

**Hillsborough County
Traffic Signal Specifications
Revision 3 January 2013**

**Section 600
Overview**

600-1 Guidance

This document is the standard specification for traffic signal installation in Hillsborough County, Florida. The different sections mimic the 2010 Edition of the Florida Department of Transportation Standard Specification for Road and Bridge Construction, Traffic Control Devices. Only deviations and/or clarifications will be noted. If no specific detail or clarification is given, then the Florida Department of Transportation Specification is the standard to be followed. All deviations and/or clarifications will be in *Italic Times New Roman*.

600-1.1 OBTAINING THIS DOCUMENT: *This document is available at: on the Hillsborough County, Florida website under Public Works Department Publications, Traffic Services.*

600-2 Definitions:

600-2.1 High Voltage: *High voltage is defined in this document as any voltage higher than 36VAC.*

600-2.1 Low Voltage: *Low voltage is defined in this document as any voltage 36VAC or lower.*

600-2.1 Substantial Completion: *Installation is substantially complete when there are only minor discrepancies. These minor discrepancies will have no effect on the operation of the signal. All signals, markings, and signs will have been installed.*

**Section 603
General Requirements for Installation and Evaluation of
Traffic Control Equipment and Materials**

603-1 Description

The provisions contained in this Section include general requirements for all traffic control signal equipment and materials used in the construction of signalized intersections.

603-2 Equipment and Materials

603-2.1 GENERAL. Follow the Florida Standard for Road and Bridge Construction.

603-2.2 EXCEPTIONS. *The County may grant an exception to the requirements in 603-2.1 when in the interest of the public or the County and to provide for advantages of state of the art equipment.*

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603-2.3 UNIFORMITY. Follow the Florida Standard for Road and Bridge Construction.

603-2.4 HARDWARE and FITTINGS. Follow the Florida Standard for Road and Bridge Construction.

603-2.5 GALVANIZING. Follow the Florida Standard for Road and Bridge Construction.

603-3 Definitions

Follow the Florida Standard for Road and Bridge Construction.

603-4 Systems Approval Requirement

The Hillsborough County Traffic Engineering Office will review and approve any system design plan of a traffic control signal device, that is controlled and/or operated from a remote location by electronic computers or similar devices. The presently approved system is the Naztec ATMS system. All controllers and controller cabinets along with associated equipment must be compatible and operate with the Naztec ATMS system.

603-5 Device Approval Process

The traffic control signal devices will have been approved by the State of Florida and the Hillsborough County Traffic Engineering Office.

603-6 Marking of Approved Equipment

603-6.1 MANUFACTURER'S IDENTIFICATION: Follow the Florida Standard for Road and Bridge Construction.

603-6.2 CERTIFICATION NUMBER: Follow the Florida Standard for Road and Bridge Construction.

603-7 Submittal Data Requirements

Submittal information for all signal equipment will be submitted to the Hillsborough County Traffic Engineering Office for approval prior to installation. The Hillsborough County Traffic Engineering Office will approve submittal data. Hillsborough County is not liable for any equipment or material purchased, work done, or delay incurred prior to such approval. The contractor will provide a complete operable signal installation as specified regardless of any failure of Hillsborough County to discover or note any unsatisfactory material.

603-7.1 AS-BUILTS: *Two complete sets of as-built red-lined drawings on 11" X 17" paper will be provided to Hillsborough County Traffic (one to Traffic Engineering and one to Traffic Operations (Signals)) prior to final completion of the signal installation. A PDF version of the as-builts will also be provided to the County.*

603-8 Documentation for Electronic Equipment

Follow the Florida Standard for Road and Bridge Construction.

Section 608

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Guaranties

608-1 Description:

Follow the Florida Standard for Road and Bridge Construction.

608-2: Guaranty Provisions.

Follow the Florida Standard for Road and Bridge Construction.

**Section 611
Acceptance Procedures**

611-1 Description:

This Section sets forth Contract acceptance procedures for signalization installations and for equipment purchase contracts.

611-2 Acceptance of Signal Installations:

611-2.1 Partial Acceptance: Follow the Florida Standard for Road and Bridge Construction.

611-2.2 Final Acceptance: Follow the Florida Standard for Road and Bridge Construction.

611-2.3 As-Built Drawings: Follow the Florida Standard for Road and Bridge Construction.

611-2.3.1 Submittal Requirements: *Submit two sets of as-built plans for review by Hillsborough County on 11" X 17" inch plan sheets along with a PDF version. Record all as-built information using block lettering or typed text to ensure legibility. All changes will be noted in red (red-lined) or revised plan sheets may be submitted that depict the changes in a clouded area.*

611-2.3.2 Components: Follow the Florida Standard for Road and Bridge Construction.

611-2.4 Installation Inspection Requirement: Follow the Florida Standard for Road and Bridge Construction.

611-2.4.1 Hillsborough County Inspection Procedure:

611-2.4.1.1: New Signal Installations: *New signals (no signal previously at intersection) will be inspected when the signal is at substantial level of completion. All signals, pedestrian signals and signs, markings, wiring, loops, and video detection will be in place. Minor requirements such as duct seal on conduits, advance signal ahead signs, and overhead illuminated signs may still be outstanding if the reason for lack of completion is significantly justified. The electrical service release will not be sent to the power company until the signal is at substantial completion.*

611-2.4.1.2: Updated Signal Installation: *New signals, where a traffic signal previously existed and is still operational, will be inspected when the signal is at a substantial level of completion except in cases where there are documented*

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Maintenance of Traffic (MOT) issues that require the new signal to be operational prior to a substantial completion point. A typical issue that would allow such an early power release would be if the existing traffic signal strain poles are conflicting with new road construction and their removal is essential to completion of the road work.

