTH WOODLAND BLVD
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 (386) 943-5000
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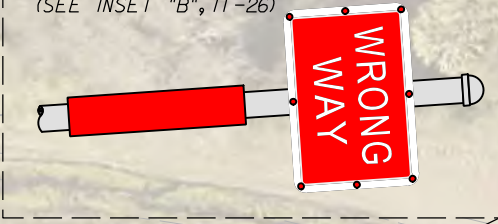
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	VOLUSIA	441133-1-52-01

PLAN SHEET (9)

SHEET NO.
IT-23

3 - 2" CONDUIT (480V PWR-CKT 2)(FIBER)(SPARE)	
630-2-11	3 RUNS at 138 LF
633-1-121	138 LF (12 SM FOC)
639-2-1	138 LF (3/C - #4 AWG)

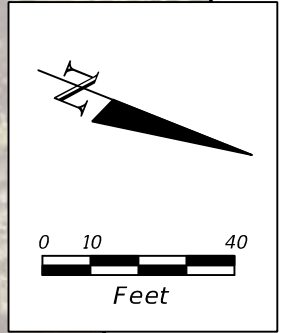
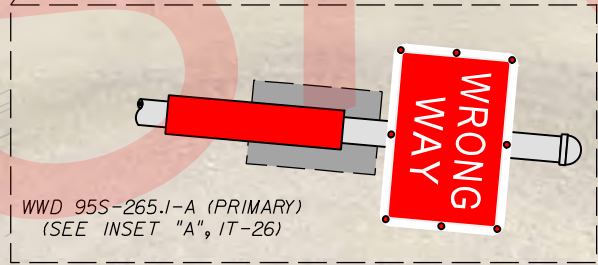
WWD 95S-265.1-B (REMOTE)
(SEE INSET "B", IT-26)



1 - 2" CONDUIT (ITS)	
630-2-12	1 RUN at 60 LF
633-8-1	60 LF (DC PWR)

1 - 2" CONDUIT (120V PWR-CKT 2B)	
1 RUN at 330 LF	
630-2-11	330 LF (3/C - #8 AWG)
639-2-1	

WWD 95S-265.1-A (PRIMARY)
(SEE INSET "A", IT-26)



MATCH LINE ITS PLAN SHEET (8)

MATCH LINE ITS PLAN SHEET (11)

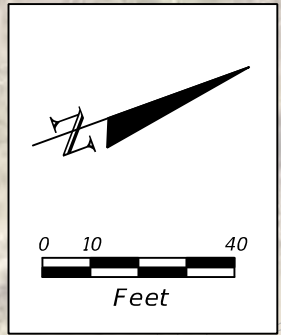
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

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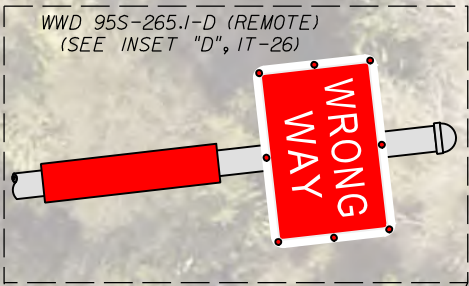
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	VOLUSIA	441133-1-52-01

ITS PLAN SHEET (10)

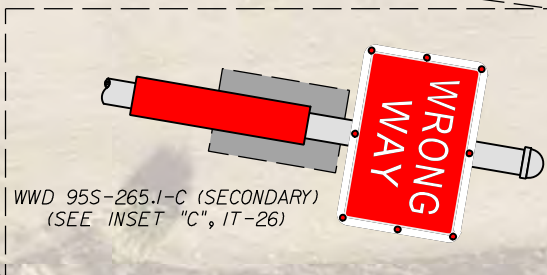
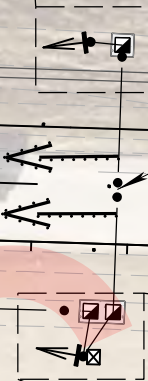
SHEET NO.
IT-24



MATCH LINE ITS PLAN SHEET (10)



1 - 2" CONDUIT (ITS)	
630-2-12	1 RUN at 60 LF
633-8-1	60 LF (DC PWR)



1 - 2" CONDUIT (120V PWR-CKT 2B)	
630-2-11	1 RUN at 58 LF
639-2-1	58 LF (3/C - #8 AWG)

201

2017

910

2015



SB ON-RAMP

2014

2013

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

FLORIDA DEPARTMENT OF TRANSPORTATION
719 SOUTH WOODLAND BLVD
DELAND, FLORIDA 32720
(386) 943-5000
JEREMY H. DILMORE, P.E. #67510

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	VOLUSIA	441133-1-52-01

ITS PLAN SHEET (11)

SHEET NO.
IT-25

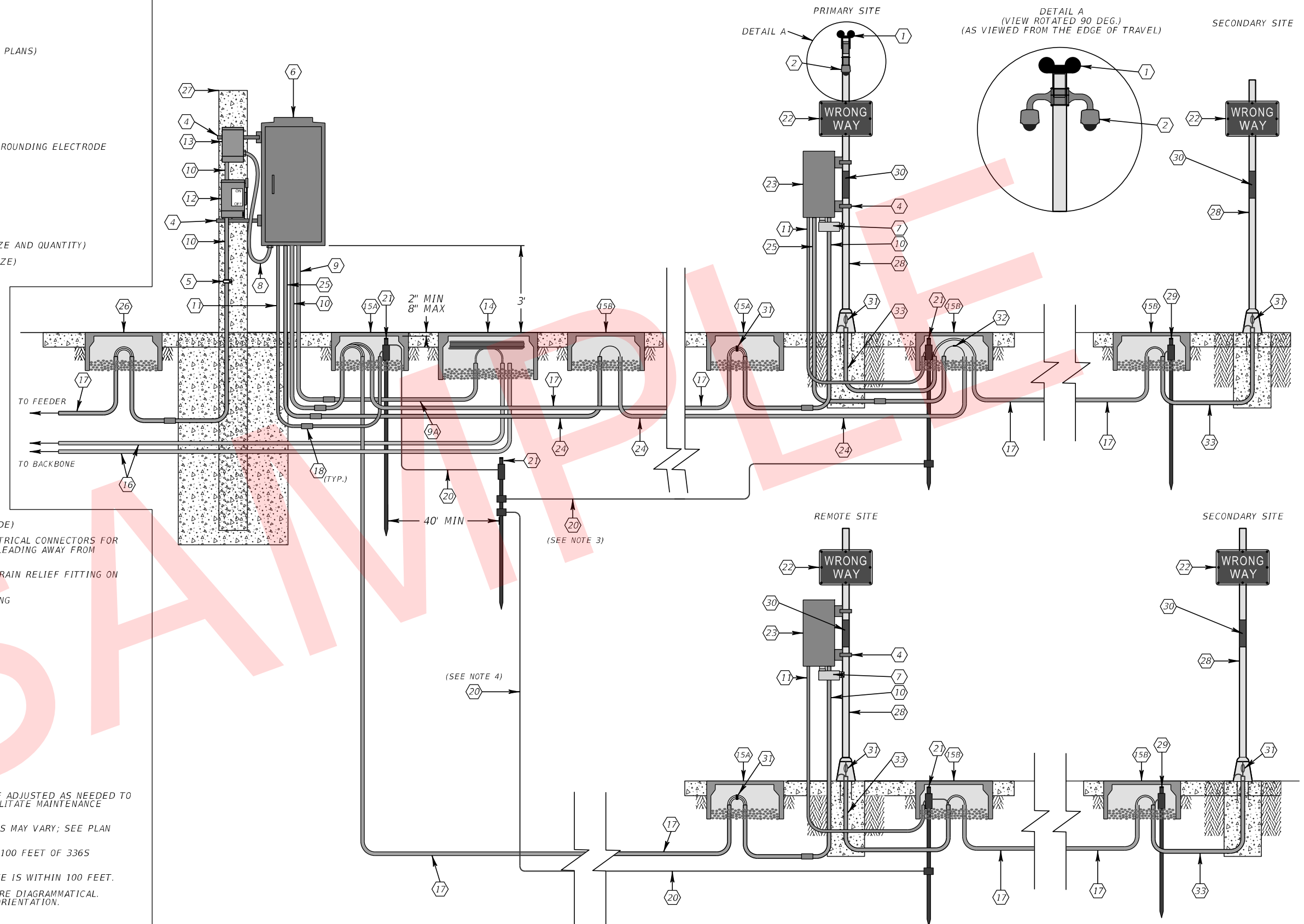
SAMPLE

LEGEND

- 1 THERMAL SENSOR
- 2 VERIFICATION CAMERA
- 3 NOT USED
- 4 STAINLESS STEEL STRAPS
- 5 CONDUIT STRAPS (3' O.C. TYPICAL)
- 6 TYPE 336S POLE MOUNTED CABINET (ORIENTATION PER PLANS)
- 7 TYPE LB 2" CONDUIT
- 8 1" LIQUID TIGHT FLEXIBLE METAL CONDUIT FOR POWER
- 9 1 1/4" RMC CONDUIT (FIBER)
- 9A 1 1/4" HDPE CONDUIT (FIBER)
- 10 2" RMC CONDUIT (POWER)
- 11 1" RMC CONDUIT FOR CABINET #2 AWG BARE COPPER GROUNDING ELECTRODE CONDUCTOR (BOND TO GROUNDING ROD)
- 12 ELECTRICAL DISCONNECT
- 13 AC TRANSFORMER (WHEN REQUIRED)
- 14 FIBER OPTIC PULL BOX
- 15A ELECTRICAL PULL BOX (120V UPS OUTPUT)
- 15B ELECTRICAL PULL BOX (CAT-6/DC POWER)
- 16 HDPE CONDUIT FOR FIBER (SEE PLAN SHEETS FOR SIZE AND QUANTITY)
- 17 HDPE CONDUIT FOR POWER (SEE PLAN SHEETS FOR SIZE)
- 18 CONDUIT COUPLER
- 19 NOT USED
- 20 #2 AWG BARE SOLID COPPER GROUNDING ELECTRODE CONDUCTOR (BOND TO GROUNDING ROD)
- 21 3/8" X 20' MIN. GROUNDING ELECTRODE (EXTEND OR ADD ADDITIONAL GROUND RODS TO ACHIEVE 5 OHM MAX. RESISTANCE TO GROUND) ROD PLACEMENT PER FDOT INDEX 641-020
- 22 WRONG WAY HIGHLIGHTED SIGN PANEL
- 23 NEMA 3R POLE MOUNTED CABINET (ORIENTATION PER SITE DETAILS)
- 24 ITS HDPE CONDUIT (SEE PLAN SHEETS FOR SIZE)
- 25 2" RMC CONDUIT (CAT-6)
- 26 ELECTRICAL PULL BOX (POWER TO LOCAL HUB)
- 27 TYPE P-II SERVICE POLE
- 28 ALUMINUM SIGN POST WITH TRANSFORMER BASE PER STANDARD INDEX 700-120. INSTALL TOP CAP.
- 29 3/8" X 20' MIN. GROUNDING ELECTRODE
- 30 RETROREFLECTIVE SIGN STRIP (RED, 2' LENGTH, 2" WIDE)
- 31 ONE-POLE, NON-FUSED, WATERTIGHT BREAKAWAY ELECTRICAL CONNECTORS FOR POWER. INSTALL STRAIN RELIEF FITTING ON CONDUIT LEADING AWAY FROM BREAKAWAY POST
- 32 BREAKAWAY CONNECTOR FOR CAT-6 CABLE. INSTALL STRAIN RELIEF FITTING ON CONDUIT LEADING AWAY FROM BREAKAWAY POST
- 33 2" PVC CONDUIT (DC POWER/GND) EMBEDDED IN FOOTING

- NOTES:
1. DISCONNECT AND TRANSFORMER MOUNTING HEIGHT MAY BE ADJUSTED AS NEEDED TO FIT ON THE POLE. ENSURE THAT MOUNTING HEIGHTS FACILITATE MAINTENANCE ACCESS.
 2. NUMBER AND USAGE OF PROPOSED UNDERGROUND CONDUITS MAY VARY; SEE PLAN SHEETS FOR FURTHER DETAIL.
 3. BOND TO GROUND ARRAYS WHEN PRIMARY SITE IS WITHIN 100 FEET OF 336S CABINET.
 4. BOND TO PRIMARY SITE GROUND ARRAY WHEN PRIMARY SITE IS WITHIN 100 FEET.
 5. CABINET AND SIGN PANEL ORIENTATION ON THIS DETAIL ARE DIAGRAMMATICAL. REFER TO PLAN SHEETS AND SITE DETAILS FOR ACTUAL ORIENTATION.

WWDS INSTALLATION DETAIL - HARDWIRE
N.T.S.



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ALEXANDER TEAL MIMS, P.E. PE No. 77095
 Traffic Engineering Data Solutions, Inc.
 80 Spring Vista Drive Phone: 386.753.0558
 DeBary, FL 32713 Fax: 386.753.0778

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 400	VARIES	446159-1-52-01

ITS INSTALLATION
DETAILS

SHEET NO.
IT-64

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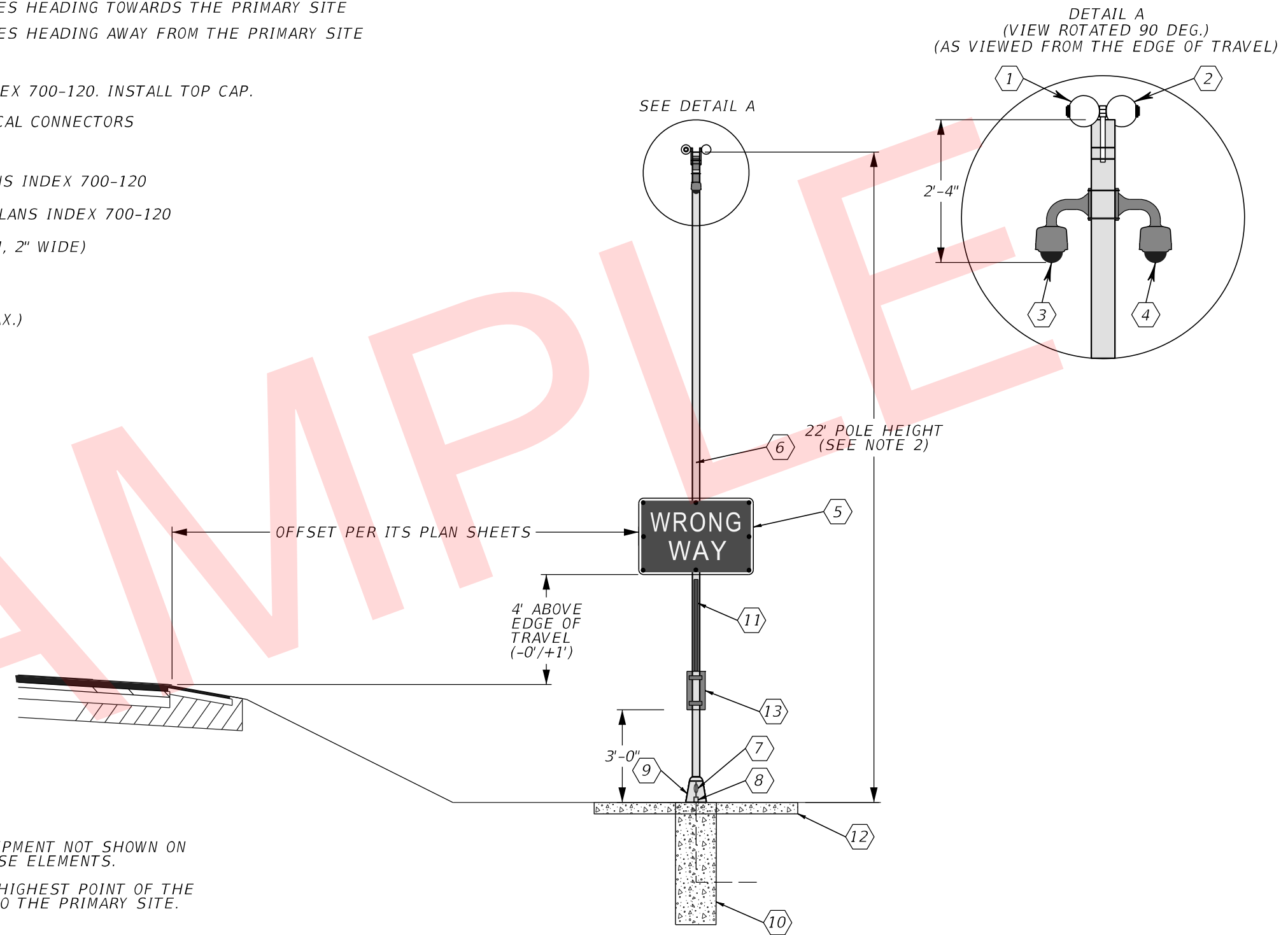
PRIMARY SITE DETAIL - HARDWIRE

N.T.S.

LEGEND

- ① INCOMING THERMAL SENSOR (SEE NOTE 2)
- ② OUTGOING THERMAL SENSOR (SEE NOTE 2)
- ③ INCOMING CAMERA AIMED FOR VIEWING VEHICLES HEADING TOWARDS THE PRIMARY SITE
- ④ OUTGOING CAMERA AIMED FOR VIEWING VEHICLES HEADING AWAY FROM THE PRIMARY SITE
- ⑤ 42" X 30" R5-1A HIGHLIGHTED SIGN
- ⑥ ALUMINUM SIGN POST PER STANDARD PLAN INDEX 700-120. INSTALL TOP CAP.
- ⑦ NON-FUSED, WATERTIGHT BREAKAWAY ELECTRICAL CONNECTORS
- ⑧ STRAIN RELIEF FITTING
- ⑨ TRANSFORMER BASE PER FDOT STANDARD PLANS INDEX 700-120
- ⑩ CONCRETE FOUNDATION PER FDOT STANDARD PLANS INDEX 700-120
- ⑪ RETROREFLECTIVE SIGN STRIP (RED, 2' LENGTH, 2" WIDE)
- ⑫ CONCRETE APRON PER APRON DETAILS
- ⑬ NEMA 3R POLE MOUNTED CABINET (36" x 24" MAX.)

SAMPLE



NOTES:

1. CONDUITS, PULL BOXES, AND ELECTRICAL SERVICE EQUIPMENT NOT SHOWN ON THIS SHEET. REFER TO INSTALLATION DETAIL FOR THESE ELEMENTS.
2. MOUNT THERMAL DETECTORS AT LEAST 20' ABOVE THE HIGHEST POINT OF THE RAMP'S PAVEMENT SURFACE THAT IS PERPENDICULAR TO THE PRIMARY SITE.

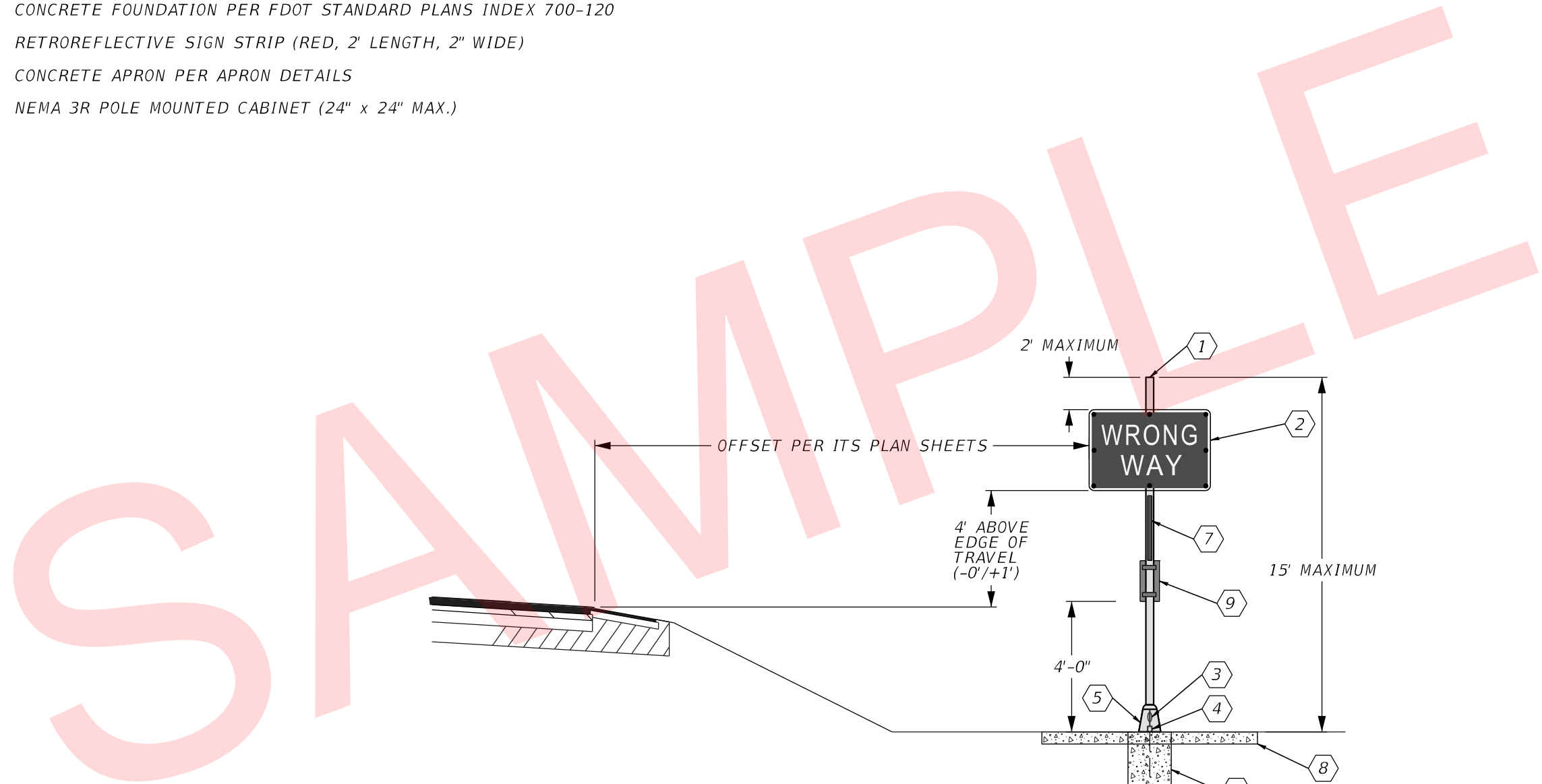
REVISIONS				ALEXANDER TEAL MIMS, P.E. PE No. 77095 Traffic Engineering Data Solutions, Inc. 80 Spring Vista Drive Phone: 386.753.0558 DeBary, FL 32713 Fax: 386.753.0778	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			ITS INSTALLATION DETAILS	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		IT-65
						SR 400	VARIES		446159-1-52-01

REMOTE SITE DETAIL - HARDWIRE

N.T.S.

LEGEND

- ① ALUMINUM SIGN POST PER STANDARD PLAN INDEX 700-120. INSTALL TOP CAP.
- ② 42" X 30" R5-1A HIGHLIGHTED SIGN
- ③ NON-FUSED, WATERTIGHT BREAKAWAY ELECTRICAL CONNECTORS
- ④ STRAIN RELIEF FITTING
- ⑤ TRANSFORMER BASE PER FDOT STANDARD PLANS INDEX 700-120
- ⑥ CONCRETE FOUNDATION PER FDOT STANDARD PLANS INDEX 700-120
- ⑦ RETROREFLECTIVE SIGN STRIP (RED, 2' LENGTH, 2" WIDE)
- ⑧ CONCRETE APRON PER APRON DETAILS
- ⑨ NEMA 3R POLE MOUNTED CABINET (24" x 24" MAX.)



NOTES:

1. CONDUITS, PULL BOXES, AND ELECTRICAL SERVICE EQUIPMENT NOT SHOWN ON THIS SHEET. REFER TO INSTALLATION DETAIL FOR THESE ELEMENTS.

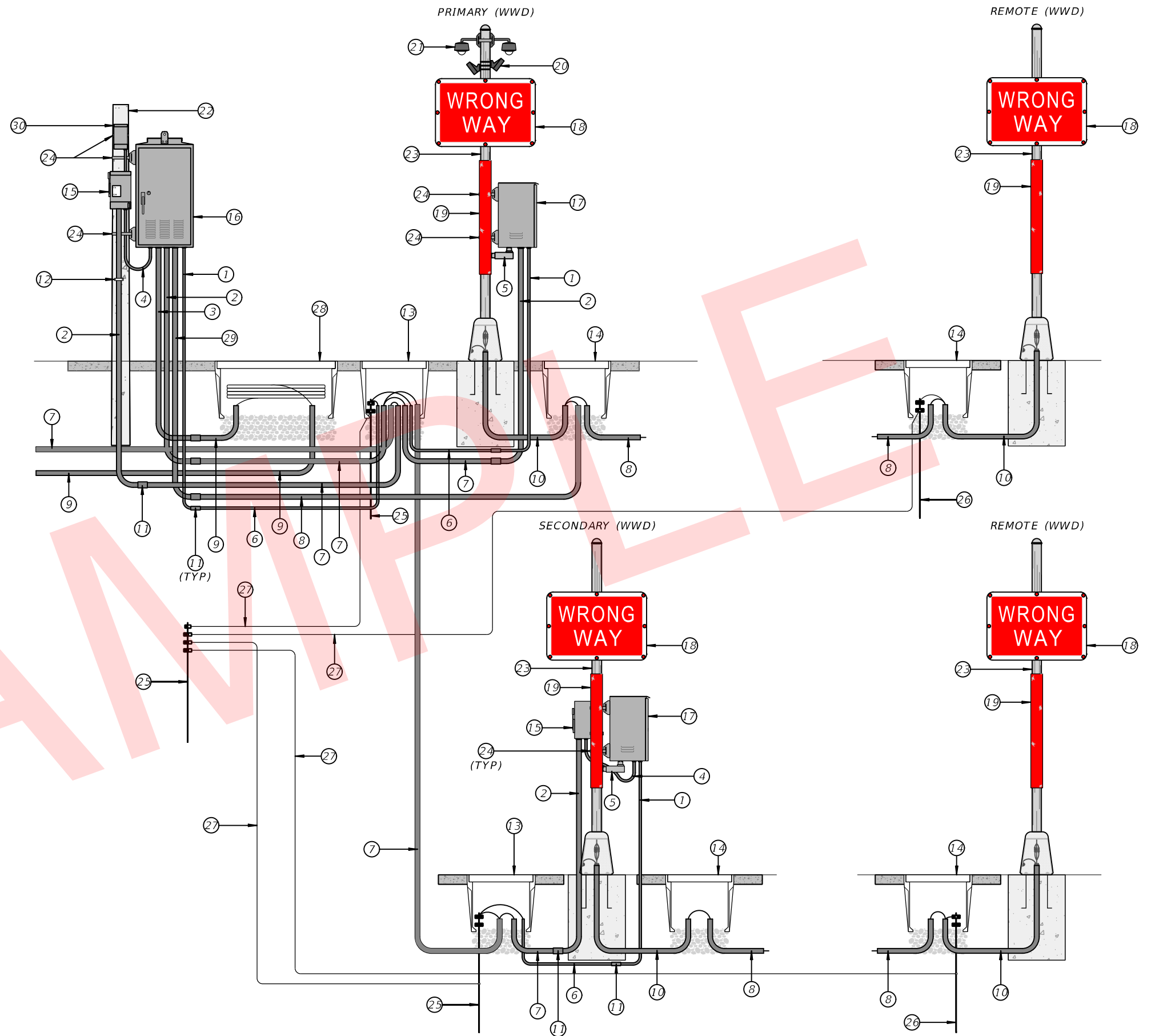
REVISIONS				ALEXANDER TEAL MIMS, P.E. PE No. 77095 Traffic Engineering Data Solutions, Inc. 80 Spring Vista Drive Phone: 386.753.0558 DeBary, FL 32713 Fax: 386.753.0778	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			ITS INSTALLATION DETAILS	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		IT-66
					SR 400	VARIES	446159-1-52-01		

LEGEND:

