Traffic Control Equipment Standards and Specifications

for the

Miami-Dade County Traffic Signal System



2026

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Miami-Dade County

Traffic Signals and Signs Division

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Effective October 1, 2026, this document supersedes the “Traffic Control Equipment Specifications and Standards (2000) and incorporates the individual sections with revision of specifications that formerly comprised the Miami-Dade County Traffic Control Equipment Standards and Specifications (Division 34). It combines the requirements into a single volume with the following key changes:

Section	Title	Key change (s)
600	GENERAL PROVISIONS FOR TRAFFIC CONTROL DEVICES	Streamlined reporting requirements for work involving or that may impact the MDC Signalization System. Added requirements for TSS Division Qualified Traffic Signal Contractor’s List. Consolidated warranty requirements for traffic control equipment.
620	GROUNDING AND LIGHTNING PROTECTION	New Section added to incorporate FDOT 620 by reference with added MDC requirements.
633	COMMUNICATION CABLE	New Section added to incorporate FDOT 633 by reference with added MDC requirements.
639	ELECTRICAL POWER SERVICE ASSEMBLY	Service wire requirements provided for distances up to 700ft from utility service point to equipment disconnect.
646	ALUMINUM POLES, PEDESTALS, AND POSTS	New Section added to incorporate FDOT 646 by reference with added MDC requirements.
649	GALVANIZED STEEL POLES AND MAST ARMS ASSEMBLIES	New Section added to incorporate FDOT 649 by reference with added MDC requirements.
650	VEHICULAR TRAFFIC SIGNAL ASSEMBLIES	New Section added to incorporate FDOT 650 by reference with added MDC requirements including: • Mounting bracket hardware must be tightened to manufacturer specifications with a torque wrench. Impact wrenches may not be used. • Five section signal heads must be mounted using two approved mast arm mounting brackets.
653	PEDESTRIAN SIGNAL ASSEMBLIES	New Section added to incorporate FDOT 653 by reference with added MDC requirements.
659	MAST ARM, SPAN WIRE, AND POLE MOUNTING ASSEMBLIES	New Section added to incorporate FDOT 659 by reference with added MDC requirements.

Section	Title	Key change (s)
663	SIGNAL PRIORITY AND PREEMPTION SYSTEMS	New Section added to incorporate FDOT 663 by reference with added MDC requirements.
665	PEDESTRIAN DETECTION SYSTEM	New Section added to incorporate FDOT 649 by reference with added MDC requirements.
670	TRAFFIC CONTROLLER ASSEMBLIES	New Section added to incorporate FDOT 665 by reference with added MDC requirements.
678	TRAFFIC CONTROLLER ACCESSORIES	New Section added to incorporate FDOT 678 by reference with added MDC requirements.
684	NETWORK DEVICES	New Section added to incorporate FDOT 684 by reference with added MDC requirements.
706	RAISED PAVEMENT MARKERS AND MARKER ADHESIVE	New Section added to incorporate FDOT 706 by reference with added MDC requirements.

Table of Contents

PRELIMINARY 1

1.01 ABBREVIATIONS 1
1.02 DEFINITIONS 1
1.03 PROPRIETARY PRODUCTS 2

SECTION 600 GENERAL PROVISIONS FOR TRAFFIC CONTROL DEVICES 3

1.01 DESCRIPTION 3
1.02 REFERENCES 3
1.03 REGULATORY REQUIREMENTS 3
1.04 LICENSES AND QUALIFICATIONS 6
1.05 ACCEPTANCE OF TRAFFIC CONTROL SIGNAL AND DEVICE INSTALLATIONS. 8
1.06 Contractor's Warranty Period for Installations (Burn-in Period). 11
1.07 MANUFACTURERS' WARRANTY REQUIREMENTS 11
2.01 EQUIPMENT AND MATERIALS. 15
2.02 DEPARTMENT-FURNISHED EQUIPMENT INSTALLED BY CONTRACTOR. 16

SECTION 620 GROUNDING AND LIGHTNING PROTECTION 17

1.01 SUMMARY 17
1.02 WARRANTY 17
2.01 MATERIALS 17
3.01 INSTALLATION 17
3.02 FIELD QUALITY CONTROL 17

SECTION 630 CONDUIT 19

1.01 SUMMARY 19
1.02 REFERENCES 20
2.01 MATERIALS 20
3.01 INSTALLATION 21

SECTION 633 COMMUNICATION CABLE 27

1.01 SUMMARY 27
1.02 WARRANTY 27
2.01 MATERIALS 27
3.01 INSTALLATION 27

SECTION 634 SPAN WIRE ASSEMBLY 29

1.01 SUMMARY 29
2.01 MATERIALS 29
3.01 INSTALLATION 29

SECTION 635 PULL, SPLICE, AND JUNCTION BOXES 31

1.01 SUMMARY 31
1.02 REFERENCES 31
1.03 WARRANTY 31
2.01 MATERIALS 32
3.01 INSTALLATION 34

SECTION 639 ELECTRICAL POWER SERVICE ASSEMBLY 37

1.01 SUMMARY 37
1.02 SYSTEM DESCRIPTION 38
1.03 WARRANTY 39
2.01 MATERIALS 39
3.01 INSTALLATION 40

SECTION 639R RETROFIT OF MIAMI-DADE COUNTY TRAFFIC SIGNAL CABINETS WITH MANUAL TRANSFER SWITCH AND EMERGENCY GENERATOR INTERFACE 42

1.01 SUMMARY 42
2.01 EQUIPMENT AND MATERIALS 42
3.01 INSTALLATION 43

SECTION 641 PRESTRESSED CONCRETE POLES 48

1.01 SUMMARY 48
1.02 SUMBITTALS 49
2.01 POLE FOR TRAFFIC SIGNAL ELECTRICAL POWER SERVICE ASSEMBLY 49

SECTION 646 ALUMINUM POLES, PEDESTALS, AND POSTS 50

1.01 SUMMARY 50
1.02 WARRANTY 50
2.01 MATERIALS 50
3.01 INSTALLATION 50

SECTION 649 GALVANIZED STEEL POLES AND MAST ARMS ASSEMBLIES 53

1.01 SUMMARY 53
1.02 WARRANTY 53
2.01 MATERIALS 53
2.02 FABRICATION 53
2.03 COATING 53
3.01 INSTALLATION 54

SECTION 650 VEHICULAR TRAFFIC SIGNAL ASSEMBLIES 55

1.01 SUMMARY 55
1.02 WARRANTY 55
2.01 MATERIALS 55
3.01 INSTALLATION 55
3.02 INSTALLATIONS ON MAST ARM 56

SECTION 653 PEDESTRIAN SIGNAL ASSEMBLIES 57

1.01 SUMMARY 57
1.02 WARRANTY 57
2.01 MATERIALS 57
3.01 INSTALLATION 57

SECTION 654 RECTANGULAR RAPID FLASHING BEACONS 59

1.01 SUMMARY 59
1.02 SYSTEM DESCRIPTION 59
1.03 WARRANTY 60
2.01 MATERIALS AND EQUIPMENT 61
3.01 REPAIRS/RESTORATION 62

SECTION 659 MAST ARM, SPAN WIRE, AND POLE MOUNTING ASSEMBLIES 63

1.01 SUMMARY 63
1.02 WARRANTY 63
2.01 MATERIALS 63
3.01 INSTALLATION 63

SECTION 660 VEHICLE DETECTION SYSTEM 65

1.01 SUMMARY 65
1.02 SYSTEM DESCRIPTION 67
1.03 WARRANTY 68
2.01 INDUCTIVE LOOP DETECTION SYSTEM 68
2.02 VIDEO VEHICLE DETECTION SYSTEM (VVDS) 69
2.03 MICROWAVE VEHICLE DETECTION SYSTEM (MVDS) 70
2.04 WIRELESS MAGNETOMETER DETECTION SYSTEM (WMDS) 71
2.05 AUTOMATIC VEHICLE IDENTIFICATION (AVI) DETECTION SYSTEM 71
2.06 COMMUNICATIONS 72
2.07 MECHANICAL REQUIREMENTS FOR ALL DETECTORS 72
2.08 ENVIRONMENTAL REQUIREMENTS FOR ALL DETECTORS 72
3.01 INSTALLATION 72
3.02 INDUCTIVE LOOP PERFORMANCE REQUIREMENTS 76
3.03 VEHICLE PRESENCE DETECTOR PERFORMANCE REQUIREMENTS 77
3.04 TRAFFIC DATA DETECTOR PERFORMANCE REQUIREMENTS: 77
3.05 AVI DETECTION SYSTEM PERFORMANCE REQUIREMENTS: 77

SECTION 663 SIGNAL PRIORITY AND PREEMPTION SYSTEMS 79

1.01 SUMMARY 79
1.02 WARRANTY 79
2.01 MATERIALS 79
3.01 INSTALLATION 79
3.02 FIELD TESTING 79

SECTION 665 PEDESTRIAN DETECTION SYSTEM 81

1.01 SUMMARY 81
1.02 WARRANTY 81
2.01 MATERIALS 81
3.01 INSTALLATION 81

SECTION 670 TRAFFIC CONTROLLER ASSEMBLIES 83

1.01 SUMMARY 83
1.02 REFERENCES 83
1.03 SYSTEM REQUIREMENTS 84
1.04 WARRANTY 84
2.01 GENERAL 84
2.02 MATERIALS 84
2.03 EQUIPMENT 84
2.04 SOURCE QUALITY CONTROL 85
3.01 INSTALLATION 85
3.02 DOCUMENTATION 86

SECTION 671 TRAFFIC SIGNAL CONTROLLERS 87

1.01 SUMMARY 87
1.02 REFERENCES 87
1.03 SYSTEM DESCRIPTION 87
1.04 SUBMITTALS 87

1.05 DELIVERY STORAGE AND HANDLING 88
1.06 OWNER'S INSTRUCTIONS 88
1.07 WARRANTY 88
2.01 MATERIALS AND EQUIPMENT 88
2.02 EXTRA MATERIALS 89
2.03 ACCESSORIES 89
2.04 SOURCE QUALITY CONTROL 89
3.01 PREPARATION 89
3.02 INSTALLATION 89
3.03 FIELD QUALITY CONTROL 90

SECTION 678 TRAFFIC CONTROLLER ACCESSORIES 91

1.01 SUMMARY 91
1.02 WARRANTY 91
2.01 MATERIALS 91
3.01 INSTALLATION 91

SECTION 682 TRAFFIC MANAGEMENT CCTV CAMERAS 93

1.01 SUMMARY 93
1.02 REFERENCES 93
1.03 SYSTEM DESCRIPTION 94
1.04 WARRANTY 94
2.01 EQUIPMENT 95
3.01 INSTALLATION 96
3.02 FIELD QUALITY CONTROL 97

SECTION 684 NETWORK DEVICES 99

1.01 SUMMARY 99
1.02 WARRANTY 99
2.01 MATERIALS 99
3.01 INSTALLATION 99

SECTION 685 UNINTERRUPTIBLE POWER SUPPLY SYSTEM FOR TRAFFIC SIGNALS 101

1.01 SUMMARY 101
1.02 REFERENCES 101
1.03 SYSTEM REQUIREMENTS 102
1.04 DOCUMENTATION 103
1.05 WARRANTY 103
2.01 MATERIALS 103
2.02 EQUIPMENT 103
2.03 COMPONENTS 103
2.04 SOURCE QUALITY CONTROL 106
3.01 INSTALLATION 106
3.02 FIELD QUALITY CONTROL 106

SECTION 700 ROADWAY SIGNS 109

1.01 SUMMARY 109
1.02 REFERENCES 112
1.03 DELIVERY STORAGE AND HANDLING 112
1.04 ACCEPTANCE OF SIGNS 112
1.05 SYSTEM DESCRIPTION 113
1.06 WARRANTY 113
2.01 MATERIALS AND EQUIPMENT 114

3.01 INSTALLATION 116
3.02 REMOVAL 117
3.03 RESTORATION 117

SECTION 706 RAISED PAVEMENT MARKERS AND MARKER ADHESIVE 119

1.01 SUMMARY 119
1.02 WARRANTY 119
2.01 MATERIALS 119
3.01 INSTALLATION 120

PRELIMINARY

1.01 ABBREVIATIONS

A. The following abbreviations, when used in this document, represent the full text shown.

1. AASHTO American Association of State Highway and Transportation Officials
2. ANSI American National Standards Institute, Inc.
3. APL FDOT's Approved Product List
4. ASCE American Society of Civil Engineers
5. ASTM American Society for Testing and Materials
6. AWG American Wire Gauge
7. FDOT Florida Department of Transportation
8. FHWA Federal Highway Administration
9. F.S. Florida Statutes
10. IMSA International Municipal Signal Association
11. MDC Miami-Dade County
12. MUTCD Manual on Uniform Traffic Control Devices
13. NEC National Electrical Code
14. NEMA National Electrical Manufacturers Association
15. DTPW Miami-Dade County Department of Transportation and Public Works
16. TSS Miami-Dade County Traffic Signals and Signs Division
17. TSSQPL Traffic Signals and Signs Division's Qualified Products List
18. UL Underwriters' Laboratories

1.02 DEFINITIONS

A. The following terms, when used in these Specifications, have the meaning described.

1. County. Miami-Dade County, Florida.
2. Department. Miami-Dade County Department of Transportation and Public Works.
3. Division or Maintaining Agency. The Department's Traffic Signals and Signs Division.
4. Engineer. The County Engineer, acting directly or through duly authorized representatives; such representatives acting within the scope of the duties and authority assigned to them.
    a. Note: In order to avoid cumbersome and confusing repetition of expressions in these Specifications, it is provided that whenever anything is, or is to be done, if, as, or, when, or where "acceptable, accepted, approval, approved, authorized, condemned, considered necessary, contemplated, deemed necessary, designated, determined, directed, disapproved, established, given, indicated, insufficient, ordered, permitted, rejected, required, reserved, satisfactory, specified, sufficient, suitable, suspended, unacceptable, or unsatisfactory," it shall be understood as if

the expression were followed by the words “by Engineer,” “by the Engineer,” “to the Engineer,” or “of the Engineer.”

b. Wherever these Specifications require either notification to or action by Engineer, it is understood to include the TSS Division authorized representative in addition to any other duly authorized Department representatives designated for the specific project.

5. Proprietary Product. A product, equipment, material, specification, or process identified in the plans or specifications by "brand," trade name, or as a specific model that, as determined by the Maintaining Agency, is required for synchronization with the existing traffic signal system. Synchronization may be determined by the Maintaining Agency based on:

   a. Function (the proprietary product is necessary for the satisfactory operation of the existing facility),

   b. Aesthetics (the proprietary product is necessary to match the visual appearance of existing facilities),

   c. Logistics (the proprietary product is interchangeable with products in the Maintaining Agency's maintenance inventory).

6. Traffic Control Signals or Devices. Any signal or device, manually, electrically, or mechanically operated, by which traffic is alternately directed to stop and permitted to proceed or controlled in any manner. Traffic control signals and devices regulate, warn, or guide traffic on, over or adjacent to a street, highway, pedestrian facility, or bikeway by authority of a public agency having jurisdiction. Traffic control signals and devices include, but are not limited to, controller assemblies (controller cabinets and their contents); signal heads including their hanging or mounting devices; vehicle detection systems (loops, sealant, amplifier, lead-in wire, or cable); pedestrian detection systems (push button, push button housing, lead-in wires, and signal); motorist information systems, video equipment, network devices, dynamic message signs, highway advisory radios, cameras, vehicle detection systems, and other equipment used within a traffic control system.

7. Work. All labor, materials and incidentals required to execute and complete the requirements of the Contract including superintendence, use of equipment and tools, and all services and responsibilities prescribed or implied.

1.03 PROPRIETARY PRODUCTS

A. The equipment and materials listed in the TSSQPL have been standardized for use in the Miami-Dade County traffic signal system. However, certain proprietary products are necessary to maintain the reliability, integrity, compatibility, and synchronization of the system as necessary to protect the safety of the motoring public. Some categories of proprietary products in the Traffic Signal System maintained by the TSS Division include:

   1. Traffic Signal Cabinet Field Communication including Cellular Modem and Managed Field Ethernet Switch.

   2. Traffic Signal Controller Assembly.

   3. Signal Priority and Preemption Systems.

   4. School Zone Programmable Time Switch

SECTION 600 GENERAL PROVISIONS FOR TRAFFIC CONTROL DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. These Provisions are in addition to all applicable requirements of Division 01 (General Requirements) of the DTPW Specifications, available from the Department's Capital Improvement Division, and are supplementary to requirements of all Sections of these Specifications and all other governing standards, requirements, and specifications.

B. All work associated with the installation, modification or repairs of traffic control devices owned, operated or maintained by Miami-Dade County must conform to the requirements of these Specifications and the current requirements of the References listed below. The Engineer of Record and the Contractor performing the work are responsible for complying with all applicable requirements. Whenever a conflict arises between these Specification and any other applicable requirement, Engineer will determine the manner in which the conflict is to be resolved which in most instances will be based on the more stringent of the applicable requirements.

1.02 REFERENCES

A. Miami-Dade County Traffic Control Equipment Standards and Specifications

B. Miami-Dade County Traffic Signals and Signs Division's Qualified Products List (TSSQPL)

C. Miami-Dade County Traffic Signals and Signs Division's Traffic Signalization Standard Details

D. FDOT Approved Product List (APL)

E. Florida Department of Transportation Standard Specifications for Road and Bridge Construction (Divisions II & III), Special Provisions and Supplemental Specifications

F. FHWA Manual on Uniform Traffic Control Devices (MUTCD)

G. National Electrical Code, NFPA 70 (NEC)

1.03 REGULATORY REQUIREMENTS

A. Permits.

1. DTPW Permit(s) and written authorization from the DTPW Traffic Signals and Signs (TSS) Division are required before proceeding with any work pertaining to or that may potentially affect the Miami-Dade County Traffic Control System.
2. This permit requirement applies to every agency, entity, or person whose work or construction activities may modify, impact, or integrate into the Miami-Dade County Traffic Control System including portions of the System that are owned by others but maintained or operated by the TSS Division.

3. Additional requirements regarding the performance and acceptance of the Work may be stipulated by the TSS Division. A DTPW traffic signalization permit and TSS Division Asset Number is required prior to scheduling an inspection with TSS Division.

B. Construction Notification Requirements.

1. Provide written and verbal notification to the TSS Division:
   a. Ten business days prior to commencement of any traffic control or signalization construction, modification or repair of any component within the Miami-Dade County traffic control system.
   b. Five business days prior to the commencement of jobs that include overhead or underground work conducted as part of roadway construction or maintenance projects within Miami-Dade County roadways or other roadways within the County whose traffic control devices are maintained by Miami-Dade County.
2. Written notification must include an updated list of names of contractor's personnel assigned to perform the Work along with current copies of their required licenses and certification cards demonstrating that they meet the requirements of Article 1.04 herein, before starting any work. In addition, ensure that these personnel have copies of their licenses and certifications available at the work site and ready to make them available to DTPW personnel if requested.
3. Notification is provided at:

   Department of Transportation and Public Works
   Traffic Signals and Signs Division
   7100 NW 36th Street
   Miami, FL 33166
   (Attn: Written Construction Notification)

   Phone: 305-679-0040

4. Notify TSS Division daily of where each crew will be working and what work will be done. This notification must be given daily, on the prior workday, between 3:00 p.m. and 4:00 p.m.
5. Provide immediate verbal notice followed by written notification to the TSS Division upon the discovery of any damage, malfunctions, or irregularities pertaining to any Miami-Dade County Traffic Control System component.

C. Preliminary Product and Equipment Data Submittals.

1. Prior to installation or within thirty days after the preconstruction conference, whichever comes first, submit to Engineer for approval:
   a. A completed "Submittal Data – Traffic Control Equipment" form listing, by FDOT APL numbers, all traffic control signals, devices, and hardware that will be used on the Project. Only current FDOT APL certified items that have also been approved and currently listed in the TSSQPL may be used.
   b. One copy of the manufacturer's descriptive literature and technical data fully describing proposed non-structural equipment or material whose category or type does not require FDOT APL certification or TSSQPL approval.
   c. Two copies of the shop drawings signed and sealed by the Specialty Engineer. Shop drawings are required for all structural support materials and other special

designs, such as non-electrical, non-mechanical, or other fabricated items, which may not be specifically detailed in the Plans.

D. Contractor's Maintenance Responsibilities.

1. Fully maintain all existing, temporary and newly installed traffic control devices located within the Project limits, including any interconnect, beginning on the date of the Notice to Proceed or the date Contractor has begun any work on any portion of the Project, whichever is sooner, through and including the ninety (90) day burn-in period following the date of Final Acceptance by the County, subject to any additional Contractor Warranty and Burn-in Period requirements. Investigate all inquiries, complaints or requests made by the County or the Public and immediately initiate all required repairs.

2. Notify Engineer of intent to begin any physical construction work on the Project, or any portion thereof, a minimum of ten (10) working days prior to the start of construction to allow sufficient time for Contractor to conduct an inspection of the existing traffic control device installation(s). In the event any deficiencies are noted by Contractor, at the County's option, they are to be repaired by the TSS Division or documented on the "Transfer of Maintenance" form. If work is started prior to the inspection, maintenance of the traffic control device(s) will immediately be transferred to Contractor without an inspection. Contractor is then responsible for repairing or replacing all equipment that is not operating properly or is damaged at no cost to the owner of the traffic control device.

3. For new traffic control devices, partial or final acceptance and inspection must be scheduled with the County Project Manager before the traffic control device is placed in normal operational mode. Notification is also required before placing the signal in the flashing mode. Meet the applicable requirements of Article 1.03 of Division 01 (General Requirements).

4. Emergency and Non-Emergency Repairs

   a. General.

      1) Provide Engineer two (2) contact names and 24-hour telephone numbers. Contractor must provide sufficient qualified personnel to respond to all notifications of malfunctions on a round-the-clock basis (24 hours a day, 7 days a week).

      2) Maintain and make available to Engineer a time and date log of each response from the time of the initial report to the time of final permanent repair.

      3) When deemed necessary by TSS Division, authorized County personnel may, at any time with prior notification to Contractor, enter the controller cabinet in order to modify timing or restore signal equipment to proper operation if the malfunction or non-function of such equipment poses a hazard or inconvenience to motorists or pedestrians. Such authorized entry may occur at any time within the period of the contract, and such authorized entry will in no way relieve the Contractor or manufacturer of their respective warranties. County will provide Contractor a written summary within five calendar days of any modifications made to the traffic controller assembly to address hazards or inconveniences to the Public.

   b. Non-Emergency Repairs

      1) When a signal malfunction occurs, Contractor must respond within two hours of notification and repair the traffic signal so that it is operating in a safe manner within four hours of initial notification.

      2) Contractor is responsible for the permanent repair within 24 hours and must notify the County immediately upon completion of the repairs.

3) If Contractor fails to respond within two hours, the County reserves the right to either repair the malfunction or employ alternate personnel and charge all costs incurred by the County to the Contractor.

c. Emergency Repairs

1) During the Contractor's Maintenance period, the following will be considered an Emergency unless otherwise identified by Engineer:

a) Any hazardous condition;

b) Any malfunction of a controller and its accessory equipment; or

c) Any Site condition, equipment malfunctions or damage, which in the opinion of Engineer constitutes a serious hazard or inconvenience to the public.

2) Contractor must dispatch personnel to undertake each such repair no later than thirty (30) minutes after the County notifies Contractor of the Emergency. Personnel responding must arrive within one hour after County's notification of the Emergency and immediately proceed to make the site safe.

1.04 LICENSES AND QUALIFICATIONS

A. Qualifications

1. Contractor must hold either a current Miami-Dade County Electrical Contractor License or a State of Florida Certified Electrical Contractor License and a minimum of five (5) years of experience troubleshooting and constructing traffic signal systems.

2. All work involving electrical traffic control devices must be performed under the direction of an employee of the Contractor who is a licensed Miami-Dade County Master Electrician, is present at the job site or able to respond within 2 hours of notification, and holds a current International Municipal Signal Association (IMSA) Traffic Signal Field Technician Level II certification or higher. The Master electrician is required to attest to the quality and accuracy of the Work and its compliance with all applicable codes, standards and specifications; and when required by Miami-Dade County, perform a final verification inspection of the Work.

3. Minimum qualifications for personnel supervising or performing work involving electrical (AC-powered or solar-powered) traffic control devices and related components or appurtenances are provided in the following table.

Work Performed	Qualification Requirements
Contractor's Superintendent	1. Must meet all applicable FDOT and DTPW requirements for a work site superintendent and be at the job site at all times that work is being performed; 2. Must hold a current IMSA Traffic Signal Construction Technician Level II certification or higher; and 3. Must be present at the final inspection of the Work as directed by Miami-Dade County.