611-3 Signal Timing:

The signal timing will be provided by the County. In the case of updated signal installation, the Engineer of Record will provide signal timings when any phasing changes have occurred from the old traffic signal to the new traffic signal. If no changes in phasing have occurred, the existing time sheet may be implemented at the time the signal is swapped over. In the case where a new signal (no signal previously existed) is being installed in a coordinated corridor, the Engineer of Record will provide basic timings and Hillsborough County Traffic Engineering (Timings Section) will provide the coordinated timing plan.

611-4 Field Test of Signal Installations:

Follow the Florida Standard for Road and Bridge Construction.

611-5 Contractor's Warranty Period for Signal Installations:

611-5.1 General Requirements: *Follow the Florida Standard for Road and Bridge Construction except; as clarification, the following applies: the contractor is responsible for all maintenance of the newly installed traffic signal until after all installation discrepancies (punch) list items have been corrected. The 90 day warranty period will begin at the end of the 48 hour test.*

611-5.2 Contractor's Responsibilities:

611-5.2.1 Responsibility for maintenance of existing traffic signal during construction: *the contractor is responsible for all maintenance of the traffic signal as soon as any modification is made to the existing traffic signal or there is a stipulation in the plan sheets or County Specifications which determine the contractor will assume maintenance responsibility at commencement of the project. Maintenance of the traffic signal is defined as repair and/or replacement of any equipment or hardware failures which cause the traffic signal to operate abnormally. This will include any damages caused by accident or criminal behavior to any underground or aboveground traffic signal related facility. Once the replacement signal is operational, the responsibility for maintenance of the new traffic signal will continue to be the responsibility of the contractor until all of the discrepancies or punch list items have been corrected and the traffic signal is deemed "acceptable".*

611-5.2.2 Responsibility for maintenance of a new traffic signal: *the contractor is responsible for all maintenance of the new traffic signal from the moment the construction starts until all discrepancies or punch list items have been corrected and the traffic signal is deemed "acceptable".*

611-5.2.3 Contractor's responsibility during the warranty period: *The warranty period of 90 days commences after the 48 hour burn in of the*

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traffic signal. This is defined as 48 hours after the new traffic signal is fully activated. If a new signal is turned on prior to all functions of the traffic signal being fully serviceable, the warranty period will begin when all functions of the traffic signal have been installed and are functional. As an example: a new traffic signal that is replacing an existing traffic signal may have to be activated due to MOT reasons prior to the pedestrian signals being functional. In this case, the 90 day warranty period will commence when the pedestrian signals, all noted discrepancies and any other item not functional have been fully activated, have been corrected, and are functional. If the maintenance responsibility of the traffic signal has been turned over to Hillsborough County during the warranty period, the contractor will be responsible for the provisions identified in Section 611-5.2 of the Florida Standard for Road and Bridge Construction.

611-5.2.3 During any period when the contractor is responsible for maintenance of the signal, the contractor will respond to a reported traffic signal failure or operational problem within two hours. If the contractor fails to respond within the allotted period and the County responds to the failure or operational problem, the contractor is subject to back charges for the County's expenses.

611-5.3 Hillsborough County's Responsibilities: Follow the Florida Standard for Road and Bridge Construction. *For clarification, Hillsborough County will maintain the newly installed traffic signal after all punch list items have been corrected. Until all punch list items have been fully corrected, the maintenance responsibility remains with the contractor.*

611-6 Manufacturer's Tests and Certifications: Follow the Florida Standard for Road and Bridge Construction

611-7 Contracts for Purchase of Equipment: Follow the Florida Standard for Road and Bridge Construction

Section 620 Signal Installation Grounding

620-1 Description: Follow the Florida Standard for Road and Bridge Construction.

620-2 Materials: Follow the Florida Standard for Road and Bridge Construction.

620-3 Requirements for Grounding:

620-3.1 General: Meet all local electrical codes. Install insulated green No. 4 AWG copper wire for electrical or lightning protection ground from the system ground (electrical service ground rod) to all elements of the traffic signal (pedestrian poles, mast

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arms, steel pull box lids, etc). No. 4 AWG insulated green copper wire will be used from the electrical service disconnect to the traffic signal controller ground. The main ground wire from the meter panel to the ground rod will be #4 AWG solid copper wire.

All connections to ground rods and connections where multiple ground wires intersect will be exothermically welded. Connections in the meter can, electrical service disconnect, pedestrian poles, mast arms, traffic signal controller cabinet, etc will be made with a crimped lug that is bolted to a grounding point or direct connection to a ground buss (usually found in the electrical service disconnect and controller cabinet).

Install **40 feet** of ground assembly or array for each of the following:

- a) Electric power service (connected directly to the meter can)
- b) Pole for the electrical power service (this will be a separate 40 feet from the electrical service ground assembly).
- c) Pole mounted cabinet (this will be a separate 40 feet from the electrical service ground assembly).

Install **20 feet** of ground assembly or array for each of the following:

a) Signal pole (whether wood, concrete, or metal). This 20 feet of grounding electrode will also be the connection point for the span wire in cases of span wire signals.

b) Pedestals for pedestrian signals.

c) Metal cover used with pull boxes that have AC power over 36VAC.

All separately grounded elements at an intersection will be bonded together (exothermically) to form an intersection grounding network and all will be tied back to the primary ground on the electrical service meter panel. The intersecting point for all ground wires in the grounding network will be a pull box adjacent to the meter panel. Refer to the Traffic Signal Underground Power Service Drawing.

A pull box adjacent to the meter/disconnect pole will be installed to provide an intersecting point for all the grounding network grounds. The ground wires from all ground network components (ie, signal poles, pedestrian poles, pull boxes, etc) will be brought into this one pull box to be tied to the main ground from the electrical service ground.