- ① 1" RGS CONDUIT W/ #2 AWG BARE COPPER GROUNDING ELECTRODE CONDUCTOR (BOND TO GROUNDING ROD)
- ② 2" RGS CONDUIT (HIGH-VOLTAGE POWER)
- ③ 2" RGS CONDUIT (FIBER)
- ④ 1" LIQUID TIGHT FLEXIBLE METAL CONDUIT (HIGH-VOLTAGE POWER)
- ⑤ TYPE LB 2" CONDUIT
- ⑥ 1" HDPE CONDUIT W/ #2 AWG BARE COPPER GROUNDING ELECTRODE CONDUCTOR (BOND TO GROUNDING ROD)
- ⑦ 2" HDPE CONDUIT (HIGH-VOLTAGE POWER)
- ⑧ 2" HDPE CONDUIT (ITS) (LOW-VOLTAGE POWER / COMMUNICATION)
- ⑨ 2" HDPE CONDUIT (ITS) (FIBER)
- ⑩ 2" PVC CONDUIT (SCH. 40 OR SCH. 80) (ITS)
- ⑪ CONDUIT COUPLER (SIZE TO MATCH CONDUIT)
- ⑫ GALVANIZED METAL CONDUIT STRAPS (3' O.C. TYPICAL)
- ⑬ "ELECTRICAL" PULL BOX (HIGH-VOLTAGE POWER)
- ⑭ "ITS" PULL BOX (LOW-VOLTAGE POWER / COMMUNICATION)
- ⑮ ELECTRICAL DISCONNECT
- ⑯ TYPE 336S CABINET, POLE MOUNTED
- ⑰ NEMA 3R CONTROL CABINET, POLE MOUNTED
- ⑱ HIGHLIGHTED LED SIGN PANEL, WRONG WAY (R5-1A)
- ⑲ RETROREFLECTIVE SIGN STRIP (RED, 2' LENGTH)
- ⑳ THERMAL IMAGING DETECTION SYSTEM (ONE FORWARD, ONE REAR FACING)
- ㉑ VERIFICATION CCTV CAMERA
- ㉒ TYPE P-II CONCRETE SERVICE POLE (12')
- ㉓ SINGLE SIGN POST W/ TRANSFORMER BASE AND CONCRETE FOUNDATION (DESIGNED BY VENDOR)
- ㉔ STAINLESS STEEL BANDING / STRAPS
- ㉕ 5/8" X 20' MIN. GROUNDING ELECTRODE (NUMBER OF GROUND RODS VARY TO ACHIEVE 5 OHM MAX. RESISTANCE TO GROUND). REFER TO FDOT STANDARD PLANS, INDEX 641-020
- ㉖ 5/8" X 20' MIN. GROUNDING ELECTRODE
- ㉗ #2 AWG BARE SOLID COPPER GROUNDING ELECTRODE CONDUCTOR (BOND TO GROUNDING ROD)
- ㉘ "FIBER" PULL BOX W/ FIBER CABLE SLACK
- ㉙ 2" RGS CONDUIT (ITS) (LOW-VOLTAGE POWER / COMMUNICATION)
- ㉚ AC STEP-DOWN TRANSFORMER (WHEN REQUIRED, REFER TO PLANS)

NOTES:

- 1. MOUNTING HEIGHT FOR POLE MOUNTED DEVICES, INCLUDING ELECTRICAL DISCONNECT, CABINETS, AND DEVICES, MAY VARY AND BE ADJUSTED AS NECESSARY TO ACCOMMODATE ALL ITEMS FITTING ON THE POLE. ENSURE THAT MOUNTING HEIGHTS FACILITATE MAINTENANCE PERSONNEL ACCESS.
- 2. NUMBER AND CABLING USAGE OF PROPOSED UNDERGROUND CONDUITS VARY, REFER TO PLANS SHEETS FOR FURTHER DETAIL.
- 3. ALL WORK SHALL MEET INSTALLATION, BONDING, AND GROUND REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC) AND FDOT STANDARD SPECIFICATIONS FOR ALL EQUIPMENT.
- 4. BARE SOLID COPPER GROUNDING CONDUCTORS SHALL BE TIN-PLATED.
- 5. CONDUCTORS FOR EQUIPMENT CABINET BONDING AND GROUND SHALL TERMINATE AT A COPPER GROUND BUS BAR LOCATED WITHIN THE EQUIPMENT CABINET. SECURELY FASTEN CONDUCTORS TO GROUNDING BUS BAR WITH CABLE LUGS.
- 6. EXOTHERMICALLY WELD ALL CONNECTIONS TO GROUND RODS.
- 7. MOUNTING HEIGHTS ARE NOT TO SCALE, REFER TO INSTALLATION DETAILS FOR EXACT MEASUREMENTS.



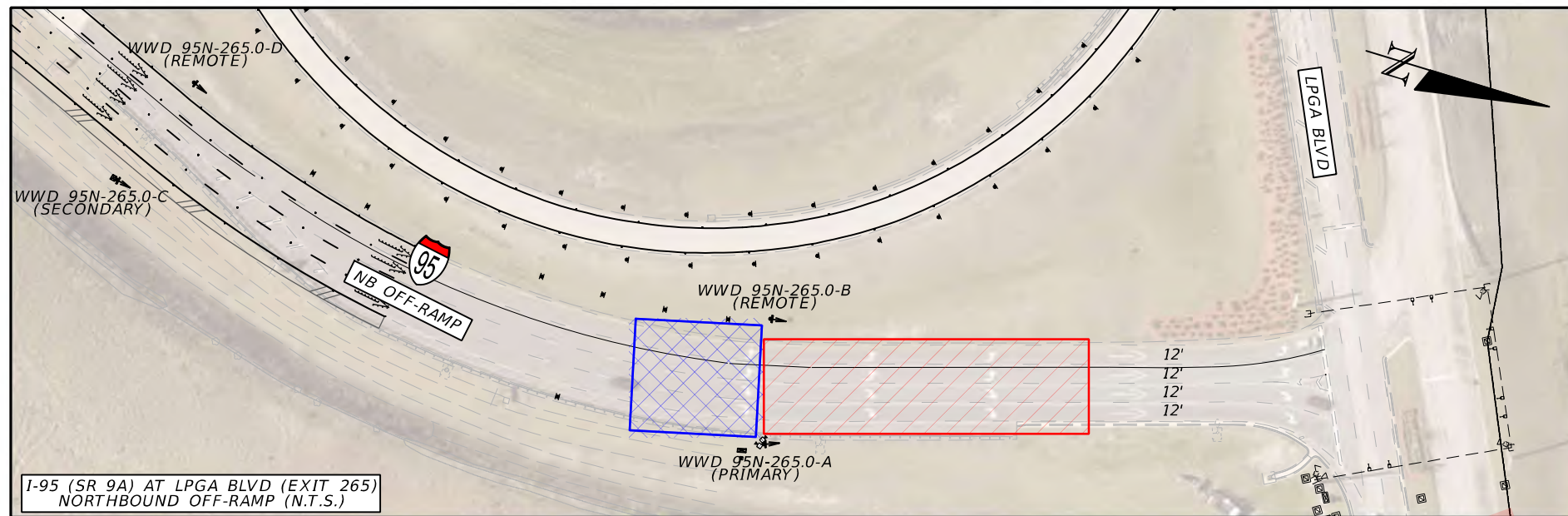
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

FLORIDA DEPARTMENT OF TRANSPORTATION
 719 SOUTH WOODLAND BLVD
 DELAND, FLORIDA 32720
 (386) 943-5000
 JEREMY H. DILMORE, P.E. #67510

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	VOLUSIA	441133-1-52-01

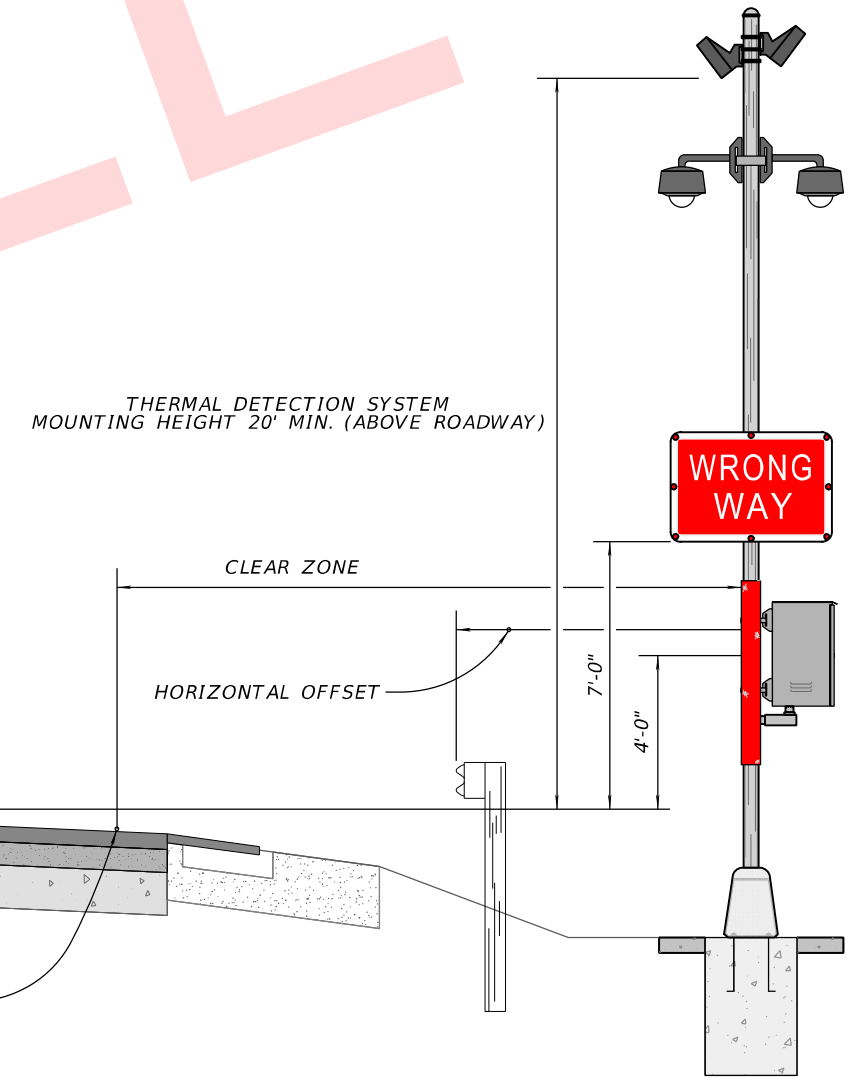
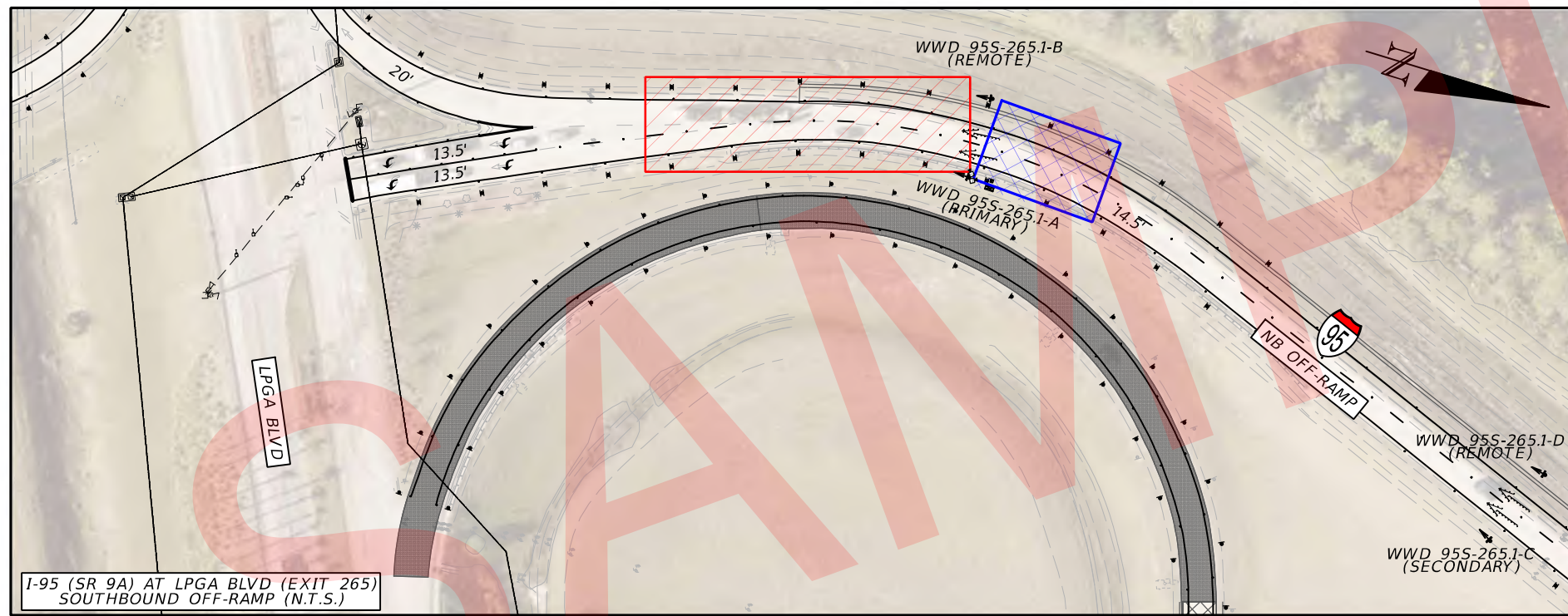
INSTALLATION DETAILS

SHEET NO.
IT-49



NOTES:

1. INSTALL SENSORS FOR THERMAL DETECTION SYSTEM PER MANUFACTURER'S RECOMMENDATIONS. ENSURE SENSORS ARE MOUNTED A MINIMUM OF 20' ABOVE THE ROAD SURFACE CROWN ELEVATION.
2. SENSORS SHALL BE POSITIONED TO PROVIDE COVERAGE FOR ALL RAMP LANES AND PAVED SHOULDERS. CONFIGURE FORWARD FACING SENSOR FOR DETECTION ZONE AND REAR FACING SENSOR FOR VERIFICATION ZONE.
3. DETECTION ZONES SHALL BE CONFIGURED TO ACTIVATE HIGHLIGHTED LED SIGN AND BEGIN FLASHING SEQUENCE AT BOTH PRIMARY AND SECONDARY LOCATIONS.
4. VERIFICATION ZONES SHALL BE CONFIGURED TO ACTUATE WRONG WAY DRIVING EVENT AND SUBSEQUENT RESPONSE ACTIVITIES.
5. INSTALL PRIMARY AND SECONDARY LOCATIONS OUTSIDE OF CLEAR ZONE AND/OR PROVIDE THE APPROPRIATE LATERAL OFFSET FROM FACE OF GUARDRAIL FOR THE FOLLOWING DESIGN PARAMETERS, IN ACCORDANCE WITH FDM SECTION 2015:
 - DESIGN SPEED: 50 MPH
 - PROJECT TYPE: NEW CONSTRUCTION
 - GEOMETRIC CONFIGURATION: TRAVEL LANES & MULTI-LANE RAMP



- LEGEND:**
- DETECTION ZONE (ACTIVATION OF HIGHLIGHTED LED SIGNS) (MAX 200', PER 20' MOUNTING HEIGHT)
 - VERIFICATION ZONE (ACTUATE WRONG WAY DRIVING EVENT) (MAX 75', PER 20' MOUNTING HEIGHT)

REVISIONS				FLORIDA DEPARTMENT OF TRANSPORTATION 719 SOUTH WOODLAND BLVD DELAND, FLORIDA 32720 (386) 943-5000 JEREMY H. DILMORE, P.E. #67510	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SHEET NO. IT-50
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID	
					SR 9	VOLUSIA	441133-1-52-01	COVERAGE AREA DETAILS

REFERENCE NOTES:

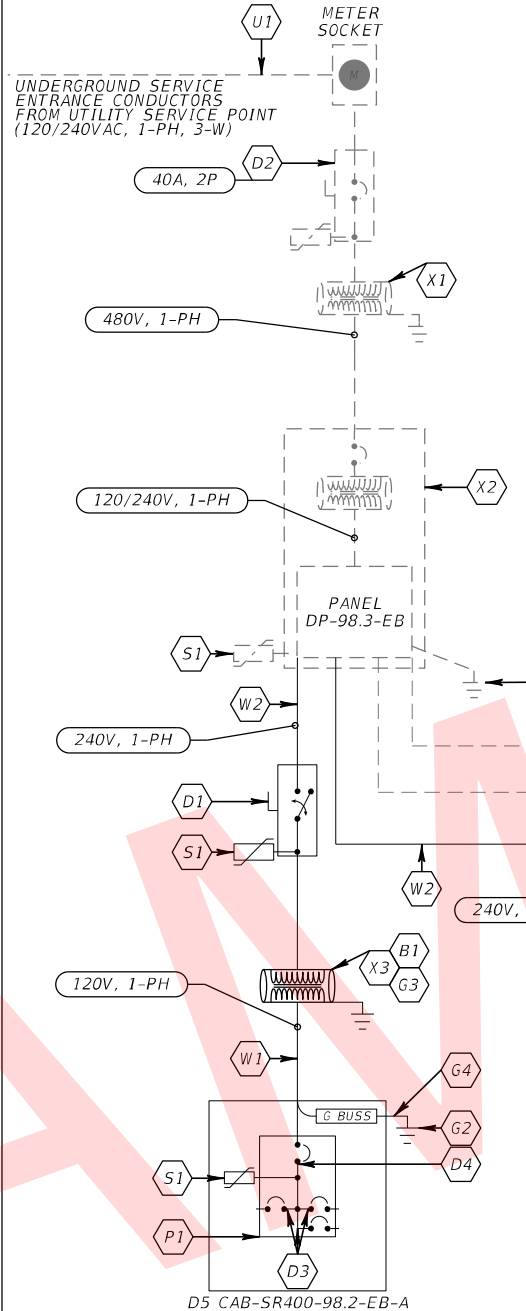
- B1 INSTALL SEPARATELY DERIVED SYSTEM BONDING JUMPER CONNECTION AT CABINET POWER PANEL, BETWEEN NEUTRAL BUS AND GROUND BUS
- D1 240V/60A MIN. RATED POLE MOUNTED SAFETY SWITCH: DOUBLE-POLE SINGLE-THROW, SOLID NEUTRAL, NON-FUSIBLE; NEMA 3R PADLOCKABLE ENCLOSURE
- D2 240V MIN. RATED POLE MOUNTED CIRCUIT BREAKER ENCLOSURE: NEMA 3R PADLOCKABLE ENCLOSURE
- D3 CABINET BRANCH CIRCUIT BREAKER: REFER TO CABINET WIRING DIAGRAMS FOR DETAILS (10K AIC MIN. RATED)
- D4 CABINET MAIN CIRCUIT BREAKER: REFER TO CABINET WIRING DIAGRAMS FOR DETAILS (10K AIC MIN. RATED)
- G1 EXISTING GROUNDING ELECTRODE ARRAY
- G2 GROUNDING ELECTRODE ARRAY; REFER TO TYPICAL INSTALLATION DETAILS
- G3 #6 AWG BONDING JUMPER (MAIN, SYSTEM, OR SUPPLY-SIDE)
- G4 #2 AWG COPPER GROUNDING ELECTRODE CONDUCTOR
- P1 CABINET POWER PANEL
- S1 TYPE 1 SURGE PROTECTION DEVICE
- U1 SERVICE CONDUCTORS: 2-#6 AWG XHHW, 1-#6 AWG XHHW GROUNDED CONDUCTOR
- W1 2-#6 AWG XHHW, 1-#6 AWG XHHW GROUND
- W2 SEE PLANS FOR CONDUCTOR SIZE
- X1 7.5 KVA XFMR 240V PRIMARY, 480V SECONDARY, 1-PH, POLE MOUNTED ENCAPSULATED DRY TYPE ISOLATION TRANSFORMER IN NEMA 3R ENCLOSURE
- X2 MINI-POWER CENTER: 7.5 KVA XFMR 480V PRIMARY, 120/240V SECONDARY, 1-PH, POLE MOUNTED, NEMA 3R ENCLOSURE
- X3 3 KVA XFMR 240V PRIMARY, 120V SECONDARY, 1-PH, POLE MOUNTED ENCAPSULATED DRY TYPE ISOLATION TRANSFORMER IN NEMA 3R ENCLOSURE

D5 ESP-SR400-98.3-EB

LEGEND:

- EXISTING
- NEW

ONE LINE DIAGRAM



VOLTAGE: 120/240
PHASE: 1
WIRES: 3

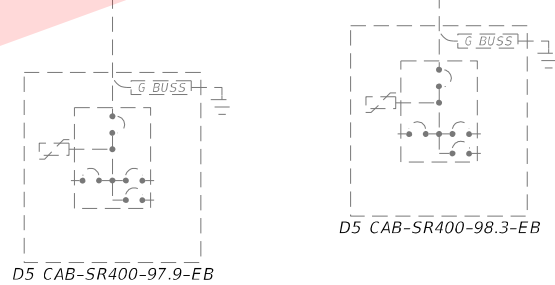
MAINS TYPE: BREAKER
PRIMARY MAIN CB: 30 A; SECONDARY MAIN CB: 40 A
AIC: 10,000 A

CKT	CKT NAME	CONNECTED EQUIP.	TRIP	POLES	A (KVA)		B (KVA)		POLES	TRIP	CKT NAME	CONNECTED EQUIP.	CKT
1	98.3-EB-1	EX. CAB-SR400-97.9-EB	20	2	0.31	0.26			2	20	98.3-EB-2	EX. CAB-SR400-98.3-EB	2
3	---	---	---	---			0.31	0.26		---	---	---	4
5	98.3-EB-3	CAB-SR400-98.2-EB-A	25	2	0.76	0.76			2	25	98.3-EB-4	CAB-SR400-98.4-WB-A	6
7	---	---	---	---			0.76	0.76		---	---	---	8
9						0			2		SPD	SPD	10
11							0		---	---	---	---	12
					LOAD PER LEG (KVA):		2.09	2.09					

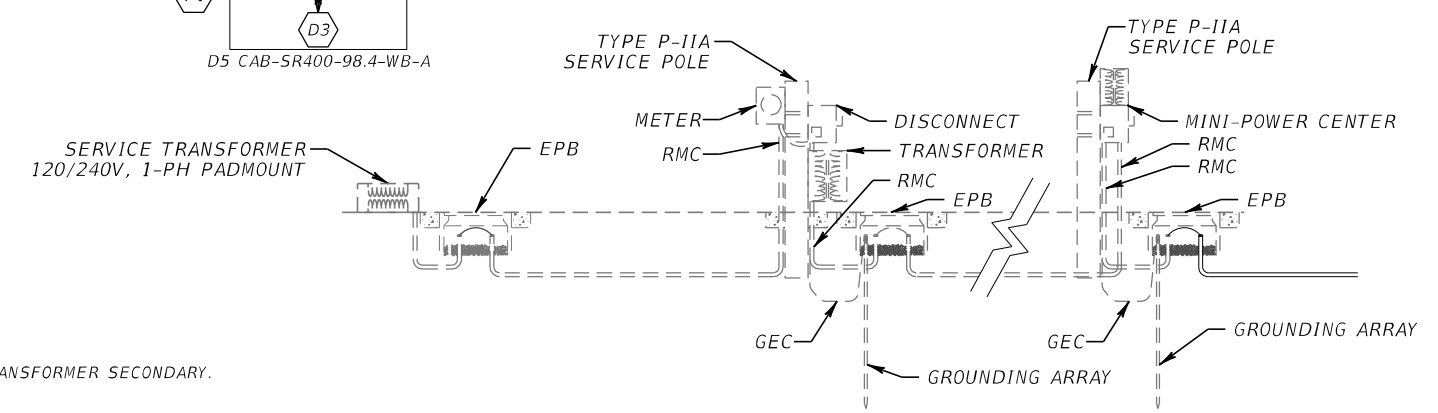
* - SIZE BREAKER PER SPD MANUFACTURERS INSTRUCTIONS

D5 CAB-SR400-98.2-EB-A

D5 CAB-SR400-98.4-WB-A



SERVICE POINT RISER DIAGRAM



- NOTES:
- ADD NEW BREAKER TO MINI-POWER CENTER PANEL ON TRANSFORMER SECONDARY.

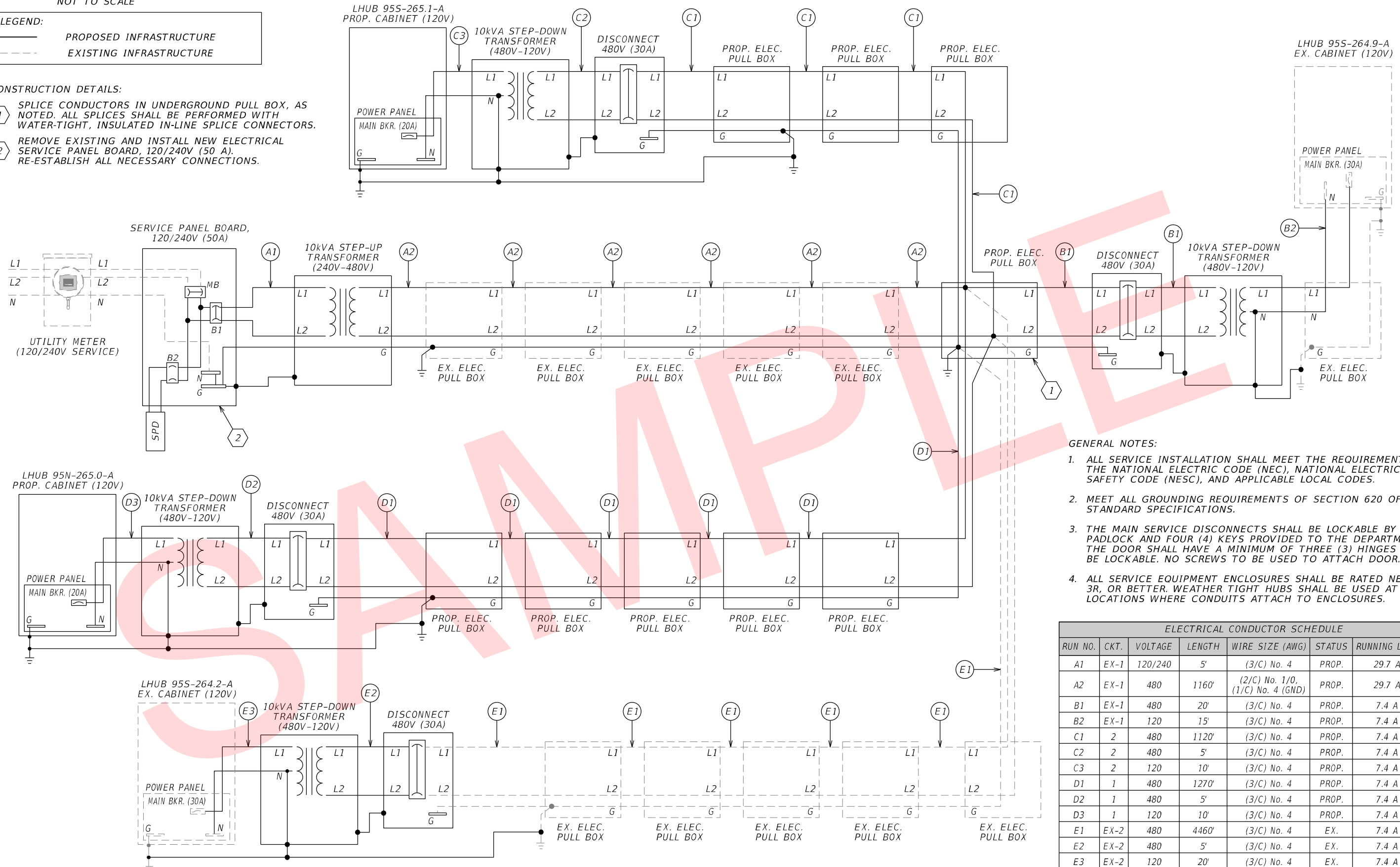
REVISIONS				ALEXANDER TEAL MIMS, P.E. PE No. 77095 Traffic Engineering Data Solutions, Inc. 80 Spring Vista Drive Phone: 386.753.0558 DeBary, FL 32713 Fax: 386.753.0778	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			POWER SERVICE DETAILS	SHEET NO. IT-86
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 400	SEMINO-L-E	446159-1-52-01		

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

LEGEND:
 ——— PROPOSED INFRASTRUCTURE
 - - - - - EXISTING INFRASTRUCTURE

CONSTRUCTION DETAILS:

- 1 SPlice conductors in underground pull box, as noted. All splices shall be performed with water-tight, insulated in-line splice connectors.
- 2 REMOVE EXISTING AND INSTALL NEW ELECTRICAL SERVICE PANEL BOARD, 120/240V (50 A). RE-ESTABLISH ALL NECESSARY CONNECTIONS.