Work Performed	Qualification Requirements
All controller cabinet assembly work including back panel wiring terminations; programming; testing; turn on; and troubleshooting.	1. Work must be performed by an employee of the Electrical Contractor that is a licensed Miami-Dade County Journeyman Electrician and that holds a current IMSA Traffic Signal Field Technician Level II certification or higher; and 2. Must be present at the final inspection of the Work as directed by Miami-Dade County.
Electrical traffic control device work including cable and wire installation and splices; signal head installation; power service installation; ground rod testing; cable and wire testing; field wiring terminations; and RRFB, Sign Beacon, ESFS, and other powered sign assemblies.	1. Work must be performed by or in the presence of and under the responsible charge of an employee of the Electrical Contractor that is a licensed Miami-Dade County Journeyman Electrician and that holds a current IMSA Traffic Signal Field Technician Level II certification or higher; and 2. Must be present at the final inspection of the Work as directed by Miami-Dade County.
ITS devices and communications.	1. Work must be performed by an employee of the Electrical Contractor that holds a current IMSA Traffic Signal Field Technician Level II certification or higher; and 2. Must be present at the final inspection of the Work as directed by Miami-Dade County.
Supervision of work that is non-electrical in nature and exclusively ancillary to the work described herein	3. Must be performed by an employee of the Contractor that holds a current IMSA Traffic Signal Field Technician Level I certification or higher.

4. Training and Certifications for Temporary Traffic Control

   a. The following certifications from FDOT approved providers are required:

      1) Contractor's designated Worksite Traffic Supervisor must have a current FDOT MOT Advanced certification. Contractor's IMSA Traffic Signal Construction Technicians and Traffic Signal Field Technicians listed in Paragraph "A.2" above, including the licensed Journeyman and Master electricians, must have a current FDOT MOT Intermediate certification or higher.

      2) Contractor's designated Flaggers must have a current FDOT MOT Flagger certification.

B. TSS Division Qualified Traffic Signal Contractor's List

1. TSS Division maintains a list of electrical contractors that have submitted the following information and accepted by TSS Division to be qualified to perform work on traffic control devices and signal system maintained by Miami-Dade County. Interested

electrical contractor must provide a submittal package to TSS Division for review and acceptance that includes:

a. A cover letter from the electrical contractor on company letterhead requesting to be added to the TSS Division Qualified Signal Contractor's List. Include the company's Office number, Fax Number, Primary Contact Person (including full name and title, cellular phone number, and email address), and Secondary Contact Person (including full name and title, cellular phone number, and email address);

b. A summary of the primary categories of work performed by the electrical contractor and the five (5) years of previous experience troubleshooting and constructing traffic signal systems required in Paragraph "A1" above;

c. A table of the electrical contractor's employees that list their names, job titles, type of work they perform at signalized intersections, and their qualifications; and a detailed list of all supporting documentation attached to the submittal package;

d. Copies of all employee licenses, certifications, and work experience arranged in the order that the employee's name appears in the submittal's list of employee table.

e. Documentation that demonstrates that the electrical contractor possesses the capabilities and capacity to carry out the required type and quantity of traffic signal work that may be required. This includes but is not limited to number of crew members, vehicles, equipment, and materials, etc.

f. Documentation demonstrating Financial Capacity through approval letter from Bonding Company.

2. Submit the above request to:

Chief, Traffic Signals and Signs Division
Department of Transportation and Public Works
7100 NW 36th Street
Miami, FL 33166
Attn: Qualified Traffic Signal Contractor's List

3. Accepted contractors are added to the Qualified Traffic Signal Contractor's List for a period of up to two years. Contractors will be removed from the listing if they do not update their company and employee information during that period.

4. Contractors on the TSS Division Qualified Traffic Signal Contractor's List are required to timely update all requisite information on file. That includes updated copies of expired documentation or the addition of new employees and their documentation. Provide updates to the information in the submittal package as soon as available to the TSS Division for review and approval.

C. Qualified Technical Representative of the Control Equipment Manufacturer.

1. A qualified technical representative of the control equipment manufacturer is required to be present at the work site to assist in checking out the operation of the controller whenever:

a. A Contractor-furnished traffic signal controller is turned on; or

b. An existing Signal is revised requiring Contractor furnished control equipment.

1.05 ACCEPTANCE OF TRAFFIC CONTROL SIGNAL AND DEVICE INSTALLATIONS.

A. Engineer will make inspection for final acceptance of traffic control signal and device installations as part of all work only after satisfactory completion of all field tests of completed installations and on the basis of a comprehensive final field inspection of all equipment installations.

B. Submit three copies of a completed Submittal Data – Traffic Control Equipment form for each cabinet location, to Engineer. Engineer will place one copy in the cabinet at each location.

C. Transfer warranties and guarantees on equipment to the Department in accordance with this Section.

D. For traffic signal installations, submit three completed copies of the Final Acceptance of Traffic Signal Installation(s) and Transfer of Maintenance form.

E. Documentation for Electronic Equipment.

1. Required Documentary Items.
    a. Operation Manual
    b. Troubleshooting and Service Manual
    c. Assembly and installation instructions
    d. Pictorial layout of components and schematics for circuit boards
    e. Parts list
    f. Diagram of the field installation wiring (not applicable to the detectors)
    g. Warranty information
2. Prior to final inspection, furnish Engineer with two copies of the aforementioned documentary items from the manufacturer for the following electronic equipment:
    a. Controllers
    b. Vehicle detectors
    c. Load switches
    d. Flasher units
    e. Preemption units
    f. Conflict monitors
    g. Special sequence relays
    h. Cameras
    i. Dynamic message signs
    j. Any other equipment which has a logic, timing, or communications function
    k. Other equipment specified in the Contract Documents

F. As-Built Drawings.

1. As a condition precedent to acceptance, provide signed and sealed As-Built Drawings, either by a State of Florida licensed professional engineer or a professional surveyor and mapper, and prepared pursuant to Subarticle 1.06.I of Division 01 (General Requirements) of the DTPW Specifications. These drawings must show the actual location of all signal poles, mast arms, traffic control devices, signs, cabinets, service points and must clearly depict all installations including the depth and location of all conduits and conductors; and the specific product number installed.
2. Submittal Requirements:
    a. Submit three sets of as-built plans for review by Engineer along with electronic copies consisting of a separate level/layer within the project design files. Coordinate the format of electronic as-built files with Engineer. Record all as-built information using typed text to ensure legibility.

b. The As-Built plans shall be neat, legible and of the correct size. Bridge projects and any road projects which include Plan, Profile and Cross-Section Sheets must be full size (22" X 36"). In general, if the job was let with full size plans, the As-Builts must be full size. All revisions to the original plans must be delineated in red, located properly on the drawing, they must be legible and true to scale. Every As-Built Plan, Profile and Cross-section Sheet must be designated as such by note or stamp "As-Built" in black.

c. Signing and pavement marking plan sheets may be used instead of signalization plan sheets, if a substantial number of changes from the original plans must be recorded. If, in the opinion of the Engineer, the changes cannot be clearly delineated on the existing drawings, clearly delineate all changes on 11 inch by 17 inch detail sheets, enlarged 200% from the reproductions.

d. Submit fiber optic splicing diagrams detailing all cable splices, terminations, equipment port assignments, and optical circuits within the communication network.

e. As-built submittals must include an electronic file with an inventory of all traffic control signals and devices, and support structures. The inventory must include horizontal position geographic coordinate data collected using Differential Global Positioning System (DGPS) equipment. The inventory must include the manufacturer, model, and serial number for each device or completed assembly. Provide coordinate data for pull boxes as well as conduit and cable at 100 feet intervals including changes in direction.

f. Aerial photographs may be furnished with as-built submittals to provide supplementary information. The aerials should not include extra features such as the right of way, baseline, or roadway edges. The aerials may be used as a base for the as-built plans with mile post and offset dimensions. Make any corrections resulting from Engineer's review, and resubmit three sets of the completed as-built plans as a condition precedent to acceptance of the installation.

3. Components: As a minimum, identify all traffic control devices, poles, support structures, cabinets, pull and splice boxes, hubs, access points, and power services.

a. Conduit and Cable: Identify all conduit and cable with unique line styles for routing (overhead, conduit, saw cut, etc.) that are clearly identified in a legend on each sheet. Identify the type of cable (example - 7 conductor signal cable) and label the number of conductors, fiber strands or other identifying features of the cable. For conduit, clearly note conduit size and number of runs.

b. Loops and Detection Zones: Identify the location of all installed loops (including the distance from the stop bar for the advance loops), the path of each loop to the pull box, the loop window and the path of the loop lead-in to the controller cabinet. Identify the device location and the approximate detection area for detection systems that are not embedded in or under pavement.

c. Pull Boxes: Label unused and out of service pull boxes clearly. Show distances to each pull box from the nearest edgeline, stop bar, or other permanent feature. If an edgeline is not near a pull box or would not clearly identify its location; a fixed monument may be used (example - FDOT pole or structure).

d. Poles: Identify poles from the nearest edgeline of both approaches. If an edgeline is not near a pole or would not clearly identify its location, a fixed monument may be used.

e. Signal Heads: As-built plans must show the final location of signal heads. Each signal head shall be identified by its corresponding movement number.

f. Cabinet: The type of cabinet, date of installation and inventory of internal components must be documented. Controller manufacturer along with the controller model number shall be provided for all traffic signal cabinets. A cabinet corner "blow up" shall be provided detailing pull box locations with all conduit and cable.

1.06 CONTRACTOR'S WARRANTY PERIOD FOR INSTALLATIONS (BURN-IN PERIOD).

A. Contractor's responsibility for warranty repairs, warranty replacement, troubleshooting, or other costs associated with repair or replacement of traffic control signals and devices within the Contract's project limits will terminate 90 days after Final Acceptance subject to any additional Contractor Warranty and Burn-in Period requirements stipulated in the Contract Documents.

B. During the contractor warranty period, the Contractor is responsible for the following:

1. Repair or replacement of equipment that fails to function properly due to defective materials or workmanship.
2. Restore the equipment to proper operating condition within 12 hours after notification by Engineer of a malfunction. If the Contractor fails to restore the equipment to proper operating condition within 12 hours after notification, Engineer has the authority to have the remedial work performed by other forces. Contractor is responsible for all incurred costs of the work performed by other forces. Remedial work performed by other forces does not alter any of the requirements, responsibilities, or obligations of this warranty.
3. If the equipment does not function or malfunctions due to defective materials or workmanship, Contractor is liable for any impairment to the safety of pedestrian and vehicular traffic resulting from such malfunction.

1.07 MANUFACTURERS' WARRANTY REQUIREMENTS

A. General.

1. Ensure that warranties and guarantees are consistent with those provided as customary trade practices; or as otherwise specified in the Plans, Standard Specifications, Supplemental Specifications or Special Provisions.
2. When a warranty is available, ensure that a manufacturer's written warranty accompanies the manufacturer/vendor's billing invoice. Ensure that the terms and conditions of warranties are documented by the manufacturer for equipment submittals on construction projects. Include terms for a specified service performance with provisions for repair parts and labor, or for replacement.
3. Manufacturer and Contractor costs associated with transferring, providing, and delivering equipment warranties, requirements, terms, and conditions are part of the Work and are included in the overall cost of the Work or where available, in the pay item for the equipment or construction feature utilizing the equipment.
4. Secure all warranties provided by the equipment manufacturer for the specific equipment included in the Contract.
5. Transfer warranties upon Final Acceptance. Document all warranties and warranty transfers and provide a copy to Engineer.

B. Terms and Conditions.

1. Ensure warranties require the manufacturer to furnish replacements within 10 calendar days (or 30 calendar days where specified in the Table below) of notification for any part or equipment found to be defective during the manufacturer's warranty period at no cost to the County.
2. Ensure that manufacturer's and supplier's warranties and guarantees are transferable to the Department, are continuous throughout their duration, and state that they are subject to such transfer.

3. Ensure that warranties cover defects for at least the warranty period specified in the Table below and the Contract Documents, beginning from the date of Final Acceptance in accordance with the applicable Contract Provisions.
4. Ensure the manufacturer will repair any faulty equipment during the specified warranty period at no charge to the Department for parts, labor, or shipping to and from the factory.
5. All control software and firmware updates must be available to the County at no additional charge, during the warranty period. Manufacturer must also provide technical telephone support at no extra charge to the County including replacement components for in-warranty repairs when provided in exchange for the part being replaced.

Specification Section	Product Category	Warranty Period/Additional Requirements
620	Surge Protective Devices	Ensure that the SPD has a manufacturer's warranty covering failures for a minimum of five (5) years from the date of final acceptance by Engineer. The term "failure" for warranty replacement is defined as follows: Parallel-connected, power-rated SPD units are considered in failure mode when any of the visual indicators shows failure mode when power is applied to the terminals at the unit's rated voltage, or the properly functioning over-current protective device will not reset after tripping. Series-connected, low-voltage power, data, or signal units are considered in the failure mode when an open circuit condition is created and no data/signal will pass through the SPD device or a signal lead is permanently connected to ground. In the event that the SPD, including any component of the unit, should fail during the warranty period, the entire SPD shall be replaced by the manufacturer at no cost to the Department.
633	Communication Cables and Appurtenances	Ensure that the fiber optic cable, the splice enclosures, and terminations have a manufacturer's warranty covering defects for a minimum of two (2) years from the date of Final Acceptance by Engineer.
635	Pull, Splice, and Junction Boxes	Ensure all pull, splice, and junction boxes have a manufacturer's warranty covering defects for a minimum of one (1) year from the date of Final Acceptance by Engineer. Ensure the warranty includes providing replacements, within 30 calendar days of notification, for defective parts and equipment during the warranty period at no cost to the Department.
639	Electrical Power Service Assembly	Ensure that the electrical service disconnect panel, meter enclosure, and their respective components have a manufacturer's warranty covering defects for a minimum of one (1) year from the date of Final Acceptance by Engineer. Ensure the warranty includes providing replacements, within 30 calendar days of notification, for defective parts and equipment during the warranty period at no cost to the Department.

Specification Section	Product Category	Warranty Period/Additional Requirements
646	Aluminum Poles, Pedestals, and Posts	Ensure aluminum poles, pedestals, and posts have a manufacturer's warranty covering defects for a minimum of one year from the date of Final Acceptance by Engineer; Painted poles, pedestals and posts must include a minimum five (5) year manufacturer's warranty from the date of Final Acceptance by Engineer in addition to meeting all requirements stipulated in the written Department authorization.
649	Mast Arms	Ensure mast arm assembly have a manufacturer's warranty covering defects for a minimum of one year from the date of Final Acceptance by Engineer; Painted mast arm assemblies must include a minimum five (5) year manufacturer's warranty from the date of Final Acceptance by Engineer in addition to meeting all requirements stipulated in the written Department authorization.
650, 653	Vehicular Traffic and Pedestrian Signal Assemblies	Ensure that the signal housings, backplates, and any other signal assembly components have a manufacturer's warranty covering defects for a minimum of three (3) years from the date of Final Acceptance by Engineer. Ensure the warranty includes providing replacements, within 30 calendar days of notification, for defective parts and equipment during the warranty period at no cost to the Department. Ensure that the LED signal modules have a manufacturer's warranty covering defects for a minimum of five (5) years from the date of Final Acceptance by Engineer. Ensure that the warranty includes providing replacements, within 30 calendar days of notification, for any defective parts and equipment (including falling below minimum intensity levels) during the warranty period at no cost to the Department.
654	RRFB	Ensure the midblock crosswalk enhancement assembly has a manufacturer's warranty covering defects for three (3) years from the date of Final Acceptance by Engineer.
659	Mounting Assemblies	Ensure mounting assemblies have a manufacturer's warranty covering defects for a minimum of three (3) years from the date of Final Acceptance by Engineer.
660	Vehicle Detection Systems	Ensure that vehicle detection and data collection systems have a manufacturer's warranty covering defects for a minimum of five (5) years from the date of Final Acceptance by Engineer.
663	Preemption Systems	Ensure that the priority and preemption system has a manufacturer's warranty covering defects for five (5) years from the date of Final Acceptance by Engineer.
665	Pedestrian Detection System	Ensure that pedestrian detection systems have a manufacturer's warranty covering defects for a minimum of five (5) years from the date of Final Acceptance by Engineer.

Specification Section	Product Category	Warranty Period/Additional Requirements
670	Traffic Controller Assembly	The Manufacturer/Vendor must bear all costs of repair or replacement in addition to the shipping of any controller, parts, or other components covered by this document, associated with the controller cabinet assembly, which fail because of normally occurring, electrical or mechanical phenomena for a period of three (3) years. Unit(s) which have been found to be defective by the Department will be removed from service by Miami-Dade County and packed for shipment by Miami-Dade County at no charge to the Manufacturer/Vendor. The Manufacturer/Vendor must bear all costs for shipping defective equipment to and from the designated County maintenance facility. The Manufacturer/Vendor shall have ten (10) working days, after receipt of the defective items, to either repair or replace them. The Manufacturer/Vendor must place each repaired item into the hands of a shipper for return to Miami-Dade County not later than ten (10) working days after receipt of the item. Should the Manufacturer/Vendor elect to repair any equipment on site in Miami-Dade County, they will have ten (10) working days after receipt of notification to completely restore all equipment concerned to proper operation. The three (3) year warranty period will commence at the date of Final Acceptance by Engineer, or at the expiration of a one hundred eighty (180) calendar day shelf life in Department inventory, whichever occurs first.
671	Traffic Controller	Ensure the traffic controller has a manufacturer's warranty covering defects for three (3) years from the date of Final Acceptance by Engineer.
676	Traffic Cabinet	Ensure cabinets and enclosures have a manufacturer's warranty covering defects for a minimum of three (3) years from the date of Final Acceptance by Engineer.
678	Traffic Controller Accessories	Ensure traffic controller accessories have a manufacturer's warranty covering defects for a minimum of three (3) years from the date of Final Acceptance by Engineer.
682	CCTV, Video Display Control Equipment, TMC Display Equipment	Ensure that CCTV cameras and video display equipment have a manufacturer's warranty covering defects for a minimum of three (3) years from the date of Final Acceptance by Engineer. Warranty repairs of the video display control system and related TMC display equipment must commence within 24 hours after notification by the Department.
684	Network Devices	Ensure that the Managed Field Ethernet Switch, Device Server, and Media Converter have a manufacturer's warranty covering defects for five (5) years from the date of Final Acceptance by Engineer. Ensure that Digital Video Encoder and Decoder have a manufacturer's warranty covering defects for two (2) years from the date of Final Acceptance by Engineer.

Specification Section	Product Category	Warranty Period/Additional Requirements
685	UPS System	Manufacturers must provide a manufacturer's warranty for the UPS system (including the batteries) covering defects for a minimum of five (5) years from the date Final Acceptance by Engineer.
700	Internally Illuminated Street Name Signs, Flashing, Beacon, and Electronic Display Sign assemblies	Ensure all IISNS, Flashing Beacon, and EDS systems have a manufacturer's warranty covering defects in assembly, fabrication, and materials for a minimum of five (5) years from the date of Final Acceptance by Engineer. Ensure the manufacturer will furnish replacements for any part or equipment found to be defective during the warranty period at no cost to the Department within 30 calendar days of notification. In addition, Electronic Speed Feedback Signs must include a manufacturer's warranty of ten (10) years from the date Final Acceptance by Engineer on the LEDs, comprising the display segments.
706	Raised Pavement Markers	Ensure that Class F RPM have a non-prorated manufacturer warranty on all components in accordance with Section 706 for a minimum of five (5) years from the date of Final Acceptance by Engineer.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS.

A. General.

1. Ensure that the traffic signal equipment, materials, and work meet the requirements of the Plans and Specifications. All equipment furnished must be new and meet the requirements of the following:
   a. Underwriter's Laboratory Incorporated (UL)
   b. Electronic Industries Association (EIA)
   c. National Electric Code (NEC)
   d. American Society of Testing and Materials (ASTM)
   e. American National Standards Institute (ANSI)
   f. International Municipal Signal Association (IMSA)
   g. National Electrical Manufacturers Association (NEMA)
2. Use only compatible units of any one item of equipment, such as signal heads, detectors, controllers, cabinets, poles, signal system or interconnection equipment, etc.
3. Use only new equipment and material.
4. Provide a complete operable signal installation as specified regardless of any failure of the Department to discover or note any unsatisfactory material.
5. Traffic control signals and devices must be currently approved and listed on the FDOT APL and the DTPW TSSQPL. Contractor may seek acceptance and inclusion of new traffic control signals and devices in the TSSQPL; however, doing so will not exempt

Contractor from meeting all requirements of the Contract Documents including timely prosecution of the Work.

B. Hardware and Fittings Used for Installation.

1. Ensure that all assembly hardware, including nuts, bolts, external screws and locking washers less than 5/8 inch in diameter, are Type 304 or 316 passivated stainless steel. Use stainless steel bolts, screws and studs meeting the requirements of ASTM F593. Use nuts meeting the requirements of ASTM F594. Ensure all assembly hardware greater than or equal to 5/8 inch in diameter is galvanized. Use bolts, studs, and threaded rod meeting the requirements of ASTM A307. Use structural bolts meeting the requirements of ASTM A325.

2. Use high-strength steel anchor bolts and U-bolts, having a minimum yield strength of 55,000 psi and a minimum ultimate strength of 90,000 psi.

C. Galvanizing: Meet the requirements of FDOT Section 962 when galvanizing for fittings and appurtenances for all structural steel (including steel poles).

D. Environmental Specifications: Ensure system electronics intended for installation outdoors or within a roadside cabinet perform all required functions during and after being subjected to the environmental testing described in National Electrical Manufacturers Association (NEMA) TS2, 2.2.7, 2.2.8, and 2.2.9.

2.02 DEPARTMENT-FURNISHED EQUIPMENT INSTALLED BY CONTRACTOR.

A. Where the Contract Documents require installation of Department-furnished equipment, the Department will turn over such equipment to Contractor when the construction progress allows or as designated in the Contract Documents.

B. The Department will test and certify the equipment to be in proper condition and ready to use and will bear the costs of correcting any defects in the equipment prior to pick-up by Contractor. Engineer will coordinate the pick-up and installation of the equipment.

C. Maintain the equipment in proper operational condition after pick-up at no cost to the Department, until either Final Acceptance or the equipment is returned to the Department.

PART 3 EXECUTION (NOT USED)

END OF SECTION 600

SECTION 620 GROUNDING AND LIGHTNING PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install grounding and lightning protection to meet the requirements of FDOT Specification Section 620 (Grounding and Lightning Protection) as specified herein and the Contract Documents.

B. Basis of Payment

1. The work specified in this Section is considered incidental work and will not be paid directly.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the material and product requirements of FDOT Specification 620-2 (Materials) and the Contract Documents.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the installation requirements of FDOT Specification 620-3 (Installation) and the Contract Documents except, resistance to ground measurement is required at each point of ground rod installation.

3.02 FIELD QUALITY CONTROL

A. Meet the testing and inspection requirements of FDOT Specification 620-4 (Ground Resistance Testing and Inspection).

END OF SECTION 620

SECTION 630 CONDUIT

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install conduit for traffic control signals and devices, and other electrically powered or operated devices as shown in the Contract Documents.

B. Method of Measurement

1. Furnish and Install:
   a. The Contract unit price per foot of conduit, furnished and installed, will include furnishing all hardware and materials and all testing as specified in this Section and the Contract Documents, and all labor, casings, removal of excavated materials and spoils, removal and disposal of drilling fluids, locate wire, trenching, boring, backfilling, flowable fill and restoration materials necessary for a complete and accepted installation.
   b. Payment for conduit placed underground will be based on the horizontal length of the trench or bore measured in a straight line between the centers of pull boxes, cabinets, poles, etc., in linear feet, regardless of the length or number of conduits installed. No allowance will be made for sweeps or vertical distances below the ground.
   c. Payment for conduit placed aboveground or bridge mounted will be based on the actual length of conduit installed.

C. Basis of Payment

1. Price and payment will be full compensation for all work specified in this Section.
2. Payment for conduit placed under existing turf will be made as open trench.
3. Payment for conduit placed under existing pavement (roadway, driveways, or sidewalk) will be made as directional bore. If conduit is being placed under both existing turf and existing pavement between two pull boxes, payment for the total pull box-to-pull box length will be made as directional bore. Payment for conduit placed by jack & bore will be made as jack & bore, for the total pull box to pull box length.
4. No additional payment will be made for multiple conduits in the same trench.
5. No payment adjustment will be made if Contractor chooses to use an alternative method approved by Engineer.
6. No payment will be made for failed bore paths, injection of excavatable flowable fill, products taken out of service, or incomplete installations.
7. Payment will be made under:

Item No.	Description	Unit
630-2-11	Conduit, F&I, Open Trench	LF
630-2-12	Conduit, F&I, Directional Bore	LF

1.02 REFERENCES

A. Miami-Dade County Traffic Signals and Signs Division's Qualified Product List (TSSQPL)

B. FDOT Approved Product List (APL)

C. American Society for Testing and Materials (ASTM)

D. American Nation Standards Institute (ANSI)

E. National Electric Code (NEC)

F. National Electrical Safety Code (NESC)

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the material and product requirements of FDOT Specification 630-2 (Materials) and the Contract Documents.