Do not install a grounding electrode assembly or array for a base mounted cabinet within six (6) feet of a grounding electrode or array for a signal pole. There must be more than six feet separation between any two grounding electrodes or arrays.

All connection points between ground wires and ground rods and all connection points where multiple ground wires meet will be exothermically welded. Do not make any exothermic bonds in the controller cabinet. Make sure all exothermic bonds at an intersection meet the requirements of the IEEE standards 80 and 837.

The measured value of the grounding array at any point will be 10 Ω or less. If that value can not be achieved with the specified number of ground rods, additional ground rods will be installed at no cost to the County.

Refer to the Hillsborough County "Typical Traffic Signal Controller Power Service" drawing for further guidance on grounding.

620-3.2 Grounding Electrode Assembly: Follow the Florida Standard for Road and Bridge Construction.

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620-3.3 Grounding Electrode Array: Follow the Florida Standard for Road and Bridge Construction.

620-3.4 Grounding Poles: Follow the Florida Standard for Road and Bridge Construction.

620-3.5 Grounding Electric Power Service: Refer to the Hillsborough County Electrical Power Service Specification sheet.

620-3.6 Grounding Controller or Detector Cabinets: Follow the Florida Standard for Road and Bridge Construction

620-3.7 Grounding Span Wire Mounted Signal Heads and Electrical Powered Signs: Follow the Florida Standard for Road and Bridge Construction.

620-4 Basis of Payment:

The work specified in this Section will not normally be paid for directly unless stipulated as a separate pay item on the plan sheets. Otherwise, this will be considered incidental work.

**Section 630
CONDUIT**

630-1 Description:

Follow the Florida Standard for Road and Bridge Construction.

630-2 Materials:

Follow the Florida Standard for Road and Bridge Construction.

630-3 Installation Requirements:

630-3.1 General: *Consider the locations of conduit as shown on the plans as approximate. Construct conduit runs as straight as possible, and obtain the Engineer and County's approval of all major deviations in the conduit locations from those shown on the plans.*

Do not place more than the equivalent of four quarter bends or 360 degree of bends, including their termination bends, between the two points of termination of the conduit (no more than 360° between termination points) without a pull box. No use of corrugated flexible conduits will be allowed without the pre-approval of the County.

Use only intermediate metal conduit, rigid galvanized conduit, rigid aluminum conduit or PVC coated intermediate metal conduit for above-ground or underground electrical power service installations. All metal conduits will have a grounding bushing installed at the termination ends. Meet the requirements of Section 562 of the Florida Standard for Road and Bridge Construction for coating all field cut and threaded galvanized pipe.

Use either schedule 80 PVC or fiberglass reinforced epoxy conduit for installations on bridge decks.

Use either schedule 40 PVC or fiberglass reinforced epoxy conduit for underground and under pavement installations.

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All PVC conduits will have bell ends installed prior to pulling any cable to protect the cable insulation from damage. If the installed bell ends appear to be cut and installed after the fact, all the cable will have to be pulled out of the conduit by the contractor and inspected by the County for damage. The contractor will have to reinstall undamaged or new cable.

When the installation of a conduit requires jacking under paved surfaces, railroads, etc., use an intermediate metal conduit as the sleeve for the underground conduit. Install the underground conduit as shown in the Design Standards, Index No. 17721.

When a conduit installation changes from underground to above-ground, make the change a minimum of six (6) inches below finished grade.

When transitioning from metal conduit above ground and underground PVC conduit the transition will be with a threaded female adapter. A slip type fitting will not be acceptable on the metal conduit.

Install 1250 lb mule tape or equivalent the full length of all conduits that are designated for future use. There must be at least 24 inches of mule tape at each conduit termination point. The mule tape must be tied to a permanent object to avoid the mule tape from being inadvertently pulled out of the conduit. If all conduits in a run of conduits are empty, a continuous run of No. 14 AWG copper wire as stipulated in the FDOT design specifications will also be installed in one of the empty conduits to allow those conduits to be marked for the Sunshine State Call One system. One conduit in any conduit run must have some sort of copper wire to allow for utility locating. Locating wire will not be spliced inside any conduit. Any splice that is performed with the locating wire will be spliced in the pull box.

Install an expansion fitting when conduit crosses an expansion joint of a structure (example: bridge joint).

Use couplings and expansion joints made of the same material as the conduit.

Ensure that all joints are made as specified by the manufacturer and are waterproof.

For installations not specifically shown, install the conduit in accordance with NEC and/or National Electrical Safety Code requirements.

Follow Florida Standard for Road and Bridge Construction Section 120 for all earth backfill and tamping.

When trenching or saw cutting, repair all pavement and sidewalks encountered. Ensure all trenches are tamped, filled, and re-sodded to provide a level restored grade.

When back filling trenches in existing pavement, use a commercially available sand-cement (approximately 10:1 mix ratio).

Provide a standard clearance between underground control cable and electrical service cable or another parallel underground electrical service cable that meets National Electrical Safety Code requirements.

All conduit will be buried at a depth specified in FDOT Index 17721.

All conduit terminations in pull boxes will be installed as in FDOT Index 17721.

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630-3.1.1 Fiber Optic Cable Conduit: Follow the Florida Standard for Road and Bridge Construction.

630-3.1.2 Fiber Optic Cable Locate Wire: *Install No. 14 AWG copper wire as stipulated in the FDOT design specifications in the spare conduit to allow for locating the conduits. The locate wire will be a continuous piece for at least 2500 feet. At termination points, the locate wire will be secured in the pull box to ensure it is not inadvertently pulled out of the pull box and conduits.*

The locate wires terminating in any cabinets will be isolated from the cabinet and labeled "FIBER OPTIC LOCATE WIRE".