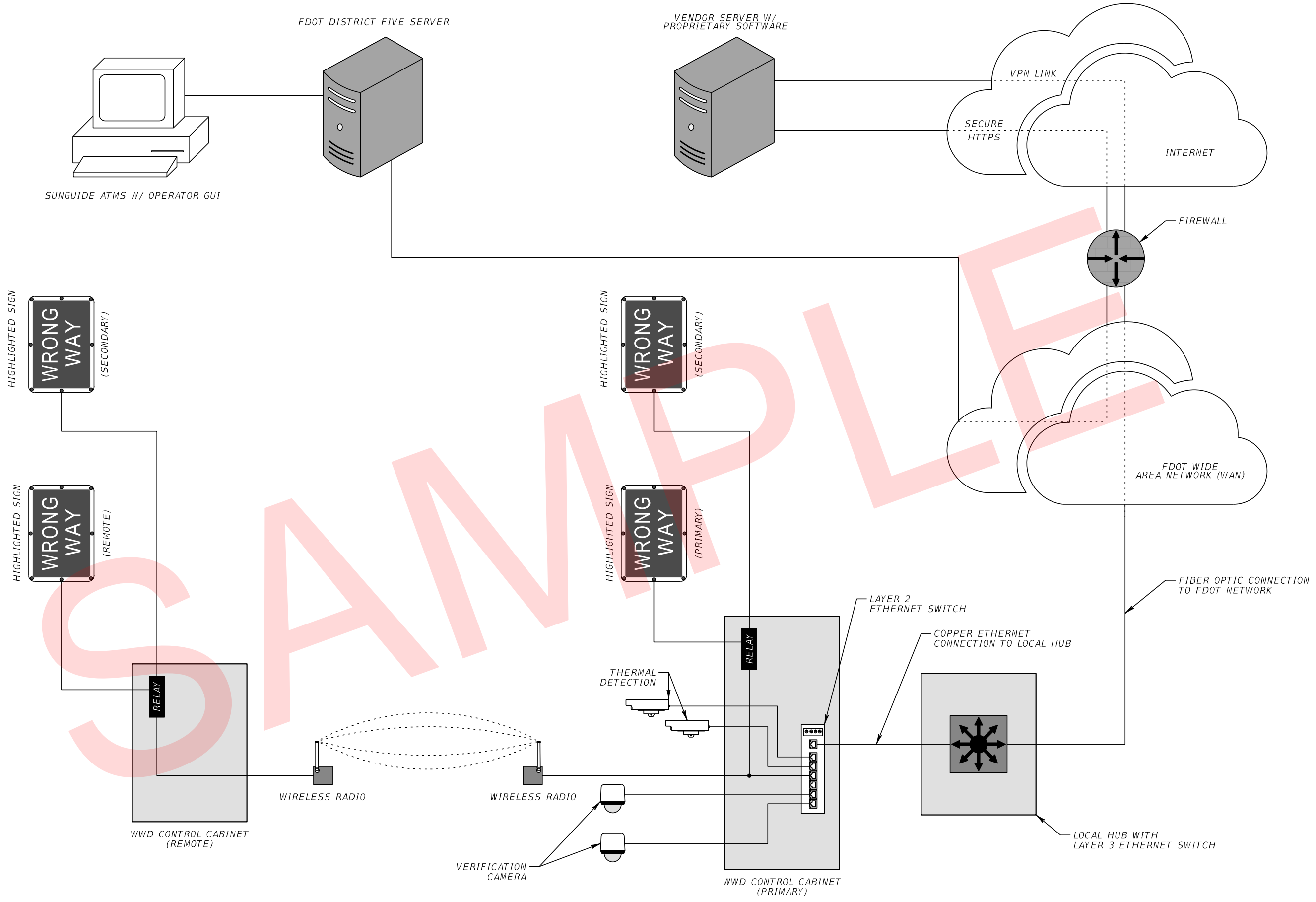
GENERAL NOTES:

- 1. ALL SERVICE INSTALLATION SHALL MEET THE REQUIREMENTS OF THE NATIONAL ELECTRIC CODE (NEC), NATIONAL ELECTRIC SAFETY CODE (NESC), AND APPLICABLE LOCAL CODES.
- 2. MEET ALL GROUNDING REQUIREMENTS OF SECTION 620 OF THE STANDARD SPECIFICATIONS.
- 3. THE MAIN SERVICE DISCONNECTS SHALL BE LOCKABLE BY PADLOCK AND FOUR (4) KEYS PROVIDED TO THE DEPARTMENT. THE DOOR SHALL HAVE A MINIMUM OF THREE (3) HINGES AND BE LOCKABLE. NO SCREWS TO BE USED TO ATTACH DOOR.
- 4. ALL SERVICE EQUIPMENT ENCLOSURES SHALL BE RATED NEMA 3R, OR BETTER. WEATHER TIGHT HUBS SHALL BE USED AT LOCATIONS WHERE CONDUITS ATTACH TO ENCLOSURES.

ELECTRICAL CONDUCTOR SCHEDULE						
RUN NO.	CKT.	VOLTAGE	LENGTH	WIRE SIZE (AWG)	STATUS	RUNNING LOAD
A1	EX-1	120/240	5'	(3/C) No. 4	PROP.	29.7 A
A2	EX-1	480	1160'	(2/C) No. 1/0, (1/C) No. 4 (GND)	PROP.	29.7 A
B1	EX-1	480	20'	(3/C) No. 4	PROP.	7.4 A
B2	EX-1	120	15'	(3/C) No. 4	PROP.	7.4 A
C1	2	480	1120'	(3/C) No. 4	PROP.	7.4 A
C2	2	480	5'	(3/C) No. 4	PROP.	7.4 A
C3	2	120	10'	(3/C) No. 4	PROP.	7.4 A
D1	1	480	1270'	(3/C) No. 4	PROP.	7.4 A
D2	1	480	5'	(3/C) No. 4	PROP.	7.4 A
D3	1	120	10'	(3/C) No. 4	PROP.	7.4 A
E1	EX-2	480	4460'	(3/C) No. 4	EX.	7.4 A
E2	EX-2	480	5'	(3/C) No. 4	EX.	7.4 A
E3	EX-2	120	20'	(3/C) No. 4	EX.	7.4 A

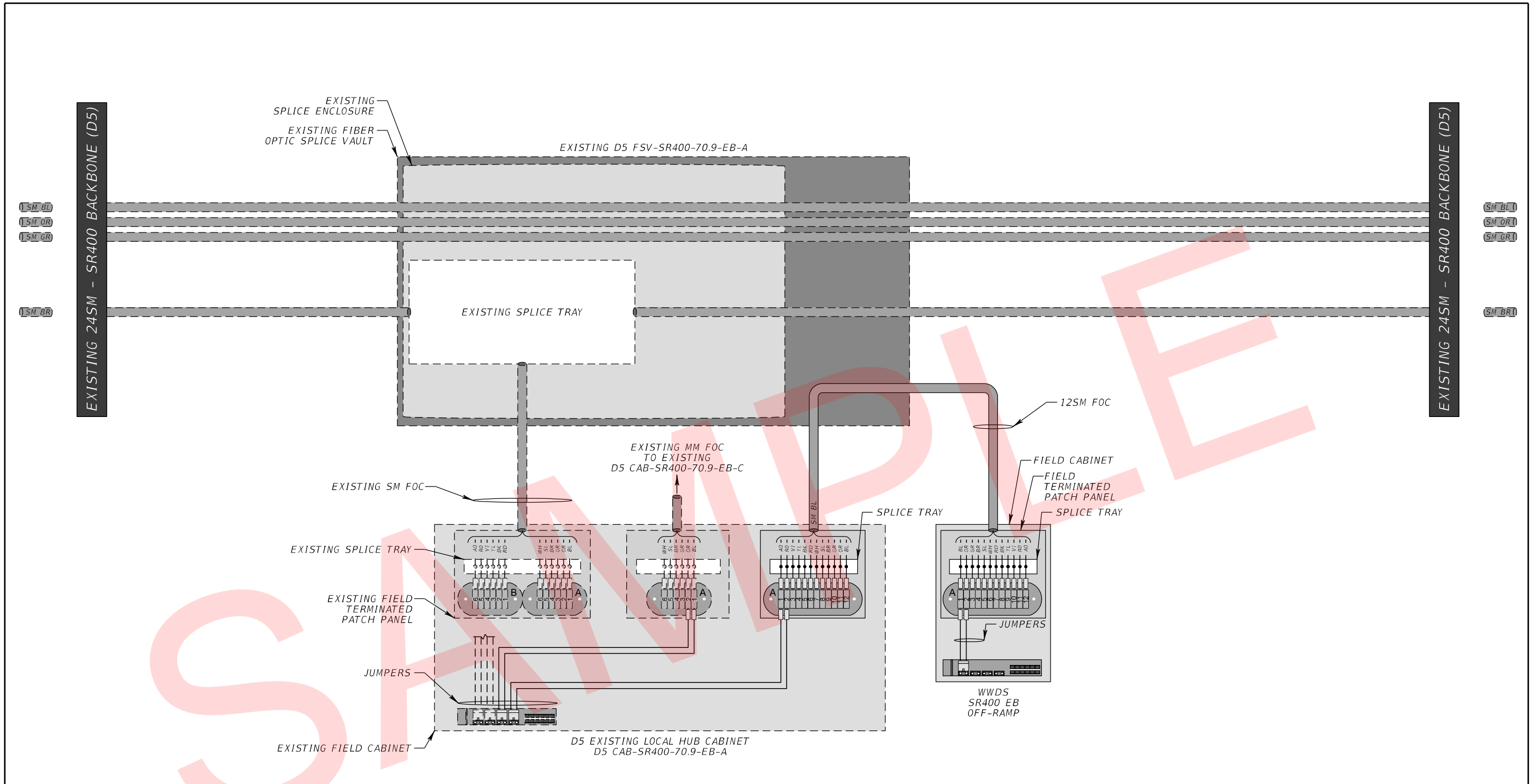
REVISIONS				FLORIDA DEPARTMENT OF TRANSPORTATION 719 SOUTH WOODLAND BLVD DELAND, FLORIDA 32720 (386) 943-5000 JEREMY H. DILMORE, P.E. #67510	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			ELECTRICAL SERVICE DETAILS	SHEET NO. IT-47
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 9	VOLUSIA	441133-1-52-01		

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REVISIONS				ALEXANDER TEAL MIMS, P.E. PE No. 77095 Traffic Engineering Data Solutions, Inc. 80 Spring Vista Drive Phone: 386.753.0558 DeBary, FL 32713 Fax: 386.753.0778	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			NETWORK COMMUNICATION DIAGRAM	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
						SR 400	VARIES		446159-1-52-01

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NOTE:
 1. ALL EXISTING CONNECTIONS ARE TO REMAIN UNLESS MODIFICATIONS ARE SHOWN ON THESE SPLICING DIAGRAMS.

LEGEND

EXISTING FIBER BUFFER TUBE	EXISTING ELEMENT	CONNECTOR PANEL
FIBER BUFFER TUBE	NEW ELEMENT	LAYER 3 ETHERNET SWITCH
EXISTING ST CONNECTOR	CAPPED AND COILED FIBER	
ST CONNECTOR	EXISTING FUSION SPLICE	
EXISTING LC CONNECTOR	FUSION SPLICE	
LC CONNECTOR	EXISTING BUFFER FUSION SPLICES (COLOR TO COLOR)	
EXISTING SC CONNECTOR	BUFFER FUSION SPLICES (COLOR TO COLOR)	
SC CONNECTOR		

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ALEXANDER TEAL MIMS, P.E. PE No. 77095
 Traffic Engineering Data Solutions, Inc.
 80 Spring Vista Drive Phone: 386.753.0558
 DeBary, FL 32713 Fax: 386.753.0778

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 400	ORANGE	446159-1-52-01

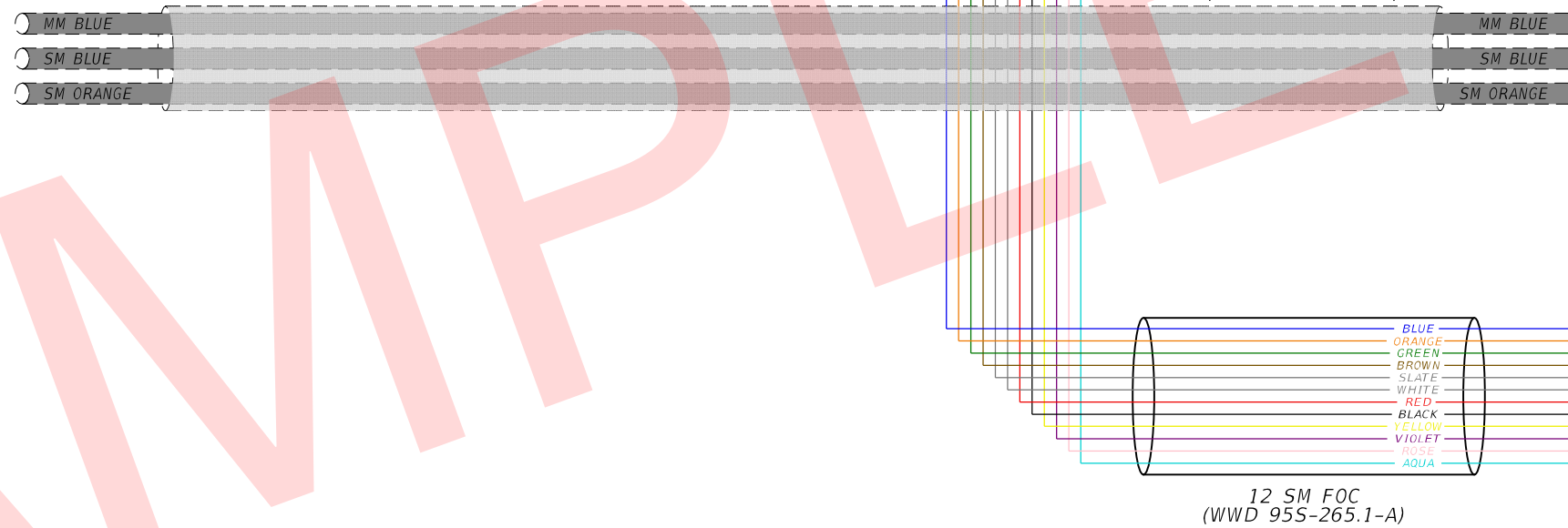
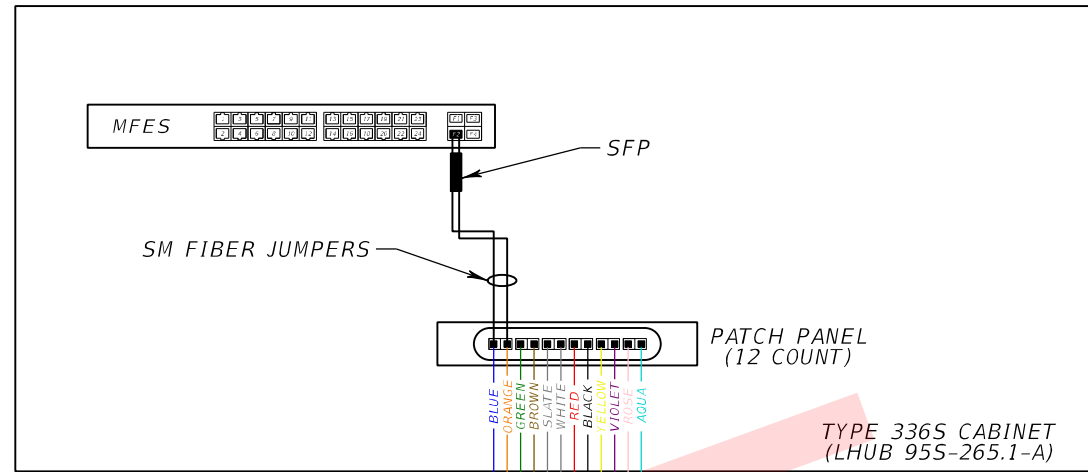
SPLICING DIAGRAM

SHEET NO.
IT-74

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

NOTES:

1. ALL CONNECTOR PANELS FOR EITHER NEW OR MODIFIED FIBER OPTIC PATCH PANELS SHALL ACCOMODATE DUPLEX SC-TYPE FIBER TERMINATION CONNECTORS.
2. FIBER OPTIC JUMPERS BETWEEN PATCH PANELS AND MANAGED FIELD ETHERNET SWITCHES SHALL BE DUPLEX SC-DUPLEX LC.
3. FOR ADDITIONAL INFORMATION RELATED TO DEVICE WIRING AND CONNECTIONS, REFER TO WIRING DIAGRAMS.



MATCHLINE SPLICING DIAGRAMS (2)

LEGEND:

■	TERMINATION (EXISTING)		FIELD TERMINATED PATCH PANEL
■	TERMINATION (PROPOSED)		CONNECTOR PANEL
●	FUSION SPLICE (PROPOSED)		BUFFER TUBE
—	UNTERMINATED FIBER		SMALL-FORM FACTOR PLUGGABLE (SFP)
---	FIBER (PROPOSED)		MANAGED FIELD ETHERNET SWITCH (MFES)
—	FIBER (EXISTING)		

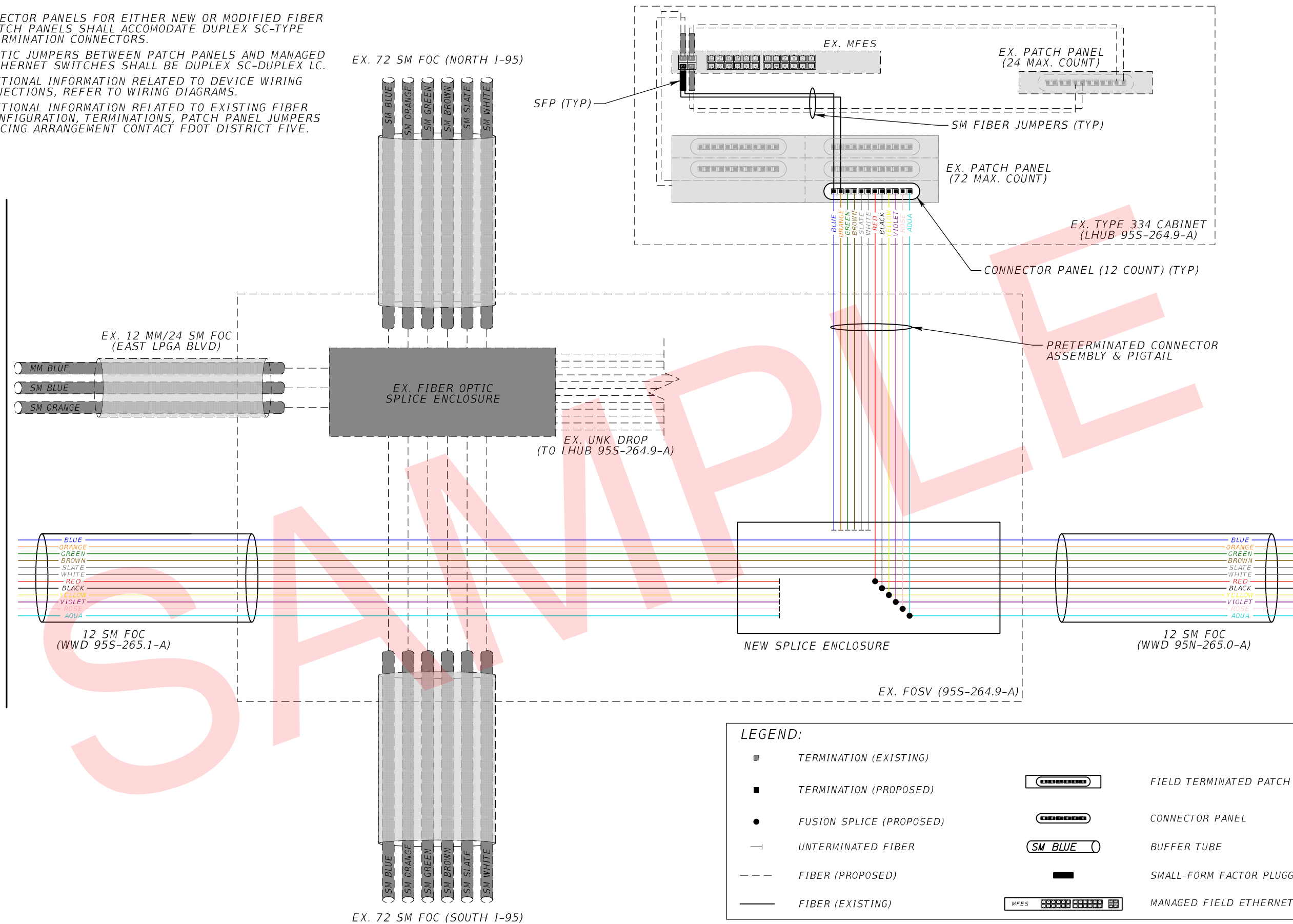
REVISIONS				FLORIDA DEPARTMENT OF TRANSPORTATION 719 SOUTH WOODLAND BLVD DELAND, FLORIDA 32720 (386) 943-5000 JEREMY H. DILMORE, P.E. #67510	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SPLICING DIAGRAMS (1)	SHEET NO. IT-37
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 9	VOLUSIA	441133-1-52-01		

NOTES:

1. ALL CONNECTOR PANELS FOR EITHER NEW OR MODIFIED FIBER OPTIC PATCH PANELS SHALL ACCOMODATE DUPLEX SC-TYPE FIBER TERMINATION CONNECTORS.
2. FIBER OPTIC JUMPERS BETWEEN PATCH PANELS AND MANAGED FIELD ETHERNET SWITCHES SHALL BE DUPLEX SC-DUPLEX LC.
3. FOR ADDITIONAL INFORMATION RELATED TO DEVICE WIRING AND CONNECTIONS, REFER TO WIRING DIAGRAMS.
4. FOR ADDITIONAL INFORMATION RELATED TO EXISTING FIBER OPTIC CONFIGURATION, TERMINATIONS, PATCH PANEL JUMPERS AND SPLICING ARRANGEMENT CONTACT FDOT DISTRICT FIVE.

MATCHLINE SPLICING DIAGRAMS (1)

MATCHLINE SPLICING DIAGRAMS (3)

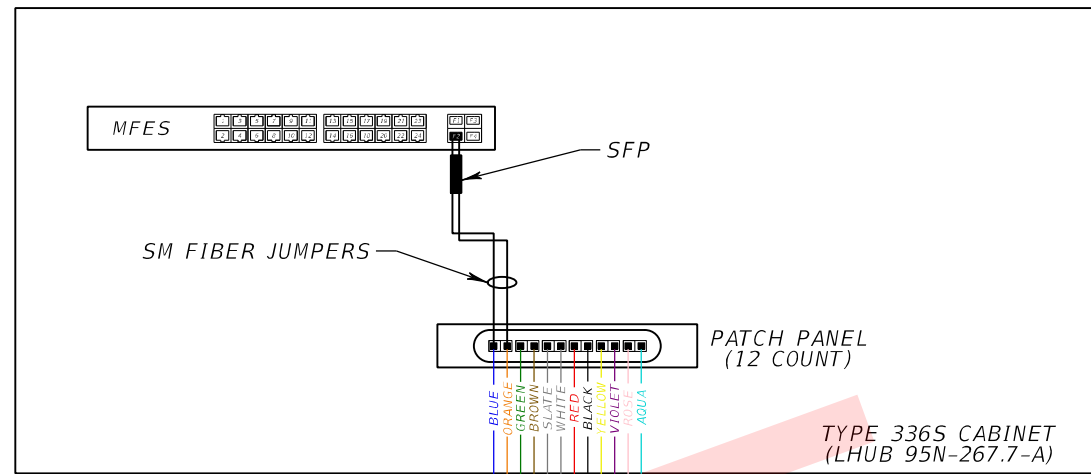
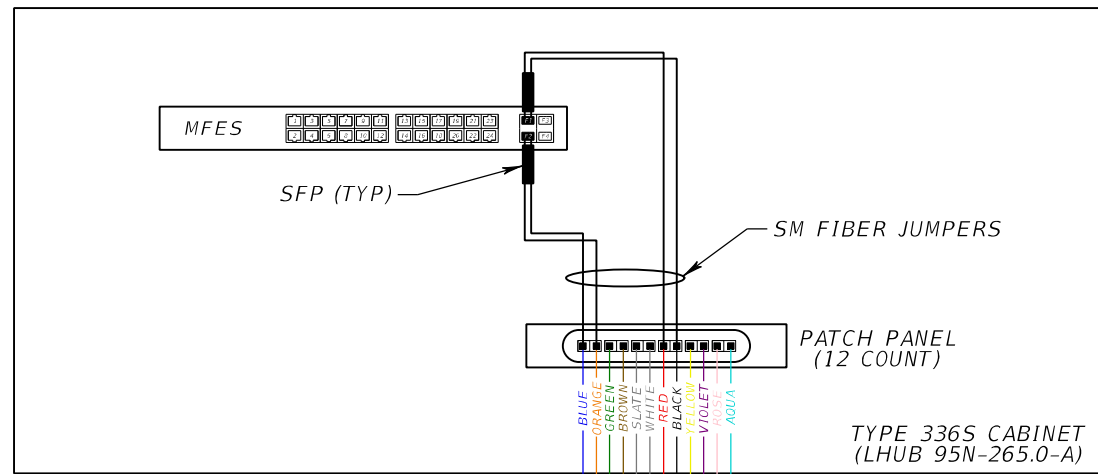


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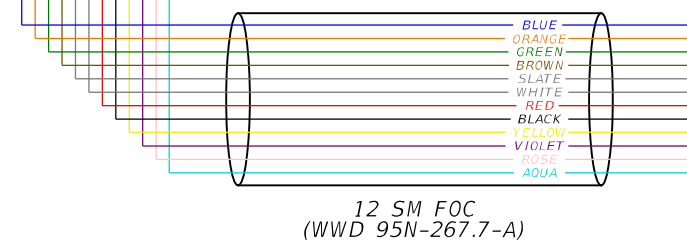
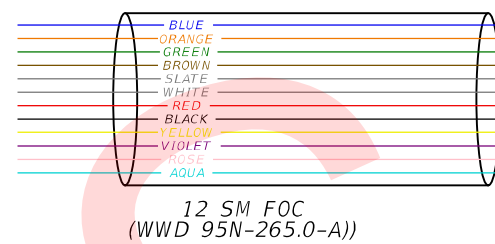
■	TERMINATION (EXISTING)		FIELD TERMINATED PATCH PANEL
■	TERMINATION (PROPOSED)		CONNECTOR PANEL
●	FUSION SPLICE (PROPOSED)		BUFFER TUBE
—	UNTERMINATED FIBER		SMALL-FORM FACTOR PLUGGABLE (SFP)
---	FIBER (PROPOSED)		MANAGED FIELD ETHERNET SWITCH (MFES)
—	FIBER (EXISTING)		

REVISIONS				FLORIDA DEPARTMENT OF TRANSPORTATION 719 SOUTH WOODLAND BLVD DELAND, FLORIDA 32720 (386) 943-5000 JEREMY H. DILMORE, P.E. #67510	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SPLICING DIAGRAMS (2)	SHEET NO. IT-38
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 9	VOLUSIA	441133-1-52-01		

MATCHLINE SPlicing DIAGRAMS (2)



MATCHLINE SPlicing DIAGRAMS (4)

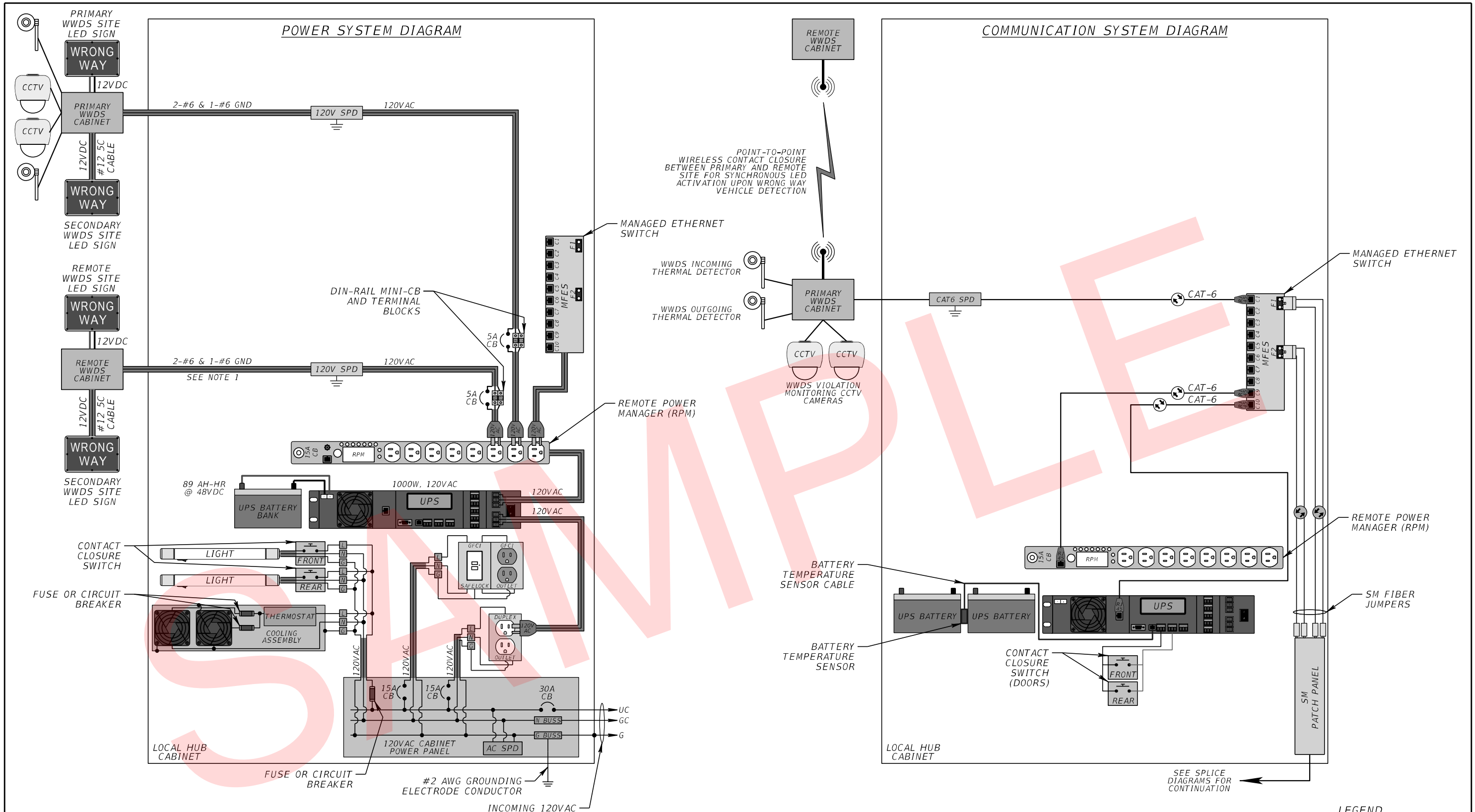


- NOTES:**
- ALL CONNECTOR PANELS FOR EITHER NEW OR MODIFIED FIBER OPTIC PATCH PANELS SHALL ACCOMODATE DUPLEX SC-TYPE FIBER TERMINATION CONNECTORS.
 - FIBER OPTIC JUMPERS BETWEEN PATCH PANELS AND MANAGED FIELD ETHERNET SWITCHES SHALL BE DUPLEX SC-DUPLEX LC.
 - FOR ADDITIONAL INFORMATION RELATED TO DEVICE WIRING AND CONNECTIONS, REFER TO WIRING DIAGRAMS.