B. Use FDOT APL approved conduits of the material type required for the installation categories listed below.

1. Above-ground and underground electrical power service installations: Use rigid galvanized metal that is hot-dipped galvanized with a minimum coating of 1.24 ounces per square foot on both the inside and outside of the conduit. The weight of the zinc coating must be determined using ASTM A90. Use conduit with both ends reamed and threaded.
2. Non-structural, above ground ITS communication and electrical conduit: Use Schedule 80 PVC or rigid galvanized metal conduit.
3. Underground installations in earth or concrete for ITS and traffic control signal applications: Use HDPE with an SDR number less than or equal to 11, Schedule 80 PVC or Schedule 40 PVC conduit except, use only HDPE conduit with an SDR number less than or equal to 11 for blown fiber optic cable installations on limited access facilities.
4. Underground installations of electrical conduit in earth for ITS electrical applications only: Use HDPE with an SDR number less than or equal to 13.5, Schedule 80 HDPE, Schedule 40 HDPE, Schedule 80 PVC, or Schedule 40 PVC conduit.
5. Underground installations of electrical conduit in earth for lighting applications: Use HDPE with an SDR number less than or equal to 13.5, Schedule 80 PVC, or Schedule 40 PVC conduit.
6. Conduit inside of or embedded within structural elements: Use Schedule 40 or Schedule 80 PVC conduit. Use conduit with solvent weld slip-fit plastic couplings unless approved by the Engineer.

7. Conduit that are outside or attached to the exterior of structural elements: Use Schedule 80 PVC conduit. Use conduit with solvent weld slip-fit plastic couplings unless approved by the Engineer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conduit Installation Requirements

1. Install the conduit in accordance with NEC or National Electrical Safety Code (NESC) requirements and the Design Standards. Consider the locations of conduit as shown in the Plans as approximate. Construct conduit runs as straight as possible, and obtain Engineer's approval for all major deviations in conduit locations from those shown in the Plans. Include buried cable warning tape with all trenched conduit. Mark the location of the conduit system with route markers as shown in the Plans and approved by Engineer. Ensure that all route markers used are new and consistent in appearance.
2. For conduit installed by directional bore, install in accordance with FDOT Specification Section 555. For conduit installed by jack and bore, install in accordance with FDOT Specification Section 556.
3. Use only rigid galvanized metal conduit, or rigid aluminum conduit for above-ground and underground electrical power service installations. Meet the requirements of FDOT Specification Section 562 for coating all field cut and threaded galvanized pipe.
4. Use Schedule 80 PVC or fiberglass reinforced epoxy conduit in structural elements in or on bridge decks.
5. Use HDPE with an SDR number less than or equal to 11, Schedule 80 PVC or Schedule 40 PVC for underground installations in earth or concrete for ITS and traffic control signal applications, except, use only HDPE with an SDR number less than or equal to 11 for blown fiber optic cable installations on limited access facilities.
6. Use HDPE with an SDR number less than or equal to 13.5, Schedule 80 PVC, or Schedule 40 PVC for underground installations of electrical conduit in earth for lighting applications and landscape irrigation applications.
7. Use HDPE with an SDR number less than or equal to 13.5, Schedule 80 PVC, Schedule 40 PVC, or rigid galvanized metal for underground installations of electrical conduit in concrete for lighting applications.
8. Do not place more than the equivalent of three quarter bends or 270 degrees of bends, including the termination bends, between the two points of termination in the conduit, without a pull box. Obtain Engineer's approval to use corrugated flexible conduits for short runs of 6 feet or less.
9. When a conduit installation changes from underground to above-ground, make the change a minimum of 6 inches below finished grade.
10. Install a No. 12 AWG pull wire or polypropylene cord inside the full length of all conduits. Ensure that a minimum of 24 inches of pull wire/cord is accessible at each conduit termination.
11. Ensure the conduit includes all required fittings and incidentals necessary to construct a complete installation.

12. When earth backfill and tamping is required, place backfill material as per FDOT Section 120 in layers approximately 12 inches thick, and tamp each layer to a density equal to or greater than the adjacent soil.
13. When backfilling trenches in existing pavement, use a flowable fill meeting the requirements of FDOT Specification Section 121.
14. Provide a standard clearance between underground control cable and electrical service cable or another parallel underground electrical service cable that meets NESC requirements.
15. Prevent the ingress of water, dirt, sand, and other foreign materials into the conduit prior to, during, and after construction. Seal the ends of conduit after wiring is complete with a moisture resistant sealant that is designed for this specific application.

B. Fiber Optic Cable Conduit

1. Install the conduit system so the fiber optic cable maintains a minimum bend radius of 20 times the cable diameter. Use approved methods for connecting inner duct or conduit within or between plowed portions, trenched portions, and bored portions. Submit the conduit manufacturer's coupling method and material to Engineer for approval.

C. Conduit Sizes

1. Size the conduit to be used on all installations, unless otherwise shown in the Contract Documents. Use conduit of sufficient size to allow the conductor to be installed without any damage and meeting NEC requirements. Use conduit that is at least 2 inches in diameter, with the following exceptions:
    a. For conduit protecting the ground wire on the side of a pole, use conduit that is at least 1/2 inch in diameter.
    b. For ITS applications where Contractor chooses to install fiber optic cable by blowing, use conduit that is at least 1-1/4 inch in diameter.
    c. For traffic control signal and device electrical service conduit, use the minimum conduit size required by the Department and the electrical service provider.
    d. Where larger size conduits are required by the Miami-Dade County Traffic Control Equipment Standards and Specifications.

D. Conduit Joints

1. Make conduit joints using materials as specified by the manufacturer. When conduit crosses an expansion joint of a structure and where shown in the Plans, install an expansion or expansion/deflection fitting as specified by the manufacturer. Certify that expansion/deflection fittings are rated to accommodate a minimum rotation of 30 degrees and that both the expansion and expansion/deflection fittings are rated to accommodate the anticipated longitudinal movement (minimum of 2 inches for deflection fittings and 0.7 inches for expansion/deflection fittings). Ensure that all installed joints are waterproof. As an exception to the threaded coupling for intermediate metal conduit, at locations where it is not possible to screw the threaded coupling properly, Contractor may use a waterproof slip-joint coupling approved by Engineer. Secure the joint, and tighten threaded connections.
2. Prior to insertion into the coupling, clean, prime and coat the ends of PVC conduit with solvent-type cement as specified by the manufacturer.

E. PVC Coating

1. Apply PVC coating to exposed metal surfaces of the conduit, except for the threads, to attain a nominal thickness of 40 mils. Ensure that the coating is free of sags and drips.
    a. Attach the coupling to the conduit prior to the application of the coating for conduit of 1 inch diameter or less.
    b. Use a coupling with sleeve extensions on conduit larger than 1 inch. Ensure that the sleeve extensions on all threaded female openings have a length equal to the diameter of the conduit up to and including size number 53.

F. Conduit Terminations

1. Fit the terminating ends of all metal conduit and metal conduit sleeves with an appropriate bushing.
2. For conduit to be encased in concrete, wrap with tape or otherwise protect all terminations to prevent the entrance of concrete.
3. Connect new underground conduits to existing underground conduits with a pull box.
4. Install conduit terminating in a concrete strain pole through the cable entry hole and up the center of the pole to a location approximately 6 inches below the handhole.
5. Seal conduits terminating in a controller base, pole, pull box, junction box, or pedestal base with a moisture resistant sealant approved by Engineer.
6. For a controller base, pole or pedestal base, and junction boxes, terminate conduit runs into the center of the base or box at least 2 inches above the surface of the base.

G. Restoration of Trench Areas

1. Restore the conduit trench construction area to an acceptable condition. Such work includes repair or replacement of all pavement areas, sidewalks, driveways, curbs, structures, landscaping, grass areas (including removal of excavated materials and spoils), removal and disposal of drilling fluids, and backfilling areas disturbed by the conduit installation.

H. Above Ground Installation

1. Use conduit designed and manufactured for use in long-term above-ground applications with UV stabilization to prevent material deterioration. Securely attach above-ground conduit installations to the surface of the supporting structure using conduit straps. As a minimum, use conduit straps located on 5 foot centers. Use galvanized metal conduit straps when installing intermediate metal conduit, fiberglass reinforced epoxy conduit, rigid galvanized conduit, rigid aluminum conduit or PVC coated intermediate metal conduit above ground.
2. Use the same PVC coating for the metal straps as the conduit, when using PVC coated intermediate metal conduit.

I. Elbows

1. The radius of curvature of the centerline of any bend shall not be less than shown below:

Size	Standard Radius
1/2 inch	4 inches
3/4 inch	4-1/2 inches
1 inch	5-1/2 inches

Size	Standard Radius
1-1/4 inches	7-1/4 inches
1-1/2 inches	8-1/4 inches
2 inches	9-1/2 inches
2-1/2 inches	10-1/2 inches
3 inches	13 inches
3-1/2 inches	15 inches
4 inches	16 inches
5 inches	24 inches
6 inches	30 inches

J. Fiber Optic Cable Locate Wire

1. Install locate wire in the trench or bore with all underground conduits to provide end-to-end electrical continuity for electronically locating the underground conduit system. Bury locate wire along the centerline of the top outer surface of installed conduit. Do not install locate wire in a conduit with fiber optic cable.
2. Do not run locate wires into field cabinets. Terminate locate wires at the first and last pull boxes in the conduit run or as shown in the Plans. Ensure that wire termination occurs in a pull box as shown in the Miami-Dade Conduit Installation Details (N.T.S).
3. In a trenching operation, install the locate wire no more than 3 inches above the conduit. Ensure that the locate wire enters all pull and splice boxes, and that a minimum of 10 feet of slack locate wire is coiled and neatly stored in each box.
4. In a boring operation, install the locate wire in an encasement, install the conduit detection wire external to the conduit with no separation between conduit and wire, or use conduit with integral locate wire. Locate wire may also be placed in the void between the inner wall of conduit and innerducts contained within the conduit as long as no other cables are present within the void.
5. Perform continuity tests and insulation resistance tests on all locate wires and provide Engineer with all test results. Replace, or repair defective locate wire at no additional cost.
6. Make locate wire splices in a flush grade-level box. Ensure that locate wire splices are waterproof and suitable for direct burial. Ensure that locate wire splices at the pull box meet NEC requirements. Ensure that locate wire splices are constructed of and in the following order: a mechanical crimp connection with a butt sleeve, an oxide-preventing aerosol lacquer, mastic electrical splicing tape, and standard electrical tape. At the completion of the installation, provide Engineer with as-built drawings that document all splice locations.
7. Install WGUs in pull boxes and splice boxes as shown in the Plans or directed by the Engineer. Mount the device in a location high enough from the bottom of the box to allow access to terminal facilities without disturbing cables present within the box. Terminate the locate wires and connect the WGU to ground in accordance with the manufacturer's instructions.

8. Test the locate wire system after installation to ensure that it functions and can be used to accurately locate the conduit system.

K. Route Markers

1. Install route markers for fiber optic cable installations as detailed in FDOT Specification Section 630-3.10.

END OF SECTION 630

SECTION 633 COMMUNICATION CABLE

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install communication to meet the requirements of FDOT Specification Section 633 (Communication Cable) as specified herein and the Contract Documents.

B. Method of Measurement

1. Per Contract Documents.

C. Basis of Payment

1. Per Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the material and product requirements of FDOT Specification 633-2 (Materials), the Miami-Dade County Information Technology Department, and the Contract Documents.

B. Cables must be 600V rated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the installation requirements of FDOT Specification 633-3 (Installation), the Miami-Dade County Information Technology Department, and the Contract Documents.

END OF SECTION 633

SECTION 634 SPAN WIRE ASSEMBLY

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install span wire assembly for supporting traffic signals, signs, and other traffic control devices to meet the requirements of FDOT Specification Section 634 (Span Wire Assembly) as specified herein and the Contract Documents.

B. Method of Measurement

1. Per Contract Documents.

C. Basis of Payment

1. Per Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the material and product requirements of FDOT Specification 634-2 (Materials) and the Contract Documents.

B. Span wire assembly components used must be approved and listed on the TSSQPL.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the installation requirements of FDOT Specification 634-3 (Installation Requirements) and the Contract Documents.

END OF SECTION 634

SECTION 635 PULL, SPLICE, AND JUNCTION BOXES

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install pull, splice, and junction boxes as shown in the Plans.

B. Method of Measurement

1. The Contract unit price each for pull, splice, and junction box, furnished and installed, will consist of the pull, splice, and junction box including all required hardware for the type of box and location as specified in the Contract Documents, and all labor and materials necessary for a complete and accepted installation.

C. Basis of Payment

1. Price and payment will be full compensation for all work specified in this Section, except grounding.
2. No separate payment for embedded junction boxes will be made. The Contractor shall include the cost of embedded junction boxes in the Contract unit price for the concrete substructure or superstructure items.
3. No separate payment will be made for the removal of pull, splice, and junction boxes.
4. Payment will be made under:

Item No.	Description	Unit
635-2-11	Pull & Splice Box, F&I, 13" X 24" Cover Size	EA
635-2-12	Pull & Splice Box, F&I, 24" X 36" Cover Size	EA
635-3-11	Junction Boxes, F&I, Aerial	EA
635-3-12	Junction Boxes, F&I, Mounted	EA

1.02 REFERENCES

A. Miami-Dade County Traffic Signals and Signs Division's Qualified Product List (TSSQPL)

B. FDOT Approved Product List (APL)

C. American Society for Testing and Materials (ASTM)

D. American Nation Standards Institute (ANSI)

1.03 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. General.

1. Use only pull and splice boxes that meet the requirements of this Specification and are listed on the FDOT's Approved Products List (APL) and the Department's Traffic Signals and Signs Division's Qualified Products List (TSSQPL).

B. Pull and Splice Boxes

1. General
   a. Manufacturers of concrete pull and splice boxes and covers must meet the requirements of FDOT Sections 105 and be currently on the FDOT's Production Facility Listing and.
   b. Ensure box bodies and covers are free of flaws such as cracks, sharp, broken, or uneven edges, and voids.
   c. Ensure in-ground boxes have an open bottom design.
2. Marking

   Ensure the following information is permanently cast into the top surface of all pull and splice box covers:

   a. Unless otherwise shown in the Plans, mark application as follows:
      1) "MIAMI-DADE COUNTY TRAFFIC SIGNAL" for signalized intersections
      2) "MIAMI-DADE COUNTY FIBER OPTIC CABLE" for fiber optic cable
      3) "MIAMI-DADE COUNTY MAST ARM LUMINAIRES" for lighting on signal mast arms
      4) "MIAMI-DADE COUNTY ELECTRICAL" for other electrical applications
   b. Manufacturer's name or logo
   c. FDOT APL or Miami-Dade County TSSQPL approval number
   d. TIER rating
3. Ensure the date of manufacture (month/day/year, or date code) is permanently located on the top or bottom of the cover. Ensure the interior of the box body has a permanent marking that includes the manufacturer part/model number and date of manufacture near the top of box in a location that is visible after installation when the cover is removed.
4. Dimensions
   a. Unless otherwise shown in the Plans, provide pull and splice boxes with the following dimensions.
      1) For signalized intersection and lighting applications, provide pull boxes with nominal cover dimensions of 13 inches wide by 24 inches long or larger and no less than 12 inches deep. Ensure the inside opening area is a minimum of 240 square inches and no inside dimension is less than 12 inches.
      2) For fiber optic cable applications, provide pull boxes with nominal cover dimensions of 24 inches wide by 36 inches long or larger and no less than 24 inches deep.

3) Provide rectangular splice boxes with nominal cover dimensions of 30 inches wide by 60 inches long or larger and no less than 36 inches deep. Provide round splice boxes with a nominal cover diameter of 36 inches or larger and no less than 36 inches deep.

5. Fabrication

a. Provide box covers constructed of concrete, polymer concrete or other materials meeting the requirements of this Section.

b. Provide box covers with lifting slots and a flush-seating lockdown mechanism. Use penta-head lockdown lag bolts. Ensure lockdown bolts and lifting slots are Type 316, 304, or 302 passivated stainless steel or brass. Ensure lockdown bolt assembly is designed to prevent seizing and can be removed without damaging the cover or box body. Ensure the lockdown bolt threaded insert/nut assembly is field replaceable.

6. Testing Requirements:

a. For all pull and splice boxes submitted provide test data demonstrating conformance with the American National Standards Institute/Society of Cable Telecommunications Engineers (ANSI/SCTE) 77 2013 Specification for Underground Enclosure Integrity for TIER 15.

C. Junction Boxes

Fabrication.

Provide galvanized steel, aluminum or NEMA 4X non-metallic junction boxes. Ensure all attachment hardware is Type 316 or 304, passivated stainless steel.

1. Ensure the outside surface has a smooth, uniform finish. Ensure boxes are free of burrs, pits, sharp corners and dents. Ensure all welds are neatly formed and free of cracks, blow holes, and other irregularities.

a. Aerial Junction Boxes

b. Unless otherwise shown in the Plans, provide aerial junction boxes with minimum inside dimensions of 8 inches wide by 8 inches long and at least 3 inches deep.

c. Mounted Junction Boxes

d. Provide mounted junction boxes fabricated of 5052 sheet aluminum alloy with a minimum thickness of 1/8 inch. Ensure all mounted junction boxes have a hinged door and lock as specified in FDOT Specification Section 676.

e. Unless otherwise shown in the Plans, provide mounted junction boxes for the following installations:

1) For pole and cabinet mounted installations, provide junction boxes with minimum inside dimensions of 13 inches long by 10 inches wide and at least 3 inches deep.

2) For base mounted installations, provide junction boxes with minimum inside dimensions of 21 inches long by 10 inches wide and at least 8 inches deep.

f. Embedded Junction Boxes

1) Provide weatherproof embedded junction boxes for use in concrete substructures or superstructures. Include gasketed weatherproof covers made of the same material as the box and Type 316 or 304, stainless steel, tamper resistant screws for securing the cover. Fabricate galvanized steel boxes and their covers from steel meeting the requirements of ASTM A36 and galvanized in accordance with ASTM A123.

2) For embedded junction boxes not exposed to vehicular impacts, provide the following types of junction boxes.

3) Where the structure's environmental classification is slightly or moderately aggressive, provide a galvanized steel or NEMA 4X (non-metallic) box, as approved by the Engineer.

4) Where the structure's environmental classification is extremely aggressive, provide a NEMA 4X (non-metallic) box, unless otherwise directed by the Engineer.

5) For embedded junction boxes exposed to vehicular impacts, provide a galvanized steel box regardless of the structure's environmental classification.

2. Barrier Terminal Blocks

a. Provide a barrier terminal block with a minimum of ten positions and rated at 600 V_{AC} in all aerial and mounted junction boxes. Ensure each terminal block position has two screws electrically connected by a shorting bar or other Department approved method. Ensure all terminal block positions are numbered sequentially.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Do not install power and communication cables in the same box unless otherwise shown in the Plans.
2. When signal or 120 volt (or greater) power is present, ground all metal covers in accordance with Section 620.

B. Pull and Splice Boxes

Install pull and splice boxes in accordance with the Miami-Dade Pull Box / Fiber Optic Box Details (N.T.S), Index. Ensure pull and splice boxes are sized for the amount of cable to be placed inside. Ensure that the pull or splice box cover is flush with the concrete apron or sidewalk. Do not install pull or splice boxes in roadways, driveways, parking areas, ditches or public sidewalk curb ramps. Avoid placing pull and splice boxes in low-lying locations with poor drainage. Ensure that pull and splice boxes house fiber optic cable without subjecting the cable to a bend radius less than 14 times the diameter of the cable.

1. Placement and Spacing

Place pull and splice boxes as shown in the Plans, Standard Details, and at the following locations, unless directed otherwise by Engineer:

a. Space so that no conduit runs exceed 250 feet in length except, for fiber optic cable applications, a maximum of 1,760 feet.
b. At all major fiber optic cable and conduit junctions.
c. At each end of a tunnel, and on each side of a river or lake crossing.
d. On each side of an aboveground conduit installation, such as an attachment to a bridge or wall.
e. At all turns in the conduit system.
f. Near the base of a service pole.

g. Near communication cabinet to provide:

1) A transition point between the fiber optic conduits extending from the fiber backbone and the conduit feeding the communication cabinet.

2) An assist point for the installation of fiber optic drop cable.

3) Storage of slack fiber optic drop cable.

2. Electronic Box Marker

Equip all pull and splice boxes buried below finish grade with an electronic box marker inside the pull or splice box to mark the location. Ensure that the electronic box marker is a device specifically manufactured to electronically mark and locate underground facilities. Ensure that the electronic box marker includes circuitry and an antenna encased in a waterproof polyethylene shell. Ensure that the outer shell is impervious to minerals, chemicals, and temperature extremes normally found in underground plant environments. Ensure that the electronic box marker does not require any batteries or active components to operate. Ensure that electronic box markers used to mark fiber optic cable and general telecom applications are orange in color and operate at 101.4 kHz. Ensure that the electronic box marker's passive circuits produce an RF field when excited by a marker locator to direct the locator to the marker's position. Ensure that the electronic box marker has a minimum operating range of 5 feet from the marker locator.

C. Aerial Junction Boxes

Install aerial junction boxes in accordance with FDOT Standard Plans, Index No. 634-002.

D. Mounted Junction Boxes

Ensure that the bottom surface of pole mounted junction boxes is a minimum of 4 feet above the finished grade.

E. Cable Terminations

Make cable terminations in junction boxes. Route and form the cable to allow access to the terminal screws. Do not cover the terminal identification numbers with the cable.

END OF SECTION 635

SECTION 639 ELECTRICAL POWER SERVICE ASSEMBLY

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. This Section addresses electrical power service assemblies that are utilized for traffic signalization, ITS, and other traffic related roadway applications. Electrical Power Service Assembly must meet the requirements of this Specification, Standard Details, and the Contract Documents.

B. Products Required But Not Supplied Under This Section

1. Concrete strain pole

C. Related Sections

1. Section 620 Grounding
2. Section 630 Conduit
3. Section 635 Pull and Junction Boxes
4. Section 641 Concrete Strain Pole
5. FDOT Section 562 Repair of Galvanized Surfaces

D. Method of Measurement

1. Complete Electrical Power Service Assembly:
    a. Electrical Power Service, Furnish and Install, Underground, Meter Furnished By Power Company:
        1) The Contract unit price per assembly includes all labor, equipment, material, and services for a complete and accepted installation as specified and described herein and in the Contract Documents including the coordination of service with the electrical power company and connecting to the supplied power company electrical source. Materials include all conduit, electrical service wire, pull boxes, meter socket, service disconnect(s), grounding, surge protective device, and miscellaneous appurtenances needed for a complete installation. Measurement and payment for concrete strain pole(s) provided under a separate Contract pay item.
        2) Where site-specific Department authorization and approved Plans allow for the electrical power company's service point to exceed 700 feet from the traffic equipment cabinet; the additional pull boxes, conduit, and service wire required for the installation beyond the aforementioned 700 feet may be paid separately if the additional pay items and their respective Contract unit prices are included in the Contract Documents explicitly for said purpose.
2. For use in maintenance and repair work:
    a. Electrical Service Wire:

1) The Contract unit price per foot of electrical service wire, furnished and installed, will include furnishing all materials and hardware as specified in the Contract Documents, and all labor, equipment, and miscellaneous materials necessary for a complete and accepted installation. Payment for Electrical Service Wire is based upon the distance of the cable run and includes payment for all conductors used in the run.

b. Electrical Service Disconnect:

1) The Contract unit price each for electrical service disconnect, furnished and installed, will include furnishing all materials and hardware as specified in the Contract Documents, and all labor, equipment, and miscellaneous materials necessary for a complete and accepted installation.

E. Basis of Payment

1. Prices and payments will be full compensation for all work specified in this Section.
2. Payment will be made under:

Item No.	Description	Unit
639-1121	Electrical Power Service, F&I, Underground, Meter Furnished By Power Company	AS
	(For use in maintenance and repair work)	
639-2-16	Electrical Service Wire	LF
639-3-11M	Electrical Service Disconnect, F&I, Pole Mount	EA

1.02 SYSTEM DESCRIPTION

A. Design Requirements

1. Locate the electrical power company service point as close as possible to the traffic equipment cabinet.
2. Place pull boxes so that no conduit runs exceed 250 feet in length.
3. Place Electrical Power Service Assembly in the right-of-way at a readily accessible location within 15 feet of the traffic equipment cabinet.
4. Provide bonding, grounding, and lightning protection pursuant to Section 620.
5. Size of feeder to the traffic equipment cabinet, from disconnect that is adjacent to the cabinet, must be No. 6 AWG conductors.
6. Size of service wire is based on distance from utility service point to equipment service disconnect as follows:

Distance of Utility Service Point to Equipment Service Disconnect	Minimum Conductor Size (AWG)		
	Standard Intersection	Standard Intersection plus UPS Assembly	Isolated Traffic Sign Assembly
300 ft or less	6	4	6
301 ft to 500 ft	4	2	6
501 ft to 700 ft	2	1/0	6

7. Voltage drop in electrical service wire, feeder, or branch circuits must not exceed three percent and the total combined voltage drop for the entire circuit must be less than five percent. For voltage drop calculations, assume a minimum load of 12 amp for a typical signalized intersection, 20 amp for a typical intersection with an added UPS assembly, or 3 amp for an isolated traffic control sign assembly circuit. These assumed design amperages only account for electrical features or equipment considered by the Department to be typical of a standard intersection. Designs with added electrical features, equipment or intersection lighting must account for the added elements and require site-specific voltage drop calculations.