630-3.2 Conduit Sizes and Quantities: *The following conduit sizes and quantities will be used unless specifically stipulated in the plans:*

All conduit runs across roadways will be a minimum of four (4) each 2" PVC conduits installed (two (2) each high voltage, one (1) each low voltage, and one (1) each spare).

All mast arm bases will have three (4) each 2" PVC conduits (two (2) each high voltage and two (2) each low voltage) and one (1) each 1" PVC conduit (ground) installed. The conduits will be routed to the nearest associated pull box.

All pedestrian signal bases will have two (2) each 2" PVC conduits (one (1) each high voltage and one (1) each low voltage) along with one (1) each 1" PVC conduit (ground) installed. The conduits will be routed to the nearest associated pull box.

All interconnect conduit runs will be two (2) each 3" PVC conduit. Two (2) each 3" PVC conduit will be installed from the nearest interconnect (communication) pull box and the traffic signal controller base.

The traffic signal controller cabinet base will have the following conduits installed (minimum):

Four (4) each 2" PVC conduits for high voltage.

Four (4) each 2" PVC conduits for low voltage.

Two (2) each 3" PVC conduit for interconnect.

One (1) each minimum 1" PVC conduit for electrical service.

One (1) each 1" PVC conduit for ground.

All conduits runs will be routed to the nearest associated pull boxes from the controller cabinet base.

The engineer of record will ensure, through calculations, that sufficient conduit is shown on the plans. A greater than forty per cent fill of any conduit will not be allowed. The engineer of record will show additional conduit runs if the less than forty per cent fill can not be achieved.

630-3.3 Conduit Joints: Follow the Florida Standard for Road and Bridge Construction.

630-3.4 PVC Coating: Follow the Florida Standard for Road and Bridge Construction.

630-3.5 Conduit Terminations: *Fit the terminating ends of all metal conduit and metal conduit sleeves with an appropriate bushing. All PVC conduits will*

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have bell ends installed at the terminating ends prior to any cables being pulled into the conduits.

All other provisions under the Florida Standard for Road and Bridge Construction 630-3.5 will apply as written.

630-3.6 Existing Underground Facilities: Follow the Florida Standard for Road and Bridge Construction.

630-3.7 Restoration of Trench Areas: Follow the Florida Standard for Road and Bridge Construction.

630-3.8 Jacking Conduit: Follow the Florida Standard for Road and Bridge Construction.

630-3.9 Above Ground Installation: *Securely attach above ground conduit installations to the surface of the supporting structure using conduit straps. As a minimum, use conduit straps located on three (3) foot centers. Use galvanized metal conduit straps for all conduits above ground.*

630-3.10 Elbow: Follow the Florida Standard for Road and Bridge Construction.

630-4 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

630-5 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.

**Section 632
Signal and Interconnect Cable**

632-1 Description: Install underground and aerial signal and interconnect cable.

632-2 Materials: Follow the Florida Standard for Road and Bridge Construction.

632-3 Installation Requirements:

632-3.1 Number of Conductors: *The contractor will determine the number of conductors required for each signal and interconnect cable by utilizing the Contract Documents or contacting the County traffic signal inspector.*

For span wire installations using trunk cables, there will be a minimum of three spare conductors for each signal trunk cable used at all signal installations. Install the three spare conductors from the controller cabinet through each signal head disconnect hanger to the furthest disconnect hanger. Each direction will have its own neutral. Double (2-way) signal heads will not be allowed as this would cause two separate directions to share one neutral. The white conductor in the signal cable will be used for the neutral. For span wire installation using individual cables to each signal head, there will be a minimum of two spare conductors to each signal head (except for potential future 5-section locations). Where the potential exists for a future 5-section, a minimum of three spare conductors will be made available.

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For mast arm installations, there will be two spare conductors to each signal head. Each signal head will have an individual cable from the mast arm hand hole to the signal head without any splices or breaks. If there is a hand hole terminal compartment manufactured for the use of a terminal block, a trunk cable will be run to the hand hole continuously from the controller cabinet with at least three spare conductors. If no hand hole exists in the mast arm, each signal head will have a continuous signal cable from the signal head to the controller cabinet with no splices.

For span wire installations with single point attachment or where a pole mounted junction box is stipulated, a trunk cable will be run continuously from the controller cabinet to the junction box. Individual cables will be run from the junction box to the individual signal heads. Each direction will have a separate junction box. The number of spares will be as stipulated for mast arm installations.

For pedestrian signals, there will be two spare conductors for all pedestrian signals. Pedestrian poles with a single pedestrian signal will have a minimum of a 5-conductor signal cable. Pedestrian poles with a double (2-way) pedestrian signal will have a minimum of a 9-conductor cable. Double (2-way) pedestrian signals will only be installed with the approval of Traffic Engineering to ensure compliance with ADA requirements. The cables for the pedestrian signals will be a continuous run from the pedestrian signal to the controller cabinet with no splices. All pedestrian buttons will have a separate 2-conductor cable (belden) run from the button to the controller cabinet with no splices. The bare wire for the belden will be tied to ground in the controller cabinet.

All spare signal cable conductors will be terminated on the ground bus in the controller cabinet. The spares in a signal disconnect will be terminated on the terminal strip inside the disconnect. Any other spares (mast arm, signal heads, pedestrian heads) will be individually capped or taped. All spares routed from the overhead mast arm signals to the hand hole (terminal compartment) or span wire with junction boxes will be grounded in the hand hole (terminal compartment).

All spare signal cable conductors in the controller cabinet will be labeled as spare and of sufficient length to be utilized for future use anywhere in the controller cabinet. Spare signal cable conductors within the controller cabinet will be terminated to the ground buss.

632-3.2 Number of Cables: Follow the Florida Standard for Road and Bridge Construction.