LEGEND:

■	TERMINATION (EXISTING)		FIELD TERMINATED PATCH PANEL
■	TERMINATION (PROPOSED)		CONNECTOR PANEL
●	FUSION SPLICE (PROPOSED)		BUFFER TUBE
—	UNTERMINATED FIBER	■	SMALL-FORM FACTOR PLUGGABLE (SFP)
---	FIBER (PROPOSED)		MANAGED FIELD ETHERNET SWITCH (MFES)
—	FIBER (EXISTING)		

REVISIONS				FLORIDA DEPARTMENT OF TRANSPORTATION 719 SOUTH WOODLAND BLVD DELAND, FLORIDA 32720 (386) 943-5000 JEREMY H. DILMORE, P.E. #67510	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SPLICING DIAGRAMS (3)	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
						SR 9	VOLUSIA		441133-1-52-01



NOTE:
 1. FOR SOLAR POWERED REMOTE SITES, THE 120VAC CIRCUIT TO THE REMOTE WWDS SITE IS NOT INCLUDED AND EACH REMOTE SITE POWERS AND ACTIVATES A SINGLE HIGHLIGHTED SIGN PANEL.

- LEGEND**
- 1-Gbps ETHERNET
 - 10/100 MBPS ETHERNET
 - SERIAL COMMUNICATION

REVISIONS				ALEXANDER TEAL MIMS, P.E. PE No. 77095 Traffic Engineering Data Solutions, Inc. 80 Spring Vista Drive Phone: 386.753.0558 DeBary, FL 32713 Fax: 386.753.0778	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SHEET NO. IT-71
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID	
					SR 400	VARIES	446159-1-52-01	

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LEGEND:

- ELEC. CONDUCTOR, LIVE (120 VAC)
- ELEC. CONDUCTOR, NEUTRAL (120 VAC)
- ELEC. CONDUCTOR, GROUND (120 VAC)
- ELEC. CONDUCTOR (12 VDC)

HIGHLIGHTED LED SIGN



2/C - #12 AWG (12VDC PWR)



2/C - #12 AWG (12VDC PWR)

HIGHLIGHTED LED SIGN



2/C - #12 AWG (12VDC PWR)

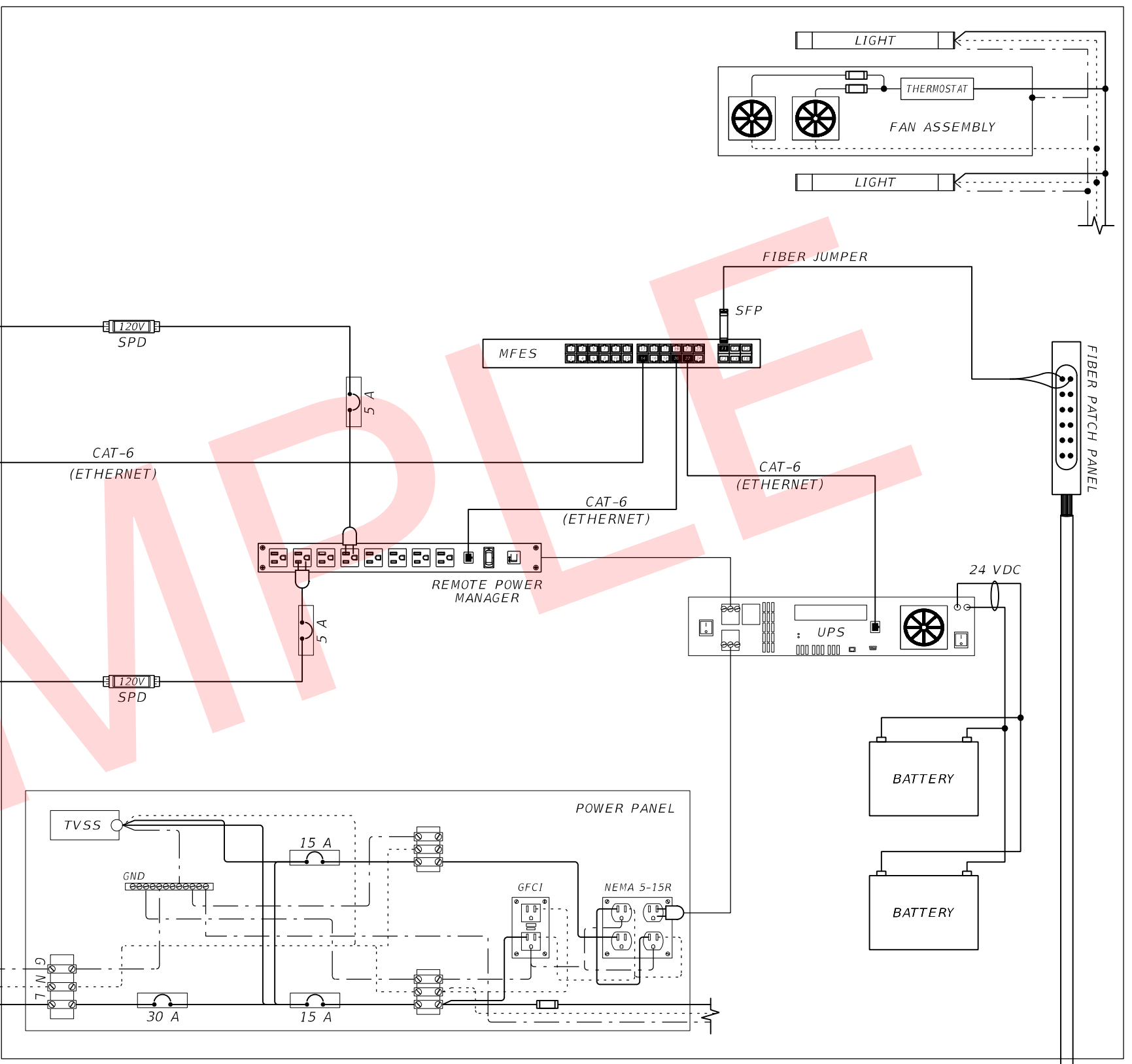
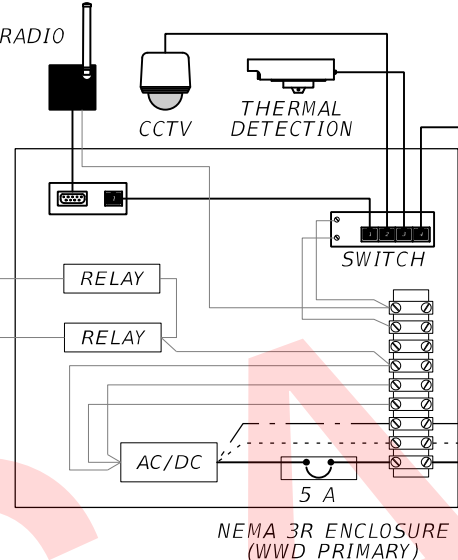
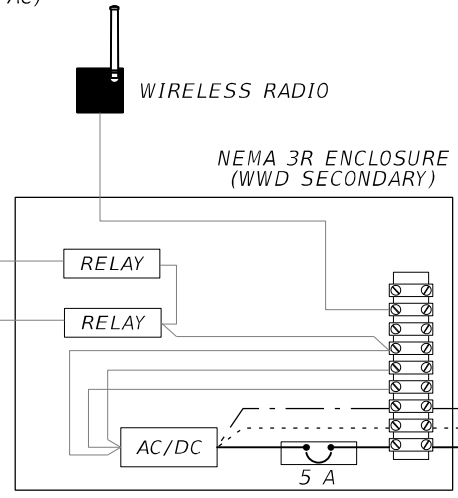


2/C - #12 AWG (12VDC PWR)

HIGHLIGHTED LED SIGN

NOTES:

1. EXISTING COMPONENTS--INCLUDING DEVICES, IN-CABINET EQUIPMENT, CONNECTIONS, AND WIRING--MAY DIFFER FROM THE WIRING DIAGRAM DEPICTED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING CONDITIONS PRIOR TO BEGINNING CONSTRUCTION ACTIVITIES.
2. ALL NEW EQUIPMENT, ELECTRICAL COMPONENTRY, AND WIRING SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. REFER TO MANUFACTURER'S SPECIFICATIONS FOR WIRING OF NEMA 3R ENCLOSURE AND ALL ASSOCIATED DEVICES TO THE WRONG WAY DRIVING SYSTEM FOR BOTH PRIMARY AND SECONDARY LOCATIONS.
4. ALL PORT ASSIGNMENTS, IP ADDRESSES, VLANs, AND DEFAULT NETWORK GATEWAYS SHALL BE COORDINATED WITH THE DEPARTMENT. PORT ASSIGNMENTS DEPICTED ARE FOR COMPLETENESS ONLY AND SHALL NOT BE INTERPRETTED AS DIRECTIVE.
5. REFER TO WIRING DIAGRAM FROM THE FOLLOWING LOCATIONS:
 - LHUB 95N-265.0-A
 - LHUB 95S-265.1-A
 - LHUB 95N-267.7-A
 - LHUB 95S-267.8-A



REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

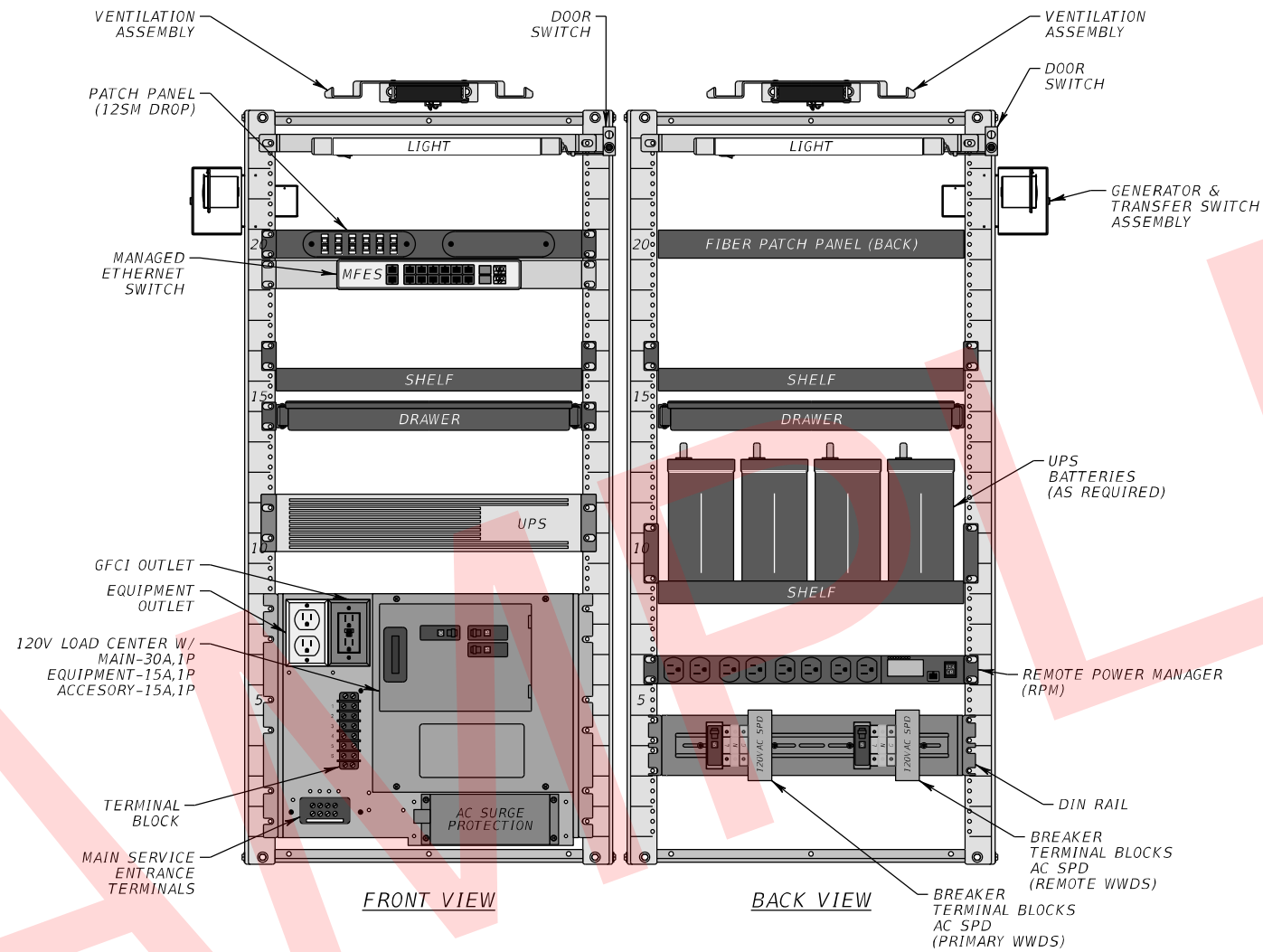
FLORIDA DEPARTMENT OF TRANSPORTATION
 719 SOUTH WOODLAND BLVD
 DELAND, FLORIDA 32720
 (386) 943-5000
 JEREMY H. DILMORE, P.E. #67510

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	VOLUSIA	441133-1-52-01

WIRING DIAGRAMS

SHEET NO.
IT-46

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



WWDS LOCAL HUB CABINET
336S CABINET POLE MOUNTED

REVISIONS				ALEXANDER TEAL MIMS, P.E. PE No. 77095 Traffic Engineering Data Solutions, Inc. 80 Spring Vista Drive Phone: 386.753.0558 DeBary, FL 32713 Fax: 386.753.0778	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			SHEET NO. CABINET DETAILS IT-70
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID	
					SR 400	VARIES	446159-1-52-01	

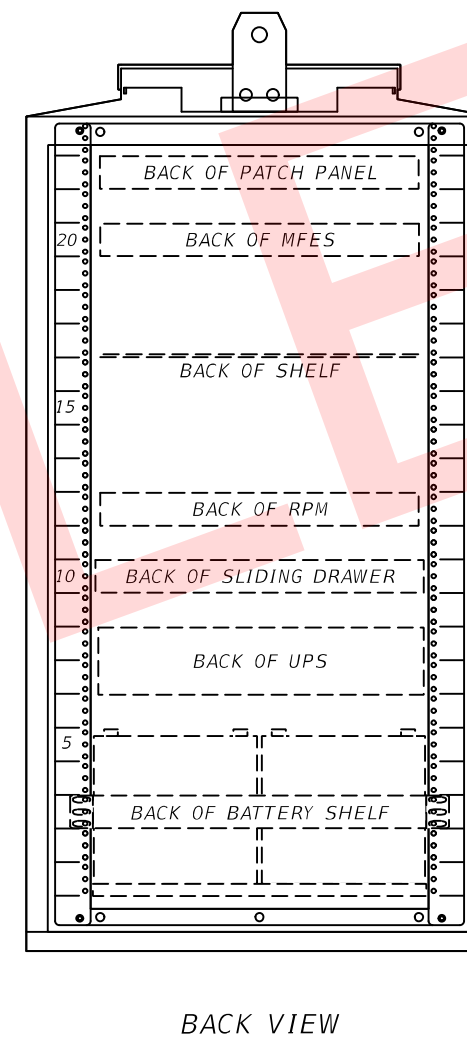
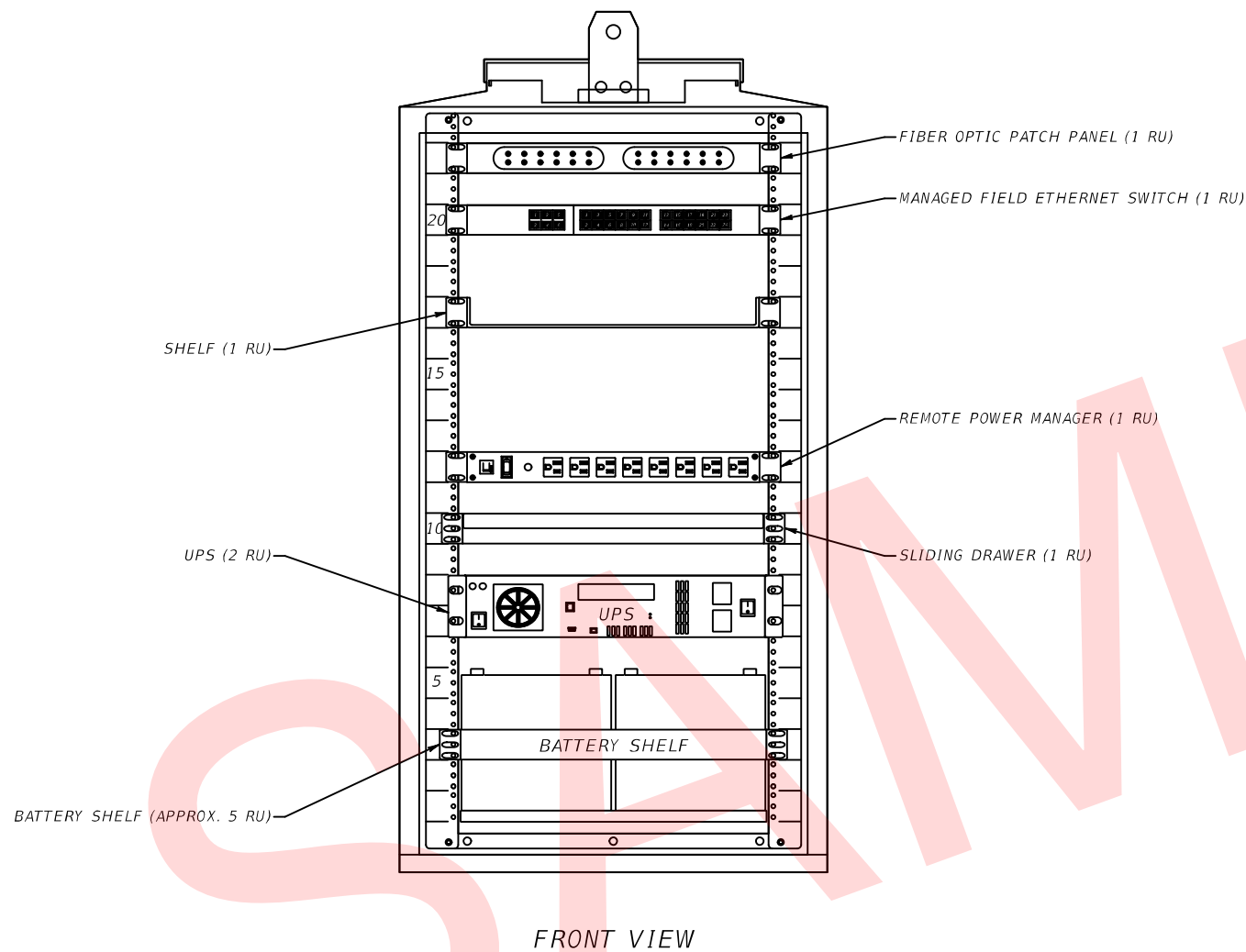
Alex

3/6/2020

10:29:04 AM

Z:\2018 Projects\11128 (FDOT-5 Safety)\TWO 15 Wrong Way Enhancements\CAD\ITS\SSDTIT02.DGN

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NEW TYPE 336S CABINET (MULTIPLE LOCATIONS)

- 95N-265.0-A
- 95S-265.1-A
- 95N-267.7-A
- 95S-267.8-A

LEGEND:

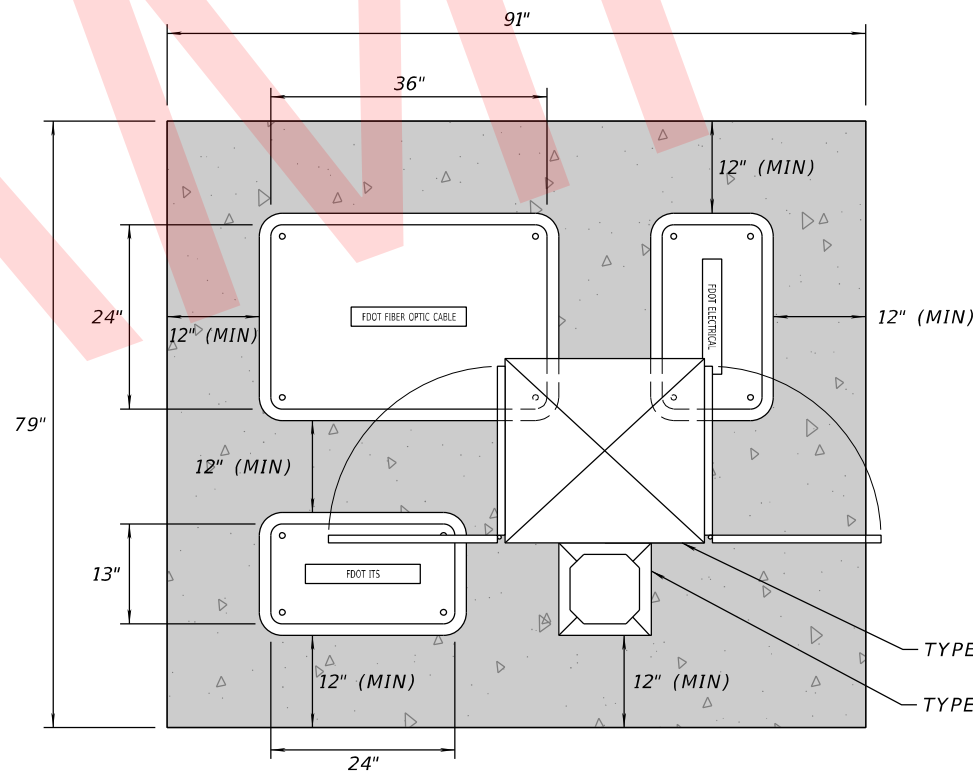
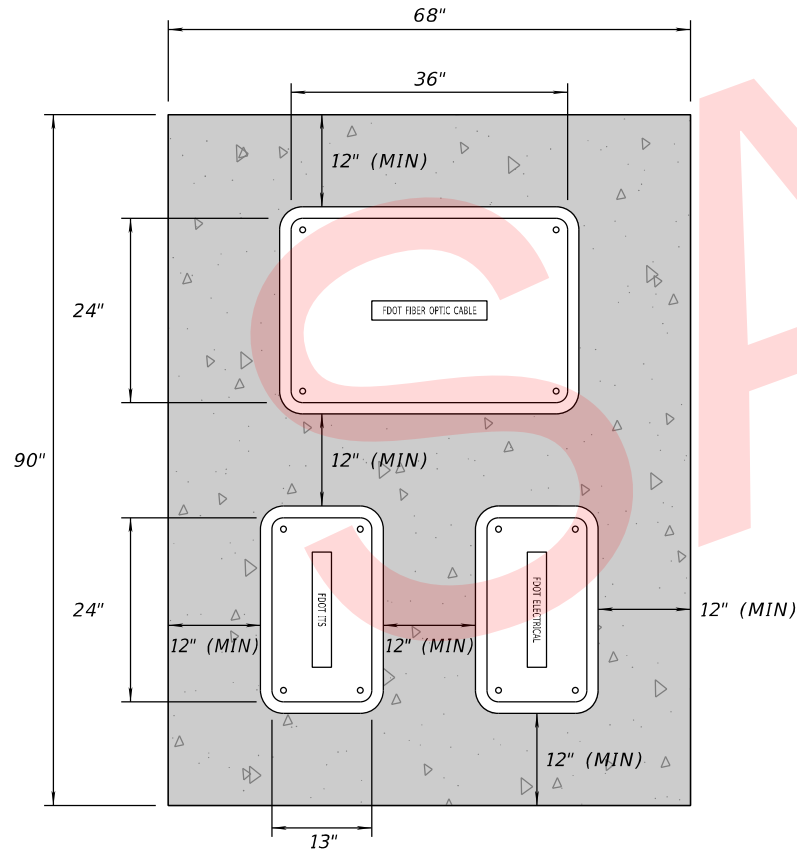
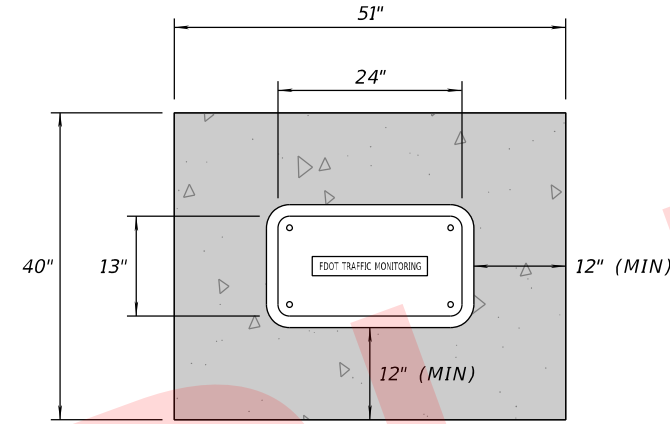
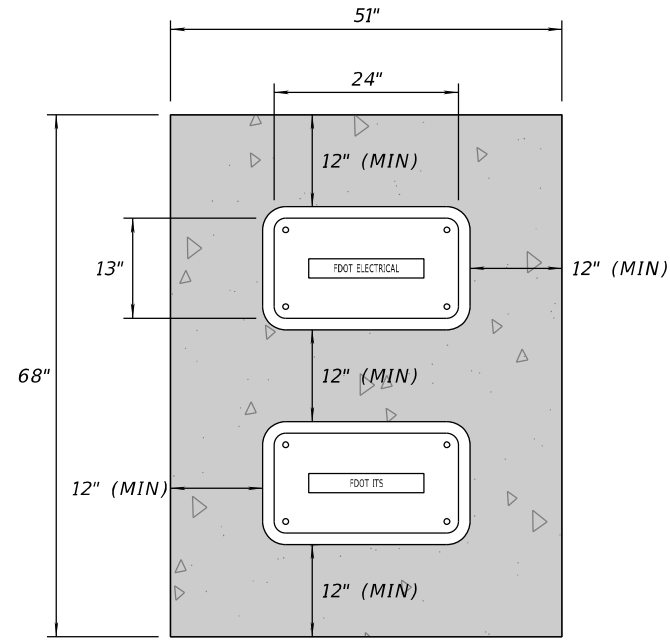
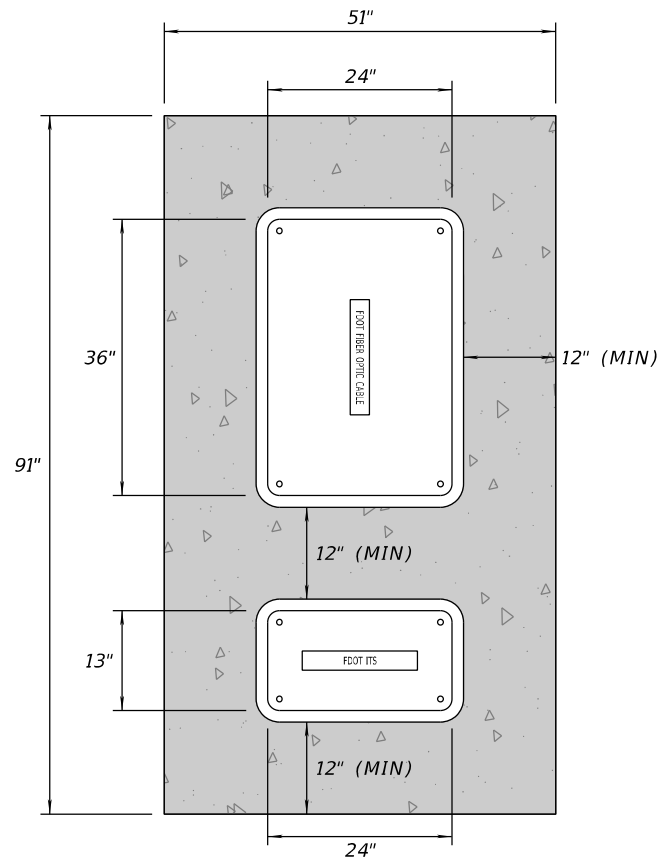
- PROPOSED, RACK UNIT OCCUPIED (FRONT)
- EXISTING, RACK UNIT OCCUPIED (FRONT)
- PROPOSED (FUTURE)
- PROPOSED, RACK UNIT AVAILABLE (REAR)
- EXISTING, RACK UNIT AVAILABLE (REAR)