B. Utility Service Point Located Greater Than 700 Feet From Equipment Service Disconnect

1. A utility service point location that is greater than 700 feet from the Equipment Service Disconnect requires written Department authorization and is subject to additional design requirements. A written request for authorization must be provided with the initial plans and include the following:
   a. An engineering statement of what is being requested with a reference to or a quote of the specification requirement(s) that is being addressed;
   b. Engineering rationale explaining why it is not possible to meet the requirement(s) along with documentation of the effort to comply;
   c. Proposed engineered alternative(s), solution(s), or modifications including increasing the size of the conductors to meet voltage drop requirements; and
   d. Voltage drop calculations, signed and sealed by a State of Florida licensed Professional Engineer, for each traffic equipment controller whose service point is located at more than 700 feet away.

1.03 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Electrical Conduit: Use conduit meeting the requirements of Section 630. Meet the requirements of FDOT Section 562 for coating all field cut and threaded galvanized pipe.

1. Rigid Steel Conduit: Conduit and fittings must meet the requirements of UL 6 and shall be hot dip galvanized. Each section of conduit must bear the UL label.
2. Rigid Nonmetallic Conduit: Use Schedule 40 nonmetallic conduit except where accompanying details call out for Schedule 80. Conduit and fittings must be polyvinyl chloride heavy wall meeting the requirements of UL 651. Each section of conduit must bear the UL label.

B. Electrical Service Wire and Feeder:

1. Stranded copper wire Type RHW-2 with cross-linked polyethylene (XLPE) high heat-resistant, water-resistant, sunlight resistant insulation rated at 600 V in dry and wet

condition. All cables must be single conductor, minimum No. 6 AWG Actual of service wire or greater depending on distances to the utility service point.

2. Insulation Jacket Colors must be BLACK for Ungrounded Conductor and WHITE for Grounded Conductor.

C. Meter Socket: Meter socket must be aluminum, Florida Power and Light listed Category 3/3a with isolated neutral, Landis & Gyr./Talon 41405-025F or approved equal.

D. Service Disconnect:

1. Enclosure (Cabinet): Use stainless steel enclosure conforming to National Electrical Manufacturers Association (NEMA) Standards for Type 4X that is approved and listed in the TSSQPL. Ensure that the inside dimensions meet NEC requirements.
2. Circuit Breaker: Use a manually resettable circuit breaker which has a current rating above the current rating of the circuit breaker to which electrical power is provided. Do not use less than a 40A circuit breaker.
3. Surge Protective Device: Use a lightning arrester rated for a maximum permissible line to ground voltage of 175 VAC.
4. Attachment Hardware: Use attachment hardware that meets the requirements of Section 600.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Meet the following requirements for the installation of individual components of the electrical power service assembly:

1. Use extreme care and caution in the installation of all components of the electrical power service assembly.
2. Follow installation procedures recommended by NEC and National Electrical Safety Code (NESC).
3. Consider the location of the utility's electrical power service point as shown in the Plans to be approximate, and coordinate with the appropriate electrical power company authority to determine the exact locations of each utility service point.

B. Provide a 2-inch PVC conduit with a minimum 24 inch bending radius between the "Electric" pull box and the power company pole to provide for their installation of the DPX cable. Stub up next to the pole at 6 inches above final grade.

C. Conduit: Securely attach all conduits to the pole or cabinet with a maximum distance of three feet between conduit attachment hardware.

D. Electrical Service Wire:

1. Install the electrical service wire in a manner which will ensure that damage to the installation will not occur.
2. Service wire must be continuously run wire. Splices are not permitted.

3. Ensure that the service wire is of sufficient length after installation in the conduit to provide for attachment to the power company service and for termination within the cabinet for which power is required.

E. Meter Socket: Securely fasten the meter base to the pole. Install pole mounted meter bases at a minimum height of 5-1/2 feet above grade when measured from the center of the meter ring.

F. Service Disconnect:

1. Securely fasten the service disconnect to the pole, and electrically position the service disconnect between the service meter and the traffic control device cabinet to which electrical service is being supplied.
2. Install pole-mounted service disconnects a minimum of 8 feet above grade when measured from the bottom of the disconnect.

END OF SECTION 639

SECTION 639R RETROFIT OF MIAMI-DADE COUNTY TRAFFIC SIGNAL CABINETS WITH MANUAL TRANSFER SWITCH AND EMERGENCY GENERATOR INTERFACE

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. This specification sets forth the minimum requirements for retrofitting existing Miami-Dade County MD-552 and MD-660 series traffic signal cabinets with an externally mounted enclosure containing a manual transfer switch and emergency generator interface.

B. Related Sections

1. Section 620 (Grounding and Lightning Protection)

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Transfer Switch and Enclosure

1. Manual Transfer Switch and Emergency Generator Interface must be a Reliance Controls Corporation Pro/Tran Signa Series transfer switch Model C51A1L-C1 (with #2 key) or approved equal.
2. Manual Transfer Switch and Emergency Generator Interface must be a UL 1008 Listed non-automatic transfer switch.
3. The enclosure must meet the requirements of NEMA 3R, 4, or 4X as rated for outdoor environments. NEMA 3R aluminum, or NEMA 4 or 4X stainless steel may be left unpainted. The enclosure must be constructed of heavy-duty, 12-gauge, Type 5052-H32 aluminum or rust and corrosion-resistant stainless steel rated for outdoor use. The transfer switch must be constructed to prevent cross connection of power sources.
4. The transfer switch enclosure must have a lockable door with tamper-resistant hinge to completely enclose all components, and be furnished with a lock with two #2 keys. The door must have a movable plate to cover the opening for the generator cable when the generator is not connected.
5. An integrally mounted NEMA L5 male power inlet rated at 125V must be provided inside a lockable enclosure at the front of the transfer switch.
6. The transfer switch shall be capable of being operated manually under fully rated load conditions.
7. The generator and utility supply source neutral leads are tied together in the cabinet. The transfer switch only switches the phase conductor (hot) and not the neutral.
8. The transfer switch enclosure outside cover must be labeled “Emergency Generator Connector” in red.

9. Provide a “utility-on” light that can be observed from outside of the transfer switch enclosure when a generator is connected to indicate that the utility power has been restored.
10. The transfer switches must be sized to meet the amperage rating of the AC power service overcurrent protection rating and shall be provided with manually operated toggle type transfer switches.

B. Materials

1. Flat Washers: 1/4“, min 5/8” outer diameter, stainless steel 18/8 (304)
2. Hex Head Bolts: 1/4" – 20, 1” inch length, full thread, stainless steel 18/8 (304)
3. Blind Threaded Inserts: 1/4" – 20, low profile head, round knurled shank, closed end thread, sealant under the head, Atlas® SpinTite® PEM-AELS8-420-165BS or Approved Equal.
4. Ground Hub: 1 inch; Aluminum with captive sealing washer; Eaton's Crouse-Hinds Division Myers Ground Hub Model STAG3 or Approved Equal.
5. Chase Nipple, Zinc Die Cast, Rigid/IMC Conduit, 1 in.: Arlington Industries, Inc. Model 503 or Approved Equal.
6. Sealing Washer: Neoprene Rubber Seal with 18-8 Stainless Steel Backing, Fits 1 Inch; or PTFE, 1 Inch, 2” OD x 0.062”. Placed between the transfer switch enclosure and the outside of the traffic signal cabinet where the ground hub penetrates the cabinet.
7. Pre-Insulated Connector (hex): UL Listed 486B Wire Connector; 1/0-14 AWG; Cold temperature rated to -45 °C, rated 600V, 90 °C; Polaris™ Model IT-1/0 connector or Approved Equal.
8. Fire-retardant edge trim and tie-wraps as needed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Attachment of the Transfer Switch Enclosure (general).

1. Use the materials listed in Part 2 above for installation of the transfer switch enclosure.
2. The transfer switch enclosure must be mounted on the side of the traffic signal cabinet, as close as possible to the AC main circuit breaker, away from any pedestrian walkway and must not be mounted on a controller cabinet door. If the orientation of an existing traffic signal cabinet is such that the transfer switch enclosure would face the pedestrian walkway if installed, ensure that with the enclosure door in a closed position that:
   a. A minimum of 42” of walking surface is maintained in front of the enclosure; and
   b. That the enclosure does not protrude more than 4” from the existing traffic signal cabinet into the walking path.
3. Ensure that upon final installation, the paved level working area in front of the transfer switch enclosure be at least 30-inches wide with a minimum clearance in front of the enclosure of at least 3 feet.
4. Unless otherwise shown on approved site Plans, the enclosure must be centered on the side of the traffic signal cabinet.

5. Use a 25/64” drill bit or as specified by the manufacturer of the blind threaded inserts to achieve hole in sheet within the tolerances specified by the manufacturer. Use tools and method for installation of blind threaded inserts specified by its manufacturer consistent with the requirements of these specifications.
6. Ground hub:
   a. The bottom of the opening for the ground hub must be approximately 2.5 to 3 inches above the top of the field service panel inside the traffic signal cabinet (Figure 1).
   b. The ground nut is placed in the transfer switch enclosure (Figure 2).
   c. The hub with captive o-ring gasket and chase nipple is placed in the traffic signal cabinet (Figure 3).
   d. A sealing washer is sandwiched between the back of transfer switch enclosure and the outside of the traffic signal cabinet where the ground hub is located. If the washer has only a single sided sealing surface, the sealing surface must face the transfer switch enclosure.

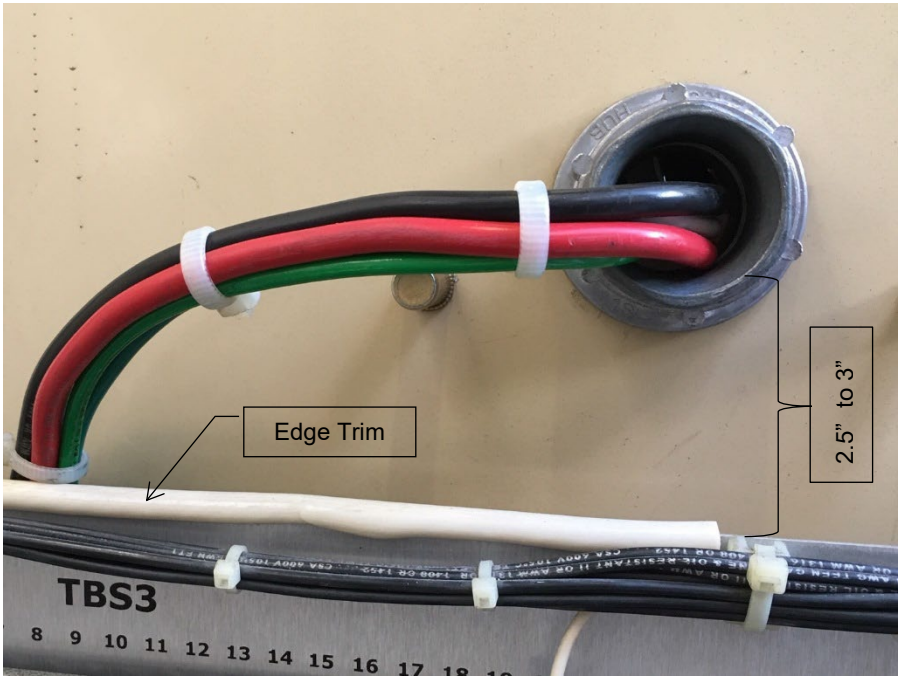


Figure 1 Ground hub Inside Traffic Signal Cabinet

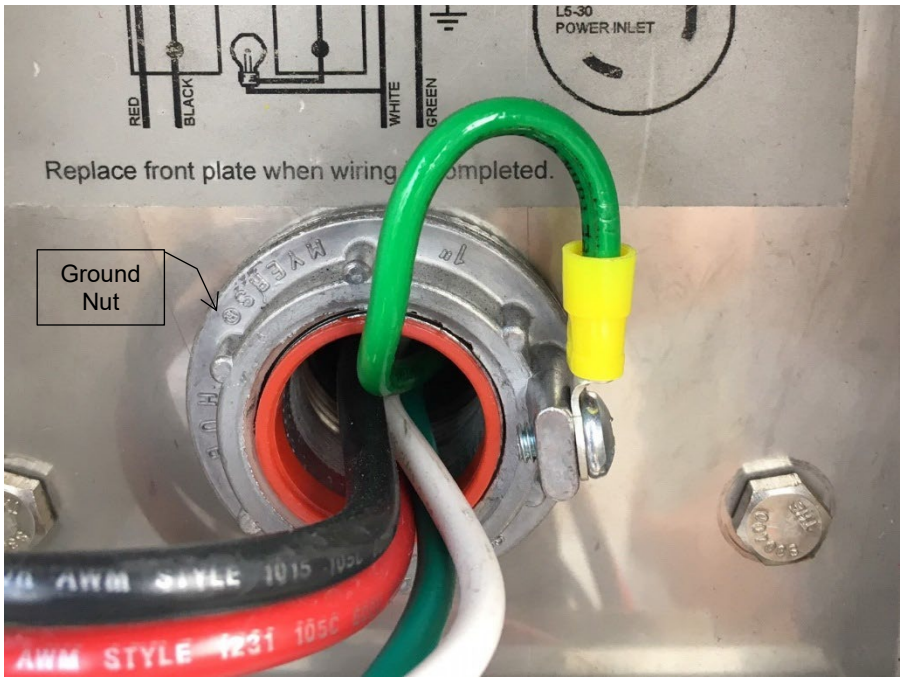


Figure 2 Ground Nut inside Transfer Switch Enclosure

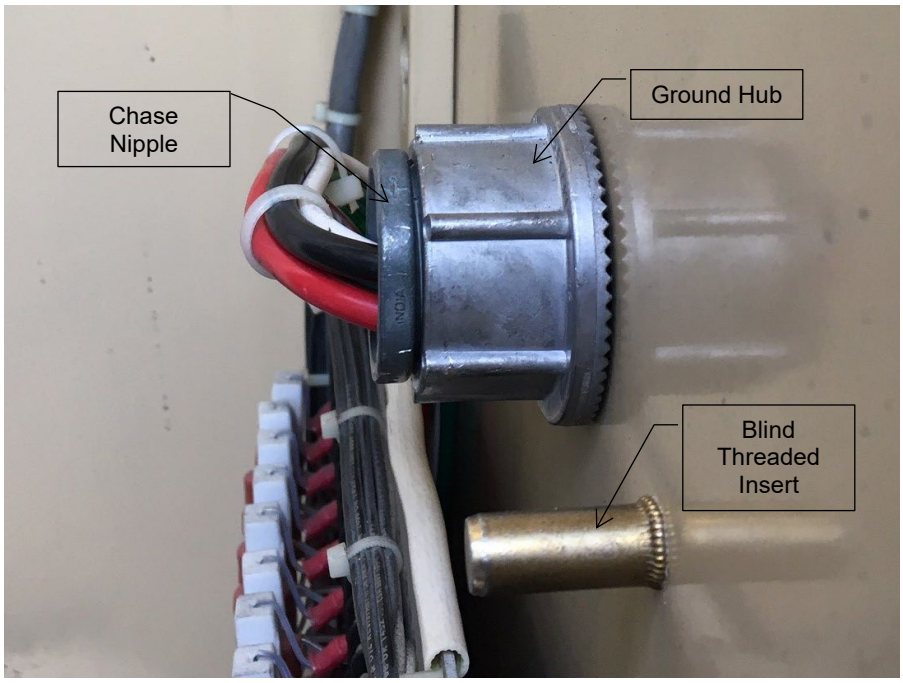


Figure 3 Ground Hub and Chase Nipple Inside Traffic Signal Cabinet

B. Wiring of the Transfer Switch.

1. Neatly route all conductors to their point of termination.

2. Using the color coding (GREEN, WHITE, RED, and BLACK) for the conductors provided with the Reliance Controls Corporation Pro/Tran Signa Series transfer switch Model C51A1L-C1:

   a. Terminate the GREEN color conductor to the grounding bus bar near the base of the signal cabinet.

   b. Terminate the WHITE color conductor to the neutral bus bar near the base of the cabinet.

   c. Splice the RED color conductor with the utility service line conductor (AC+) using the Polaris™ connector. Neatly coil and tie-wrap the spliced conductors. Secure the Polaris™ connector so that it remains at least 12 inches above the bottom of the cabinet (Figure 4).

   d. Terminate the BLACK color conductor (load) to the input side of the TBS1(1) terminal on the signal cabinet's field service panel (Figure 5).

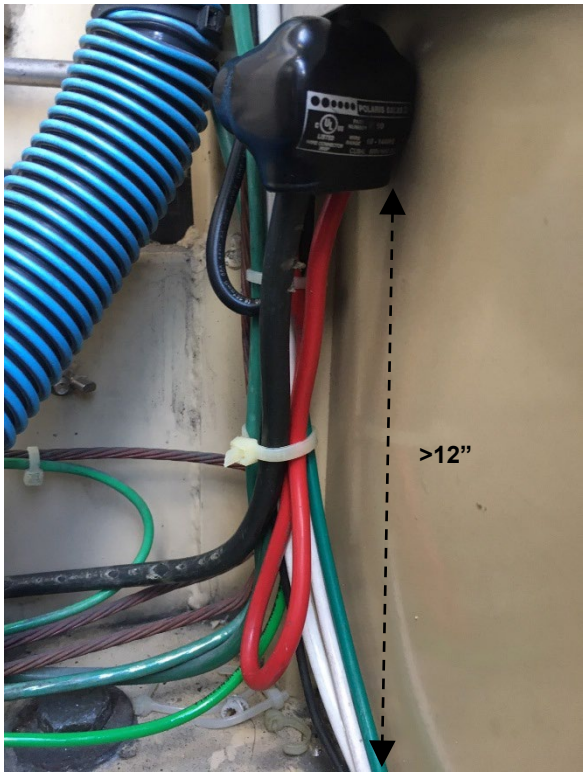


Figure 4 Splice Connector Inside Traffic Signal Cabinet

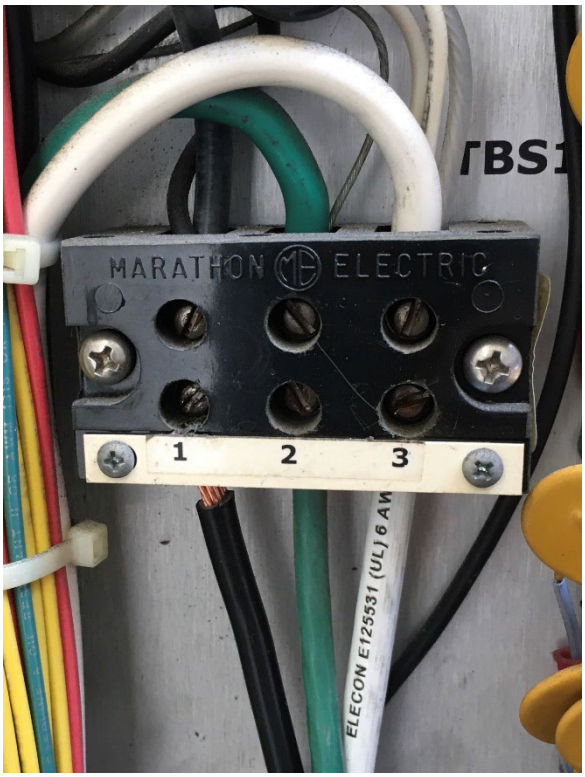


Figure 5 TBS1 Terminal Inside the Traffic Signal Cabinet

3. Connect a green insulated No. 10AWG copper equipment grounding conductor from the ground hub grounding screw in the transfer switch enclosure to the grounding bus bar near the base of the traffic signal cabinet.

END OF SECTION 639R

SECTION 641 PRESTRESSED CONCRETE POLES

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install prestressed concrete poles pursuant to FDOT Specification Section 641 (Prestressed Concrete Poles) except as otherwise specified herein.

B. Related Sections

1. Section 620 (Grounding and Lightning Protection)
2. Section 639 (Electrical Power Service Assembly)
3. FDOT Specification Section 125 (Excavation for Structures and Pipe)
4. FDOT Specification Section 346 (Portland Cement Concrete)
5. FDOT Specification Section 347 (Portland Cement Concrete - Class NS)
6. FDOT Specification Section 450 (Precast Prestressed Concrete Construction)
7. FDOT Specification Section 634 (Span Wire Assembly)

C. Method of Measurement

1. Measurement for payment will be in accordance with the following work tasks:
   a. Furnish and Install:
      1) The Contract unit price for prestressed concrete poles, furnish and install, will consist of the pole plus all labor, concrete when required for the foundation and other materials necessary for a complete and accepted installation as specified in the Contract Documents.
   b. Pole Removal:
      1) Pole Removal Shallow: The quantity to be paid for will be the removal of each pole, including the foundation and all accessories and attachments, to a depth of not less than 4 feet below existing grade.
      2) Pole Removal Deep: The quantity to be paid for will be the complete removal of the pole, foundation and all accessories and attachments.

D. Basis of Payment

1. Price and Payment under the applicable pay item below will be full compensation for all work specified in this Section.
2. Payment will be made under:

Item No.	Description	Unit
641-2-11	Prestressed Concrete Pole, F&I, Type P-II Pedestal	EA
641-2-12M	Prestressed Concrete Pole, F&I, Type P-II Service (16 feet)	EA

641-2-60	Prestressed Concrete Pole, Complete Pole Removal- Pedestal/Service Pole	EA
641-2-70	Prestressed Concrete Pole, Shallow Pole Removal- Pole 30' and Greater	EA
641-2-80	Prestressed Concrete Pole, Complete Pole Removal- Pole 30' and Greater	EA

1.02 SUMBITTALS

A. Product Data

1. Provide pole design details and supporting calculations signed and sealed by a Florida Registered P.E. certifying that the pole meets applicable specification for intended signals application.

PART 2 PRODUCTS

2.01 POLE FOR TRAFFIC SIGNAL ELECTRICAL POWER SERVICE ASSEMBLY

A. Each traffic signal electrical power service assembly pole must be a Type P-II Service Prestressed Concrete Pole meeting the requirements of FDOT Standard Plans Index No. 641-010 except that its overall length must be 16 feet (10 feet above final grade location and 6 feet below grade) and be listed on the Miami-Dade County Traffic Signals and Signs Division’s Qualified Products List.

B. Must be solid core with no circular void.

PART 3 EXECUTION (NOT USED)

SECTION 646 ALUMINUM POLES, PEDESTALS, AND POSTS

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install grounding and lightning protection to meet the requirements of FDOT Specification Section 646 (Aluminum Poles, Pedestals, and Posts) except as otherwise specified herein and the Contract Documents.

B. Method of Measurement

1. As required by the Contract Documents.

C. Basis of Payment

1. As required by the Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the material and product requirements of FDOT Specification 646-2 (Materials) and the Contract Documents

B. Pedestals, bases, and ancillary components used must be approved and listed on the TSSQPL.

C. Ground-mounted solar powered assembly requires use of approved 4-inch nominal (4.5" O.D.) Schedule 80 aluminum pedestal and reinforcing pedestal base collar.

D. Pedestals, bases, and ancillary components must be unpainted. Factory painted assemblies require prior written Department authorization and may be subject to additional requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the installation requirements of FDOT Specification 646-6 (Installation) and the Contract Documents; except set anchor bolts 90 degrees apart with a bolt circle diameter of 13 inches.

B. Tighten with pipe strap wrench or appropriate non-marring tool to manufacturer's specifications.

C. Poles or pedestals not installed to the requirements of the Contract Documents, or these Specifications must be corrected at Contractor’s expense and to the satisfaction of Engineer.

D. Exercise due diligence and care when drilling in poles and pedestals to prevent any damage to conductors or structural support. Damaged poles must be replaced at contractor’s expense. Holes must not be larger than needed to accommodate nipple or fitting to be installed.

E. Do not use expansion material around the pole base in sidewalk.

END OF SECTION 646

SECTION 649 GALVANIZED STEEL POLES AND MAST ARMS ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. The work in this Section consists of furnishing and installing unpainted galvanized steel mast arms.