632-3.3 Protection of Cable: *Ensure all cables drawn through conduits, ducts, drilled holes are suitably protected to prevent damage to the conductors or insulation. Bell ends must be installed on all conduit ends prior to pulling cable in PVC conduit. Rigid conduit will have a grounding bushing (if appropriate) or a PVC bushing on the rigid conduit end. Grommets must be installed on all metal poles where cable passes through a drilled or manufactured hole unless the opening has been manufactured in such a manner that cable will not be damaged by pulling it through the opening or by laying on the opening.*

632-3.4 Cabling for a Mast Arm Assembly or Span Wire Installations using Junction Boxes: *If the mast arm has a terminal*

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compartment, sufficient trunk cable conductors will be pulled from the controller cabinet to the mast arm terminal compartment to provide for cabling of the signals. The trunk cables will be terminated on a terminal strip mounted in the terminal compartment. The terminal strip will be manufactured with non-corrosive screws. The terminal compartment size will be as specified in the FDOT index or stipulated on the signalization General Note sheet. Individual signal cables will be run from each individual signal head and terminated on the terminal strip in the terminal compartment. The terminal strip will be sized to ensure that no more than three fork terminals will be installed on any one terminal position of the terminal strip. Spare conductors from each signal head will be tied to ground in the mast arm pole at the terminal compartment. If the mast arm is not equipped with a terminal compartment, individual, continuous cables will be run from the each individual signal head to the controller cabinet. In cases of span wire installations using junction boxes mounted on the signal poles, the above guidance is applicable.

Attach strain relief approved by the Engineer to the “J” or “C” hook inside the mast arm pole.

The signal cable for each signal attached to the mast arm will protrude from the bottom of the mast arm through a grommetted hole. The cable will be formed into a drip loop and then enter the signal through the lower arm of the mast arm astro brac assembly. The drip loop will be held in place by the use of UV rated cable ties having a minimum width of 3/8”. This can be seen below:



The color code will be obtained from Hillsborough County Traffic Operations prior to wiring the mast arm signals and controller cabinet.

632-3.4a Cabling for a Single Point Box Span or on Span Wire Installations Stipulated to have Junction Boxes: *The cables running across a span wire installation will be lashed to the messenger wire. Cable ties will be used only in the area of the drip loops.*

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NEMA approved water-tight enclosures(junction boxes) will be mounted on the each strain pole at each corner of the intersection near the weatherhead or span wire attachment point. An appropriate sized trunk cable will be run from the NEMA enclosure to the controller cabinet. Individual cables, with appropriate spares, will be installed between the NEMA enclosure and individual signal heads. All terminations in the NEMA enclosure will be terminated on a terminal strip in the NEMA enclosure. The terminal strip will be sized to ensure that no more than three fork terminals will be installed on any one terminal position of the terminal strip. Spare conductors from each signal head will be tied to ground in the NEMA enclosure. All entries into the NEMA enclosure will be with water-tight connectors.

632-3.5 Cable Termination: Follow the Florida Standard for Road and Bridge Construction.

632-3.6 Labeling: *All cables and wires will be adequately labeled to ensure identification of their purpose. Labels will be permanent in nature.*

632-3.7 Color Code: *The basic color code for span wire installations is as follows:*

<u>Terminal #</u>	<u>Wire Color</u>	<u>Signal Indication</u>	<u>Street</u>
1	Solid Red	Main Street Red	Main
2	Solid Orange	Main Street Yellow	Main
3	Solid Green	Main Street Green	Main
4	Solid Blue	Main St Yellow Arrow (5-section)	Main
5	Red w/black stripe	Minor Street Red	Side
6	Orange w/black stripe	Minor Street Yellow	Side
7	Green w/black stripe	Minor Street Green	Side
8	Blue w/black stripe	Main St Green Arrow (5-section)	Main
9	Black	Red Arrow (protected)	Main/Side
10	Black w/white stripe	Yellow Arrow (protected/permissive)	Main/Side
11	White w/black stripe	Green Arrow (protected/permissive)	Main/Side
12	White	common/Neutral	always neutral
13	Red w/white stripe	Red arrow (protected)	usually spare
14	Black w/red stripe	Yellow arrow (protected)	usually spare
15	Green w/white stripe	Green arrow (protected)	usually spare
16	Blue w/white stripe	always spare	always spare

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The above information is provided as general guidance. The contractor is required to contact the Hillsborough County Traffic Signal Shop for specific color code requirements based on individual intersections.

632.4 Signal Cable: Follow the Florida Standard for Road and Bridge Construction *except as noted previously.*

632.5 Interconnect Cable: Follow the Florida Standard for Road and Bridge Construction

632-6 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

632-7 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.

**Section 634
SPAN WIRE ASSEMBLY**

634-1 Description: Install a span wire assembly for supporting traffic signals, signs, and/or other traffic control devices. Provide fiberglass insulators when required.

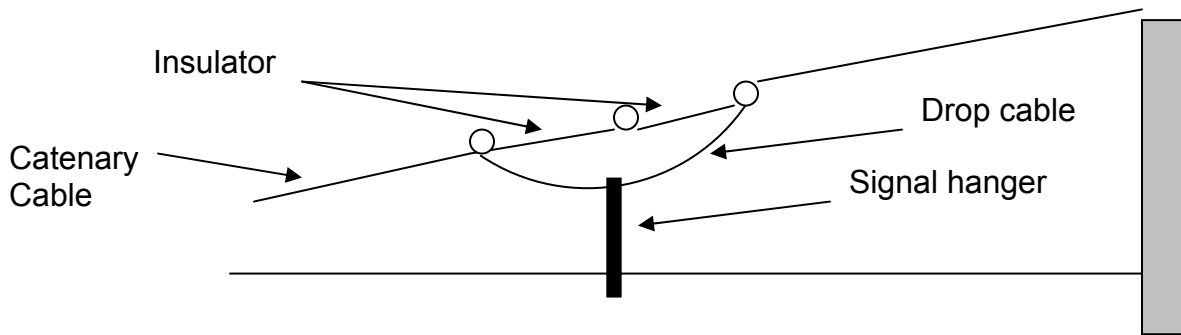
634-2 Materials: Follow the Florida Standard for Road and Bridge Construction.