REVISIONS				STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			CABINET DETAILS	SHEET NO. IT-57
DATE	DESCRIPTION	DATE	DESCRIPTION	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
				SR 9	VOLUSIA	441133-1-52-01		

FLORIDA DEPARTMENT OF TRANSPORTATION
719 SOUTH WOODLAND BLVD
DELAND, FLORIDA 32720
(386) 943-5000
JEREMY H. DILMORE, P.E. #67510

NOTES:

1. REFER TO PLAN SHEETS FOR ADDITIONAL INFORMATION ON PULL BOX COVER LABELS FOR EACH LOCATION.
2. POLE MOUNTED TYPE 336S CABINET SHALL BE ORIENTED SUCH THAT THE DOORS OPEN ALLOWING A TECHNICIAN TO ACCESS INTERNAL EQUIPMENT WITHOUT HIS/HER BACK TO TRAFFIC.



PULL BOX COVER LABEL:

- FDOT TRAFFIC MONITORING
- FDOT ELECTRICAL
- FDOT ITS
- FDOT FIBER OPTIC CABLE

TYPE 336S CABINET, POLE MOUNT

TYPE P-II POLE (12')

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

FLORIDA DEPARTMENT OF TRANSPORTATION
 719 SOUTH WOODLAND BLVD
 DELAND, FLORIDA 32720
 (386) 943-5000
 JEREMY H. DILMORE, P.E. #67510

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 9	VOLUSIA	441133-1-52-01

CONCRETE PAD DETAILS

SHEET NO.
IT-58

Appendix B – Sample MSPs



Appendix C – Sample TSPs



TECHNICAL SPECIAL PROVISION

FOR

T633 - MULTI-CONDUCTOR COMMUNICATION CABLE

FINANCIAL PROJECT NO.:

4461591-52-01

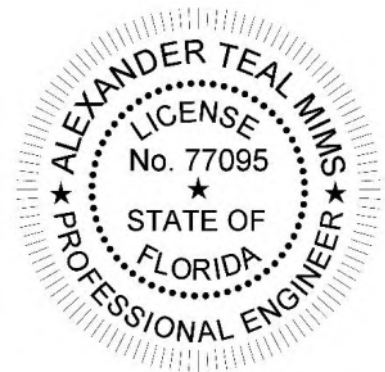
ORANGE COUNTY, SEMINOLE COUNTY, AND VOLUSIA COUNTY

This item has been digitally signed and sealed by Alexander Teal Mims, P.E. on the date adjacent to the seal.

Alexander T 2020.03.18
Mims 17:26:07 -04'00'

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Firm Name: Traffic Engineering Data Solutions, Inc.
Firm Address: 80 Spring Vista Drive
City, State, Zipcode: DeBary, FL, 32713
Certificate of Authorization Number: 27392
Page(s): 1 - 3



T633 – MULTI-CONDUCTOR COMMUNICATION CABLE

T633-1 Description.

Furnish and install multi-conductor communication cable for ITS field devices as shown in the Plans. Multi-conductor communication cable is used to carry communication signals between ITS equipment, via communication protocols such as Ethernet and RS-485 serial, or is used to energize signaling equipment as part of signaling circuits.

T633-2 Materials.

T633-2.1 General: Use only new materials meeting the requirements of this Technical Special Provision.

T633-2.2 CAT-6 Cable: Use polyethylene jacketed CAT-6 cable conforming to the requirements of TIA 568 C.2 with ETL verification. Cable which is ran outside of equipment enclosures must be shielded twisted pair Ethernet cable (FTP) using an aluminum foil shield with drain wire, include solid copper conductors, and be terminated with shielded RJ-45 connectors. Cable which remains within the equipment enclosure where it originates may be un-shielded twisted pair (UTP), include stranded copper conductors, and be terminated with un-shielded RJ-45 connectors. Use straight-through cables when connecting data terminating equipment (DTE) to data communications equipment (DCE), and cross-over cables when connecting DTE to DTE or DCE to DCE. For RJ-45 connector color coding: use TIA T-568B connectors as the standard configuration for straight-through cables, and use TIA T-568B on one end and TIA T-568A on the other end for cross-over cables.

T633-2.2.1 Break-away Connectors: Use break-away connectors that employ an in-line circular pin and sleeve style connector capable of transmitting 1,000 megabits per second Ethernet and compatible with shielded CAT-6 cable. Connector shall lock upon engagement but separate if 25 or more pounds of cable pulling force is applied without causing damage to the connector or connected cabling.

Connectors must be rated to operate in temperatures ranging from -34° C to 74°C, be corrosion resistant, be IP68 or IP6K9K rated when engaged, and be 300 volts minimum rated.

T633-3 Installation Requirements.

Install multi-conductor communication cable in continuous lengths between ITS cabinets and from ITS cabinets to the appropriate ITS device. Separate multi-conductor communication cables from high voltage conductors: do not install multi-conductor communication cabling in the same conduit or pull boxes, as cable carrying current in excess of 1.5 amps or energized to a voltage in excess of 24 VDC/VAC to ground or between conductors. Keep cable on the unprotected side of surge suppression devices separate from cable on the protected side to prevent induction of lightning and other high voltage transient currents.

T633-3.1 Protection of Cable: Ensure cable drawn through conduit, ducts, drilled holes protected by a rubber grommet, or support structures is installed in such a manner as to prevent damage to conductors or insulation.

T633-3.2 Surge Protective Devices: Install surge protective devices, meeting the requirements of Section 620, on cable when entering traffic signal cabinets, ITS cabinets, or other equipment enclosures, and as indicated in the Plans, prior to connection to Ethernet switches, PoE injectors, device servers, and other terminal devices.

T633-3.3 Outdoor Connections: Cable connections to equipment located outdoors must be provided with a means to prevent water intrusion at the equipment connection or cable entrance to the equipment housing.

T633-3.4 Break-away Connections: When installing cabling that enters a post or pole that is attached to a break-away base, install an in-line break-away connector for the cable in the pull box at the base of pole or post or within the post's or pole's break-away base. The break-away connection shall be installed to disengage if the break-away post or pole is knocked down and thereby prevent damage to underground cabling leading to the pole or post.

Install a strain relief mechanism that attaches to the cabling or break-away connector and prevents the section of cabling that does not enter the break-away pole or post from moving if pulled. The mechanism must be strong enough to allow disengagement of the break-away connector and must not cause damage to the cable's jacket. The strain relief mechanism must be manufactured of corrosion resistant materials and be suitable for installation in wet conditions.

T633-4 Method of Measurement.

The Contract unit price for multi-conductor communication cable, furnished and installed, will include furnishing all material, terminal connectors, break-away connections, strain relief mechanisms, surge suppression devices, cable shield grounding, and labor necessary for a complete and accepted installation. Payment will be based on the linear feet of multi-conductor cable installed.

For removal of multi-conductor communication cable, payment will be based on linear feet of cable removed.

T633-5 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. 633-8-1	Multi-Conductor Communication Cable, Furnish & Install -
per foot.	
Item No. 633-8-6	Multi-Conductor Communication Cable, Remove -per foot.

TECHNICAL SPECIAL PROVISION

FOR

T639 - ELECTRICAL POWER SERVICE TRANSFORMER

FINANCIAL PROJECT NO.:

446159-1-52-01

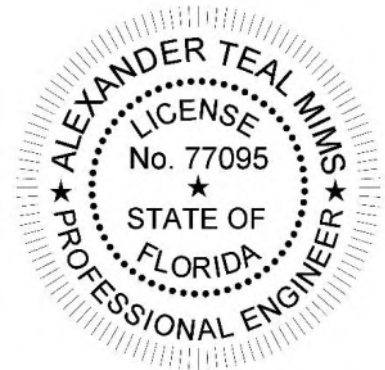
ORANGE COUNTY, SEMINOLE COUNTY, AND VOLUSIA COUNTY

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Firm Name: Traffic Engineering Data Solutions, Inc.
Firm Address: 80 Spring Vista Drive
City, State, Zipcode: DeBary, FL, 32713
Certificate of Authorization Number: 27392
Page(s): 1 - 4



T639 – ELECTRICAL POWER SERVICE TRANSFORMER

T639-1 Description.

Furnish and install Electrical Power Service Transformer for ITS field devices in accordance with the Contract Documents.

T639-2 Materials.

T639-2.1 General: Distribution transformers shall be dry type, air-cooled, factory assembled transformers. All units shall be UL listed under the requirements of UL 5085 and UL 1561 and meet the requirements of NEMA ST-20. All products used for installation of dry type transformer shall be designed, manufactured and installed to facilitate a minimum useful life of 20 years.

Transformers shall be specifically designed for their intended use in stepping up or stepping down voltages between the primary and secondary windings as specified in the plans.

All transformers up to 25 KVA must have encapsulated windings that provide protection against corrosive environments. Transformers intended to be pole mounted or wall mounted, where no wall clearance will be provided beyond that provided by the mounting provisions, shall be sealed encapsulated type.

T639-2.2 Enclosure (Cabinet): Use an enclosure conforming to NEMA Standards for Type 3R, made of galvanized steel, aluminum, stainless steel or other materials approved by the Engineer.

T639-2.3 Electrical Rating: Transformers shall be 120, 240, 480, 600, 120/240, 240/480, 240x480 single phase, primary or secondary, as shown in the plans. Primary windings shall be provided with a minimum of two 2.5% full capacity above nominal (FCAN) voltage taps and a minimum of two 2.5% full capacity below nominal (FCBN).

T639-2.4 Temperature classifications: Transformers rated less than 15 KVA shall utilize Class 180 or 185 insulation systems, with a 115°C or lower winding temperature rise. Transformers rated 15 KVA and greater shall utilize Class 220 insulation systems, with a 150°C or lower winding temperature rise. The transformer shall utilize an insulation system that has been properly temperature classified in accordance with NEMA ST-20.

Encapsulated transformers rated 15KVA to 25KVA using a Class 180 or 185 insulation system with a 115°C or lower winding temperature rise may be utilized if specific approval is provided by the Engineer.

T639-2.5 Load rating: Furnish and install transformers with load ratings as described in the plans. Transformers shall be capable of operating continuously at 100 percent of nameplate rating in an ambient temperature not exceeding 40° C. Transformers 5 KVA and above shall be capable of meeting overload requirements per ANSI C57.96 with normal life maintained.

T639-2.6 Sound rating: Sound levels shall not exceed following:

Transformer Rating (KVA)	Maximum Sound Level Decibels per NEMA ST-20
0-9	40
10-50	45
51-150	50
150-300	55
301-500	60

T639-3 Installation Requirements.

T639-3.1 General:

Follow installation procedures recommended by National Electric Code (NEC) and National Electrical Safety Code (NESC).

Ground mount transformer unit shall be set level on a concrete pad and secured to the pad with bolts. Pole mount transformer is required to be fastened securely to the pole.

T639-3.2 Testing: Each transformer shall be given the following production tests: loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level. Each transformer shall be given the following field quality control checks:

1. Check wiring connections for damage and torque, as applicable, prior to energizing the transformer.
2. Measure primary and secondary voltages under normal load conditions. Then, with the transformer de-energized, adjust tap settings as necessary to approach nominal system voltage on the transformer secondary, by selecting the tap setting that provides the nearest to nominal secondary output voltage.
3. Check grounding and bonding of transformer enclosure. Ensure that separately derived systems, which are required to be grounded by the NEC or the plans, are fitted with an appropriately installed and sized system bonding jumper in accordance with the NEC.

T639-4 Warranty.

Ensure that the transformer has a manufacturer's warranty, transferrable to the Department, covering defects for five years from the date of final acceptance by the Engineer in accordance with Section 5-11 and Section 608.

T639-5 Method of Measurement.

The quantity to be paid will be the plan quantity for each Electrical Power Transformer furnished, installed, and accepted. Shall include the cost of all mounting hardware, a concrete pad for ground mount transformers, all materials, all labor, all hardware, and all incidentals necessary to complete the work.

T639-6 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. 639-6-1 Electrical Power Service Transformer – each.

Item No. 639-6-2 Electrical Power Service Transformer, replace existing –

each.

SAMPLE

TECHNICAL SPECIAL PROVISION

FOR

T684 – MANAGED HUB ETHERNET SWITCH (MHES)

FINANCIAL PROJECT NO.:

446159-1-52-01

ORANGE COUNTY, SEMINOLE COUNTY, AND VOLUSIA COUNTY

This item has been digitally signed and sealed by Alexander Teal Mims, P.E. on the date adjacent to the seal.

Alexander T 2020.03.18

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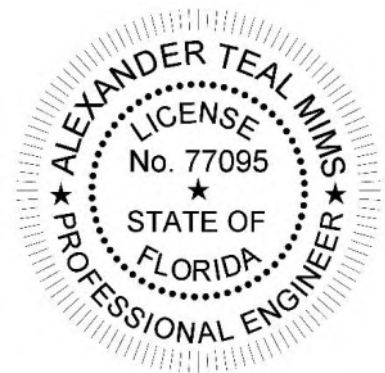
Firm Name: Traffic Engineering Data Solutions, Inc.

Firm Address: 80 Spring Vista Drive

City, State, Zipcode: DeBary, FL, 32713

Certificate of Authorization Number: 27392

Page(s): 1 - 5



T684-1 - MANAGED HUB ETHERNET SWITCH

T684-1.1 Description.

Furnish and install a Managed Hub Ethernet Switch (MHES) for intelligent transportation system (ITS) projects to be installed in ITS Local Hubs as indicated in the ITS plans. Ensure that the MHES provides wire-speed Ethernet connectivity at transmission rates of 1 or 10 Gigabit/second to and from adjacent MHES within the ITS network. Use only equipment and components that meet the requirements of these minimum specifications.

T684-1.2 Materials.

T684-1.2.1 General: Ensure that the ITS network administrator will be able to manage each MHES individually and as a group for switch configuration, performance monitoring, and troubleshooting. Ensure that the MHES provides QoS, IGMP, rate limiting, security filtering, and general management features.

Ensure that the furnished MHES is fully compatible and interoperable with the ITS trunk Ethernet network interface, and that the MHES supports half and full duplex Ethernet communications.

Ensure that the MHES includes layer 3 support capabilities, including, Open Shortest Path First (OSPF) routing protocol, Routing Information Protocol (RIP), must support 12,000 IPv4 routes and 2,000 IPv6 routes, and Protocol Independent Multicasting (PIM). Ensure all routing protocols are performed by way of hardware to ensure maximum line rates speed. Ensure the MHES includes any license(s) required to utilize all available layer 3 features. Furnish all small form factor pluggable (SFP) transceivers listed in Table 1 below for each MHES.

Table 1 - Required Optical Transceivers

GBIC QUANTITY	PHYSICAL LAYER STANDARD	DATA TRANSFER RATE	MINIMUM TRANSCEIVER DISTANCE
2	1GBASE-EX	1 Gbps	40 kilometers
2	1GBASE-LX10	1 Gbps	10 kilometers

Furnish an MHES 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 transmission medium and Category 5E/6 copper transmission medium. Provide a switched Ethernet connection for each remote ITS field device.

Ensure that the MHES 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.

Ensure all routing protocols are performed by way of hardware to ensure maximum line rates speed. Ensure the MHES includes any license(s) required to utilize all layer 3 features.

T684-1.2.2 Networking Standards: Ensure that the MHES complies with all applicable IEEE networking standards for Ethernet communications, including but not limited to:

1. IEEE 802.1D Standard for Media Access Control (MAC) Bridges used with the Rapid Spanning Tree Protocol (RSTP).
2. IEEE 802.1Q standard for port-based virtual local area networks (VLANs).
3. IEEE 802.1P standard for Quality of Service (QoS).
4. IEEE 802.3 standard for local area network (LAN) and metropolitan area network (MAN) access and physical layer specifications.
5. IEEE 802.3u supplement standard regarding 100 Base TX/100 Base FX.
6. IEEE 802.3x standard regarding flow control with full duplex operation.
7. IEEE 802.3z supplement standard regarding 1000 Base X.

T684-1.2.3 Optical Ports: Ensure that all fiber optic link ports operate at 1,310 or 1,550 nanometers in single mode. Ensure that the optical ports are Type LC unless otherwise specified in the Plans. Do not use mechanical transfer registered jack (MTRJ) type connectors.

Provide an MHES having a minimum of six optical Ethernet ports capable of transmitting data at 1 or 10 Gigabit/second unless otherwise shown in the Plans. Ensure the MHES is configured with the number and type of ports detailed in the Contract Documents. Provide optical ports designed for use with a pair of fibers; one fiber will transmit (TX) data and one fiber will receive (RX) data.

T684-1.2.4 Copper Ports: Provide an MHES that includes a minimum of twelve gigabit Ethernet end user copper ports unless otherwise shown in the Plans. All copper ports shall be Type RJ-45 and shall auto-negotiate speed (i.e., 10/100/1000 Base) and duplex (i.e., full or half). All 10/100/1000 Base TX ports shall meet the specifications detailed in this section and shall be compliant with the IEEE 802.3 standard pinouts.

T684-1.2.5 Management Capability: Ensure that the MHES supports all Layer 2 management features and certain Layer 3 features as defined by these specifications. Layer 2 features shall include, but not be limited to:

1. An MHES that is a port-based VLAN and supports VLAN tagging that meets or exceeds specifications as published in the IEEE 802.1Q standard, and has a minimum 4-kilobit VLAN address table.
2. A forwarding/filtering rate that is a minimum of 14,880 packets per second for 10 megabits per second, 148,800 packets per second for 100 megabits per second, and 1,488,000 packets per second for 1000 megabits per second.
3. A minimum 4 kilobit MAC address table.
4. Support of, at a minimum, Version 2 of the Internet Group Management Protocol (IGMP).
5. Support of remote and local setup and management via telnet and secure Web-based GUI.
6. Support of the Simple Network Management Protocol (SNMP) version 2 and 3. Verify that the MHES can be accessed using the resident EIA-232 management port, a telecommunication network, or the Trivial File Transfer Protocol (TFTP).
7. Port security through controlling access by the users. Ensure that the MHES has the capability to generate an alarm and shut down ports when an unauthorized user accesses

the network.

8. Support of remote monitoring (RMON) of the Ethernet agent and the ability to be upgraded to switch monitoring (SMON), if necessary.

9. Support of TFTP and either Network Time Protocol (NTP) or the Simple Network Time Protocol (SNTP). Ensure that the MHES supports port mirroring for troubleshooting purposes when combined with a network analyzer.

10. Sampled Flow Network Monitoring export protocol capable of being turned on or off on individual Ethernet ports without affecting traffic.

Layer 3 features shall include, but not be limited to:

1. Open Shortest Path First (OSPF) routing protocol 12000 IPv4 routes and 2000 IPv6 routes.

2. Routing Information Protocol (RIP).

3. Protocol Independent Multicasting (PIM).

T684-1.2.6 Mechanical Specifications: Ensure the MHES is no greater than 1-Rack Unit tall when mounted with the MHES front face 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.

T684-1.2.7 Electrical Specifications: MHES must be capable of operating on a nominal voltage of 120 volts alternating current (V_{AC}).

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

T684-1.2.8 Environmental Specifications: Ensure that the MHES has an operating temperature range of 0° Celsius to 45° Celsius. Ensure that the MHES has a storage temperature range of -40° Celsius to 70° Celsius. Ensure that the MHES has a non-condensing relative humidity range of 5% to 90% at 40° Celsius.

T684-1.3 Installation Requirements.

T684-1.3.1 General: Mount the MHES inside a field site cabinet utilizing a rack mount kit that does not exceed 1-Rack Unit. Ensure that the MHES 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.

T684-1.3.2 Testing: Subject the MHES to all tests as required by Subarticle 684-1.4 of the Standard Specifications, technical special provisions, and manufacturer's recommendations.

T684-1.4 Testing:

T684-1.4.1 General: Subject the MHES to field acceptance tests (FATs). Develop and submit a test plan for FATs to the Engineer for consideration and approval. The Engineer reserves the right to witness all FATs. Complete the tests within five calendar days.

T684-1.4.2 Field Testing: Once the MHES has been installed, conduct local FATs at the MHES field site according to the submitted test plan. Perform the following:

1. Verify that physical construction has been completed as detailed in 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.
5. Verify all connections, including correct installation of communication and power cables.
6. Verify configuration of the MHES Internet Protocol (IP) addresses and subnetwork mask.
7. Verify the network connection to the MHES through ping and telnet sessions from a remote personal computer (PC).
8. Verify command line interface is responding through serial ports.
9. Verify graphical user interface is responding through Ethernet ports.
10. Verify that VLAN's have been configured as directed by and coordinated with the Department.
11. Verify that correct IGMP multicast group has been configured as directed by and coordinated with the Department.
12. Verify SNMP and RADIUS and TACAS+ settings are as specified on www.cflsmartroads.com.

T684-1.5 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.

The manufacturer will warranty all components against defects in materials and workmanship for five years from the date of final acceptance by the Engineer. The warranty will cover all parts and onsite labor required for troubleshooting and repair.

Contractor hereby assigns to the Department any and all manufacturers' or other sellers' warranties that come with any products, material or supplies which are incorporated into or are consumed in the project in any way. To the extent that any such warranties do 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 with the intent that the Department be the 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. All subcontracts shall contain a similar provision which requires subcontractors to assign any such warranties to the Department.

T684-1.6 Method of Measurement.

The quantity to be paid for will be the number of MHES furnished, installed, and accepted.

T684-1.7 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. 684-1-1 Network Device, Managed Field Ethernet Switch-each.

Appendix D – Example PPCs



STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION
PROPRIETARY PRODUCT CERTIFICATION

630-020-07
SPECIFICATION
08/14

To: Jim Stroz, PE
Design Engineer

Date: 7/22/2020

Financial Project ID: 446159-2-52-01 New Const. RRR
Federal Aid Number: N/A
Project Name: Wrong Way Driving Signs Bundle B
State Road Number: SR 400 Co. / Sec. / Sub.: Volusia (79110, 79060)
Begin Project MP: 9.210 End Project MP: 13.200
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, Alexander Teal Mims, P.E., Engineer of Record, of the Traffic Engineering Data Solutions,
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 (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."

Alexander T Mims 2020.08.03 11:10:35 -04'00' , 7/22/2020
Signature Date

For Department Use Only

"I, James S. Stroz, Jr., P.E., District Traffic Operations Engineer,
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 (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:

DocuSigned by:
James S. Stroz, Jr. 8/5/2020 | 3:20 PM EDT
Signature Date

July 22, 2020

Mr. Jim Stroz, P.E.
FDOT District Five Traffic Operations Engineer
719 South Woodland Boulevard
DeLand, Florida 32720

Subject: **Proprietary Product Certification Justification Letter**
FPID: 446159-2-52-01
Project Name: Wrong Way Signs Bundle B
Product: Alpha FXM UPS

Mr. Stroz,

Please refer to the attached Proprietary Product Certification Form 630-020-07, completed in accordance with Procedure 630-020-005 adopted August 20, 2014. Please also refer to the following justification provided for the use of the proprietary product:

1. Description of project need for the proprietary product.

- a. **Project Description:** Wrong Way Signs Bundle B includes installation of wrong way vehicle detection system (WWVDS) and other wrong way driving deterrents on 6 SR 400 off-ramps in Volusia County. New ITS cabinets, fitted with Uninterruptible Power Supplies (UPS), are proposed to support the WWVDS.
- b. **Need for Reliable Power:** The supply of reliable uninterrupted power for the WWVDS is important to ensure proper operation in the field for this live-saving system. WWVDS includes sensitive electronics that require a reliable source of power to operate properly. UPS will provide a reliable source of power that will reduce the impacts of short-term power outages and over-voltage and under-voltage events.
- c. **Compatibility with Existing UPS:** District 5 has over 200+ Alpha FXM UPS in operation, which is the same product included in this Proprietary Product Certification Request. In order to leverage the existing spare parts inventory, existing network configuration, and existing personnel knowledge, it is beneficial to use the same product.
- d. **Proprietary Product Description:** The Alpha FXM UPS is a line-interactive UPS that can perform a wide range of Automatic Voltage Regulation (AVR) that lengthens battery life by providing protection without transferring to battery backup during over-voltage and under-voltage events. The UPS can also switch to battery back-up power during loss of utility power and thereby continue supplying power to the WWVDS.

2. Factual and technical supporting evidence for synchronization.

- a. **Function:** The proprietary product is necessary for synchronization with the District's existing ITS. This product is the same product already in use and is guaranteed to be compatible with the existing infrastructure's network configuration; a specification sheet for the Alpha FXM UPS is attached to this letter as Exhibit A.
- b. **Logistics:** The proprietary product is interchangeable with products in the District's maintenance inventory. ITS Maintenance Contractor personnel are familiar with installation, troubleshooting, and repair of this product.
- c. **Training:** The District's staff and ITS Maintenance Contractor are familiar with and trained to use the product. By using the same product, no additional training costs are anticipated.