B. Galvanized steel mast arm must meet the materials, fabrication, and installation requirements of FDOT Specification Section 649 (Galvanized Steel Poles, Mast Arms, And Monotube Assemblies). Mast arm assembly design must meet the latest FDM Chapter 261; FDOT Standard Plans indices 649-030 and 649-031 (except no Terminal compartment, and handhole placement at Zero (0) degree to primary arm); and the requirements of LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 1st Edition with 2017, 2018, 2019, 2020, and 2022 Interim Revisions and the FDOT Structures Manual Volume 3 - FDOT Modifications to LRFD Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (LRFDLTS-1).

C. Method of Measurement

1. Per Contract Documents.

D. Basis of Payment

1. Per Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the materials requirements of FDOT Specification 649-2 (Materials) and the Contract Documents.

2.02 FABRICATION

A. Meet the material and product requirements of FDOT Specification 649-3 (Fabrication) and the Contract Documents.

2.03 COATING

A. Mast arms must be unpainted galvanized steel meeting the requirements of FDOT Specification 649-4 (Coatings).

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the installation requirements of FDOT Specification 649-7 (Installation Requirements) and the Contract Documents.

B. All work must be executed in a neat and workmanlike manner while meeting all applicable requirements.

C. Construct foundation to ensure proper radial alignment of the arm relative to the approach at a location near the stop bar. Unless otherwise specified in the Contract Documents, mast arm must be perpendicular to the approach measured from a point fifty feet before the stop bar.

D. Foundations that result in radial alignment of the arm exceeding three degrees, as measured above, must be replaced at the contractor's expense. Engineer may authorize correction of minor misalignments, less than three degrees, with the use of County approved articulating signal mounting brackets.

END SECTION 649

SECTION 650 VEHICULAR TRAFFIC SIGNAL ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. Meet the materials and installation requirements of FDOT Specification Section 650 (Vehicular Traffic Signal Assemblies) except as otherwise specified herein and the Contract Documents.

B. Method of Measurement

1. Per Contract Documents.

C. Basis of Payment

1. Per Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the requirements of FDOT Specification 650-2 (Materials).

B. Vehicular traffic signal assembly components used must also be approved and listed on the TSSQPL.

C. All signal heads, backplates, and LED signal modules must be new, uniform, and from the same manufacturer for each intersection.

D. All traffic signal heads must be black twelve (12) inch diameter aluminum housing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the requirements of FDOT Specification 650-3 (Installation).

B. Do not install any traffic signal heads for a period greater than six days prior to signal turn-on.

C. Bag all newly installed vehicular signal heads with burlap until inspection and conditional acceptance by Engineer, unless otherwise specified in the Contract Documents.

D. Upon completion of the operational check, signals must be turned off, and bags placed over the signal heads. Signals must not be placed in flashing operations until Final Acceptance.

3.02 INSTALLATIONS ON MAST ARM

A. All traffic signal heads must be mounted horizontally on mast arm with adjustable aluminum mounting bracket (natural color) listed on the TSSQPL.

B. Mounting bracket attachments must be centered on traffic signal heads for equal weight distribution.

C. Five section signal heads mounted at the tip end of the mast arm must be mounted 3.0 feet from the tip to the center of the signal head; four section signal heads mounted at the tip end of the mast arm must be mounted 2.5 feet from the tip to the center of the signal head; three section signal heads must be mounted 2.0 feet from the tip to the center of the signal head.

D. Mounting bracket hardware must be tightened to manufacturer specifications with a torque wrench. Impact wrenches may not be used.

E. Five section signal heads must be mounted using two approved mast arm mounting brackets.

F. Placement of signal head assembly above or below the mast arm is unacceptable.

END OF SECTION 650

SECTION 653 PEDESTRIAN SIGNAL ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. Meet the materials and installation requirements of FDOT Specification Section 653 (Pedestrian Signal Assemblies) except as otherwise specified in this Section and the Contract Documents.

B. Method of Measurement

1. Per Contract Documents.

C. Basis of Payment

1. Per Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the requirements of FDOT Specification 653-2 (Materials).

B. Pedestrian signal assembly components used must also be approved and listed on the TSSQPL.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the requirements of FDOT Specification 653-3 (Installation).

B. Bag all newly installed pedestrian signal heads with burlap until inspection and conditional acceptance by Engineer, unless otherwise specified in the Contract Documents.

END OF SECTION 653

SECTION 654 RECTANGULAR RAPID FLASHING BEACONS

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install Rectangular Rapid-Flashing Beacon (RRFB) assemblies meeting the requirements of this Specification; the RRFB Assembly Standard Details; Chapter 4L (Rectangular Rapid Flashing Beacons) of the current MUTCD; and the Plans.

B. Related Sections

1. Section 620 (Grounding and Lightning Protection)
2. Section 676 (Controller Cabinets)
3. Section 700 (Roadway Signs)

C. Method of Measurement

1. General: Unless otherwise specified herein, midblock crosswalk assemblies must include all materials, equipment, and labor necessary for a complete, functional and accepted installation.
2. Rectangular Rapid Flashing Beacon Assembly: The RRFB sign assembly includes the rectangular beacons, signs, sign support structure, cabinet, electronics, conduit, pull box, wiring, grounding, pedestrian pushbutton and all necessary appurtenances needed to meet the requirements of these Specifications. In addition:
   a. Solar powered assembly: Includes solar panels and all components for a complete solar powered installation.
   b. AC powered assembly: Does not include the cost of the Electrical Power Service Assembly.

D. Basis of Payment

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

Pay Item	Description	Unit
654-2-12	Rectangular Rapid Flashing Beacon, Furnish & Install- AC Powered, Complete Assembly- Back To Back	AS
654-2-22	Rectangular Rapid Flashing Beacon, Furnish & Install - Solar Powered, Complete Assembly - Back To Back	AS

1.02 SYSTEM DESCRIPTION

A. Design and Performance Requirements for RRFB Assembly

1. Design Wind Speed: 150 mph

a. Manufacturer must provide engineering certification that the RRFB assembly's major components along with the recommended attachments for mounting on a 4.5" outer diameter pole, meet the load requirements of Section 3 of AASHTO LTS-6 as modified by FDOT Structures Manual Volume 3 using a Basic Wind Speed (V) of 150 mph in the determination of the design wind pressure.

b. Engineer of Record must ensure that the proposed sign assemblies and foundation are designed to withstand all applicable wind loads.

2. The duration of a predetermined period of operation of the RRFBs following each actuation must be consistent with the requirements of Section 4L.03 of the MUTCD. The required duration period for each crosswalk must be shown in the Plans and record documents.

3. Meet all Conditions of the current MUTCD as further specified below:

a. Unless otherwise specified herein, all RRFB sign assemblies must be double-sided and include a RRFB LED light bar on each side of the sign assembly between the bottom of the fluorescent yellow-green W11-2 (Pedestrian), S1-1 (School), or W11-15 (Trail) crossing warning sign and the top of the supplemental diagonal downward arrow (W16-7p) plaque. Double-sided sign assemblies at crosswalks located on one-way roads do not require the additional RRFB LED light bar on the side opposite the approach of traffic.

b. Each assembly must have an ADA compliant pedestrian pushbutton (except for an RRFB installed in advance of the crosswalk having an AHEAD plaque) that meets the requirements of the MUTCD and:

1) Provides a volume-controlled verbal message "Warning Lights are Flashing" that is spoken twice when the beacons are flashing and a locator tone that repeats every four seconds when the beacons are dark;

2) Includes a PUSH BUTTON FOR WARNING LIGHTS/WAIT FOR GAP IN TRAFFIC (R10-25) sign mounted adjacent to or integral with each pedestrian pushbutton explaining the purpose and use of the pedestrian pushbutton detector; and is

3) Positioned per the details that accompany these Specifications.

4. Unless otherwise shown in the Plans and approved by Engineer, the RRFB assembly, its components, and signs must be U-bolt mounted on a Miami-Dade County TSSQPL approved 4-1/2 inches outer diameter (4 inch nominal) threaded aluminum pedestal pole and square aluminum break away base with a reinforcing collar assembly. Attachment hardware must meet or exceed the requirements of the Florida Department of Transportation (FDOT) Standard Plans, Index No. 700-010.

5. Unless approved otherwise, provide a suitable surge protection device (SPD) that meet the requirements of Section 620(Grounding and Lightning Protection).

6. The individual RRFB components must be replaceable independently of other components and be equipped with approved terminal strips or wire-end molded connectors.

7. RRFB must be capable of being readily reprogrammed in the field in order to support future changes in MUTCD or MDC requirements.

8. Certification of Compliance from a third-party accredited laboratory, certifying compliance with the required minimum Class 1 yellow peak luminous intensity, must be provided upon request.

1.03 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. RRFB assembly and components must be listed on the FDOT APL and the Miami-Dade County TSSQPL.

B. Aluminum materials must meet the requirements of the Aluminum Association Alloy 6061-T6 (ASTM B209, B221, B308 or B429), except as noted.

C. Cabinets, Housings, and Hardware: Cabinets used as part of the midblock crosswalk enhancement assembly must meet the applicable criteria of Section 676.

D. All housings other than approved cabinets must be powder coat painted dull black (Federal Standard 595A-37038) with a reflectance value not exceeding 25 percent as measured by American Society for Testing and Material E1347. Cabinets and housings must prevent unauthorized access.

E. Ensure all assembly hardware, including nuts, bolts, external screws and locking washers less than 5/8 inch in diameter, are Type 304 or 316 passivated stainless steel. Stainless steel bolts, screws, and studs must meet ASTM F593. Stainless steel nuts must meet ASTM F594. All assembly hardware greater than or equal to 5/8 inch in diameter must be galvanized. Carbon steel bolts, studs, and threaded rod must meet ASTM A307. Structural bolts must meet ASTM A325.

F. Electrical Specifications:

1. Equipment must operate on solar power or a nominal voltage of 120 volts alternating current (V_{AC}). If the device requires operating voltages of less than 120 V_{AC}, supply the appropriate voltage converter.
2. Solar powered systems must be designed to provide a minimum of 10 days of continuous operation without sunlight. Solar powered systems must automatically charge batteries and prevent overcharging and over-discharging. Solar powered systems must include a charge indicator and AC/DC battery charger.
3. Ground and bond assemblies in accordance with the accompanying standard details and per NEC and Section 620 requirements.
4. Conduits must meet the requirements of Section 630 (Conduit).
5. Pullboxes must meet the requirements of Section 635 (Pull, Splice, and Junction Boxes).
6. Electrical power assembly must meet the requirements of Section 639 (Electrical Power Service Assembly).

G. Environmental Specifications: All electronic assemblies shall operate as specified during and after being subjected to the transients, temperature, voltage, humidity, vibration, and shock tests described in National Electrical Manufacturers Association (NEMA) TS2, 2.2.7, 2.2.8, and 2.2.9. Electronics must meet Federal Communications Commission (FCC) Title 47, Subpart B, Section 15.

PART 3 EXECUTION

3.01 REPAIRS/RESTORATION

A. Restore any areas impacted by the installation of the crosswalk enhancement assembly to original condition unless otherwise shown in the Plans. Install crosswalk enhancement assembly in accordance with the Americans with Disabilities Act Standards for Transportation Facilities.

END OF SECTION 654

SECTION 659 MAST ARM, SPAN WIRE, AND POLE MOUNTING ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. Meet the materials and installation requirements of FDOT Specification Section 659 (Mast Arm, Span Wire, and Pole Mounting Assemblies) except as otherwise specified in this Section and the Contract Documents.

B. Method of Measurement

1. Per Contract Documents.

C. Basis of Payment

1. Per Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the requirements of FDOT Specification 659-2 (Materials).

B. Mast arm, span wire, and pole mounting assembly components used must also be approved and listed on the TSSQPL.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the requirements of FDOT Specification 659-3 (Installation).

END OF SECTION 659

SECTION 660 VEHICLE DETECTION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install vehicle detection system in accordance with the Contract Documents. Use only vehicle detection systems that meet the requirements of this Specification and are listed on the FDOT's Approved Products List (APL) and the Department's Traffic Signals and Signs Division's Qualified Products List (TSSQPL).

B. Method of Measurement

1. Furnish and Install:

a. Inductive Loops

1) The Contract unit price for each Inductive Loop Detector furnished and installed at the traffic signal cabinet includes all labor, equipment, testing and configuration necessary for a complete and accepted installation.

2) The Contract unit price for each Loop Assembly, furnished and installed, will include all equipment, labor, equipment, and materials necessary for a complete and accepted installation of the entire loop assembly as specified in the Contract Documents including the shielded lead-in cable into the traffic signal cabinet, proper termination, and testing.

b. Microwave Vehicle Detection System

1) The Contract unit price for Microwave Vehicle Detection System (MVDS), Cabinet Equipment, furnished and installed, includes all materials, tools, labor, equipment, approved mounts and hardware, operational software packages and firmware, supplies, support, testing, calibration, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the MVDS installation at each traffic signal cabinet location.

2) The Contract unit price for Microwave Vehicle Detection System (MVDS), Above Ground Equipment, furnished and installed, includes all materials, tools, labor, equipment, approved mounts and hardware, routing of cables and wiring properly terminating inside the traffic signal cabinet, operational software packages and firmware, supplies, support, testing, calibration, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the above ground MVDS work for each intersection approach.

c. Video Vehicle Detection System

1) The Contract unit price for Video Vehicle Detection System (VVDS), Cabinet Equipment, furnished and installed, includes all materials, tools, labor, equipment, approved mounts and hardware, operational software packages and firmware, supplies, support, testing, calibration, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the VVDS installation at each traffic signal cabinet location.

2) The Contract unit price for Video Vehicle Detection System (VVDS), Above Ground Equipment, furnished and installed, includes all materials, tools, labor, equipment, approved mounts and hardware, routing of cables and wiring

properly terminating inside the traffic signal cabinet, operational software packages and firmware, supplies, support, testing, calibration, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the above ground VVDS work for each camera.

d. Wireless Magnetometer Detection System

1) The Contract unit price for a Wireless Magnetometer Detection System (WMDS), Cabinet Equipment, furnished and installed, will include furnishing, placement, and testing of all materials and equipment, and for all tools, labor, equipment, hardware, operational software packages and firmware, supplies, support, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the work at each intersection.

2) The Contract unit price for a Wireless Magnetometer Detection System (WMDS), Above Ground Equipment, furnished and installed, includes all materials, tools, labor, equipment, approved mounts and hardware, routing of cables and wiring properly terminating inside the traffic signal cabinet, operational software packages and firmware, supplies, support, testing, calibration, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the above ground WMDS work for each intersection.

3) Separate payment will be made for each magnetometer in-road device furnished and installed in conjunction with the WMDS installation, pursuant to the Contract Documents, and approved locations depicted on the Plans.

e. Automatic Vehicle Identification

1) The Contract unit price for a complete Automatic Vehicle Identification (AVI) detection system, furnished and installed, will include furnishing, placement, and testing of all materials and equipment, and for all tools, labor, equipment, hardware, operational software packages and firmware, supplies, support, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the work at each location.

C. Basis of Payment

1. Price and Payment under the applicable pay item below will be full compensation for all work specified in this Section.

2. Payment will be made under (Pay Items Numbers for Department Contracts to be determined by the Contracts and Specifications Section):

Item No.	Description	Unit
660-1-109C	Inductive Loop Detector, F&I	EA
660-2-106	Loop Assembly, F&I, Type F	AS
660-2-106M	Loop Assembly, F&I, Type F Modified (Bicycle)	AS
660-3-11	Vehicle Detection System- Microwave, F&I Cabinet Equipment	EA
660-3-12	Vehicle Detection System- Microwave, F&I Above Ground Equipment	EA
660-4-11	Vehicle Detection System- Video, F&I Cabinet Equipment	EA
660-4-12	Vehicle Detection System- Video, F&I Above Ground Equipment	EA

660-5-11	Vehicle Detection System- Wireless Magnetometer, F&I, Cabinet Equipment	EA
660-5-12	Vehicle Detection System- Wireless Magnetometer, F&I, Above Ground Equipment	EA
660-5-13	Vehicle Detection System- Wireless Magnetometer, F&I, In-Road Electronics	EA
660-6-120	Vehicle Detection System- Avi, Bluetooth, F&I, Complete System	EA

1.02 SYSTEM DESCRIPTION

A. Classification of Types

1. Functional Types

   a. Vehicle Presence Detection System: Vehicle presence detectors produce a corresponding output any time that a vehicle occupies the physical or virtual area of the detector.

   b. Traffic Data Detection System: Traffic data detectors provide presence, volume, occupancy, and speed data for the lanes they are configured to monitor.

   c. Probe Data Detection System: Probe data detection systems provide speed data and travel times for a road segment. Probe data detectors use automatic vehicle identification (AVI) technologies to establish a unique identifier for each vehicle they detect. This identifier is then transmitted to a central site where it can be matched to past or future detections of the same vehicle at different detector locations.

2. Technology Types

   a. Inductive Loop Detection System: An inductive loop detection system uses a minimum of one inductive loop and loop detector. The system operates by energizing and monitoring wire embedded in the road surface to detect vehicle presence and provide an output to traffic controllers or other devices that can generate volume, occupancy, and speed data (detection output).

   b. Video Vehicle Detection System (VVDS): A VVDS uses one or more cameras and video analytics hardware and software to detect vehicle presence, provides a detection output, and generates volume, occupancy, and speed data.

   c. Microwave Vehicle Detection System (MVDS): A MVDS transmits, receives, and analyzes a FCC-certified, low-power microwave radar signal to detect vehicle presence, provide a detection output, and generate volume, occupancy, and speed data.

   d. Wireless Magnetometer Detection System (WMDS): A WMDS uses one or more battery-powered wireless sensors embedded in the road surface, which communicates data by radio to a roadside receiver. Wireless magnetometer systems detect vehicle presence and provide a detection output to traffic controllers or other devices that can generate volume, occupancy, and speed data.

   e. Automatic Vehicle Identification (AVI): AVI detection systems use one or more different methods to collect information that can be used to establish a unique identifier for each vehicle detected and the time and location that the vehicle was detected. AVI detection systems collect data using probe detectors that utilize radio-frequency identification (RFID), optical character recognition, magnetic signature analysis, laser profiling, Bluetooth®, or other technologies to establish vehicle identifier, time, and location.

B. Design Requirements

1. Provide stop bar detection in all lanes to provide a detection system that is capable of supporting a fully-actuated intersection and meet the requirements of the standard details for vehicle detection of the Miami-Dade County Traffic Control Equipment Standards and Specifications.
2. Use Inductive Loop Detection System technology type unless an alternate technology described herein is demonstrated by the Engineer of Record to be more suitable and reliable for the intersection under design. Written Department approval is required for use of detection technologies other than inductive loops.
3. Vehicle Detection Zones.
    a. In addition to the Stop Bar Detection required by the standard details, the Department may approve the following general detection zones for use in a signal plan design where appropriate due to site-specific operational requirements:
        1) Queue Detection: Used on protected/permissive left turn lanes in addition to stop bar detection. Leading edge is placed at 50 feet from the Stop Bar.
        2) Long-Loop-Occupancy Detection: Used in each through lanes on very low-speed (25 mi/h or less) approaches for signal green time extension. Provided by increasing the length of the Stop Bar inductive loop detection to 50 feet from the Stop Bar.
        3) Multiple-Point Detection: Used on through lanes to ameliorate dilemma zone problems through the strategic placement of multiple sensors at high-speed (greater than 40 mi/h) approaches to intersections controlled by actuated controllers. Design based on guidance provided in Chapter 4, of the FHWA Traffic Detector Handbook: Third Edition—Volume I Inductive-loop detector placement in multiple-point detection systems used to ameliorate effects of dilemma zones.

1.03 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 INDUCTIVE LOOP DETECTION SYSTEM

A. Materials.

1. Use inductive loop detectors and loop sealant currently listed on the FDOT's APL and the Department's TSSQPL.
2. Inductive Loop Detector Units: Ensure loop detector units meet the requirements of NEMA TS-2-2016.
3. Loop Wire:
    a. Use No. 14 AWG stranded copper wire with Type XHHW cross-linked polyethylene insulation and an additional outer sleeve composed of polyvinylchloride or polyethylene insulation that meets the requirements of International Municipal Signal Association (IMSA) 51-7.

b. The wire must have surface-printed information indicating the manufacturer ID and its NRTL listing (UL, CSA, etc.), the maximum rated voltage, AWG size, the proper type letter or letters for the type of wire or the IMSA specification number every 2 feet or less.

4. Shielded Lead-in Cable: Use No. 14 AWG two conductor, stranded copper wire with shield and polyethylene insulation, meeting the requirements for IMSA 50-2.

5. Splicing Material:

   a. Use rosin-core solder for soldered splices.

   b. Butt-end connectors must be non-insulated Panduit Part Number BS14, BS10; Ideal Model Number TV16X, TV12X; Thomas and Betts Catalog Number BB-2, CC-2 or Engineer approved equivalent.

   c. Insulated tubing used to cover splice must be heat-shrinkable, cross-linked polyolefin with a silicon sealant inside the tubing and an insulation rating of at least 600 V. Outer tubing must be dual/multiple wall type.

   d. Splicing tape must be self-fusing silicone rubber.

6. Loop Sealant:

   a. Ensure that loop sealant:

      1) Is manufactured for traffic loop embedding in both asphalt and concrete pavement.

      2) Consists of multi-component systems having simple mix ratios of 1:1 or 2:1 or are supplied in pre-measured containers in which all contents of both packages are to be mixed.

      3) Is self-leveling when applied.

      4) Does not run out of unlevel slots as tested for viscosity using ASTM D562 at 77°F.

      5) Is tack free within a maximum of 2 hours from time of application and when cured as tested for tack free time using ASTM C679 at 77°F.

      6) Securely adheres to concrete and asphalt when installed in a 3/8 inch by 3 inch saw cut, cured for 2 weeks at 77°F as tested for adhesion using visual inspection.

      7) Shows no visible signs of shrinkage after curing when installed in a 3/8 inch by 3 inch saw cut, cured for 2 weeks at 77°F as tested for shrinkage using a dimensional measurement.

      8) Resists weather, oils, gasoline, antifreeze, and brake fluid as tested for absorption using ASTM D570 for water, No. 3 oil, gasoline, antifreeze, and brake fluid for 24 hours.

      9) Resists penetration of foreign materials as tested for durometer hardness using ASTM D2240 Shore A for 24 hours.

      10) Resists cracking caused by expansion and contraction due to temperature changes as tested for tensile strength and elongation using ASTM D412.

      11) Does not become brittle with age or temperature extremes as tested for weight loss, cracking, and chalking using ASTM C1246.

      12) Has a minimum shelf life of 1 year in undamaged containers when stored per manufacturer recommendations.

2.02 VIDEO VEHICLE DETECTION SYSTEM (VVDS)

A. Configuration and Management:

1. Ensure that the VVDS:
    a. Is provided with software that allows local and remote configuration and monitoring.
    b. Can display detection zones and detection activations overlaid on live video inputs.
    c. Allows a user to edit previously defined configuration parameters, including size, placement, and sensitivity of detection zones.
    d. Retains its programming in nonvolatile memory.
2. Ensure that the detection system configuration data can be saved to a computer and restored from a saved file. Ensure that all communication addresses are user programmable.
3. Ensure that the detection system software offers an open Application Programming Interface (API) and software development kit available to the Department at no cost for integration with third party software and systems.

B. Detection Camera: Provide a camera that is furnished or approved by the video detection system manufacturer.

C. Machine Vision Processor: Ensure the VVDS includes a machine vision processor that allows video analysis, presence detection, data collection, and interfaces for inputs and outputs as well as storage and reporting of collected vehicle detection data.

D. Video Inputs and Outputs: Ensure that analog video inputs and outputs utilize BNC connectors.

E. Solid State Detection Outputs: Ensure outputs meet the requirements of NEMA TS2-2021, 6.5.2.26.

F. Electrical Requirements: Ensure the system operates using a nominal input voltage of 120 volts of alternating current (V_{AC}). Ensure that the system will operate with an input voltage ranging from 89 to 135 V_{AC}. If a system device requires operating voltages other than 120 V_{AC}, supply a voltage converter.

2.03 MICROWAVE VEHICLE DETECTION SYSTEM (MVDS)

A. Ensure that MVDS used for stop bar intersection presence detection can detect vehicles throughout a minimum detection range of 6-140 feet from the sensor and are capable of detecting up to 10 lanes of traffic.

B. Ensure that MVDS used for dilemma zone protection can detect vehicles throughout a minimum detection range of 50-600 feet from the sensor; can report the speed, range, and estimated time of arrival at the stop bar of each vehicle detected; and can provide contact closure outputs when a vehicle meeting user-defined alert criteria is detected.

C. Ensure that sidefire MVDS sensors used for data collection have a minimum 200-foot range and the capability to detect 8 lanes of traffic.

D. Configuration and Management:

1. Ensure that the MVDS is provided with software that allows local and remote configuration and monitoring. Ensure that the system software can display detection zones and detection activations in a graphical format.