634-3 Installation Requirements: Follow the Florida Standard for Road and Bridge Construction except as amplified and noted below:

When the signal cable continues past a disconnect, the signal cable will be looped behind the signal hanger with sufficient slack to ensure the cable does not rub against the hanger assembly. A minimum of one inch of clearance will be obtained between the messenger block area and the cable running across the span. Lashing rod will be used to attach signal cable to the messenger. Cable ties will be used to dress up the drip loops at the disconnects. The lashing wire will continue for one turn into the drip loop

Insulators will be installed on the centenary cable at any location where the centenary falls underneath a distribution or transmission electrical line. If insulators are installed and a disconnect and signal hanger fall under the insulator or in cases of single point attachments, a drop span will be installed underneath the insulator to allow for the installation of the signal hanger saddle clamp as depicted below.

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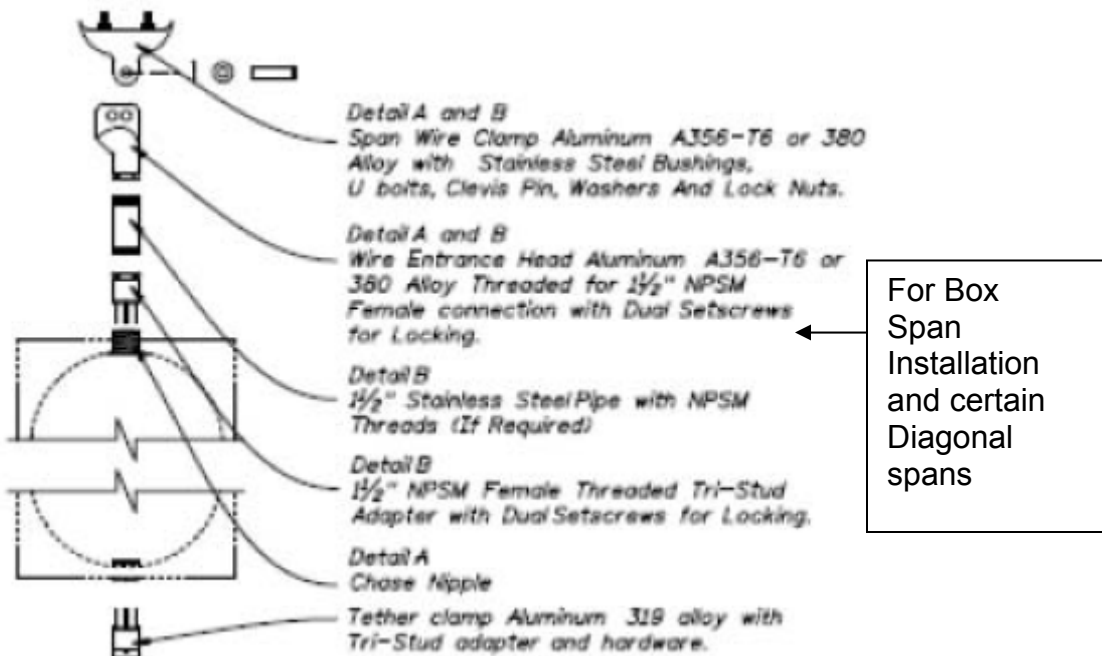
All disconnect doors will face traffic. The contractor will contact the Traffic Signal Operation's shop prior to installation if any questions may arise as to the orientation of the disconnect door.

If the installation calls for single point attachment, the below pictures depicts Hillsborough County's requirement when disconnects are installed. The below picture depicts a single point attachment with diagonal span. If the single point is a box span or, under certain conditions, a diagonal span, then individual NEMA enclosures (junction boxes) will be mounted on each strain pole and individual signal cables run from the NEMA enclosures to each signal. For box span installation or certain diagonal spans, the disconnect shown below will be eliminated.

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If the single point is a box span, individual NEMA enclosures (junction boxes) will be mounted on each strain pole and individual signal cables run from the NEMA enclosures (junction box) to each signal. For box span installation and certain diagonal spans, the disconnect will be eliminated. Below is attachment criteria.



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For 2-point span
wire assemblies
when specified.

When specified by the Engineer, FDOT, or Hillsborough County Traffic Engineering, the contractor will be required to install the approved pivotable hanger assembly (shown above) instead of a standard 2-point hanger assembly. All applicable parts of the pivotable hanger assembly will be installed.

634-4 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

634-5 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.

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**Section 635
PULL AND JUNCTION BOXES**

635-1 Description:

Install pull and junction boxes for traffic signals and traffic signal interconnect.

635-2 Materials: *Use pull and junction boxes listed on the FDOT Approved Products List (APL). Ensure that all Pull and Junction boxes are marked in accordance with 603-6 and the markings are visible after installation. All pull boxes lids will be classified as Heavy Duty and have a minimum design/test load of 15,000 (design)/22,500 (test) lbs (Tier 15). All pull boxes will be classified as Heavy Duty and have a minimum design/test load of 22,500 (design)/33,750 (test) lbs (Tier 22). All pull boxes and pull box covers will meet or exceed test provisions of ANSI/SECT.77-2202. All pull box lids or pull box bodies will be provided with electronic markers. The electronic markers will either be encased in the pull box cover or the marker will be a drop in device that will be inside the actual pull box enclosure. The markers will be the standard telephone marker (orange) (101.4Khz) for any communication or fiber optic pull boxes or the standard power marker (red) (169.8Khz) for any traffic signal or street light application outside of the communication and fiber optic application.*

635-3 Pull Box Installation: *Install pull boxes in accordance with FDOT Design Standards, Index No 17700 and 17721. Pull boxes will be installed with the greatest length of the pull box perpendicular to the roadway. The Pull box cover will be flush with the finished grade. No pull box will be installed in a sidewalk, roadway, driveway, parking area, lower portion of a ditch (standing water) or public sidewalk curb ramp. In cases where right-of-way is the limiting factor, special permission may be given to install a pull box in the sidewalk. In no case, will a pull box be installed in the pedestrian ramp.*

635-4 Junction Box Installation:

635-4.1 Aerial Junction Box: Follow the Florida Standard for Road and Bridge Construction.