3. Explanation how the evidence links the proprietary product to the project need.

Exhibit A is a specification sheet for the Alpha FXM 1100 UPS, which is the same product line (Alpha FXM series) in use throughout the District.

4. Factual and technical supporting evidence that no alternatives are available.

There are no alternative UPS that ensure synchronization with the District's existing maintenance inventory, network configurations, and staff familiarity.

5. Conclusion:

Approval for use of the Alpha FXM UPS, a proprietary product, is requested for approval on this project to ensure synchronization with District 5's existing maintenance procedures, network configuration, and personnel training.

If you have any questions, or need additional information, please contact me at (386)753-0558 or via email at amims@teds-fl.com.

Sincerely,

Alexander T Mims 2020.08.03 11:10:52
-04'00'

Engineer of Record

Alexander Teal Mims, P.E.



an EnerSys company

FXM 1100

Rugged UPS Module



- 1100W/VA UPS designed to operate in extreme environments and provide maximum flexibility while ensuring critical loads remain protected and running during power outages and other power disturbances
- Wide range Automatic Voltage Regulation (AVR) lengthens battery life by providing protection without transferring to backup mode during voltage surges or sags
- Independently programmable control and reporting dry contacts allow monitoring and controlling of key functions
- Temperature compensated battery charging protects batteries from overcharging or undercharging at extreme temperatures, extending the life of the battery
- Local and remote monitoring and control via RS232 port and Ethernet SNMP interface
- UPS panels can be rotated, improving flexibility and viewing convenience

Alpha FXM is a line of rugged UPS power modules used worldwide where clean backup power is needed.

Designed to perform in the most extreme demanding environments, Alpha FXM units ensure equipment in security, communications, traffic, industrial environments, and many other critical applications remains safe and protected from power disturbances. Thanks to its powerful programmable battery charger, the FXM is capable of providing the runtime you need. All FXM models are available in 120Vac and 230Vac.










Alpha's FXM family of uninterruptible power supplies (UPS) are designed to provide clean and reliable backup power. Featuring an automatic voltage regulation (AVR), each FXM UPS provides power stability in varied power conditions without using batteries as well as the ability to switch to emergency backup power while maintaining critical loads. The factory installed SNMP card allows remote programming, monitoring and automatic e-mail notification via a web browser.

FXM 1100 Rugged UPS Module

03/2020

Consult your sales representative for P/N configurations

Electrical	
120Vac Model	
Battery String Voltage:	48Vdc
Nominal Voltage:	120Vac
Frequency:	60/50Hz ±5% (auto-detection)
Input:	Voltage Range: 85 to 175Vac Current: 15.5A (@ nominal voltage and max battery charging current)
Output:	Waveform: Pure sinewave Nominal Voltage: 120Vac Voltage Regulation: ±10% on line mode, ±2% on inverter mode Power at 55°C: 1100W/VA Frequency: Output frequency = Input frequency
230Vac Model	
Battery String Voltage:	48Vdc
Nominal Voltage:	230Vac
Frequency:	60/50Hz ±5% (auto-detection)
Input:	Current: 8A (@ nominal voltage and max battery charging current) Voltage range: 150 to 328Vac
Output:	Waveform: Pure sinewave Nominal Voltage: 230Vac Voltage Regulation: ±10% on line mode, ±2% on inverter mode Power at 55°C: 1100W/VA Frequency: Output frequency = Input frequency
Mechanical	
Dimensions:	mm: 133H x 394W x 222D inches: 5.22H x 15.5W x 8.75D
Weight:	16kg (35lbs)
Communication Interface	
Display:	2 x 20 backlit alpha-numeric LCD
Ports:	<ul style="list-style-type: none"> DE-9 Female: Local RS232 Communication RJ45: Remote Communication RJ11: Battery Temperature Compensation
Indicators:	<ul style="list-style-type: none"> Green & Red LED's Solid Green: Line Mode Flashing Green: Inverter Mode Flashing Red: Alarm Solid Red: Fault
Dry Contacts:	Programmable NO/NC (250Vac, 1A)*, 3 user inputs, ATS
Factory Default:	<ul style="list-style-type: none"> C1: On Battery C2, C3: Low Battery C4: Load Shed Timer 1 C5: Alarm C6*: 48Vdc @ 500mA C7: User Inputs <ul style="list-style-type: none"> S1: Self test S2: User Input S3: Shutdown(EPO) C8: ATS
*C6 is factory configurable only	

Environmental		
Operating Temp Range*:	-40 to 74°C (-40 to 165°F)	
Humidity:	Up to 95% (non condensing)	
Altitude (m/ft):	Up to 3700 (12,000)**	
Audible noise @ 25°C:	45dBa @ 1 meter (39in)	
MTBF (hours):	150K + as per Telcordia SR-332, 100% duty cycle, full load	
BTU/Hr:	Normal mode: 22W/75 BTU/hr Backup mode: 242W/825.75 BTU/hr	
*Derates after 55°C **Derates 2°C per 300m (1000ft) above 1400m (4500ft)		
Performance		
Typical Output Voltage THD:	<3% (resistive load)	
Typical Efficiency:	>98% (resistive load)	
Typical Transfer Time:	<5ms	
Load Crest Factor:	3:1 (load dependent)	
Power Connector Options		
120Vac Model		
Input:	Output:	
Standard	 Terminal Block	 Terminal Block
Optional	 Terminal Block	 Terminal Block + Dual 5-15R
 IEC**	 IEC**	
230Vac Model		
Standard	 Terminal Block	 Terminal Block
**FXM models with IEC connectors come with 4 lines LCD display instead of the traditional 2 lines display Only available in Kit 0380009-003		
Agency Compliance * * *		
Electrical Safety:	UL1778, CSA 22.2 No 107.3; EN62040-1	
Marks:		
EMC:	CFR47, Part 15 Subpart B, Class A; CES-003 Class A; EN62040-2 Class A	
Compliance only applies to units with standard input and output connectors. Contact us for compliance information on models with optional power connectors *CE applies to 230Vac version only		



February 2, 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
426905-3-32-01 I-95 (SR 9) Interchange at Ellis Rd./St. Johns Heritage Pkwy.
(CyberLock electronic key and lock system for ITS Cabinets)

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 426905-3-32-01 Design Bid Build project includes the installation of an Intelligent Transportation System (ITS) along I-95 (SR 9) at the interchange for Ellis Road. Much of the proposed high value technical equipment will be installed in metallic cabinets along the roadside.
- b. Equipment Security: Typical cabinet locking systems include only a generic key (No. 2). Unfortunately this is a very common key which many unauthorized personnel own and carry. The use of an electronic key system greatly reduces, if not completely eliminates, unauthorized access to FDOT owned equipment on the roadways.
- c. Compatibility with Existing Electronic Key Systems: The Department has already installed the CyberLock product by CyberLock, Inc. included in this Proprietary Product Certification request. In order to utilize the existing infrastructure (i.e., key programming software and hardware, existing electronic keys, and existing spare par inventory), it is imperative to use the same product on this project.
- d. Proprietary Product Description: The CyberLock electronic key and lock system includes the following primary components:
 - i. Electronic Keys
 - ii. Electronic Cylinders (Locks)
 - iii. Electronic Keypoints (Remote key programming access points)
 - iv. Software

2) Factual and technical supporting evidence for Synchronization.

- a. Function: the proprietary product is necessary for the satisfactory operation of the existing facility.
 - i. The proposed product sheets are included with this letter as Exhibit A.
 - ii. 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.

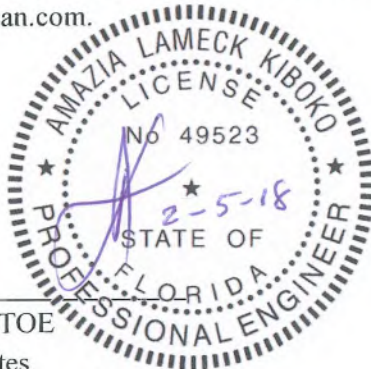
- a. The attached product specifications sheet for Cyberlock, details the proposed electronic key and lock system.

4) Factual and technical supporting evidence that no alternatives are available.

- a. In order to be compatible with the existing CyberLock electronic key and lock system, a CyberLock electronic key and lock system must be used on this project.
- b. There are no alternatives that are compatible with the existing CyberLock electronic key and lock system currently being utilized by the Department for ITS cabinet security.

If you have any questions, please feel free to contact me at (305) 591-8777 or via email at amazia.kiboko@fr-aleman.com.

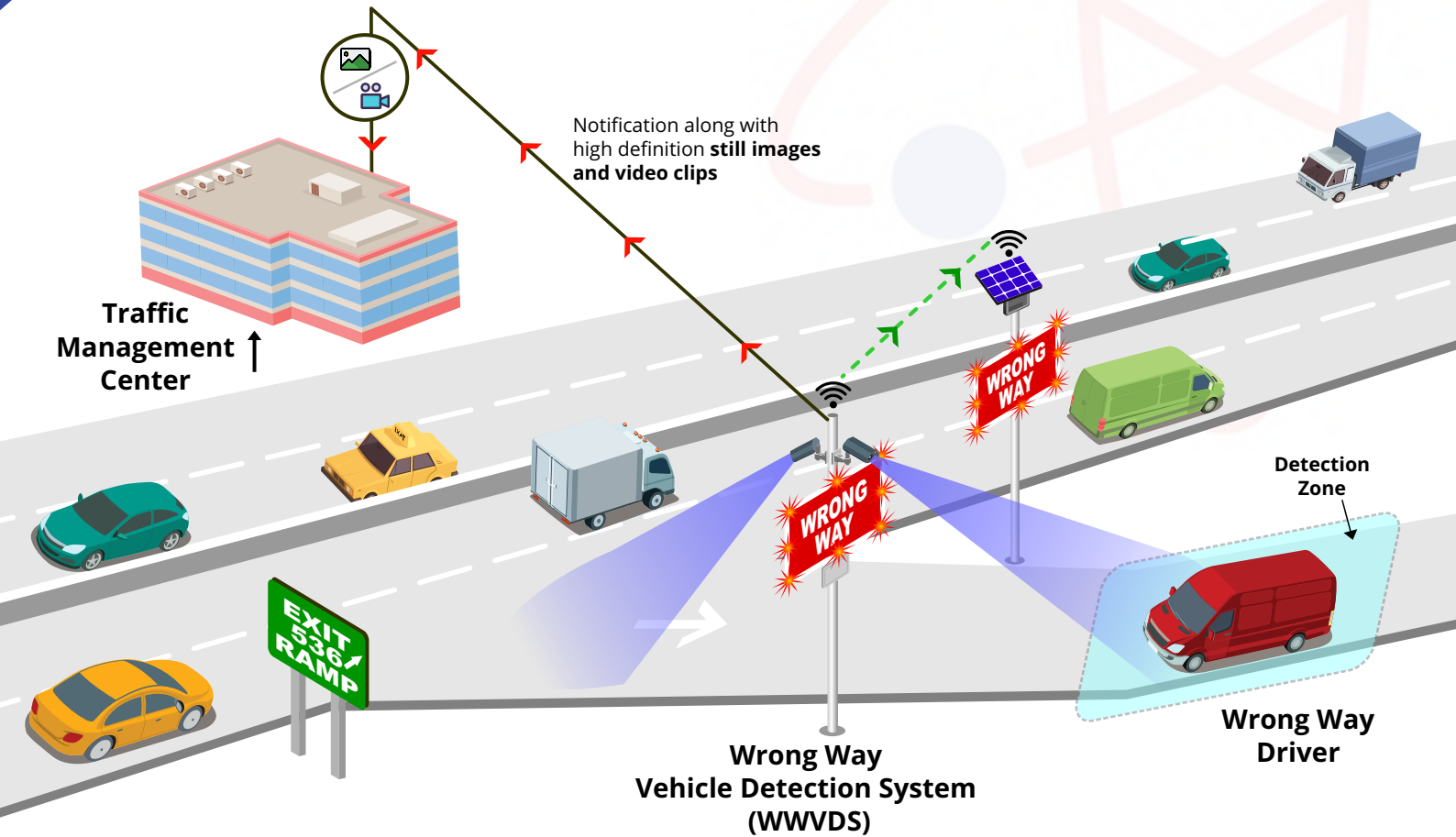
Sincerely,



Amazia Kiboko, P.E., PTOE
F.R. Aleman & Associates
Transportation Design & Planning, Vice President
(426905-3-32-01 EOR)

Appendix E – Product Data Sheets





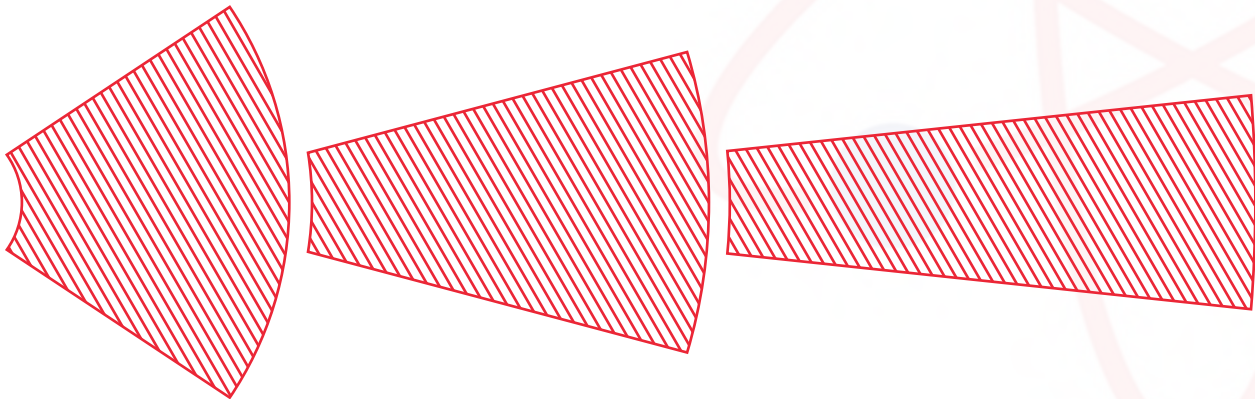
Key Attributes

- ◆ Hardened for Environmental Elements
- ◆ Local & Remote Graphical User Interface for Configuration & Monitoring
- ◆ Detection Zone(s) Editable & Configurable
- ◆ Alarms Out to ATMS Software & Warning Devices on Detection of Event
- ◆ Provides Incident High Definition Still Images & Video
- ◆ AC and Solar Power Options
- ◆ Wired and Wireless Network Options
- ◆ Highlighted Warning Signs Alert Drivers in Real-Time for Countermeasure
- ◆ User Management, System Health and Incident Reporting
- ◆ Central Server Management of Multiple Systems Available
- ◆ Bi-Spectrum (Thermal & Optical) ITS Camera for All Lighting & Weather Conditions
- ◆ Artificial Intelligence (AI) & Machine Learning Technologies

Wrong Way Vehicle Detection System

Model - GC-WWVDS-Series

GovComm detection systems are tailored for site specific topography...a bi-spectrum (optical & thermal) ITS camera is fitted with lenses best suited to cover the detection zone(s).



Wide Angle Lens
Field of View for Multiple Lanes at Short Distances

Medium Angle Lens
Field of View for Several Lanes at Common Distances

Narrow Angle Lens
Field of View for Few Lanes at Long Distances

Detection zones from one to eight lanes at distances as far as one thousand feet

Cameras

Features	Detection Camera - Bi-spectrum (Optical & Thermal)	Rear Camera
Resolution	4 Megapixel (Optical) 384 X 288 (Thermal)	2 Megapixel or 4K Optional
Lenses	Fixed - Site Specific	Varifocal - Site Specific
Infrared Illuminators	Yes	Yes
Environmental	NEMA TS-2 Lab Certified IP66 IK 10	NEMA TS-2 Lab Certified IP66 IK 10
Mounting	Pole	Pole
Logo Overlay	Yes	Yes

NVIDIA® Compute Module (Edge Device)

GPU: 256-core Pascal™ GPU

CPU: Dual-Core Denver 1.5 64-Bit CPU and Quad-Core ARM®Cortex®A57 MPCore processor

Memory: 8 GB 128-bit LPDDR4

Storage: 32 GB eMMC 5.1 Flash

Communication Interface: 1RJ45 1GB Ethernet Port

Nonvolatile Memory: System Programming is Retained in Nonvolatile Memory

Central Server Management Platform - COMPASS

Host: Amazon Web Services (AWS)

Security: SSL Certificates

Device Management: Individual & Groups

User Management: Permission Based

Detection Notifications: Phone, Email, Text & Push

Alarm Notifications: Phone, Email, Text & Push

Reporting: Permission Defined

Highlighted Warning Signs

Sign Type: Highlighted High Intensity Wrong Way Sign w/ 8 Red Embedded LEDs

Size: 42" X 30"

Activation: On Detection

Mounting: Z-Bar Brackets (set of 2)

Material: 5052 Aluminum, Type XI DG3 3M Sheet w/ Anti-Graffiti Overlay

Ultra-Bright LEDs: Peak MC 500,000 per LED, Applied Voltage 12VDC, LED 1 Watt each

Flash Rates: Adjustable From 50/50 to 90/10 Duty Cycle

Environmental: NEMA TS-2-2016 Certified by Independent Laboratory

Power: AC or Solar Option

Communications: Hard Wired or RF Wireless

Solar Option: Panel, 5052 Aluminum Enclosure & Mounting Bracket, DC20 Solar Pack

Detection Pole: 20' 4" Crash Tested Spun Aluminum Pole w/ Base, Cap & 4 Anchor Bolts

Secondary Pole: 15' 3" Crash Tested Spun Aluminum Pole w/ Base, Cap & 4 Anchor Bolts

Web Accessible User Interface

Configuration: Local and Remote Configuration, Monitoring & AI Training

Communication (IP) Addresses: User Programmable

Detection Zones: Configure, Edit & Display

Viewing: Real-Time & Historical

Reporting: View Detection / Activation History

NTP Server Integration: Sync over Network, User Configurable w/ Flexible Polling Intervals, Defined by URL or IP Address

Save System Configuration: Import / Export

System Health Monitoring: Yes

General

Materials: Corrosion-Resistant

Fasteners: Type 304 or 316 Passivated Stainless Steel

Environmental: -40°F to 167°F Operating & Storage Temperature, 95% Humidity

API: API Provided for Integration w/ 3rd Party Software & Systems

Network Cables & Connectors: Network cables and connectors comply with TIA-568

On-Board Battery Back-Up: Yes

Regulatory: FCC & UL

Network: Ethernet or Optional Cellular Modem

Power: 120VAC Standard w/ DC Converters & On-Board Battery Back-Up

Solar Power Option: Solar Panels, Battery Cabinet, Solar Charger / Inverter – 10 Day Survival w/o Sunlight



K&K Systems, inc.
Traffic Safety Products Manufacturer

WRONG WAY SYSTEMS

THERMAL | IR | RADAR | 24/7

DETECT & ALERT





WRONG WAY DONE THE RIGHT WAY

Smart systems that detect, warn, and alert.

In response to the increased frequency of wrong way related accidents, K&K Systems has developed a Wrong Way framework of components that function together or independently to make our highways safer.

We utilize Thermal Imaging cameras, Optical IR cameras, and Radar Sensors integrated with our Sign Alert System/CrossTalk Controller to detect a violator, to alert the driver, and to report the incident to the proper authorities.

Our Thermal and IR imaging cameras are proudly made in the USA. They utilize sophisticated AI software that allows visual clarity to determine a violation. While thermal and IR cameras operate in the same manner, thermal imaging allows detection through dense fog, heavy rain, smoke, and other conditions that hinder sight.



Every part of K&K Wrong Way Systems has been rigorously tested and has met the requirements set forth by NEMA and the FCC for temperature, moisture, shock, static, and more. Furthermore, our systems have also passed the Florida Department of Transportation Traffic Engineering Research Laboratory testing reporting 200 accurate alerts with no misses and no false positives.

K&K Systems is driving the standard for Solar and AC powered Wrong Way Systems. Contact us today for Wrong Way Systems that are done right.



Our Wrong Way Detection System has been tested to the extremes by third party labs to make sure that it can and will perform properly in any condition.

Some of these test include:



TEMPERATURE



VIBRATION



MOISTURE



STATIC



SALT



WIND



SOLAR



BATTERY

- **NEMA TS2 / TS4:**
 - Temperature Testing -34c to +74c
 - Vibration and Drop Testing
- **FCC Part 15 subpart B, Class B**
- **ESD IEC 6100-4-2-B & TS-4**
- **NEMA 3R Cabinet**
- **High Humidity Environment Survival (+53c, 95%RH)**
- **Salt Environment ASTM B-117**

- **Salt Environment ASTM B-117**
- **150 MPH Wind Load Survival**
- **FDOT Traffic Engineering Research Lab Test:**
 - 200 Accurate Alerts
 - 0 Misses
 - 0 False Positives
- **Solar System Tested to 10 Days Without Sunlight**
- **Built in Battery Backup with AC Systems**



I M A G I N G T H E R M A L C A M E R A

OUR THERMAL IMAGING CAMERA is embedded with self-learning video analytics to provide long-range perimeter protection and leverages thermal technology to operate under challenging conditions while minimizing false alarms. It is designed to detect the presence and movement of people and vehicles in areas with poor visibility, including partly camouflaged scenes, low lighting and even absolute darkness, without the need for additional light sources.



I M A G I N G O P T I C A L I R C A M E R A

THE OPTICAL IR CAMERA tracks and monitors vehicles while stationary or moving and determines directions and violations. It combines high-definition imaging, self-learning video analytics, network video recorder functionality and embedded Avigilon Control Center™ video management software to create an all-in-one video security solution. The cameras record video directly to an on-board solid-state drive, eliminate the need for a separate NVR, and reduce installation and system costs.



C O M P U T I N G K K - 7 0 0 P C

THE KK-700PC is a robust computer built to withstand the elements while processing large amounts of data from multiple cameras. It has a built in cell modem which can be used to monitor, alert, and send images or video of monitored areas. Additional software can monitor the location health and allow complete control of the system.



C O N T R O L L E R C R O S S T A L K - 1 0

The CrossTalk is a rugged, integrated, compact, all-in-one advanced, lighting controller, flasher, auto-dimmer and scheduler. The CrossTalk can be accessed with any cellular connected device with on-board cellular technology over a secure cloud server connection. Multiple Sign Alerts across an entire detection zone can be accessed for real-time access for low battery, status monitoring, and diagnostics.



R A D A R S E N S O R S Y S T E M

RADAR is our most cost effective way to detect motion and activate signage. It can be used alone to activate signs or in a system with other types of detectors. Our Radar Sensor is durable and built to withstand the elements with a heavy duty weatherproof enclosure that installs easily. It detects moving objects in an area 12° wide by 14° high.



- Embedded LED
- Sign Alert Back with Z-Frame

S I G N A L E R T S Y S T E M



K&K SIGN ALERT SYSTEM is designed to increase road safety by increasing motorist visibility by embedding ultra-bright LEDs into an MUTCD regulatory sign that can be activated using cameras or sensors. Our proprietary process assures the is durable and weathertight. Each ultra-bright LED is embedded into the sign and sealed. K&K's smart controller preserves energy and/or battery life with its auto-dimming feature while maintaining brightness through all weather conditions.

HOW IT WORKS

The K&K Solar Powered Wrong Way Systems diagram below divides the roadway or ramp into 3 zones of detection - The Warning Zone, the Correction Zone, and the Alert Zone. The Warning and Correction Zones are equipped with Sign Alert Systems that are controlled by the Thermal and IR cameras via the CrossTalk Controller. The Thermal camera monitors the entire detection zone. The IR cameras monitor the Correction Zone and the rear area of the Alert Zones. The Thermal and IR Camera System powered by the Power Pack is located in the Alert Zone.

WRONG WAY DETECTION ZONE ANATOMY

WARNING

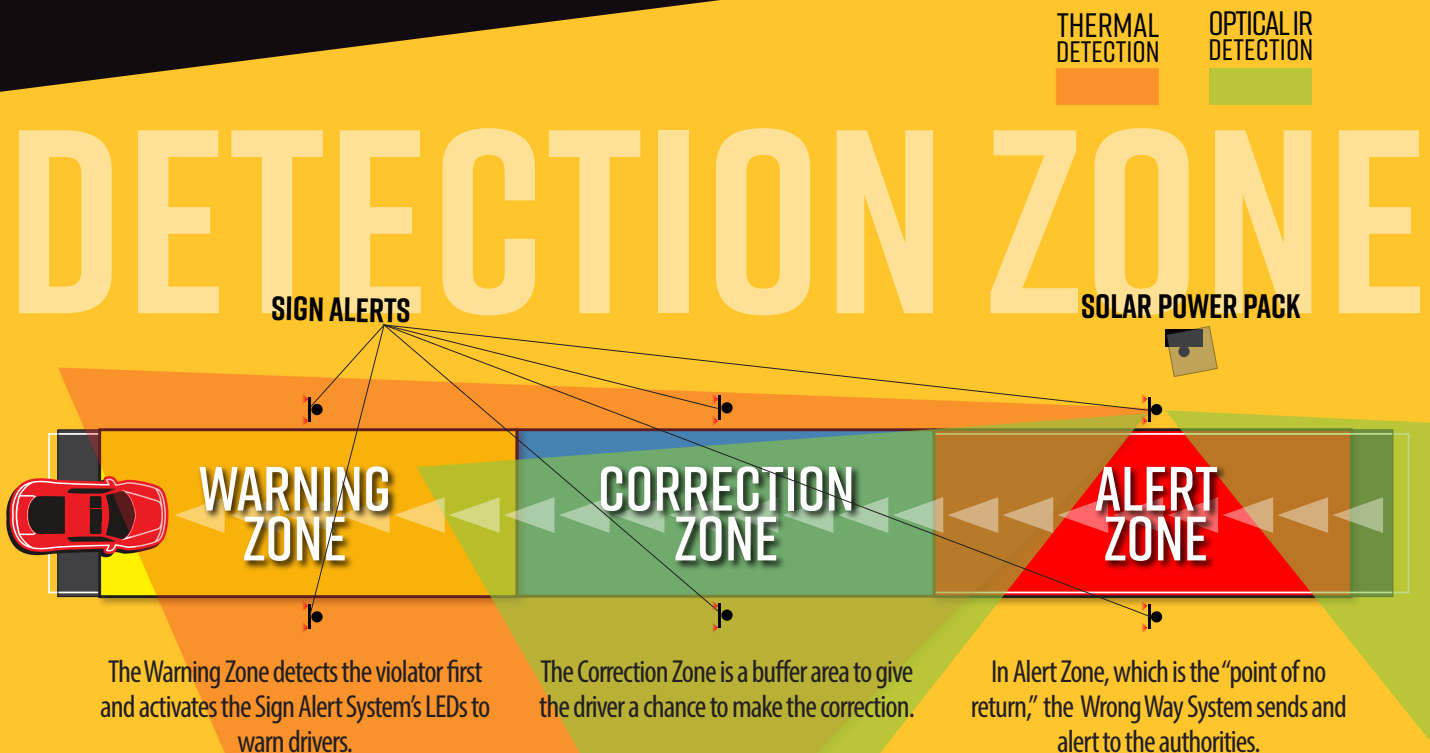
When a vehicle enters the Warning Zone the cameras and/or radar detect its presence and the direction it is traveling. If the system determines the vehicle is traveling the wrong direction, the Sign Alerts are activated causing the LEDs to flash to warn the driver.

CORRECTION

The cameras monitor the vehicle's activity. If the vehicle corrects its path, no more action is taken.

ALERT

If the vehicle continues in the wrong direction in the Alert Zone, the cameras flag the video and sends an alert to the proper authorities.