2. Ensure that the MVDS allows a user to edit previously defined configuration parameters, including size, placement, and sensitivity of detection zones.
3. Ensure that the MVDS retains its programming in nonvolatile memory. Ensure that the detection system configuration data can be saved to a computer and restored from a saved file. Ensure that all communication addresses are user programmable.
4. Ensure that the detection system software offers an open API and software development kit available to the Department at no cost for integration with third party software and systems.

E. Solid State Detection Outputs: Ensure outputs meet the requirements of NEMA TS2-2021, 6.5.2.26.

F. Electrical Requirements: Ensure the microwave detector will operate with a nominal input voltage of 12 V_{DC}. Ensure the microwave detector will operate with an input voltage ranging from 89 to 135 V_{AC}. If any system device requires operating voltages other than 120 V_{AC}, supply a voltage converter.

G. Ensure that the detector is FCC-certified and that the FCC identification number is displayed on an external label. Ensure that the detector transmits within a frequency band of 10.525 gigahertz, plus or minus 25 megahertz, or another FCC-approved spectral band.

2.04 WIRELESS MAGNETOMETER DETECTION SYSTEM (WMDS)

A. Configuration and Management:

1. Ensure that the detection system is provided with software that allows local and remote configuration and monitoring.
2. Ensure that the WMDS allows a user to edit previously defined configuration parameters.
3. Ensure that the WMDS retains its programming in nonvolatile memory. Ensure that the detection system configuration data can be saved to a computer and restored from a saved file. Ensure that all communication addresses are user programmable.
4. Ensure that the detection system software offers an open API and software development kit available to the Department at no cost for integration with third party software and systems.

B. Solid State Detection Outputs: Ensure outputs meet the requirements of NEMA TS2-2021, 6.5.2.26.

C. Electrical Requirements: Ensure the detection system will operate with an input voltage ranging from 89 to 135 V_{AC}. If any system device requires operating voltages other than 120 V_{AC}, supply a voltage converter.

2.05 AUTOMATIC VEHICLE IDENTIFICATION (AVI) DETECTION SYSTEM

A. Configuration and Management: Ensure that the detection system is provided with software that allows local and remote configuration and monitoring.

B. Probe Detector Requirements:

1. Transponder Readers: Ensure transponder readers are compatible with multiple tag protocols, including Allegro and the protocol defined in ISO18000-6B.

2. Bluetooth Readers: Ensure that Bluetooth readers will operate using solar power and cellular communications. Ensure that Bluetooth readers will operate using power over Ethernet. Ensure that Bluetooth readers will operate with a nominal input voltage of 12 V_{DC}.
3. License Plate Readers: License plate readers must not require the use of visible strobes or other visible supplemental lighting.

C. Electrical Requirements: Ensure the detection system will operate with an input voltage ranging from 89 to 135 V_{AC}. If any system device requires operating voltages other than 120 V_{AC}, supply a voltage converter.

2.06 COMMUNICATIONS

A. Communication requirements for VVDS, MVDS, WMDS and AVI:

1. Ensure that the VVDS includes a minimum of one Ethernet communications interface. Ensure that components of the MVDS, WMDS and AVI detection system (such as sensors, controllers, and processing hardware) include a minimum of one serial or Ethernet communications interface.
2. Ensure serial interfaces and connectors conform to applicable Telecommunications Industry Association (TIA) standards. Ensure that serial ports support data rates up to 115200 bps; error detection utilizing parity bits (i.e., none, even, and odd); and stop bits (1 or 2). MVDS sensors must a serial interface that supports RS-232 and RS-485.
3. Ensure that wired Ethernet interfaces provide a 10/100 Base TX connection. Verify that all unshielded twisted pair/shielded twisted pair network cables and connectors comply with TIA-568.
4. Ensure wireless communications are secure and that wireless devices are Federal Communications Commission (FCC) certified. Ensure that the FCC identification number is displayed on an external label and that all detection system devices operate within their FCC frequency allocation.
5. Ensure cellular communications devices are compatible with the 4G system and cellular carrier used by the agency responsible for system operation and maintenance.
6. Ensure the system can be remotely configured and monitored via one or more communications interface

2.07 MECHANICAL REQUIREMENTS FOR ALL DETECTORS

A. Ensure that all parts are made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal.

B. Ensure that all fasteners exposed to the elements are Type 304 or 316 passivated stainless steel.

2.08 ENVIRONMENTAL REQUIREMENTS FOR ALL DETECTORS

A. Meet the environmental requirements of NEMA TS-2-2021.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation Requirements for all detectors:

1. Install, configure, and demonstrate a fully functional vehicle detection system, as shown in the plans. Connect all field equipment to the existing communication network, and provide all materials specified in the Contract Documents. Install all equipment according to the manufacturer's recommendations and these Specifications.
2. Mount above-ground detectors on existing poles or sign structures, or on new poles, as shown in the Plans. Furnish all equipment with the appropriate power and communication cables. Install the power cable and the communication cables according to the manufacturer's recommendation. Ensure that the cables comply with NEC sizing requirements and meet all other applicable standards, specifications, and local code requirements.
3. Do not install communication cables in the same conduit or pull boxes as power cables carrying voltage greater than 24 V_{DC}/V_{AC} or current in excess of 1.5 amps.
4. Cut cabinet wiring to the proper length. Do not double back wire to take up slack. Neatly lace wires into cables with nylon lacing or plastic straps. Secure cables with clamps and provide service loops at all connections.
5. In the event that power to the vehicle detection system or a subcomponent thereof is interrupted, ensure that the equipment automatically recovers after power is restored. Ensure that all programmable system settings return to their previous configurations and the system resumes proper operation.
6. Provide a dedicated circuit for the cabinet equipment that meets all applicable requirements.
7. Provide grounding and surge protection that meets the requirements of Section 620 (Grounding and Lightning Protection).

B. Inductive Loop Detector Installation:

1. Except as otherwise specified herein, install vehicle loops in accordance with the manufacturer's instructions, standard details for vehicle detection of the Miami-Dade County Traffic Control Equipment Standards and Specifications, and the Plans.
2. Unless otherwise specified in the Plans, stop bar loops in vehicular travel lanes must be thirty feet long Type F loops. Where specified in the Plans, a modified 3' x 20' Type F loop may be installed in dedicated bicycle lanes.
3. The leading edge of a loop cannot extend more than ten feet past the stop line.
4. The saw cut may not encroach into the crosswalk.
5. Inductive Loop-Detector Units: Adjust the operating frequency of each detector unit, if required, to prevent crosstalk of the units.
6. Saw Cuts:
   a. Saws must be equipped with a depth gauge to assist in maintaining proper depth and a horizontal guide to assure alignment.
   b. Use a chalk line or equivalent method to outline the perimeter of the loop on the pavement and routes for lead-in cables. Do not allow the saw cut in the pavement to deviate by more than 1 inch from the chalked line.
   c. Ensure that all saw cuts are free of any dust, dirt or other debris and completely dry prior to the installation of the loop wire, loop wire twisted pair lead or lead-in cable. Use compressed air to thoroughly dry the sawed slot.

d. Make saw cuts in accordance with standard details for vehicle detection of the Miami-Dade County Traffic Control Equipment Standards and Specifications unless otherwise stipulated in the Contract Documents.

e. Ensure that the top conductor of the loop wire or lead-in cable is a minimum of 2 inch below the final surface of the roadway.

7. Loop Wire:

a. Ensure that the first turn of the loop wire is placed in the bottom of the saw cut, with each subsequent turn placed on top of the preceding turn. Push the loop wire to the bottom of the saw cut with a non-metallic tool which will not damage the insulation.

b. Label the loop wires in the pull box with waterproof tags and identify the start (S), finish (F) lead and the loop number.

c. Use alternate polarity on adjacent loops.

d. Hold the loop in place with strips of rubber, neoprene, flexible tubing, or foam backer rod as approved by Engineer. Ensure that the backer rod material is non-metallic, is placed in the saw slot using segments 1 to 2 inches long, spaced 12 inches apart, and that the distance from the top of the hold down material to the final surface of the roadway is not less than 1.5 inches.

8. Loop Wire Twisted Pair Lead:

a. Create a loop wire twisted pair lead by twisting the loop wire pair a minimum of 10 turns per foot to form a loop wire twisted pair lead from the edge of the loop to the pull box located adjacent to the roadway. Place only one loop wire twisted pair lead in a saw cut. Ensure that the distance between a twisted loop wire pair lead within the roadway is a minimum of 6 inches from any other twisted loop wire pair lead or loop, until they are within 1 foot of the edge of pavement or curb, at which point they may be placed closer together.

b. Hold the loop wire twisted pair lead in place with strips of rubber, neoprene, flexible tubing, or foam backer rod as approved by Engineer. Ensure that the backer rod material is non-metallic, is placed in the saw slot using segments 1 to 2 inches long, spaced 24 inches apart, and that the distance from the top of the hold down material to the final surface of the roadway is not less than 1.5 inches.

c. Provide a minimum of 3 feet of twisted loop wire pair lead in the pull box located adjacent to the roadway. Do not route twisted loop wire pair lead directly through conduits to the cabinet, unless otherwise shown in the Plans.

9. Splicing:

a. Splices must be made by crimping and soldering. Splice lead-in cable to the loop wire in accordance with these Specifications.

b. Perform the splicing in a pull box located off the roadway, not in the roadway itself. Splices must be made on the same day wires are installed unless the ends of the wires are sealed with Scotchkote to keep water out of the insulating jacket.

c. Strip insulation of loop wires and lead-in cable as necessary. Clip one of the loop wires 3 inches shorter than other and clip the non-corresponding lead-in cable wire accordingly in order to stagger the splices.

d. Splice the black conductor of the lead-in cable to the finish (F) “lead” of the loop.

e. Crimp the appropriate wires with a non-insulated butt connector using a pressure crimping tool that provides a uniform 360-degree crimp. Insulate each wire splice separately using cross-linked polyolefin tubing.

f. Insulate the total splice using dual/multiple wall cross-linked polyolefin tubing.

g. Ensure that the ends of the cable jackets, twisted pair and lead-in, are encased in the loop splice material.

h. Ensure that each loop has an individual return to the cabinet and series splicing is performed on a separate terminal block in the cabinet.

10. Terminations:
    a. Using insulated terminal lugs, terminate lead-in cables or twisted pair loop wire on a terminal strip which is located in the controller or detector cabinet.
    b. Use a calibrated ratchet type crimping tool to attach the lugs to the conductors of the lead-in cable or twisted loop wire.
11. Loop Sealant:
    a. Prepare the loop sealant in accordance with the manufacturer's instructions.
    b. Using a manufacturer approved applicator or dispenser, apply only sufficient sealant to completely fill the saw cut without overfilling
    c. Remove excess material from pavement.
    d. Ensure that the loop sealant has cured completely before allowing vehicular traffic to travel over the sealant.
12. Loop Assembly Identification: Identify and tag each loop assembly in the controller or detector cabinet by lane and movement number.

C. Video Detector Installation:

1. Install cameras and configure detection zones and settings in accordance with the Contract Documents, standard details for vehicle detection of the Miami-Dade County Traffic Control Equipment Standards and Specifications, manufacturer's recommendations, and as directed by Engineer.
2. Submit configuration settings (including, but not limited to detector names, communication settings, and output assignments) and configuration file backups to Engineer.
3. Submit a graphical depiction of each camera site, its pole location, mounting height, the ratio of distance away from the camera versus the mounting height, the camera's mounting type (i.e., pole or structure), camera aiming procedures, and the placement of the proposed detection zone for each lane.
4. Do not use coaxial cable runs in excess of 500 feet. Mount and aim cameras in a manner that eliminates as much environmentally generated glare as possible.
5. For systems where composite cables are used, Power over Ethernet (PoE) injectors are required for cable runs longer than 330 ft.

D. Microwave Detector Installation:

1. Install detector and configure detection zones and settings in accordance with the Contract Documents, manufacturer's recommendations, and as directed by Engineer.
2. Submit configuration settings (including, but not limited to detector names, communication settings, and output assignments) and configuration file backups to Engineer.

E. Wireless Magnetometer Installation:

1. Install in accordance with the Contract Documents, manufacturer's recommendations, and as directed by Engineer.
2. Ensure that materials used for the installation of magnetometers in the road surface have cured completely before allowing vehicular traffic to travel over them.

F. AVI Detection System Installation:

1. Install in accordance with the Contract Documents, manufacturer's recommendations, and as directed by Engineer.

3.02 INDUCTIVE LOOP PERFORMANCE REQUIREMENTS

A. Obtain latest Department's Loop Assembly Test Form from Engineer. Tests must be performed and the form completed and signed by a Contractor representative that is IMSA Traffic Signal Level II certified. Deliver the completed original to Engineer prior to Engineer's inspection and place a copy in the controller cabinet.

B. Measure loop inductance, series resistance, insulation resistance, and quality factor. Take measurements both at the junction box (loop including twisted pair lead-in) and the Cabinet (loop and shielded lead-in cable). Measurements at the junction box must be taken before and after the loop wires are sealed in the pavement.

C. Test Equipment. Conduct tests using one or more loop tester devices capable of measuring continuity, inductance in microhenrys (μH), integrity of the wire insulation in mega-ohms (MΩ), loop wire resistance in ohms (Ω), and the Loop Quality Factor (Q).

D. Inductive Loop Tester:

1. Measure inductance.
2. Measure series resistance.
3. Measure Loop Quality Factor.

E. High voltage resistance tester:

1. Measure and record the insulation resistance (leakage to ground) of each loop assembly. Use a 500 VDC insulation megger to measure the resistance. Reference all measurements to a good earth ground (ground rod, metallic water pipe, etc.). Disconnect the transient suppression devices from the loop assemblies before taking any measurements.

F. Acceptable test results.

1. Inductance (L): The inductance reading on the loop tester is within 10 percent of the Department's calculated value.
2. Series resistance (R): Less than or equal to 10 Ω at the Controller.
3. Loop Quality Factor (Q): Greater than 5.
4. Insulation Resistance: Greater than 100 MΩ.

G. Corrective Actions:

1. Perform, at no additional cost to the Department and to the satisfaction of Engineer, all corrective actions necessary to obtain acceptable test results, as stipulated in the preceding Subarticle, and meet all requirements of these Specifications.
2. If the series resistance of a loop assembly is greater than 10 Ω, inspect the loop assembly to find the cause of the excessive resistance. Correct the cause of the excessive resistance at no additional cost to the Department.

3. If the insulation resistance is less than or equal to 100 MΩ, determine if the lead-in cable or the loop wire is causing the problem, and replace the defective cable or loop wire at no additional cost to the Department.

H. Turn On Requirements. Connect the loop assemblies to the appropriate inductive loop vehicle detectors and tune the detectors in accordance with the manufacturer's instructions. Separate the operating frequencies of vehicle detectors, in adjacent lanes, by at least 2 kHz.

3.03 VEHICLE PRESENCE DETECTOR PERFORMANCE REQUIREMENTS

A. Vehicle Presence Detection System Field Acceptance Testing:

1. Ensure presence detectors provide a minimum detection accuracy of 98%. Ensure presence detectors meet the requirements for modes of operation in NEMA TS2-2021, 6.5.2.17.

2. Verify detection accuracy at installed field sites using a reduced method to that described in FDOT Specification Section 660-2.2 (Vehicle Presence Detection Performance Requirements). Compare sample data collected from the detection system with ground truth data collected by human observation. For site acceptance tests, collect samples and ground truth data for each site for a minimum of five minutes during a peak period and five minutes during an off-peak period. For presence detection at intersections, ensure there are a minimum of three detections for each signal phase. Perform site acceptance tests in the presence of Engineer.

3.04 TRAFFIC DATA DETECTOR PERFORMANCE REQUIREMENTS:

A. Traffic Data Detection System Field Acceptance Testing:

1. Vehicle detection system must be capable of meeting the minimum total roadway segment accuracy levels of 95% for volume, 90% for occupancy, and 90% for speed for all lanes, up to the maximum number of lanes that the device can monitor as specified by the manufacturer.

2. Verify detection accuracy at installed field sites using a reduced method to that described in FDOT Specification Section 660-2.3 (Traffic Data Detection System Performance Requirements). Compare sample data collected from the detection system with ground truth data collected by human observation. For site acceptance tests, collect samples and ground truth data for each site for a minimum of five minutes during a peak period and five minutes during an off-peak period. Perform site acceptance tests in the presence of the Engineer.

3.05 AVI DETECTION SYSTEM PERFORMANCE REQUIREMENTS:

A. AVI detectors must meet the performance requirements described in FDOT Specification Section 660-2.4 (Probe Data Detection Performance Requirements).

B. Calculation of AVI Detection System Speed and Travel Time Accuracy: Calculate speed and travel time accuracy by comparing the speeds and travel times reported by the system against ground truth collected through human observation or another method approved by Engineer.

END OF SECTION 660

SECTION 663 SIGNAL PRIORITY AND PREEMPTION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Meet the materials and installation requirements of FDOT Specification Section 663 (Signal Priority and Preemption Systems) and the Contract Documents except as otherwise specified in this Section.

B. Method of Measurement

1. Per Contract Documents.

C. Basis of Payment

1. Per Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the material and product requirements of FDOT Specification 663-2 (Materials) and the Contract Documents.

B. Signal priority and preemption systems used must be approved and listed on the TSSQPL.

C. Cabling must be 600V rated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the installation requirements of FDOT Specification 663-3 (Installation) and the Contract Documents.

3.02 FIELD TESTING

A. Meet the field-testing requirements of FDOT Specification 663-4 (Field Testing) and the Contract Documents.

END OF SECTION 663

SECTION 665 PEDESTRIAN DETECTION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Meet the materials and installation requirements of FDOT Specification Section 665 (Pedestrian Detection System) except as otherwise specified in the Contract Documents.

B. Method of Measurement

1. Per Contract Documents.

C. Basis of Payment

1. Per Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the material and product requirements of FDOT Specification 665-2 (Materials) and the Contract Documents.

B. Pedestrian detection system used must be approved and listed on the TSSQPL.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the installation requirements of FDOT Specification 665-4 (Installation) and the Contract Documents.

B. Install pedestrian detectors per Contract Documents and Miami-Dade County TSS approved details.

C. Push buttons must be installed as indicated on the Plans and be mounted on the pole or pedestal at three and one-half feet above ground surface.

END OF SECTION 665

SECTION 670 TRAFFIC CONTROLLER ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install traffic controller assembly including foundation, work pad, grounding electrode and adjacent pull boxes and conduit that meet the requirements of the Contract Documents and all applicable specifications.

B. Related Sections

1. Section 620 (Grounding and Lightning Protection)
2. Section 630 Conduit
3. Section 635 Pull and Junction Boxes
4. Section 671 Traffic Signal Controllers
5. Section 676 (Traffic Cabinets)
6. FDOT Specification Section 522 (Concrete Sidewalks and Driveways)

C. Method of Measurement

1. The Contract unit price per assembly for traffic controller assembly includes all labor, equipment, materials, and miscellaneous appurtenances necessary for a complete and accepted installation.

E. Basis of Payment

1. Price and Payment will be full compensation for all work specified in this Specification Section that have awarded Contract Unit Prices under the following items:

Pay Item	Description	Unit
670-5-140	Traffic Controller Assembly, Furnish & Install Model 2070	AS

1.02 REFERENCES

A. NEMA Standards Publication TS 2-2016

B. Miami-Dade County Traffic Signals and Signs Division's Qualified Product List (TSSQPL)

C. FDOT Approved Product List (APL)

D. Miami-Dade County Traffic Controller Assemblies Specifications, 2007 Edition

E. American Society for Testing and Materials (ASTM)

F. FHWA Manual on Uniform Traffic Control Devices (MUTCD)

G. National Electrical Code, NFPA 70 (NEC)

1.03 SYSTEM REQUIREMENTS

1. Traffic controller assembly must be wired and configured to support intersection operations per approved Signal Operating Plan.
2. Traffic controller assembly must communicate and be integrated with the County's approved ATMS software.

1.04 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 GENERAL

A. Meet the requirements of Section 600 (General Provisions for Traffic Control Devices). Traffic control products that are required to be on the FDOT APL must also be listed on the TSSQPL unless otherwise approved and accepted by the Department in writing for project-specific use.

2.02 MATERIALS

A. Conduit.

1. Conduit must meet the requirements of Section 630.
2. Conduit must be two-inch schedule 40 PVC except:
    a. Ground rod installation requires a one-inch schedule 40 PVC conduit.
    b. Signal cable conduits must be three-inch schedule 40 PVC from the cabinet base to the closest pull box(es) located outside of the cabinet foundation.

B. Concrete. Must be Class II, 3000 PSI minimum strength in twenty-eight days.

C. Pull Boxes. Must meet the requirements of Section 635 and the Contract Documents.

D. Grounding. Must meet the requirements of FDOT Specification Section 620 (Grounding and Lightning Protection).

2.03 EQUIPMENT

A. Traffic Controller Assembly Equipment.

1. Traffic controller assembly equipment includes traffic controller cabinet, traffic controller, traffic controller cabinet accessories (including monitors, load switches, flashers, flash transfer relays, power supplies), cellular modem, managed field ethernet switch, and other equipment wired into the controller cabinet to make a complete and operational assembly.
2. Traffic controller assembly equipment must be Model MD660X meeting the requirements of Traffic Signals and Signs Division technical specification: Traffic

Controller Assemblies Specifications, 2007 Edition except signal controller must be a Siemens Model 2070LX.

3. Cellular modem must be Digi IX30 Industrial Cellular Router (Part# IX30-00P7) with extended warranty (EX-WTY-5YR); Mobilemark Antenna With 5/8" basebolt and 6ft Length Cables (Part# LMWG302-3C3C2C-WHT-72); and Meanwell SDR-75-24 Industrial DIN RAIL Power Supply.

2.04 SOURCE QUALITY CONTROL

A. Factory Acceptance Test.

1. Perform and document Factory Acceptance Test for the fully configured and built-up traffic controller assembly.

B. Bench Test.

1. Perform and document a forty-eight-hour burn-in of the fully configured and built-up traffic controller assembly with dummy loads connected to the cabinet for proper testing.

PART 3 EXECUTION

3.01 INSTALLATION

A. General.

1. Traffic controller assembly cabinet must be installed with its front and back doors perpendicular to the roadway and the communications compartment facing the roadway. If any obstructions prevent proper orientation, propose alternate orientation to Engineer for approval. Placement location must minimize obstruction to sidewalk and maximize protection from vehicular traffic.
2. Installation includes all the bolts, nuts, anchors, fittings, nipples, and other materials needed to properly secure the traffic controller equipment or ancillary equipment in place.

B. Conduit.

1. Meet the requirements of Section 630 and the Contract Documents.
2. Conduits must stub up two inches.

C. Pull Boxes.

1. Meet the requirements of Section 635 and the Contract Documents.

D. Grounding.

1. Meet the requirements of FDOT Specification Section 620 (Grounding and Lightning Protection).

E. Concrete Foundation and Adjacent Areas.

1. Controller Work Pad. Construct controller work pad that meets the materials and installation requirements of FDOT Specification Section 522, except that transverse joints are not required. The controller work pad shall be 48 inches wide x 36 inches deep x 4 inches high. Provide the top of the pad nominally 1 inch above ground line. If the controller cabinet has both front and back doors, install a work pad for each door. Pour controller work pad separately from foundations.
2. Orient the foundation as shown in the Plans or as directed by Engineer to meet ADA and other applicable requirements.
3. Excavate material to the proper physical dimensions to form the foundation and surrounding areas as shown in the Plans, Controller Cabinet Installation Details, or approved engineering details that are specific to the Contract Documents.
4. Place conduits, reinforcing rods, pull boxes as shown in the Plans or approved engineering details.
5. Notify Engineer prior to concrete pour after forming foundation and preparing adjacent areas.

F. Traffic Controller Assembly.

1. Apply a mastic sealant between the cabinet base and the concrete foundation to prevent dust and moisture from entering the cabinet floor.
2. Secure and level the cabinet to the foundation with four (4) 5/8-inch x 5 -inch stainless steel (304) wedge anchors, washers and aluminum shims per cabinet manufacturer recommendations and requirements.
3. Field wiring must be terminated on the appropriate terminal strips in the controller cabinet using insulated terminal lugs. Use a calibrated ratchet type crimping tool to install the insulated terminal onto the ends of the field wires.
4. All field wiring cable in the cabinet must be neatly bundled and labeled.

3.02 DOCUMENTATION

A. Quality Assurance/Control Submittals

1. Timing and phasing sheets
2. Cabinet wiring diagrams showing all changes made to the traffic controller assembly configuration.
3. Cabinet field wiring hookup sheet.
4. Completed and signed “Acceptance Test Procedure” sheets.

END OF SECTION 670

SECTION 671 TRAFFIC SIGNAL CONTROLLERS

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install a Caltrans Model 2070LX advanced transportation controller as required by the Contract Documents.