635-4.2 Mounted Junction Box: Follow the Florida Standard for Road and Bridge Construction.

635-4.3 Cable Terminations: Follow the Florida Standard for Road and Bridge Construction.

635-5 General Requirements:

Loops, pedestrian button, some video detection, and Opticom (pre-emption) (low voltage) cables will be routed through the same pull box. No signal cable or interconnect cable will be routed through a low voltage pull box. Depending on the manufacturer of video detection, the video detection cables may or may not have voltages lower than 36VAC. The contractor will have to confirm with the video detection manufacturer as to what voltage is present prior to installing cable to ensure cable is placed in the appropriate pull box.

Signal cables, illuminated sign cables, pedestrian cables, some video detection cables, and any other cabling with voltages over 36VAC (high voltage) will be routed

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through the same pull box. No low voltage or interconnect cables will be routed through the high voltage pull box.

Interconnect cable cables (copper and fiber) will be routed through the same pull box. No low voltage or high voltage cables will be routed through the interconnect pull box.

In cases where pull boxes and conduits are being re-used (signal update) versus an entirely new traffic signal installation, exceptions will be made to the requirement to separate low voltage, high voltage, and interconnect cables. Exceptions will be requested prior to starting the installation.

All metal pull box covers/lids will be grounded in accordance with Section 620 unless the pull boxes contain low voltage or interconnect cables only.

635-6 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

635-7 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.

**Section 639
ELECTRICAL POWER SERVICE ASSEMBLIES**

639-1 Description:

Install electrical power service assemblies for either overhead service or underground service in accordance with the details stipulated by the local power company. In most cases for Hillsborough County, this will be Tampa Electric Company (TECO). Utilize the Hillsborough County Electrical Service Specification (Attachment A).

639-2 Definitions: Follow the Florida Standard for Road and Bridge Construction.

639-3 Materials:

Use materials meeting the requirements of Section A639 of the current Minimum Specifications for Traffic Control Devices (MSTCSD), except as noted in Attachment A of this document or noted below. All material cut sheets will be submitted prior to acceptance.

639-4 Installation Requirements:

639-4.1 General: *Meet the following requirements for the installation of individual components of the electrical power service assembly:*

Use extreme care and caution in the installation of all components of the electrical power service assembly.

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

Consider the location of the electrical power service assemblies as shown in the plans to be approximate. Coordinate exact location with the Tampa Electric or electrical power field engineer to determine exact location.

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Hillsborough County Traffic Operations will provide the electrical service address. All traffic signals' addresses will end in "1/8". All other electrical services will not have a fraction after the address

The traffic signal subcontractor installing the electrical power service assembly will be required to obtain a layout number from Tampa Electric Company prior to installation of the electrical power service. Once the layout number is obtained the traffic signal subcontractor will arrange to meet the assigned Tampa Electric field engineer on sight to confirm exact location and type of feed (overhead or underground).

The contractor will be responsible for any additional costs associated with the installation of the electrical power service.

639-4.2 Weatherhead: Follow the Florida Standard for Road and Bridge Construction.

639-4.3 Conduit: *Securely attach all conduits to the pole or cabinet with a maximum distance of three feet between conduit attachment hardware. The conduit between the electrical service disconnect (breaker panel) and the traffic control cabinet may be rigid conduit with grounding bushings. For underground electrical service feeds from the electrical power company to the line side of the electrical meter, the type of conduit (metal or PVC) will be as stipulated by the electrical power company guidelines.*

639-4.4 Electrical Service Wire: *Install the electrical service wire in a manner which will ensure that the wire will not be damaged in any manner. This will include the installation of all grounding bushings (for metal conduit) and bell ends (for PVC conduit) prior to installation of the service wire.*

The size (AWG) or gauge of wire will be a minimum of AWG 6 but will be increased in size depending on the length from the electrical power company service point and the traffic signal controller cabinet. It will be the responsibility of the contractor to size the wire correctly. The contractor will be responsible for providing the documentation that determined the size of wire when request by Hillsborough County.

639-4.5 Meter Base: *The meter will be securely fastened to the pole. The service disconnect will not be mounted on the traffic controller cabinet. The meter will be mounted on the nearest traffic signal concrete strain pole, nearest mast arm pole, or separate (specific for electric service) concrete pole. The height of the meter will be based on the requirements of the power company (TECO). The meter will be a bypass type meter that is rated between 100 and 200 amps and approved by the electrical power company. The meter will have the address of the electrical service attached as directed by the electrical power company. The pole, meter, and disconnect will be installed within 15 feet of the point of service. If that point of service is in excess of 50 feet from the controller cabinet, a separate pole and electrical disconnect will be mounted within 15 feet of the controller cabinet.*

639-4.6 Service Disconnect: *Securely fasten the service disconnect (breaker panel) to the pole. The service disconnect will not be mounted on the traffic controller cabinet. The service disconnect will be mounted on the nearest traffic signal concrete strain pole, nearest mast arm pole, or separate (specific for electric service) concrete pole. The service disconnect breaker size will be a minimum of 50amps.*

639-4.6a Service Disconnect Surge Protection: *The surge suppressor mounted on the main service disconnect will have a rating of 150 KVa or greater.*

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639-5 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

639-6 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.