Thermal Camera
IR Camera
IR Camera



7 ft. for
crash-worthiness



WRONG WAY MODEL SELECTION



CAPABILITY	WWS-1	WWS-2	WWS-3	WWS-4	WWS-5	WWS-6
AC or Solar Powered	■	■	■	■	■	■
Remote Connection	■	■	■	■	■	■
Sign Activation	■	■	■	■	■	■
Signal Lane	■	■	■	■	■	
Multiple Lanes	■	■	■	■		
Alert Notification	■	■	■	■		
Thermal Detection	■	■				
Forward Facing IR Detection	■		■	■		
Rear Facing IR Detection	■		■			

WRONG WAY DETECT & ALERT SYSTEM

MODEL# WWS-AC/SP-1

POST & COMPONENTS

- ▶ Thermal Imaging Camera
- ▶ (2) IR Optical Cameras
- ▶ Wrong Way Sign Alert Diamond Grade Material
- ▶ (8) Sign Alert LEDs Available in Red or White
- ▶ Drop Down Aluminum Control Box
- ▶ Spun Aluminum Post with Pole Collar
- ▶ Drive Base or other Anchoring Option

CONTROL BOX & COMPONENTS

- ▶ Weathertight Aluminum Cabinet
- ▶ KK-700PC
- ▶ Advanced Controller
- ▶ Photocell with Solar Panel
- ▶ Battery for Backup Power
- ▶ Power Source
- ▶ Battery Charger



Beacon options available

BUILD YOUR SYSTEM



K&K Wrong Way System's Solar Power Pack provides energy for systems using Thermal and Optical IR Cameras. It can be located in the clear zone away from traffic.



Radar Sensor and 24/7 Wrong Way System's Eco Solar Panel and Control Box.

K&K Wrong Way Systems include options to best monitor your roadway's Detection Zones. Below are some key features that will help determine the proper components for your Wrong Way System.

POWER SOURCE:

- SOLAR POWERED SYSTEM
- WIRED AC SYSTEM

K&K Wrong Way Systems can be powered with Solar or AC. Solar has the benefit of allowing Wrong Way Systems to be located virtually anywhere. No wiring or boring needed.

NUMBER OF LANES MONITORED:

- ONE LANE
- MULTIPLE LANES

Multiple lanes are monitored by Thermal and Optical IR cameras. A single lane can be monitored with a Radar Sensor.

ROADWAY SHAPE:

- STRAIGHT
- CURVED

Thermal and Optical IR Cameras placed in the Alert Zone are capable of monitoring an entire access ramp with a straight line of sight. Radar Sensor Systems can be placed in the Warning and Correction Zones in curved roadways.

THERMAL DETECTION:

- YES
- NO

Thermal Imaging Cameras utilize sophisticated AI software that allows visual clarity through dense fog, heavy rain, smoke, and other conditions.

ALERT NOTIFICATIONS:

- YES
- NO

Cameras (Thermal and/or IR) flag the video and send images to the proper authorities if a vehicle continues in the wrong direction in the Alert Zone. K&K systems provide data plans or can connect to an existing alert systems.

SIGN ALERT QUANTITY:



The monitoring equipment on each Sign Alert is dictated by the length and shape of the Detection Zone. Longer and curved detection zones may require more Sign Alerts.

LED COLOR:

- RED
- WHITE

Check your state's requirements for Sign Alert LED colors.

CALL FOR A QUOTE



K&K Systems, inc.
Traffic Safety Products Manufacturer

888.414.3003 | sales@k-systems.com
www.k-systems.com



WRONG-WAY DRIVER SOLUTIONS

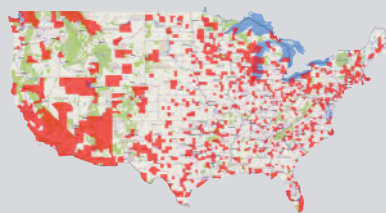




As an industry-leading innovator, TAPCO manufactures, services and distributes a wide portfolio of traffic and parking safety solutions designed to increase safe travels for all. Since 1956, we have set the standard for delivering reliable, cutting-edge traffic safety enhancements. From our world-renowned line of LED-enhanced BlinkerSign® solutions to our pedestrian crossing products and early detection warning systems, safety is at the heart of all TAPCO innovations.

Generations of Expertise

Working alongside traffic professionals for more than 60 years-gives our team an exclusive perspective on the past, present and future needs of the traffic and parking safety industry.



A Nationwide Reach

With successful solution installations throughout all 50 states, we understand the safety concerns communities face across the nation.

Innovative, Smart City Technology

Our mission is to continue to lead the industry with an innovative, customer-focused approach that evolves with the technological demands of our customers.



Award-Winning Mindset

As a family-owned company, we take pride in establishing and maintaining our innovative culture.

Table of Contents

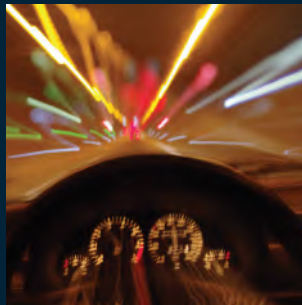
- System Overview.....4-5
- System Configuration.....6
- System Activations.....7-8
- Wireless Communication.....9
- LED-Enhanced Warning Alerts.....10-13
- Smart City Software.....14-15
- Critical Components.....16
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- Enhancements.....19-20
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Wrong-Way Driving: a Nationwide Problem

Among the most lethal types of traffic incidents due to their head-on nature, wrong-way driving collisions claim an average of 360 lives annually in the United States. Common wrong-way driving hotspots include side-by-side highway entrance and exit ramps and exit ramps near side streets.

Wrong-Way Driving Risk Factors



Impaired Drivers

Seventy-one percent of wrong-way drivers have alcohol in their system at the time of collision. On top of impairment, problematic highway ramps can lead to driver confusion and increased wrong-way incidents.



Slow Response Time

Every second counts when a wrong-way incident occurs. Unfortunately, law enforcement agencies often learn of wrong-way drivers via civilian 911 calls, delaying their ability to respond.



Lack of Insight

A lack of consistent, reliable data, including where and when incidents occur, leaves sites vulnerable to future incidents and local officials in the dark on how to prioritize problem ramps.

SYSTEM OVERVIEW

WRONG-WAY DRIVER SOLUTIONS

Uniquely engineered to fit any ramp configuration, TAPCO Wrong-Way Alert Systems detect wrong-way drivers, immediately activate LED-enhanced warning alerts and send real-time wrong-way event notifications through BlinkLink®.

Add another layer of safety with the Connected Vehicle Interface, an Ethernet interface to connect with and communicate information to connected vehicle infrastructure.

From simple deterrents to complex Intelligent Warning Systems, TAPCO wrong-way driver solutions are proven to reduce wrong-way events by 38 percent at notorious wrong-way driver entry points, including:

- Side-by-side highway entrance and exit ramps
- Exit ramps near side streets
- Poorly lit entrance and exit ramps
- Tollways and reversible HOV lanes
- Mainlines

PROVEN RESULTS

- Reduces risk to right-way drivers by reducing wrong-way incidents
- Improves response time of law enforcement by providing confirmation notifications

SYSTEM FLEXIBILITY

- Solar power capability allows for installation in any environment
- Modem or fiber communication
- Vehicle-activated, Dusk 'Til Dawn or 24/7 alert options available



SYSTEM OVERVIEW

WRONG-WAY DRIVER SOLUTIONS

1 ACTIVATION SENSORS

Thermal sensors, radar sensors or inductive loops detect vehicles traveling the wrong way.

2 WARNING ALERTS

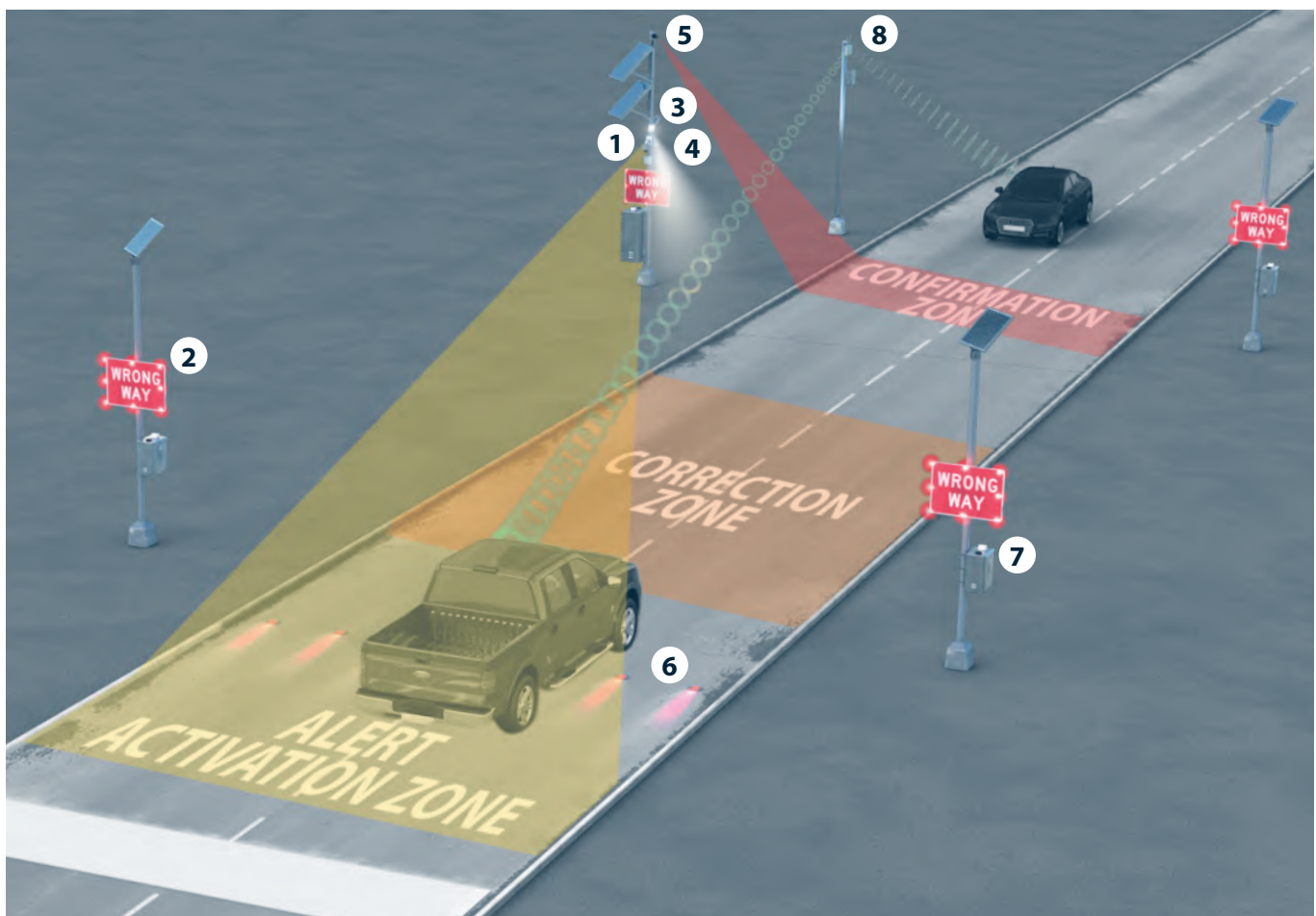
BlinkerSign®, RFB, LegendViz™ BlinkerSign® and BlinkerBeacon™ warning alerts catch the driver's attention and communicate that they are traveling in the wrong direction.

3 LED ILLUMINATORS

Illuminators activate with the system at night to increase wrong-way vehicle visibility for image capture.

4 HIGH-DEFINITION CAMERAS

Cameras capture images of wrong-way vehicles after detection.



5 CONFIRMATION SENSORS

Sensors confirm the vehicle has continued to proceed in the wrong direction.

6 IN-ROAD WARNING LIGHTS

IWRLs span the width of the road, illuminating to act as an additional warning to the driver.

7 BLINKLINK®

The software sends real-time verification of system activation, enables remote system monitoring and collects data, including activation trends.

8 CONNECTED VEHICLE INTERFACE

TAPCO's CVI integrates with connected vehicle infrastructure to send in-vehicle alerts to CAVs. Contextual messages are sent to both right-way and wrong-way drivers.

SYSTEM CONFIGURATION

WRONG-WAY DRIVER SOLUTIONS

Wrong-Way Alert Systems feature a three-zone configuration to optimize system accuracy and effectiveness.

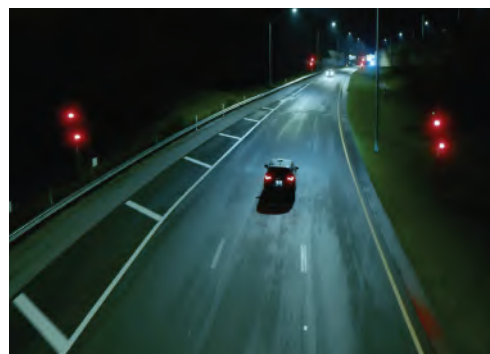
ALERT ACTIVATION ZONE

DETECT

Instantly detects any wrong-way vehicle

ALERT

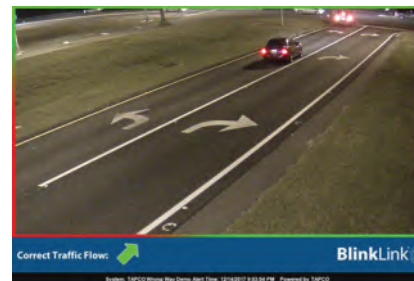
Immediately flashes LED-enhanced warning alerts to capture the driver's attention



CORRECTION ZONE

CORRECT

Allows for driver self-correction and captures vehicle information



CONFIRMATION ZONE

CONFIRM

Verifies that the vehicle has proceeded in the wrong direction

NOTIFY

Sends notification alerts through BlinkLink® to local authorities

WARN

Integrates with Traffic Management Center software to enable activation of dynamic overhead message boards for communication to right-way drivers



SYSTEM ACTIVATIONS

THERMAL DETECTION

The Wrong-Way Vehicle Thermal Sensor uses infrared heat profiles to detect vehicles traveling the wrong direction, activating TAPCO Wrong-Way Alert Systems.

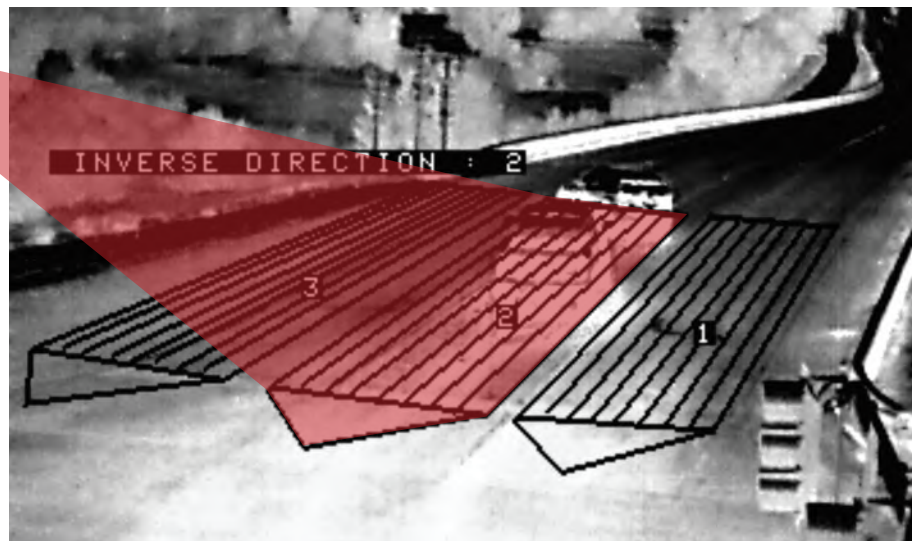
WHY THERMAL?

This sensor's accuracy and directional precision reduce false detections in all roadway configurations and environments. It has been specifically developed to reliably detect in all weather conditions, including fog, rain and snow.

- Thermal imaging sensors work in total darkness, through shadows and in sun glare, providing reliable detection 24/7
- Versatile functionality accommodates up to six lanes of traffic over several hundred feet
- Easily integrates with existing TMC platforms, including BlinkLink®



**WRONG-WAY
THERMAL SENSOR**



EXAMPLE OF WRONG-WAY THERMAL DETECTION

SYSTEM ACTIVATIONS

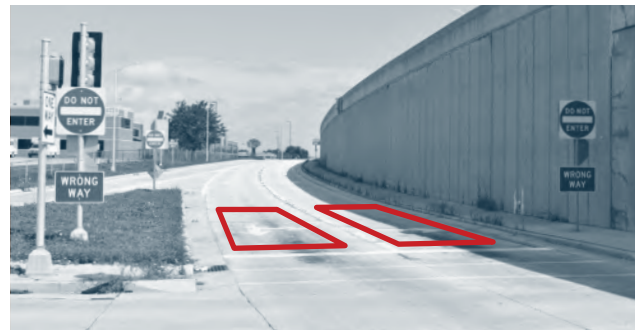
PASSIVE AND SCHEDULED

PASSIVE ACTIVATION



RADAR

Radar sensors trigger activation when vehicles are detected traveling the wrong way.



INDUCTIVE LOOP

Installed beneath the surface of the road, inductive loops detect wrong-way vehicles.

SCHEDULED ACTIVATION



24/7 OPERATION

A cost-effective first step to mitigate wrong-way driving, 24/7 TAPCO flashing wrong-way alerts are always operating.



SCHEDULED/DUSK 'TIL DAWN OPERATION

Scheduled flashing wrong-way alerts are standalone solutions that only activate during specified times via TAPCO's time clock functionality.

WIRELESS COMMUNICATION

BLINKERBEAM®

BlinkerBeam® wireless radios communicate system activation to all TAPCO warning alerts.

Placed at the detection location, a transmitter radio sends wireless signals upon system activation to receiver radios located inside the control cabinet of each warning alert, triggering the alert to flash.

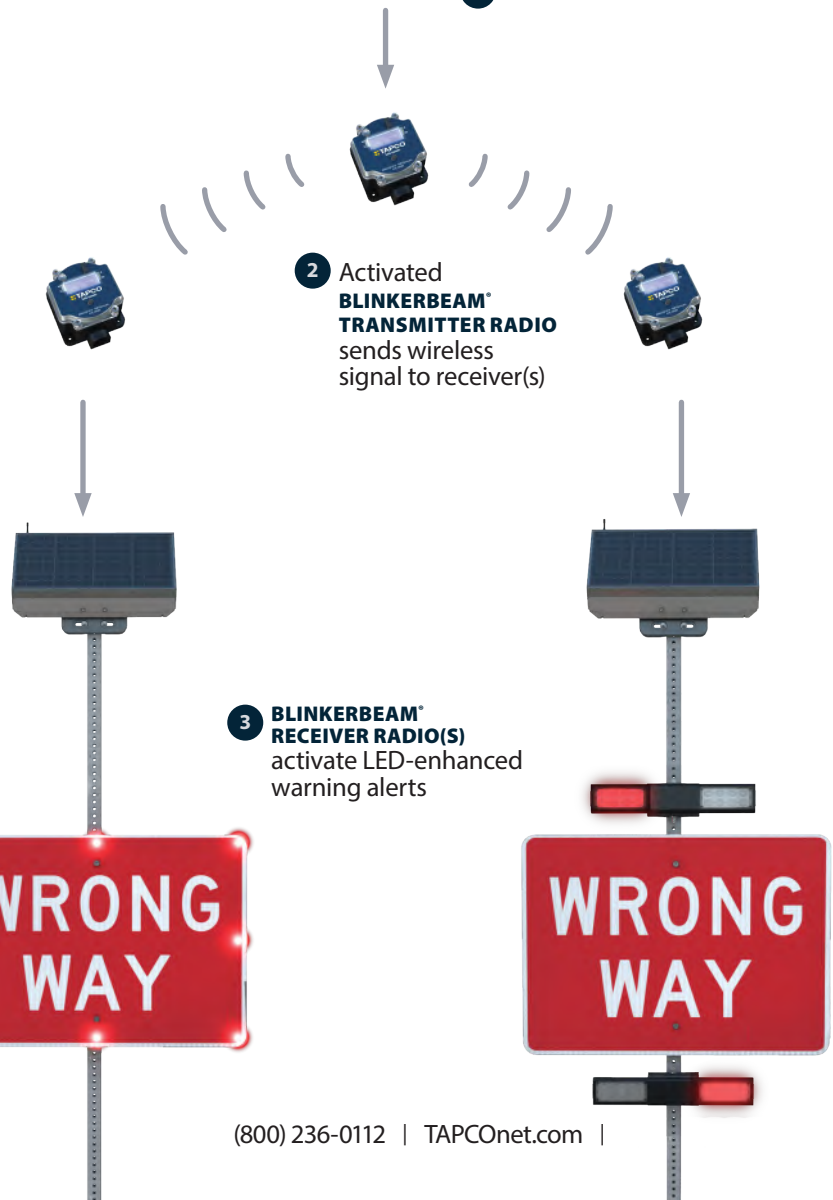


**BLINKERBEAM®
WIRELESS RADIO**

- Easy-to-read, backlit LCD display
- Intuitive joystick for in-field control
- Menu-driven diagnostics for quick set-up and configuration
- Three selectable power levels, up to one watt, to increase signal distance
- Range of up to 900 feet; works with multiple antenna options to extend distance
- Utilizes 900 MHz frequency-hopping spread spectrum for reliable operation



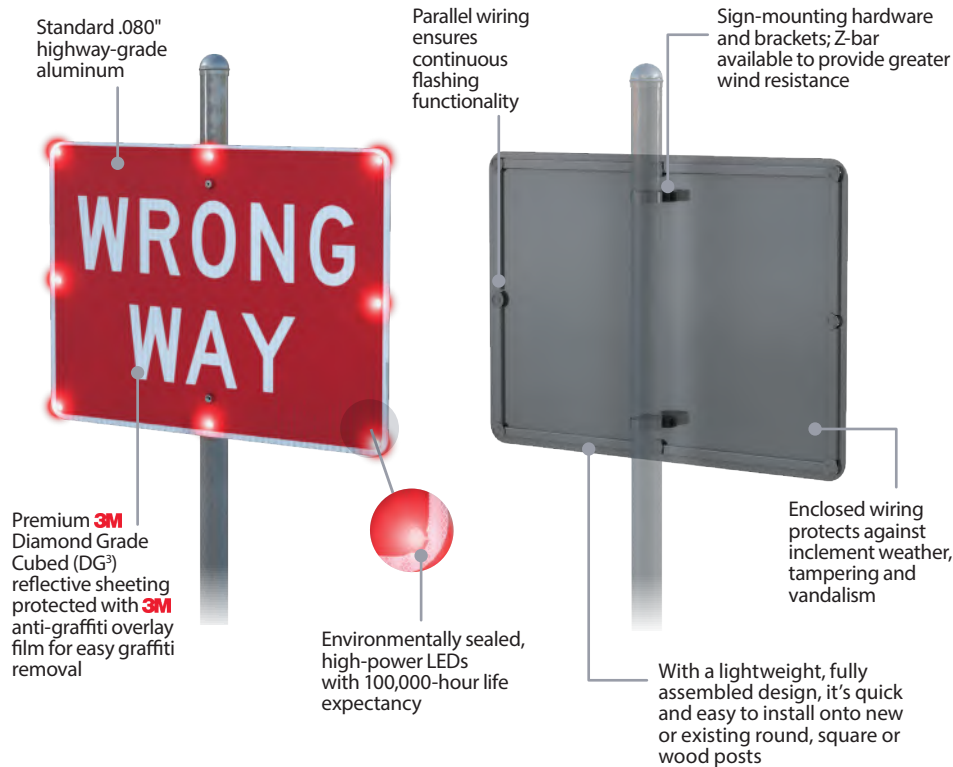
1 SYSTEM DETECTION



LED-ENHANCED WARNING ALERTS

BLINKERSIGN® FLASHING LED SIGNS

BlinkerSign® Flashing LED Signs are edge-lit signs engineered to command drivers' attention day and night, increasing self-correction rates in wrong-way incidents.



MUTCD COMPLIANT

- Each BlinkerSign® is MUTCD compliant and flashes in accordance with MUTCD section 2A.07

HIGH QUALITY, MADE IN THE USA

- Manufactured in Brown Deer, Wisconsin, each BlinkerSign® is engineered to withstand the harshest environmental conditions

VARIABLE DIMMING

- LEDs automatically dim based on ambient light, maintaining optimal LED output and extending system autonomy

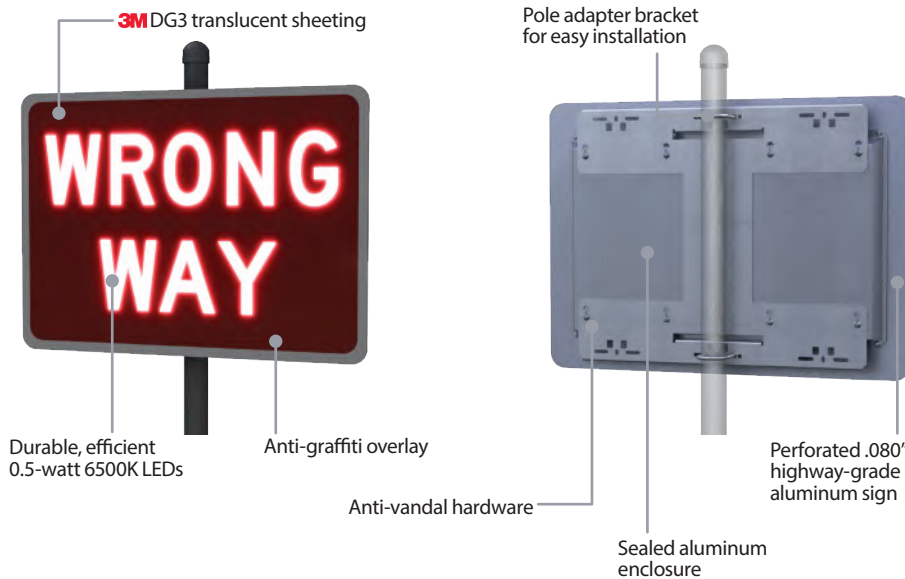


LED-ENHANCED WARNING ALERTS

LEGENDVIZ™ TRAFFIC SIGN AND BLINKERSIGN®

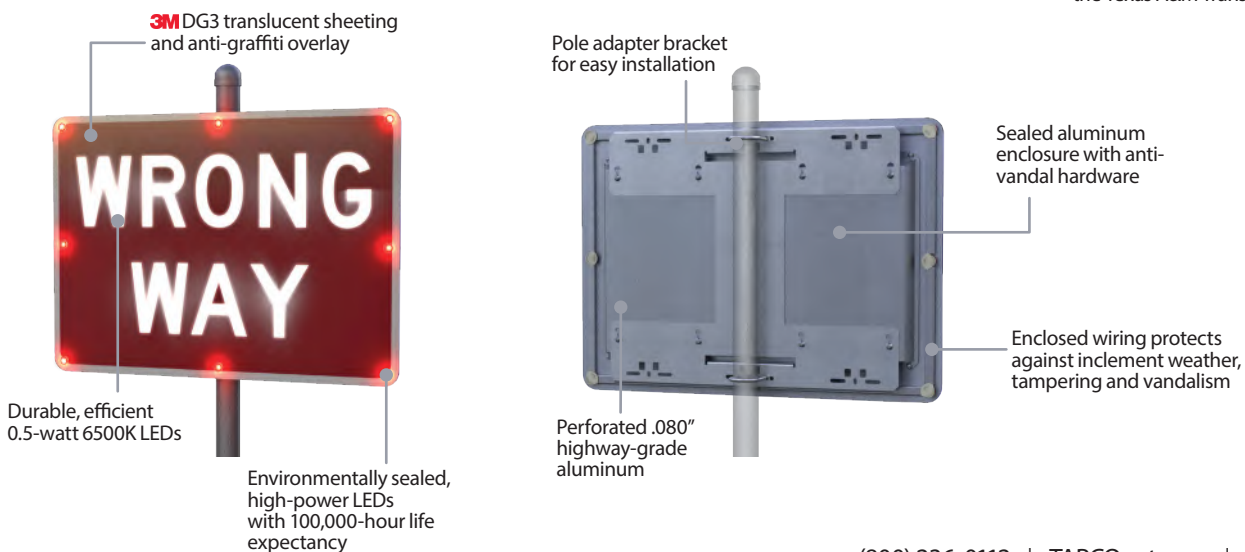
LEGENDVIZ™ TRAFFIC SIGN

LegendViz™ Traffic Signs feature highly visible, LED-illuminated legends for improved legibility at night.