1.02 REFERENCES

A. Traffic Control Equipment Specifications and Standards for Metro Traffic Control System, Miami-Dade County

B. California Department of Transportation (Caltrans) Transportation Electrical Equipment Specifications (TEES), 2020 and Errata

C. ATC 5201 v06.25: Advanced Transportation Controller (ATC) Standard Version 06

D. National Transportation Communications for ITS Protocol (NTCIP) 1202: Object Definitions for Actuated Traffic Signal Controller (ASC) Units V02.19

E. FDOT Standard Specifications for Road and Bridge Construction, Section 671 – Traffic Controllers

F. Florida Department of Transportation Approved Products List (APL)

G. Miami-Dade County Traffic Signals and Signs Division's Qualified Products List (TSSQPL)

H. Caltrans' Traffic Signal Control Equipment Qualified Products List (QPL)

I. National Electrical Manufacturers Association (NEMA) TS-2-2021

1.03 SYSTEM DESCRIPTION

A. General Requirements

1. Controllers must provide functionality that meets or exceeds operational characteristics, including NTCIP support, as described in NEMA TS-2-2021.
2. Controllers must capture all mandatory event-based data elements listed in the FDOT State Traffic Engineering and Operations Office supplemental requirements for controllers (*SR-671-2, Supplemental Traffic Controller High Resolution Data Logging Requirements).* Controllers must provide all event-based data elements listed in the FDOT State Traffic Controller High Resolution Data Logging Requirements without any missing data.
3. Controller software must meet or exceed the requirements of the Miami-Dade Traffic Signal Controller Local Software Specifications maintained by the Miami-Dade County Department of Transportation and Public Works (the Department).

1.04 SUBMITTALS

A. Certificates

1. The traffic controller submittal information must include certificates or other documented evidence that the 2070LX controller provided is approved and listed on the Caltrans QPL, FDOT APL, and TSSQPL.

B. Manufacturers' Instructions and Information

1. Submit or ensure that the following documentation from the manufacturer has been submitted to the Department:
   a. Operation Manual
   b. Troubleshooting and Service Manual
   c. Assembly and installation instructions
   d. Pictorial layout of components and schematics for circuit boards
   e. Parts list
2. Electronic copies of all documentation must be provided. Electronic documentation must not require licenses, fees, or additional purchase for duplication or distribution.

1.05 DELIVERY STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading

1. If the traffic controller is not packaged and shipped as part of a traffic controller assembly, ensure it is packaged in a manufacturer provided box and handled as per manufacturer's handling, storage, and protection requirements.

1.06 OWNER'S INSTRUCTIONS

A. Manufacturers' instructions and information documentation provided must describe all controller features and operations, including all user interfaces and settings required to configure the traffic controller.

1.07 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Controller must meet the latest Caltrans TEES requirements for a 2070LX Traffic Signal Controller unit and include, at minimum, the unit chassis, 2070-1C CPU, 2070-2E+ field I/O module, 2070-3B Front Panel, and 2070- 4A Power Supply.

B. Controller must be approved and listed on the:

1. Caltrans' QPL as a Model 2070LX Controller Unit,
2. Florida Department of Transportation's APL, and
3. Miami-Dade County Traffic Signals and Signs Division's TSSQPL.

C. Ensure equipment is permanently marked with the manufacturer's name or trademark, part number, and serial number. Controller serial number must be readily visible without putting the intersection into a flash operation.

2.02 EXTRA MATERIALS

A. A spare Data Key and a spare 2070-2E+ module must be provided for every ten traffic controllers supplied.

B. A physical set of controller schematics and a repair manual must be provided for every one hundred (100) traffic controllers supplied.

2.03 ACCESSORIES

A. The controller must be provided with all accessories and incidental material necessary for installation and operation in a Miami-Dade traffic controller cabinet including, but not limited to, mounting hardware, power cable, data key, and interface card such that installation into the Miami-Dade cabinet does not require any additional components.

2.04 SOURCE QUALITY CONTROL

A. Tests, Inspections

1. Provide all documentation related to manufacturer Quality Assurance/Quality Control with regards to the controller, including batch/lot information as applicable, to the Department.

PART 3 EXECUTION

3.01 PREPARATION

A. Equipment

1. Verify the controller to be installed appears undamaged and in good working conditions prior to installation.
2. Confirm that controller has been pre-programmed for site-specific operation and has passed all testing and verification requirements necessary for field deployment including establishing communication between the controller and central software.
3. When replacing an existing controller, observe and document the current operational status of the intersection prior to controller replacement.

B. Site Condition

1. Preparation for controller replacement
   a. Allow all stacked traffic to clear side streets.
   b. Wait until main street is on green and traffic moving.
   c. Ensure that pedestrians and other traffic in crosswalks have safely crossed the street. Place intersection in flash.

3.02 INSTALLATION

A. General

1. Install equipment as shown in the plans and according to the manufacturer's recommendations.

B. Removal

1. After verifying Flash control at intersection, turn off controller power, remove power cord, field I/O (C1) and communication (Ethernet/Serial) from the existing Traffic Controller.
2. Remove hardware retaining the Traffic Controller in rack.
3. Carefully remove existing Traffic Controller, ensure no wires are pinched or pulled from their current location.

C. Replacement

1. Carefully install the new Traffic Controller, ensure no wires are pinched or pulled from their connection.
2. Connect power, field I/O, and communication; Verify calls from detectors.
3. Using proper hardware, secure Traffic Controller into cabinet rack. Controller assembly includes all integration by the Contractor that is necessary for the proper operation of the controller assembly in the signal system.
4. Place intersection out of Flash and back in Traffic Control.

3.03 FIELD QUALITY CONTROL

A. Site Tests, Inspection

1. Ensure the intersection is functioning properly following controller installation, including verification that all vehicle and pedestrian detectors are properly mapped and placing calls to the traffic controller, and that all signals are operating properly.

END OF SECTION 671

SECTION 678 TRAFFIC CONTROLLER ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Meet the materials and installation requirements of FDOT Specification Section 678 (Traffic Controller Accessories) except as otherwise specified in this Section and the Contract Documents.

B. Method of Measurement

1. Per Contract Documents.

C. Basis of Payment

1. No separate payment will be made for traffic controller accessories. Include the cost in the Contract unit price for the traffic controller assembly.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the material and product requirements of FDOT Specification 678-2 (Materials), and the Contract Documents.

B. Traffic controller accessories components used must be approved and listed on the TSSQPL.

C. Cables must be 600V rated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the installation requirements of FDOT Specification 678-3 (Installation Requirements), the and the Contract Documents.

END OF SECTION 678

SECTION 682 TRAFFIC MANAGEMENT CCTV CAMERAS

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. Furnish and install a high definition (HD) internet protocol (IP) closed-circuit television (CCTV) camera and cabinet at the location(s) shown in the Plans. Use new equipment and components that meets the minimum requirements of these specifications. Ensure that the installed equipment provides the Video Display Equipment at the Miami-Dade County TSS Division Traffic Management Center (TMC) with unobstructed video of the roadway, traffic, and other current conditions around a roadside CCTV field site; that it responds to camera control signals from the TMC operator; and that the video images can be transmitted to remote locations for observation.

B. Method of Measurement

1. The Contract unit price for each CCTV camera system furnished and installed, will include furnishing, placement, and testing of all equipment and materials, and for all tools, labor, operational software packages and firmware, supplies, support, personnel training, shop drawings, documentation, and incidentals necessary to complete the work.

C. Basis of Payment

1. Prices and payment will be full compensation for all work and materials required by this Section.
2. Payment will be made under:

Item No.	Description	Unit
682-1-133	ITS CCTV Camera, F&I, Dome PTZ Enclosure - Non-Pressurized, IP, High Definition	EA

1.02 REFERENCES

A. Miami-Dade County Traffic Signals and Signs Division’s Qualified Product List (TSSQPL)

B. FDOT Approved Product List (APL)

C. National Electrical Manufacturers Association (NEMA) TS-2-2016

D. Telecommunications Industry Association (TIA)-568

1.03 SYSTEM DESCRIPTION

A. Design Requirements

1. Design to meet the requirements of all applicable standards. Ensure that the CCTV camera, cabinet, mounting hardware, and any other camera-related material that is exposed to the environment can withstand loading from 150 mph wind speeds and meet the requirements of the FDOT Structures Manual, Volume 3.

B. Performance Requirements

1. CCTV camera must provide titling and masking features, including, but not limited to, programmable camera title, programmable preset titles for each preset position, and programmable privacy zones. Ensure that programmable titles are a minimum of 18 characters per line.
2. CCTV camera must provide the following features and capabilities:
    a. Day (color)/night (monochrome) switchover and iris control, with user-selectable manual and automatic control capabilities.
    b. Ability to produce clear, detailed, and usable video images of the areas, objects, and other subjects visible from a roadside CCTV field site. Ensure that video produced by the camera is true, accurate, distortion free, and free from transfer smear, oversaturation, and any other image defect that negatively impacts image quality under all lighting and weather conditions in both color and monochrome modes.
    c. User-selectable automatic gain control (AGC) that is peak-average adjustable to 28 decibels (dB).
    d. A minimum signal-to-noise ratio of 50 dB.
    e. Automatic color balance that references the white areas of the scene through the lens.
    f. An automatic electronic shutter that is user selectable from 1/60 to 1/10,000 of a second.
    g. A digital signal processor that provides a minimum 10x digital zoom.
    h. Programmable azimuth and compass display with ability to display pan and tilt position with a 1 degree resolution.
3. CCTV camera must comply with FDOT Specification Section 682-1.2.9 (Additional Requirements for IP Cameras) for:
    a. Video Encoding
    b. Encoded Video Interoperability
    c. Encoded Video Specifications
    d. Network Interface
    e. Configuration Management

1.04 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Use a dome-type High Definition (HD) Internet Protocol (IP) CCTV camera assembly that meet the requirements of this Specification and are listed on the Miami-Dade County TSS Division Qualified Products List (TSSQPL) and the Florida Department of Transportation (FDOT) Approved Product List (APL). Ensure equipment is permanently marked with the manufacturer's name or trademark, part number, and serial number and:

1. Is compatible with the current version of the FDOT's SunGuide® software system, and any other camera operating software indicated in the Plans and contract documents.
2. Has a minimum 18x motorized optical zoom lens with automatic iris that is:
    a. Capable of automatic and manual focus and iris control.
    b. Have a lens depth of field provides a clear image of roadside areas under all lighting conditions; and
    c. Has a maximum aperture of at least f/1.6.
3. Has an integrated pan/tilt mechanism capable of providing 360 degree continuous pan with a minimum 90 degree tilt range (i.e., 0 degrees to minus 90 degrees); provide variable speed control; have a preset position return accuracy of plus or minus 0.36 degree, or less than 0.10% or better; support a minimum of 64 presets; support a minimum of one tour with a minimum of 32 presets; and support a minimum of eight programmable blackout zones.
4. Has a positioner with a minimum automatic pan speed of 240 degrees per second to a preset camera position; that the maximum manual pan speed is a minimum of 80 degrees per second; and that maximum manual tilt speed is a minimum of 40 degrees per second.
5. Supports the National Transportation Communications for ITS Protocol (NTCIP) 1205 v1.08. Ensure that the camera is capable of communication with other devices using Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA)-232 or TIA-422 at a rate of 9600 bps, transmission control protocol (TCP)/IP, or user datagram protocol (UDP)/IP. Ensure that the CCTV camera supports the communication links shown in the Plans. The camera must be capable of remote firmware upgrade via the communication interface.
6. Supports the Open Network Video Interface Forum (ONVIF) Core, Streaming, and Media Service specification.

B. Electrical Specifications:

1. Camera must operate on a nominal voltage of 120 volts alternating current (VAC). Supply an appropriate voltage converter for devices that require operating voltages of less than 120 VAC.
2. Meet the requirements of FDOT Specification Section 620 for Grounding and Lightning Protection.

C. Mechanical Specifications:

1. Provide camera housings and hardware that are light in color or as noted in the Plans.
2. Ensure that the camera housing has a sunshield to reduce the solar heating of the camera. Ensure that the total weight of dome type CCTV cameras (including the housing, sunshield, and all internal components) is less than 17.0 pounds. Ensure that the lower dome of the camera housing is distortion free clear plastic.

3. Ensure that pressurized dome-type housings are capable of pressurization at 5 pounds per square inch (psi) using dry nitrogen, that they have a low-pressure alarm feature, and has a NEMA 4X/IP-67 rating.
4. If a non-pressurized dome-type housing enclosure is used, ensure that the unit is vented with a thermostat-controlled heater and blower. Ensure that the non-pressurized enclosure has a NEMA 4/IP-66 rating.
5. Ensure that the total weight of external positioner-type CCTV cameras (including housing, sunshield, all internal components, and external pan and tilt mechanism) is less than 35 pounds.

D. Environmental Specifications:

1. Ensure that the CCTV camera performs all required functions during and after being subjected to the environmental testing procedures described in NEMA TS2, Sections 2.2.7, 2.2.8, and 2.2.9.

E. CCTV Equipment Cabinet.

1. General. The cabinet shell must be a Caltrans Type 336 cabinet type (36”H x 24”W x 20 to 22”D) meeting the requirements of FDOT Specification subarticle 676-2.5 (Intelligent Transportation System Cabinets) with a typical equipment layout as shown in FDOT Design Standards Index 18104 (FY 2017-18). In urban areas where the minimum required right-of-way clearances cannot be maintained with a standard cabinet, a Miami-Dade County TSSQPL approved pole mounted CCTV cabinet may be proposed by the Engineer of Record as an alternative to the standard cabinet. When proposed, the alternative cabinet type must be shown on the Plans along with all detailed cabinet specifications meeting the Miami-Dade County Alternative CCTV Cabinet requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Ensure that the CCTV camera is installed at the locations shown in the Plans. Install the CCTV camera in accordance with the Miami-Dade County standard details and as shown in the Plans.

B. Furnish and install the power supplies, local control equipment, and any other camera-related field electronic equipment and transient voltage surge suppressors within the approved lockable CCTV cabinet. Ensure that the cabinet protects these electrical and electronic devices from rain, dust, dirt, and other harmful elements of nature.

C. Furnish and install all power, video, and data cables necessary to provide connection points for camera video and pan/tilt/zoom (PTZ) control signals within the cabinet. Furnish and install any and all ancillary equipment required to provide a complete and fully operational CCTV camera. Verify that all wiring meets National Electric Code (NEC) requirements where applicable.

D. Ensure that data and video cables from the pole to the camera are routed inside the mounting hardware and protected from exposure to the outside environment.

E. Coat the exterior of the dome-type enclosure's lower half with a manufacturer-approved clear, rain repellant product prior to final acceptance.

F. Provide grounding and surge protection that meets the requirements of Section 620 (Grounding and Lightning Protection).

G. Provide a dedicated power cable. If terminated at the signal cabinet, provide a dedicated circuit that meets all applicable requirements.

3.02 FIELD QUALITY CONTROL

A. Subject the equipment covered by these specifications to a field acceptance test (FAT). Develop and submit a test plan to Engineer for review and approval. Ensure that the test plan demonstrates each and every functional requirement specified for the device or system under test. Engineer reserves the right to witness all tests:

B. Field Test Requirements: Perform local field operational tests at CCTV field sites according to the following:

1. Verify that physical construction has been completed as specified in the Plans.
2. Verify the quality and tightness of ground and surge protector connections.
3. Verify proper voltages for all power supplies and related power circuits.
4. Verify all connections, including correct installation of communication and power cables.
5. Verify that the video signal from the camera is present and of consistent quality at all connection points between the camera, the cabinet, and any video devices therein.
6. Verify camera network configuration settings are correct and that encoded video from the camera can be viewed on the network via a local connection at the field site and from the TMC. Verify that field site and TMC video quality is consistent and does not exhibit source degradation such as distortion and artifacts.
7. Exercise PTZ and focus in all directions and execute a minimum of three other unique programming commands to ensure that the communication link between the cabinet and the camera is functioning properly.

END OF SECTION 682

SECTION 684 NETWORK DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Meet the materials and installation requirements of FDOT Specification Section 684 (Network Devices) except as otherwise specified in this Section and the Contract Documents.

B. Method of Measurement

1. Per Contract Documents.

C. Basis of Payment

1. Per Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the material and product requirements of FDOT Specification Section 684 (Network Devices) and the Contract Documents.

B. Network devices used must be approved and listed on the TSSQPL.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the installation requirements of FDOT Specification Section 684 (Network Devices) and the Contract Documents.

END OF SECTION 684

SECTION 685 UNINTERRUPTIBLE POWER SUPPLY SYSTEM FOR TRAFFIC SIGNALS

PART 1 GENERAL

1.01 SUMMARY

A. Description

1. This specification sets forth the minimum requirements for an uninterruptible power supply (UPS) system for providing reliable emergency power to a traffic signal intersection (vehicle and pedestrian) in the event of utility power failure or interruption.

B. Related Sections

1. Section 620 (Grounding and Lightning Protection)
2. Section 630 (Conduit)
3. Section 635 (Pull and Junction Boxes)
4. Section 676 (Traffic Cabinets)

C. Method of Measurement

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

D. Basis of Payment

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

Item No.	Description	Unit
685-1-13	UPS System, Furnish and Install	EA

1.02 REFERENCES

A. NEMA Standards Publication TS 2-2021, Section 2

B. UL Standard 1778, Uninterruptible Power Systems

C. Miami-Dade County Traffic Signals and Signs Qualified Products List (TSSQPL)

D. FDOT Approved Products List (APL)

E. California Department of Transportation Qualified Products List (Caltrans QPL)

F. Caltrans Transportation Electrical Equipment Specifications (TEES)

G. Caltrans Specifications for Battery Back-Up System (TEES Chapter 4)

H. Caltrans Specifications for Green Technology Battery Back-Up System (TEES Chapter 12)

1.03 SYSTEM REQUIREMENTS

A. Performance Requirements

1. UPS system must:

a. be capable of providing continuous, fully conditioned, regulated, pure sinusoidal (AC) power to the traffic control signal system during all modes of operation except when the UPS is in bypass.

b. be capable of providing a minimum of 1000 watts @+25°C, continuous active output capacity, with a minimum of 80% inverter efficiency while running in Backup Mode (on batteries). When operating in Backup mode, the system output must be 120 VAC ± 5 VAC, pure sine wave output, ≤ 3% THD, 60 Hz ± 0.05 Hz.

c. be capable of operating a signalized intersection (500-watt load at 120 V_{AC}) for a minimum of 6 hours of full runtime when utility power is disabled and under ambient temperatures of 25˚C. The UPS system must switch the intersection to flash mode of operation when approximately 40% of battery charge is remaining, via relay contact connection points on front panel of unit. The UPS system must operate the intersection in the flash mode of operation (300-watt load at 120 V_{AC}) for at least an additional 2 hours.

d. operate in hot standby mode with power transfer being accomplished in 40 milliseconds or less from disruption of normal utility line voltage to stabilized inverter line voltage from batteries. The same allowable transfer time applies when switching from inverter line voltage to utility line voltage. Loss of utility power, transfer from utility power to battery power, and transfer back to utility power must not interfere with normal operation of connected equipment. In the event of UPS failure or battery depletion, connected equipment must be energized automatically upon restoration of utility power. Removal and replacement of the UPS system components must not disrupt the operation of the equipment being protected. The UPS unit and the Batteries must be hot swappable. There must be no disruption of the critical load (Traffic Signal) when removing the UPS unit or batteries for maintenance.

e. Double-conversion UPS systems

1) Must additionally be capable of simultaneously producing fully regenerated and regulated, conditioned, True Sine Wave power and hot standby AC output, and have a minimum operating efficiency of 90%. Ensure the UPS is listed to the requirements of UL 1778. Upstream back-feed voltage from the UPS system must be less than 1 V_{AC}.

f. Nickel-Zinc Battery UPS Systems

1) UPS systems designed for use of nickel-zinc batteries must meet the more stringent or additional requirements of Caltrans Specifications for Green Technology Battery Back-Up System (TEES Chapter 12).

B. Functional Requirements

1. Unless otherwise specified herein, UPS System must meet the requirements for functionality, displays, and controls specified in Section 3 of Caltrans Specifications for

Battery Back-Up System (TEES Chapter 4) or Section 3 of Caltrans Specifications for Green Technology Battery Back-Up System (TEES Chapter 12) for systems using nickel-zinc batteries.

C. Green Technology Battery Backup System

1. UPS Systems meeting the requirements of Caltrans Specifications for Green Technology Battery Back-Up System (TEES Chapter 12) and all applicable requirements specified in this Section.

1.04 DOCUMENTATION

A. Manufacturers' Instructions

1. Include a UPS operation and maintenance manual in the cabinet where the UPS is installed that includes cabinet wiring schematics, electrical interconnection drawings, parts layout and parts lists.
2. Battery documentation and replacement information.

B. Quality Assurance/Control Submittals

1. Production Quality Control Testing
   a. Provide certification for each UPS System of satisfactory results for a (1) 100-Hour Burn-In-Period and (2) Visual Inspection as described Section 8 of Caltrans Specifications for Battery Back-Up System (TEES Chapter 4).

1.05 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mechanical

1. All parts must be made of corrosion-resistant materials such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal. All fasteners exposed to the elements must be Type 304 or 316 passivated stainless steel.
2. All connectors must be keyed to prevent improper connection.

2.02 EQUIPMENT

A. Use only UPS system equipment that meet the requirements of this Specification and are listed on the FDOT's Approved Products List (APL), Caltrans QPL and the Department's Traffic Signals and Signs Division's Qualified Products List (TSSQPL). Except that the UPS system cabinet is not required to be on the Caltrans QPL.

2.03 COMPONENTS

A. UPS Unit

1. Displays, Controls and Diagnostics
    a. The UPS system software must be programmable from the front panel of the UPS unit by means of a keyboard or momentary buttons allowing user to step through menu driven software.
    b. Local and remote configuration and management of the UPS unit, including access to all user-programmable features as well as alarm monitoring, event logging, and diagnostic utilities must be provided.
    c. Configuration and management functions must be password protected.
    d. Alarm function monitoring must include the following: loss of utility power, inverter failure, low battery, battery temperature, and inverter active/utility fail.
    e. Must include a front panel display and controls that allows programming of configurable parameters, features, and functions without the need for another input device. The UPS must have visual indications for Power-On, Mode of Operation (utility power or inverter), Battery Status, Alarm Status, Load Levels, and AC Output Voltage.
2. A RS232 port must be provided on the front panel of the UPS Unit.
3. An Ethernet port (RJ45) for local control using a laptop PC and remote control via a network connection must be provided on the front panel of the UPS Unit.
4. The UPS unit must include an event log that indicates the date and time of the following events: AC high, AC low, AC frequency high, AC frequency low, AC fail/blackout, overload, over temperature, battery voltage high, battery voltage low, battery disconnected, battery temperature high, temperature probe disconnected, and short circuit. The UPS event log must be able to store a minimum of 200 events.
5. The UPS unit must include battery management functions that includes active or equalized balancing; monitoring of temperature, voltage, and amperage of charge and discharge; and temperature compensated automatic charging to maximize the life of the batteries.
6. UPS system software must be provided for the operational needs of the UPS system. The user/operator must be able to access all system software via the Ethernet port and RS232 port on the front panel of the UPS unit. The user must be able to read logged events and/or change programmable parameters from the keyboard, laptop or local area network via the Ethernet port.
7. Ensure a minimum of 6 sets of NO and NC single-pole double-throw dry contact relay closures are available on the front face of the inverter/charger and labeled so as to identify each contact. The relay closures must consist of:
    a. A set of NO and NC contact closures must be energized whenever the unit switches to battery power. Contact must be labeled or marked as “On Battery” or equal.
    b. A second set of NO and NC contact closures must be energized whenever the battery approaches approximately 40% of remaining capacity. This limit will determine when the unit will switch from normal operation to flash. Contact must be labeled or marked as “Low Battery” or equal.
8. Nickel-Zinc Battery UPS Systems
    a. UPS systems designed for use of nickel-zinc batteries must meet the more stringent or additional requirements of Caltrans Specifications for Green Technology Battery Back-Up System (TEES Chapter 12).

B. UPS System Batteries

1. Use only deep discharge sealed prismatic valve regulated lead acid AGM cell batteries except for approved systems except batteries for approved UPS Systems meeting the requirements of Caltrans Specifications for Green Technology Battery Back-Up System (TEES Chapter 12) are required to meet the requirements of Section 6 therein.
2. Individual batteries must be 12V type, and must be easily replaced and commercially available for purchase as common off the shelf equal.
3. Batteries must indicate maximum recharge data and recharging cycles and manufacture defaults on the inverter must not allow the recharging process to exceed the batteries maximum values.
4. Batteries must be sealed and require no maintenance, cause no corrosion, and be capable of maintaining 80% of original capacity and performance for a minimum of five years.
5. Battery terminals must include a protective covering to prevent accidental spark or shorting.
6. Battery interconnect wiring must connect to the inverter unit via modular harness with red and black cabling that terminates into a typical power pole style connector. Harness must be equipped with mating power flag style connectors for batteries and a single insulated plug-in style connection to UPS unit. Harness must allow batteries to be quickly and easily connected in any order and must be keyed to ensure proper polarity and circuit configuration.
7. The battery wiring harness must allow 6 feet of separation between the UPS and its battery bank. Battery cables provided to connect battery to battery harness main cable must be a minimum of 24 inches. Battery harness must be sized accordingly with system requirements.
8. An integral lifting handle shall be provided on the batteries for ease of removal/installation.
9. Battery Monitoring System
    a. The UPS system must use a temperature compensated battery charging system. The charging system must compensate over a range of 2.5 to 4.0 mV/°C per cell.
    b. The temperature sensor must be used to monitor the temperature and regulate the charge rate of the batteries.
    c. The UPS system must provide an alarm should the temperature sensor fail. Should the temperature sensor fail, the inverter/charger must not allow the UPS system to overcharge the batteries.
    d. Recharge time for the batteries to 80% or more of full battery charge capacity must not exceed 20 hours at 70°F.
    e. Batteries must not be charged when battery temperature exceeds 50°C ± 3°C.
    f. The UPS system shall monitor battery strings within a system and set a fault indicator if battery voltage falls below normal operating voltages.
10. Nickel-Zinc Battery UPS Systems
    a. UPS systems designed for use of nickel-zinc batteries must meet the more stringent or additional requirements of Section 6 of Caltrans Specifications for Green Technology Battery Back-Up System (TEES Chapter 12).

C. UPS System Cabinet

1. The UPS system cabinet must be capable of base mounting to its own foundation.

2. The cabinet must be NEMA type 3R all aluminum with stainless steel hardware that meets the requirements of FDOT Section 676 and includes shelves and rack rails to house all UPS system components including the UPS, batteries, harnesses, switches, surge protective device, power terminal block and a generator hookup with transfer switch. All system components of the UPS system must be housed within the UPS system cabinet.
3. The cabinet include a power panel with:
    a. A main breaker and a breaker for the technician GFCI outlet. The main breaker must be 30 amps and provide protection for the UPS system components. The breakers must be Square "D" QUO 150 Series, or approved equal.
    b. A 20 amp, 120 volt, 60 Hz technician GFCI receptacle. The receptacle must be wired to utility power and not regulated by the UPS module.
    c. A surge protective device must be installed within the cabinet where the supply circuit enters the cabinet in accordance with FDOT 620-2.7.1.
    d. Separate neutral bus bar and equipment ground bus bar.
4. The utility line service must terminate to a 3 circuit termination block sized for #6 AWG wire.
5. The UPS cabinet must allow a maintenance technician to safely insert power for traffic signal operation while the UPS or associated equipment is serviced or replaced.
6. The cabinet must include a transfer switch and generator access panel in accordance with FDOT Section 676. The generator access door must not protrude more than 1 inch when closed.

2.04 SOURCE QUALITY CONTROL

A. Tests, Inspections

1. Environmental: UPS assemblies, including batteries, must provide continuous power with specified wattage and operate properly during and after being subjected to the environmental testing procedures described in NEMA TS 2, Sections 2.2.7, 2.2.8, and 2.2.9.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install UPS assemblies in accordance with the manufacturer’s recommendations. All equipment used to keep the intersection signalized must be backed up and protected by the UPS System.

3.02 FIELD QUALITY CONTROL

A. Site Tests, Inspection

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

END OF SECTION 685

SECTION 700 ROADWAY SIGNS

PART 1 GENERAL

1.01 SUMMARY

A. Furnish and erect roadway signs at the locations and in accordance with the details shown in the Plans or as otherwise required herein. Roadway signs include roadway static sign assemblies, Internally Illuminated Street Name Signs, Electronic Display Sign assemblies, and Sign Beacon assemblies.

B. Related Sections

1. Section 620 (Grounding and Lightning Protection)
2. Section 630 (Conduit)
3. Section 635 (Pull, Splice, and Junction Boxes)
4. Section 646 (Aluminum Poles, Pedestals, And Posts)
5. Section 676 (Controller Cabinets)
6. FDOT Specification Section 700 (Highway Signing)

C. Method of Measurement

1. General:
   a. Unless otherwise specified herein, a completed assembly includes all materials, equipment, and labor necessary for a complete, functional and accepted installation.
   b. The cost of furnishing and installing the required installation decals is considered incidental and is included in the unit prices for the signs or assemblies.
   c. The cost for documenting and returning removed sign panels and assemblies to the Traffic Signals and Signs Division's Yard is considered incidental and is included in the unit prices for removal.
2. Roadway Static Sign Assembly (ground-mounted).
   a. Single/Multi Post Sign Assembly items: A completed assembly includes the support structure and all the sign panels required to be mounted on the support structure. The Contract unit price per assembly for ground mounted signs (single post and multi-post), furnished and installed, includes furnishing and installing the sign panels, support structure, foundation, hardware, appurtenances, and labor required for a complete and accepted installation.
   b. Single/Multi Post Sign Assembly Relocation/Removal items: Relocation of sign assembly consists of removing the existing sign assembly and installing the assembly on a new foundation at the location shown in the Plans. When the Plans call for existing ground-mounted signs to be relocated or removed, after removing the sign panel(s) from the assembly, remove support(s) and footing(s). Restore the area of the sign assembly removal or relocation to the condition of the adjacent area at no additional cost.
   c. Sign Panel Pay Items:

1) Pay items for adding/removing sign panel are used only when adding/removing a panel to/from an existing support structure that will remain in place. Adding sign panel requires the use of new attachment hardware. For new single post and multi-column signs, all panels on a new assembly are included in the payment for the assembly. No additional payment will be made for adding/removing panels on single/multi post sign assembly where the entire assembly has been relocated or removed.

2) Relocation of sign panels includes new attachment hardware for mounting the relocated signs onto existing support structures as indicated on the Plans.

3. Internally Illuminated Street Name Sign (IISNS).

   a. Contract unit price per each for IISNS, furnished and installed, will include furnishing the sign panels, housing, hardware, electrical connection, photocontrol, and labor necessary for a complete and accepted installation.

   b. Includes all hardware necessary to complete the attachment to the mast arm structure as required by the Contract Documents.

4. Electronic Display Sign Assembly (EDS).

   a. EDS refers to a general category of electronically enhanced signs that includes electronic speed feedback signs and blank-out signs.

   b. The Contract unit price per assembly for EDS, furnished and installed, includes the sign panels, electronic display, housing, cabinet, controller, speed detector, hardware, electrical connection, wiring, appurtenances, and labor necessary for a complete, functional, and accepted installation as required by the Contract Documents. When the EDS is ground mounted, the Contract unit price includes the sign support structure, conduit, pull box, grounding, and foundation. When the EDS is mounted on span wire or mast arm, the Contract Unit Price includes the hardware necessary to complete the attachment to the support structure; the span wire or mast arm structure will be paid separately.

   c. In addition:

      1) For AC powered assembly does not include the cost of the Electrical Power Service Assembly.

      2) For solar powered assembly, price includes solar panels and all components for a complete and functional solar powered installation.

5. Sign Beacon Assembly.

   a. The Contract unit price per assembly for sign beacon assembly includes the beacons, sign panels, cabinet, electronics, wiring, all necessary appurtenances, and labor necessary for a complete, functional, and accepted installation as required by the Contract Documents. When the sign beacon assembly is ground mounted, the Contract unit price includes the sign support structure, conduit, pull box, grounding, and foundation. When the sign beacon is mounted on span wire or mast arm, the Contract Unit Price includes the hardware necessary to complete the attachment to the support structure; the span wire or mast arm structure will be paid separately.

   b. In addition:

      1) For AC powered beacon assembly, does not include the cost of the Electrical Power Service Assembly.

      2) For solar powered beacon assembly, price includes solar panels and all components for a complete and functional solar powered installation.

3) For beacon assembly intended for use with applicable school zone signing, price includes time switch and service approved by the Department for centralized remote calendar programming of days and times of operation.

4) For vehicle-activated sign beacon assembly, price includes vehicle detection system listed on the FDOT APL and the TSSQPL.

5) For pedestrian-activated sign beacon assembly, price includes a pedestrian detector listed on the FDOT APL and the TSSQPL.

6) For warning beacons assembly operated from a wired input received from traffic signal cabinet to temporarily actuate beacons ahead of a change in signal phase, single cable and conduit from the signal cabinet to the sign beacon will be paid separately under the applicable pay items and Specifications in the Contract Documents.

D. Basis of Payment

1. Price and Payment will be full compensation for all work specified in this Specification Section that have awarded Contract Unit Prices under the following items:

Pay Item	Description	Unit
700-1-11B	Single Post Sign, F&I Ground Mount, Up To 12 SF	AS
700-1-12C	Single Post Sign, F&I Ground Mount, 12-20 SF	AS
700-1-50	Single Post Sign, Relocate	AS
700-1-60	Single Post Sign, Remove	AS
700-2-50	Multi- Post Sign, Ground Mount, Relocate	AS
700-2-60	Multi- Post Sign, Remove	AS
700-3-101	Sign Panel, F&I Ground Mount, Up To 12 SF	EA
700-3-102	Sign Panel, F&I Ground Mount, 12-20 SF	EA
700-3-201	Sign Panel, F&I Overhead Mount, Up To 12 SF	EA
700-3-202	Sign Panel, F&I Overhead Mount, 12-20 SF	EA
700-3-203	Sign Panel, F&I Overhead Mount, 21-30 SF	EA
700-3-204	Sign Panel, F&I Overhead Mount, 31-50 SF	EA
700-3-501	Sign Panel, Relocate, Up To 12 SF	EA
700-3-502	Sign Panel, Relocate, 12-20 SF	EA
700-3-503	Sign Panel, Relocate, 21-30 SF	EA
700-3-601	Sign Panel, Remove, Up To 12 SF	EA
700-3-602	Sign Panel, Remove, 12-20 SF	EA
700-5-21	Internally Illuminated Sign, F&I Overhead Mount, Up To 12 SF	EA
700-5-60	Internally Illuminated Sign, Remove	EA
700-11-139	Electronic Display Sign, F&I Ground Mount- AC Powered, Speed Feedback Sign	AS
700-11-239	Electronic Display Sign, F&I Ground Mount- Solar Power, Speed Feedback	AS

Pay Item	Description	Unit
700-11-391	Electronic Display Sign, F&I Overhead Mount- AC Powered, Blank Out Sign, Up To 12 SF	AS
700-12-11	Sign Beacon, F&I Ground Mount- AC Powered, One Beacon	AS
700-12-12	Sign Beacon, F&I Ground Mount- AC Powered, Two Beacons	AS
700-12-21	Sign Beacon, F&I Ground Mount- Solar Powered, One Beacon	AS

1.02 REFERENCES

A. Miami-Dade County Traffic Signals and Signs Division's Qualified Product List (TSSQPL)

B. FDOT Approved Product List (APL)

C. Miami-Dade County's Public Works Manual, Standard Road Detail Sheets R18.1

D. American Society for Testing and Materials (ASTM)

E. FHWA Manual on Uniform Traffic Control Devices (MUTCD)

F. National Electrical Code, NFPA 70 (NEC)

1.03 DELIVERY STORAGE AND HANDLING

A. Storage, Handling and Labeling:

1. Storage and handling:

   a. If signs are stored prior to installation, store them in accordance with the manufacturer's recommendations. Properly package signs to protect them during storage, shipment and handling to prevent damage to the sign face and panel.

2. Installation Decals:

   a. In addition to the information required in FDOT Specification Section 994, all permanent roadway signs (new, repaired or relocated) must be labeled on the back lower right-hand corner with the date of installation, repair or relocation punched out. The decal must not be placed over any existing installation decal.

   b. Decals must be manufactured from Type II (ASTM D4956) sheeting with black legend and yellow reflectorized background. The decal must show information that includes the date of installation, repair, or relocation; the name "Miami-Dade County, Florida"; the relevant Florida Statues and associated fine for sign tampering and the telephone number for reporting damaged or missing signs.

   c. Make the labels unobtrusive, but legible enough to be easily read by an observer on the ground when the sign is in its final position. Apply the label in a manner that is at least as durable as the sign face.

1.04 ACCEPTANCE OF SIGNS

A. Sign Inspection:

1. Submit certification that the sign assembly meets the material and installation requirements of the Contract Documents and the approved Shop Drawings. Engineer

will inspect the signs at the final construction inspection. Repair and replace signs deemed unacceptable by Engineer at no expense to the Department.

B. Certification of Conformance:

1. Provide a Certificate of Conformance with a notarized Affidavit specifying the alloy and domestic source origin of aluminum signs.
2. Provide a certification that all signs, materials, and installation are in strict accordance with the requirements of this Specification Section.

1.05 SYSTEM DESCRIPTION

A. Design Requirements

1. Engineer of Record must ensure that the proposed sign assemblies and foundation are designed to withstand all applicable loads and meet performance requirements.
2. Electronic Display Signs
   a. Electronic Speed Feedback Signs (ESFS).
      1) Plans must include a schedule listing the programming parameters for the ESFS including Speed Limit, Violation Alert Speed, “SLOW DOWN” Speed, High Speed Cutoff Function (Blank Display), High Speed Cutout Speed, and Minimum Display Speed.
      2) ESFS in a school zone may only operate while the speed limit is in effect in the zone. Otherwise the display must be blank.
   b. Blank-Out Signs (BOS).
      1) Plans must include operational details pertaining to all display phases and blank-out phases.
      2) Plan details must depict exact mounting location in relation to other traffic signal components and signs on the Mast Arm.

B. Performance Requirements

1. The sign assembly for IISNS, Sign Beacon Assembly, and EDS must be designed and constructed to meet the requirements of FDOT’s Structures Manual using a Design Wind Speed of 150 mph.
2. Manufacturer must provide engineering certification that the assembly’s major components along with the recommended attachments for mounting on a 4.5” outer diameter pole (Sign Beacon and EDS Assembly) and other support structures (Mast Arms and Span Wire), meet the load requirements of Section 3 of AASHTO LTS-6 as modified by FDOT Structures Manual Volume 3 using a Basic Wind Speed (V) of 150 mph in the determination of the design wind pressure.

1.06 WARRANTY

A. Meet the manufacturer’s warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General:

1. Meet the material and equipment requirements of this Specification Section and any additional requirement stipulated in the Contract Documents.
2. Meet the Sign Fabrication requirements of FDOT Specification Section 700 (Highway Signing).
3. Meet the Storage, Handling and Labeling requirements of FDOT Specification Section 700 (Highway Signing).

B. Concrete:

1. Use concrete meeting the requirements of FDOT Specification Section 346.
2. Obtain concrete from a plant that is listed on the FDOT's Production Facility Listing.

C. Sign Panels.

1. All sign panels must be aluminum unless otherwise shown in the Plans.
2. Sheets and plates for sign panels must meet the requirements of ASTM B209, Aluminum Association Alloy 6061-T6, 5154-H38 or 5052-H38. Sign panels for single column ground mounted signs must utilize aluminum plate with a minimum thickness of 0.08 inches. All other sign panels must utilize aluminum plate with a minimum thickness of 0.125 inches. All panels shall have rounded corners.

D. Retroreflective Sign Sheeting.

1. Meet the retroreflective sign sheeting requirements of FDOT Section 700 (Highway Signing).

E. Roadway Static Sign Assembly (ground-mounted).

1. Mounting Hardware and Posts for Static Signs Only Having Sign Panels Not Exceeding 12 SF:
   a. Unless otherwise specified in the Plans, use steel sign post, base post, anchor plate (sandy/loose soils), retainer spacer strap, hardware and appurtenances meeting Standard Road Detail Sheets R18.1 of the Miami-Dade County's Public Works Manual.
   b. Sign Post:
      1) Sign post must be provided with a galvanized 30 inch base post, retainer strap, galvanized anchor plate and all the miscellaneous hardware needed for installation as required by Standard Road Detail Sheets R18.1 of the Miami-Dade County's Public Works Manual.
      2) Sign and base post must be rolled from rail steel meeting the properties established in ASTM A499. Minimum weight of each post prior to drilling must be three pounds per foot (± 5 percent) with profile dimensions as specified in Standard Road Detail Sheets R18.1 of the Miami-Dade County's Public Works Manual. Post must be galvanized pursuant to ASTM A123 as the last step after fabrication and hole punching has been completed.

3) The galvanized steel post must be furnished in appropriate lengths to provide a minimum 7 ft. ground clearance to the bottom of the lowest sign unless otherwise shown in the Contract Documents or Standard Road Detail Sheets R18.1.

4) The finished post must be machine straightened and have a smooth uniform finish free from defects affecting strength, durability or appearance.

5) Bolt holes having a diameter of 7 / 16 of an inch must be punched at one inch centers along the post's center line beginning one inch from the top of the post and continued down the length of the post.

c. Anchor Plate:

1) Anchor plate must be 6 inch x 12 inch x 0.120 inch steel, hot dip galvanized per ASTM A123. The anchor plate must have two 7 / 16 inch diameter holes for attaching to base post with sign/base post assembly hardware.

d. Hardware:

1) Nuts, bolts, and washers for attaching signs must be 2024-T4 aluminum. Hex-head bolts must be 5 / 16 inch – 18 UNC x 2 - 1 / 2 inch with hexagon nuts and flat washers.

2) Hardware for attaching sign post to the base post and anchor plates must be Hex-head integral flange bolt, nut and lockwasher. Bolts must be 5 / 16 inch – UNC x 1 – 3 / 4 inch meeting ASTM A354, Grade BD (Grade 8). Nuts must be ASTM A563, Grade DH. Lock washer must be heavy duty external type. Finish must be cadmium plated per ASTM A165-80, Type OS, except using clear chromate.

3) Retainer-Spacer Strap must be AISI 1020 Steel and be 17 1 /8 inch x one inch x 0 – 3 / 8 inch thick with a 0 – 3 / 8 inch offset, galvanized per ASTM A123.

2. Mounting Hardware and Posts for Static Signs Having Sign Panels Exceeding 12 SF:

a. Requires use of slip base and pole meeting the requirements of FDOT Standard Plans Indices 700-010, 700-011, 700-020 as applicable.

b. Slip base assemblies for single column signs must use aluminum sleeves and base plates. Slip base assemblies for multi-column signs must use galvanized steel bases. All slip bases must be fabricated in accordance with the requirements of the FDOT Standard Plans.

c. Uni-directional slip bases cannot be used at intersections.

F. Internally Illuminated Street Name Sign.

1. Use Internally Illuminated Street Name Sign and mounting hardware that meet the requirements of FDOT Specification Section 700 (Highway Signing) and this Specification.

2. Use Internally Illuminated Street Name Sign and mounting hardware that are listed on the FDOT's APL and the Department's TSSQPL.

G. Electronic Display Sign Assembly.

1. Meet the requirements of FDOT Specification Section 700 (Highway Signing) and this Specification.

2. Use Electronic Display Sign and mounting hardware that meet the requirements of this Specification and are listed on the FDOT's APL and the Department's TSSQPL.

3. Unless otherwise shown in the Plans and approved by Engineer, the ESFS, its components, and sign panels must be U-bolt mounted on a Miami-Dade County TSSQPL approved 4-1/2 inches outer diameter (4 inch nominal) threaded Schedule 80 aluminum pedestal pole and square aluminum break away base with a reinforcing collar assembly meeting the requirements of FDOT Specification Section 646. Attachment hardware must meet or exceed the requirements of the Florida Department of Transportation (FDOT) Standard Plans, Index No. 700-010.

H. Sign Beacon Assembly:

1. Meet the requirements of FDOT Specification Section 700 (Highway Signing) and this Specification.
2. Use Sign Beacon assembly and mounting hardware that meet the requirements of this Specification and are listed on the FDOT's APL and the Department's TSSQPL.
   a. Beacon assemblies intended for use with school zone signing must include a remote means approved by the Department for centralized remote calendar scheduling program days and times of operation.
   b. Vehicle activated beacons must utilize a vehicle detection system listed on the FDOT APL and the TSSQPL.
   c. Pedestrian activated beacons must utilize a pedestrian detector listed on the FDOT APL and the TSSQPL.
3. Unless otherwise shown in the Plans and approved by Engineer, the Beacon Assembly, its components, and sign panels must be U-bolt mounted on a Miami-Dade County TSSQPL approved 4-1/2 inches outer diameter (4 inch nominal) threaded Schedule 80 aluminum pedestal pole and square aluminum break away base with a reinforcing collar assembly meeting the requirements of FDOT Specification Section 646. Attachment hardware must meet or exceed the requirements of the Florida Department of Transportation (FDOT) Standard Plans, Index No. 700-010.

PART 3 EXECUTION

3.01 INSTALLATION

A. General.

1. Meet all requirements of Section 620 (Grounding and Lightning Protection) and the National Electrical Code.
2. Perform and document utility clearances.

B. Roadway Static Sign Assembly (ground-mounted).

1. Install pursuant to Standard Road Detail Sheets R18.1 of the Miami-Dade County's Public Works Manual and the Contract Documents.

C. Internally Illuminated Street Name Sign.

1. Install pursuant to FDOT Specification Section 700, the Contract Documents, and the wiring, mounting and installation requirements of the Miami-Dade County TSS Division's "Typical Wiring and Installation Details Internally Illuminated Street Name Signs (IISNS)".

2. Provide grounding and surge protection that meets the requirements of Section 620 (Grounding and Lightning Protection).
3. Provide a dedicated power cable. If terminated at the signal cabinet, provide a dedicated circuit that meets all applicable requirements.

D. Electronic Display Sign Assembly.

1. Install pursuant to FDOT Specification Section 700 and the Contract Documents.
2. Provide a dedicated power cable.
3. For ground mounted EDS Assembly.
   a. Construct foundation and install support structure in accordance with FDOT Section 646, this Specification Section, Standard Plans, Index 700-120, and the Contract Documents.
   b. Set anchor bolts 90 degrees apart with a bolt circle diameter of 13 inches. Adjust anchor bolts to a plumb line and hold rigidly in position to prevent displacement while pouring concrete.
   c. Meet the requirements of FDOT Specification Section 620 and the NEC.

E. Sign Beacon Assembly.

1. Install pursuant to FDOT Specification Section 700 and the Contract Documents.
2. For ground mounted Sign Beacon Assembly.
   a. Construct foundation and install support structure in accordance with FDOT Section 646, this Specification Section, Standard Plans, Index 700-120, and the Contract Documents. Bolt circle radius must be thirteen inches.
   b. Set anchor bolts 90 degrees apart with a bolt circle diameter of 13 inches. Adjust anchor bolts to a plumb line and hold rigidly in position to prevent displacement while pouring concrete.
   c. Meet the grounding requirements of Section 620 and the NEC.

3.02 REMOVAL

A. Deliver sign panels, sign assemblies, EDS, IISNS and all sign equipment removed pursuant to these specifications to the Department of Transportation and Public Works, Traffic Signals and Signs Division's Yard at 7100 NW 36th Street, Miami, FL 33166.

B. Document delivery and coordinate with the TSS Division's warehouse manager prior to offloading the material.

3.03 RESTORATION

A. Restore all areas impacted by the Work.

B. Restore any areas impacted by the installation of a crosswalk enhancement assembly to original condition unless otherwise shown in the Plans. Install crosswalk enhancement assembly in accordance with the Americans with Disabilities Act Standards for Transportation Facilities.

END OF SECTION 700

SECTION 706 RAISED PAVEMENT MARKERS AND MARKER ADHESIVE

PART 1 GENERAL

1.01 SUMMARY

A. Meet the materials and installation requirements of FDOT Specification Section 706 (Raised Pavement Markers and Marker Adhesive) except as otherwise specified in this Section and the Contract Documents.

B. Internally Illuminated Raised Pavement Markers (Class F)

1. Retroreflective raised pavement markers (RPMs) are the Department's standard type of raised pavement markers and are used as positioning guides to supplement longitudinal pavement markings for enhanced nighttime and wet weather visibility. Internally Illuminated Raised Pavement Markers (IIRPMs) are steady burn (i.e. IIRPMs do not blink) internally illuminated raised pavement markers that may be installed in the roadway surface, pursuant to Chapter 3B of the MUTCD, as an alternative to standard RPMs and subject to the following:
    a. Proposed use of IIRPMs is limited to mitigation strategies on County Roads whose curves have substandard horizontal alignment or super-elevation; substandard lane widths; or substandard shoulder widths.
    b. A signed and sealed Traffic Engineering and Safety Study must be conducted to justify the use of IIRPMs. Installation requires County-approved site-specific engineering plans and permit.
    c. IIRPM spacing must comply with Sections 3B.12 through 3B.14 of the MUTCD.

C. Method of Measurement

1. Per Contract Documents.

D. Basis of Payment

1. Per Contract Documents.

1.02 WARRANTY

A. Meet the manufacturer's warranty requirements stipulated in Article 1.06 of Section 600 (General Provisions for Traffic Control Devices) of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Meet the requirements of FDOT Specification 706-2 (Materials).

B. Class F IIRPM materials used must also be approved and listed on the TSSQPL.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet the requirements of FDOT Specification 706-4 (Application).

END SECTION 706