LEGENDVIZ™ BLINKERSIGN®

LegendViz™ BlinkerSigns combine the proven conspicuity benefits of perimeter LEDs with LED-illuminated legends for improved nighttime visibility and compliance.



SUPERIOR INNOVATION

- Shown to increase sign legibility distance by as much as 100 percent over standard signs*

- MUTCD compliant

EASE OF INSTALLATION

- Every sign is designed for one-person installation

POWER OPTIONS

- Flexible configuration, with both solar and AC power options available

- Solar offers 7+ days of autonomy

- LegendViz™ BlinkerSign® perimeter LEDs dim based on ambient lighting

- Dusk 'til Dawn illumination or activated nighttime illumination

*According to the results of a closed-course driver trial and statistical analysis conducted by the Texas A&M Transportation Institute (TTI)

LED-ENHANCED WARNING ALERTS

RFB: RECTANGULAR FLASHING BEACONS

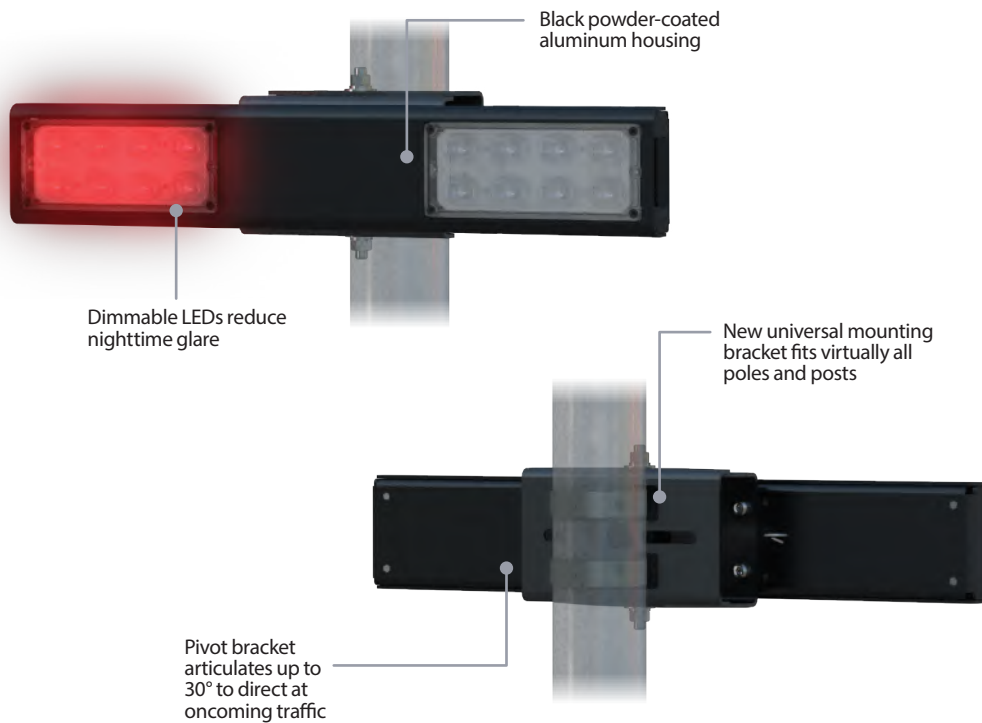
A step above the industry standard, TAPCO RFB light bars are extra-large rectangular flashing beacons, making them highly visible to wrong-way drivers.

ARRANGEMENT

- Placed above and below traffic signs, the RFBs flash in a wig-wag pattern

VARIABLE DIMMING

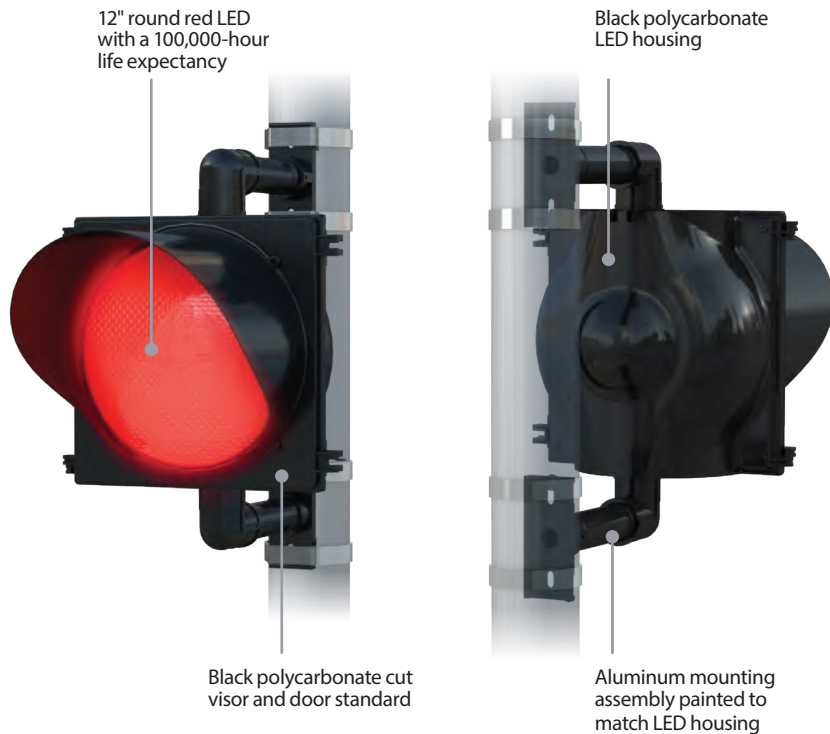
- LEDs automatically dim based on ambient light, maintaining optimal LED output and extending system autonomy



LED-ENHANCED WARNING ALERTS

BLINKERBEACON™ FLASHING LED BEACONS

BlinkerBeacon™ Flashing LED Beacons provide drivers real-time warning when traveling the wrong direction.



MUTCD COMPLIANT

- Each BlinkerBeacon™ can flash in accordance with MUTCD section 4L.03

VARIABLE DIMMING

- LEDs automatically dim based on ambient light, maintaining optimal LED output and extending system autonomy

AVAILABLE OPTIONS

- 8" or 12" LED modules
- ITE-compliant 12V power options
- Cut visor standard; tunnel visor available



SMART CITY SOFTWARE

BLINKLINK® POWERED BY TAPCO

INTELLIGENT WARNING SYSTEM MONITORING FOR SMART CITY INFRASTRUCTURE

BlinkLink®, powered by TAPCO, is an easy-to-use, cloud-based software application for agencies to remotely manage and monitor their Wrong-Way Alert Systems.

With secure application programming interface (API) integration through reliable cellular or fiber networks, BlinkLink® collects real-time data and sends voice, email and SMS notifications to predetermined recipients.

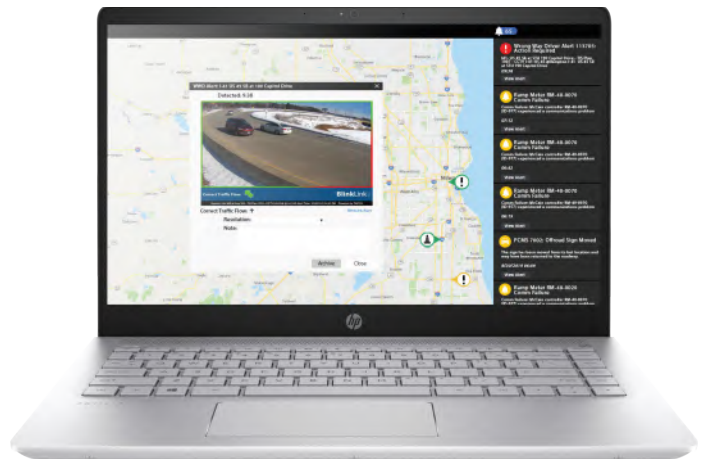
- Integrate with local Traffic Management Center's Advanced Traffic Management System software for additional upstream routing and logical commands
- Focus on high-priority events by analyzing high resolution images, event video and local system streaming
- Imagery includes a directional overlay for situational clarity
- Remotely review system health and diagnostics for optimal and reliable operation
- Minimize arterial system overhauls and get a budget-friendly adoption with scalable system architecture



Analyze system activation trends and gain insight into problem areas



Warn right-way drivers on system-integrated overhead dynamic message boards



Convert alert images and data to display in standard API

SMART CITY SOFTWARE

BLINKLINK® POWERED BY TAPCO

BlinkLink® provides data to finetune ramp configurations, allocate resources and implement best practices.

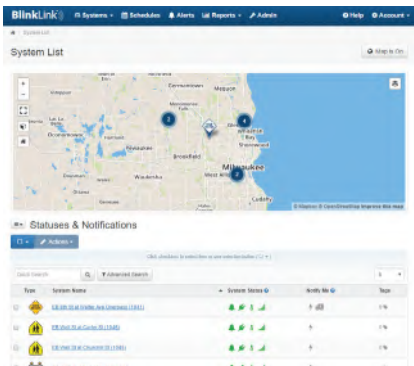


Notify

Keep your whole team informed when a wrong-way driver is detected by receiving alert notifications.

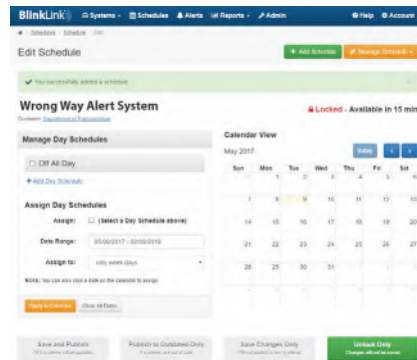
Location and time of incident

Directional overlay for situational clarity



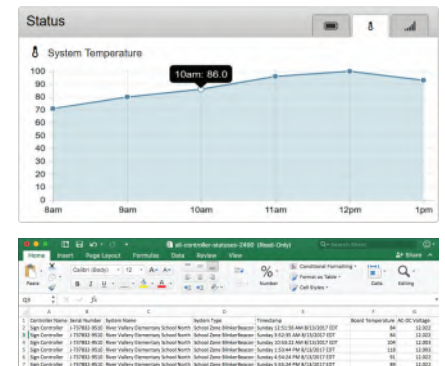
Monitor

Easily program and view the status of every TAPCO Wrong-Way Alert System from the interactive map view and gather historical data.



Manage

Eliminate time-consuming site visits by remotely managing each system anywhere, on any web-enabled device.



Report

Receive a report for every wrong-way detection, including self-corrections, providing officials the insight to correct notorious trouble spots.

CRITICAL COMPONENTS

ILLUMINATOR AND CAMERA

Upon wrong-way vehicle detection, both the illuminator and camera activate to ensure the highest quality visual verification of the wrong-way event.



HIGH-EFFICIENCY LED ILLUMINATORS

High-performance, white visible light improves nighttime camera performance and enhances vehicle visibility for critical feature identification.



HIGH-DEFINITION CAMERAS

High-speed, multi-featured camera captures high-resolution, full-color imagery, confirming wrong-way event details.

POWER AND CONTROL OPTIONS

FLEX POWER

Flex Power options provide flexible system configuration for multiple applications and power requirements while allowing easy access to control cabinets. Any TAPCO system can be designed to fit your power or environmental need.

POPULAR POWER PACKAGES

TAPCO offers many solar and AC power packages to choose from, including streetlight power. Some of the most popular are shown below, with other options available upon request.

Cabinet houses controller and radio



120VAC



**30-watt solar panel
35Ah battery capacity**

* Compatible with warning alerts only. Sensors require additional power for continuous operation.



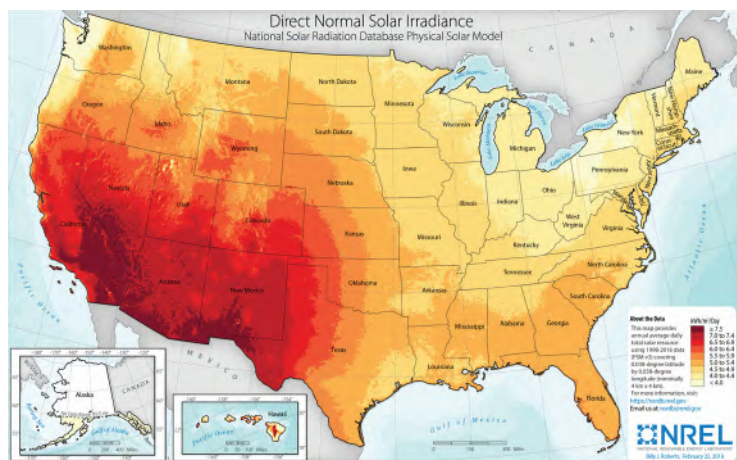
**85-watt solar panel
105Ah battery capacity**



**130-watt solar panel
105Ah battery capacity**

SOLAR REQUIREMENTS

Critical solar factors such as direct normal irradiance and global horizontal irradiance vary depending on system location. To ensure the right power configuration, we conduct solar calculations to optimize system power.



Call us today for a free solar consultation: **(800) 236-0112**

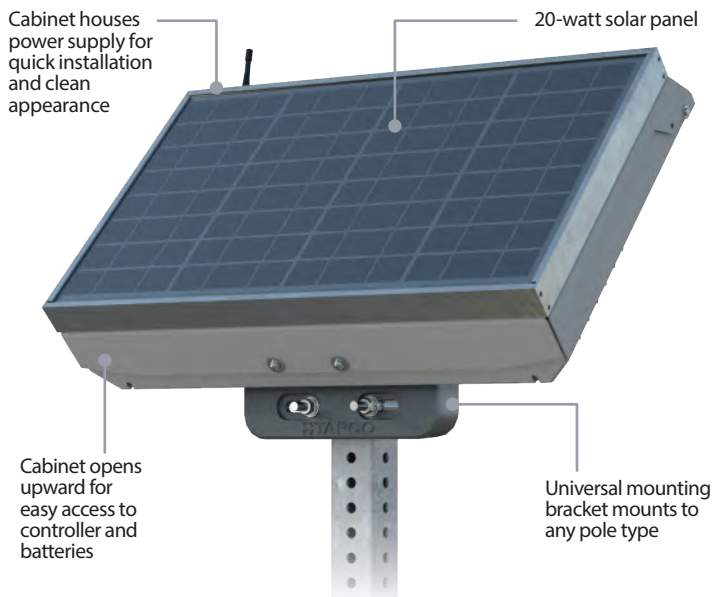
POWER AND CONTROL OPTIONS

SELF-CONTAINED SOLAR CABINETS

Uniquely designed using durable polycarbonate, TAPCO's 13-Watt Self-Contained Solar Cabinet is a lightweight option that can power warning alerts.



TAPCO's 20-Watt Self-Contained Solar Cabinet provides 44Ah of battery power for warning alerts in a discreet, powder-coated aluminum housing.



INCREASED AUTONOMY

- Up to 28Ah of battery power delivers autonomy up to 30 days

COMPATIBLE

- Supports BlinkerSign®, RFB and BlinkerBeacon™ warning alerts without reducing LED and system performance

EASY TO INSTALL

- Weighs one-third as much as traditional cabinets for one-person installation

INCREASED VOLTAGE

- 12-volt system is engineered to power a larger assortment of warning alert options

EASE OF ACCESS

- Cabinet door opens up for easy access and serviceability

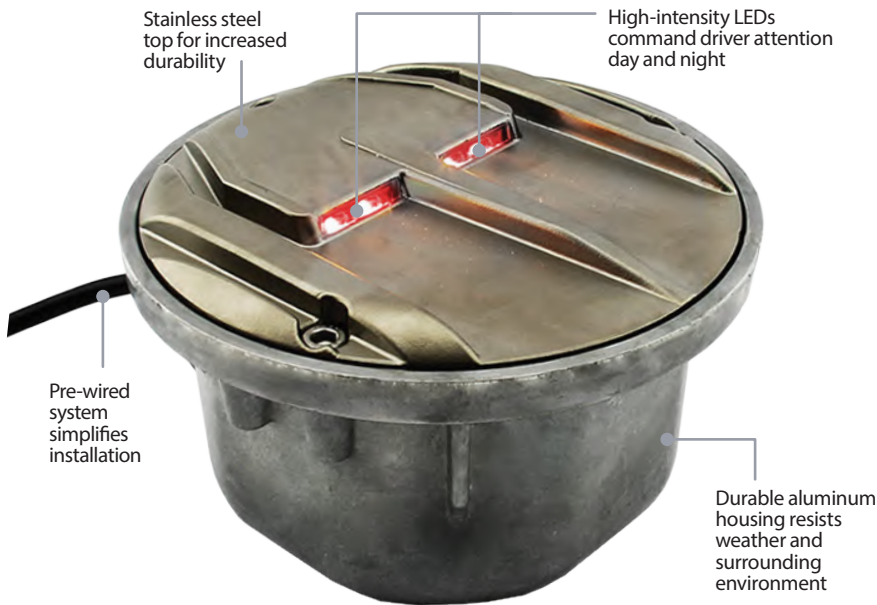
COMPACT DESIGN

- Easily attaches onto new or existing posts and poles

ENHANCEMENTS

IN-ROAD WARNING LIGHTS

Embedded in the pavement, spanning the width of the road and oriented to face wrong-way traffic, In-Road Warning Lights (IRWL) flash in unison to alert drivers of their wrong-way movement.



MUTCD COMPLIANT

- Each IRWL is MUTCD compliant

LOW PROFILE

- Allows for snowplows and vehicles to safely pass over

VARIABLE DIMMING

- LEDs automatically dim based on ambient light, maintaining optimal LED output night and day

AVAILABLE OPTIONS

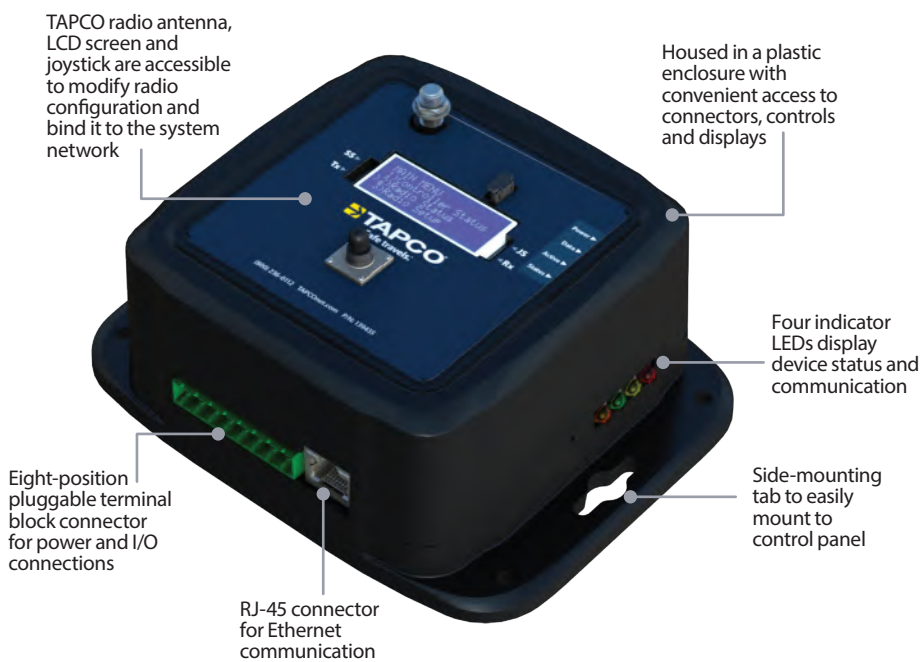
- Can flash independently or sync with other LED-enhanced warning alerts



ENHANCEMENTS

CONNECTED VEHICLE INTERFACE

Add another layer of safety to your wrong-way solution with the Connected Vehicle Interface (CVI), an Ethernet interface for TAPCO Wrong-Way Alert Systems to connect with and communicate information to connected vehicle infrastructure, such as typical roadside units (RSU).



IN-VEHICLE ALERTS

- Upon system activation, connected vehicles receive notifications through dashboard displays and other onboard devices

NETWORK AGNOSTIC

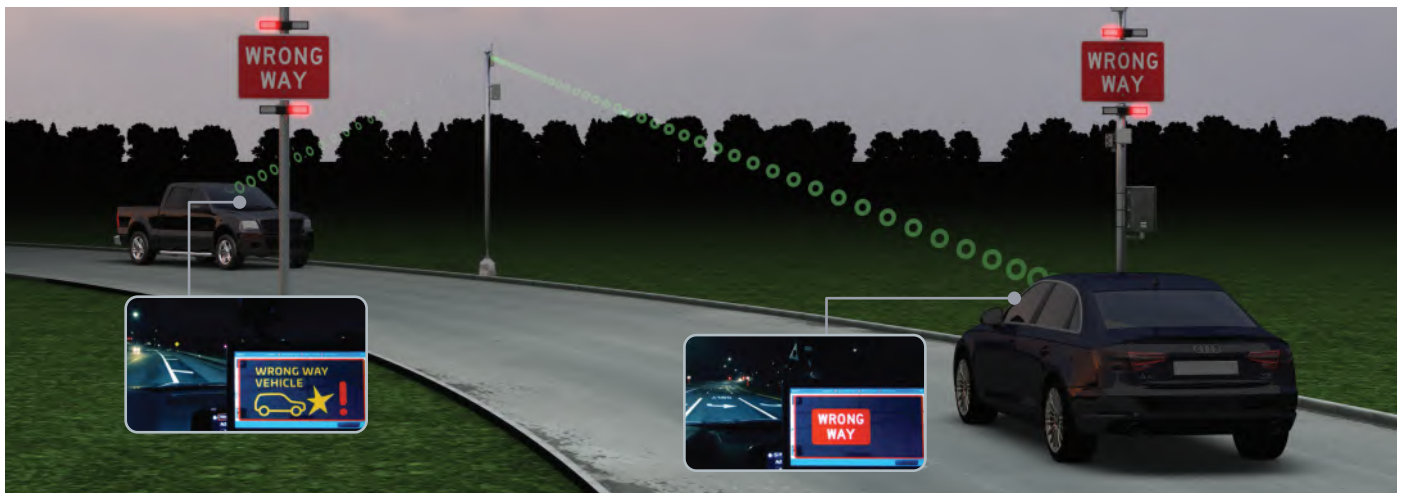
- Transmits data via Dedicated Short-Range Communication (DSRC) or cellular RSUs

ATMS INTEGRATION

- Connects with Advanced Traffic Management Systems to provide traffic managers with actionable system data

MODULAR

- Can be added to existing or new TAPCO Wrong-Way Alert Systems



PREVENTATIVE MAINTENANCE

SERVICE CONTRACTS

Preventative Maintenance Service Contracts provide customers nationwide with the peace of mind that their wrong-way solutions will perform optimally with the highest system uptime. From routine maintenance to complex diagnostic support, every contract is customized based on your labor and budgetary needs.

STANDARD SERVICES AND BENEFITS:

- Scheduled visits to perform maintenance, including:
 - Mechanical inspection and validation
 - Electrical inspection and validation
 - Detection / activation inspection and validation
 - Full system testing and recertification
- Complete records documentation after every visit
- System warranty extension

Want to learn more? Call us today to customize your contract! **(800) 236-0112**

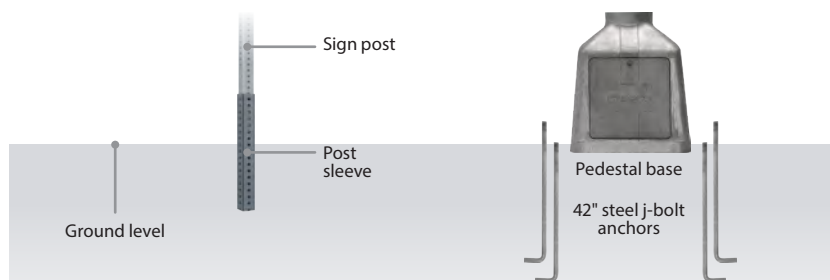
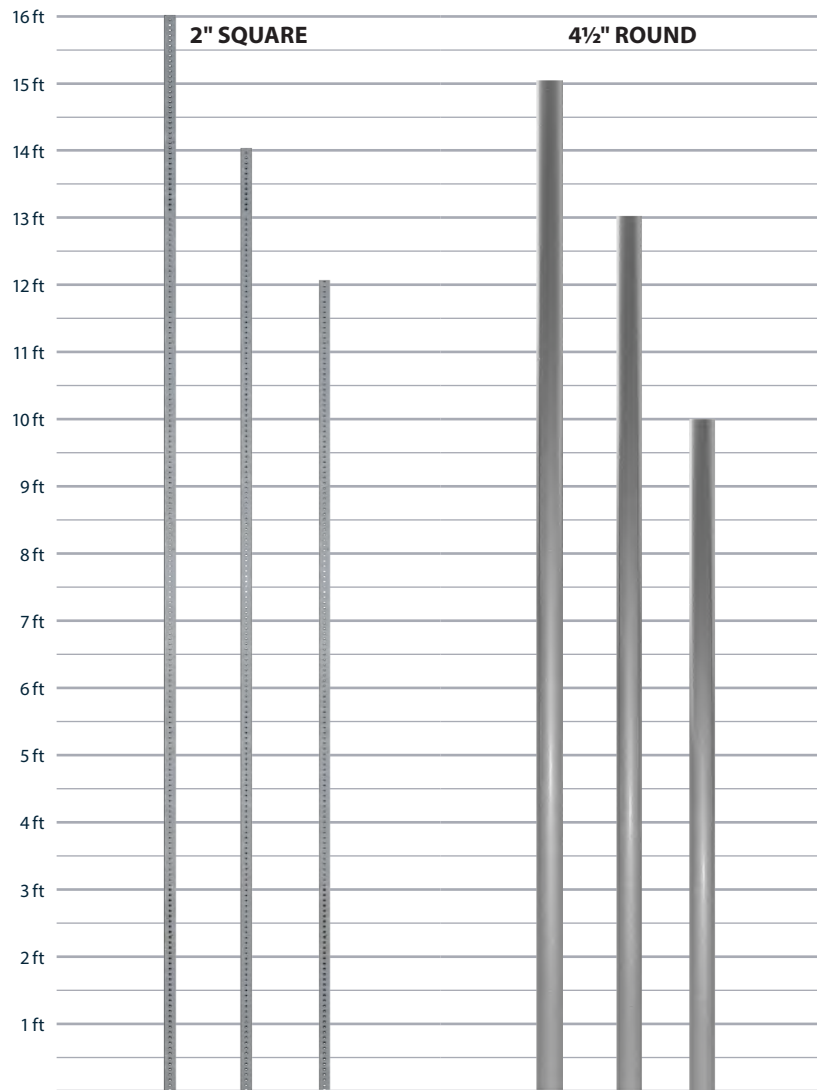


COMMON POLE KITS

POLES & BREAKAWAY ANCHORS

COMMON POLE KITS

Pole configuration plays a crucial role in the design of your Wrong-Way Alert System. Below are some of our most popular options.



2" x 2" Square Post Kits

- Accommodate warning alerts only
- Include:** post height of choice, sleeve and assembly hardware
- Sign brackets and anchor sold separately

HEIGHT	PART NUMBER
12 ft	114401K
14 ft	138313
16 ft	138314



4½" OD Round Pole Kits

- Accommodate warning alerts and sensors
- Include:** pole height of choice, pedestal base, 42" steel j-bolt anchors and assembly hardware
- 18" steel j-bolt anchors available
- Sign brackets sold separately

HEIGHT	PART NUMBER
10 ft	107889
13 ft	101919
15 ft	101920



Additional poles, anchors and mounting options are available dependent upon weight loads, including 2¾", 2⅞" and wood posts.

TAPCO SOLUTIONS

INTELLIGENT WARNING SYSTEMS

TAPCO engineers comprehensive traffic solutions that improve mobility and safety for all users.



PEDESTRIAN CROSSWALK



CURVE WARNING



SPEED AWARENESS



SCHOOL ZONE WARNING



OVERHEIGHT WARNING



INTERSECTION CONFLICT WARNING



HIGH WATER WARNING




EMERGENCY VEHICLE WARNING

SAVE MONEY AND TIME WITH OMNIA PARTNERS AND TAPCO

Did you know we offer exclusive discount pricing through our competitively solicited OMNIA Partners, Public Sector contract? Participating government and non-profit agencies that purchase direct from the contract receive the lowest available price and free shipping on our entire product offering.



 **TAPCO**[®]
Safe travels.

 (800) 236-0112

 TAPCOnet.com