**Section 641
PRESTRESSED CONCRETE POLES**

641-1 Description: Follow the Florida Standard for Road and Bridge Construction

**Section 649
STEEL STRAIN POLES, STEEL MAST ARMS AND
MONOTUBE ASSEMBLIES**

649-1 Description: Follow the Florida Standard for Road and Bridge Construction.

**Section 650
VEHICULAR SIGNAL ASSEMBLIES**

650-1 Description: Follow the Florida Standard for Road and Bridge Construction.

650-2 Materials: *Use signals and signal LED inserts listed on the FDOT APL list. All equipment will be marked with the APL number. All signals will have LED inserts for all signal indications. All LED inserts will provide an incandescent look.*

650-3 Installation:

650-3.1 Preassembly: *Pre-assemble the signal heads when more than one signal section is required prior to installation at the site. All signal heads will have LED inserts furnished meeting the most current ITE standards. Furnish signal heads with the LED signal insert with the "TOP" or "UP" positioned at the top. In the case of an arrow, align the arrow according to the directional control requirements. All door gaskets will have the small gap in the gasket at the bottom of the door. No other opening will be allowed in the gasket.*

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650-3.2 Positioning of Signals: Follow the Florida Standard for Road and Bridge Construction.

650-3.3 Clearances: Follow the Florida Standard for Road and Bridge Construction.

650-3.4 Aiming of Signal Indication: *For proper orientation, aim signals after installing and before locking them in position. The signal will be oriented to obtain the best possible view by the driver in the lane or lanes associated with the particular signal. If, in the opinion of the Hillsborough County inspector, the signal is not aimed correctly, the signal contractor will re-aim the signal at no additional cost to the county.*

650-3.5 Wiring Connections: *Do not splice signal cable. Connect the proper signal cable to the terminals in each signal head in order to provide the proper signal indication display when the cables are connected to the controller cabinet. Each approach will have its own neutral.*

For mast arm installations, each signal will have its own signal cable which will terminate in the mast arm hand hole (if so equipped) on a stainless steel equipped terminal strip. If, in the absence of a hand hole and terminal strip, each signal's cable will be continuous from the traffic signal to the controller cabinet. In cases where there is a terminal strip in the hand hole, the trunk cable will be of sufficient size to allow for at least three spare wires available in the hand hole terminal strip.

For span wire installations with disconnects, each direction will have a separate cable (four cables for a cross intersection and three cables for a T-intersection). There will be no double signal head configurations. Each direction will have a 12-conductor cable terminated in the disconnects. For this installation, there will be a minimum of 5 spare wires in each cable. The signal cable will be terminated on the bottom portion of the terminal strip inside the disconnect. The signal will be hard-wired to the top portion of the terminal strip inside the disconnect.

For span wire installations utilizing single point attachment with gooseneck devices, each direction will have its own cable. Double gooseneck devices will be used when two cables are entering an individual signal head. All unused spare conductors will be spliced through each head. The outer insulation or sheaving will not be stripped back until the cable has entered the signal head.

650-3.6 Special Installation Requirements for Optically Programmed Signals: Follow the Florida Standard for Road and Bridge Construction.

650-3.7 Vertically Mounted Polycarbonate (Light-Weight) Signal Head Assemblies: Follow the Florida Standard for Road and Bridge Construction.

650-3.8 Sealing Installed Signal Head Assembly: *Ensure that the installed signal head assembly is sealed to exclude dust and moisture. This will include silicone at the top of the signal or signal hanging device to ensure no moisture can get inside the signal head. Also, the seals on the signal head doors will be a continuous piece of O-ring type seal with a small gap at the bottom. No silicone or other type of repair material can be used to correct damage to a door seal. Two ¼" drain holes will be drilled into the bottom of each signal head assembly. All silicone will be applied neatly and in a continuous manner. There will be no voids in the silicone.*

650-3.9 Concealing Signals Not In Use: *Where traffic signals are installed and not put into service immediately, conceal the signal head assembly by placing burlap*

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bags or other covering approved by the Engineer. The bag or cover will be of sufficient weight to not allow any light from a signal to be seen by a motorist during the day or night. The bag or cover will be open at the bottom to preclude the build up of moisture. No covered signal head will block an active, existing signal head. If it does block the vision of the existing signal, the covered signal will be removed and installed at the time it is put in service.

650-3.10 Installation Sequence: Follow the Florida Standard for Road and Bridge Construction.

650-4 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

650-5 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.

**Section 653
PEDESTRIAN SIGNAL ASSEMBLIES**

653-1 Description: Follow the Florida Standard for Road and Bridge Construction.

653-2 Materials: *Use pedestrian signals and pedestrian signal countdown LED inserts listed on the FDOT APL list. All equipment will be marked with the APL number. All signals will have countdown LED inserts for all signal indications.*

653-3 Installation:

653-3.1 General: Follow the Florida Standard for Road and Bridge Construction.

653-3.2 Placement: Follow the Florida Standard for Road and Bridge Construction.

653-3.3 Installation Sequence: Follow the Florida Standard for Road and Bridge Construction.

653-4 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

653-5 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.

**Section 660
INDUCTIVE LOOP DETECTORS**

660-1 Description:

Install inductive loop detectors, harnesses, and loop assemblies. Loop assemblies will include the saw cut loop and any belden required to complete the loop assembly back to the controller cabinet.

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660-2 Materials: Follow the Florida Standard for Road and Bridge Construction.

660-3 Installation Requirements:

660-3.1 Inductive Loop-Detector Units: Follow the Florida Standard for Road and Bridge Construction.

660-3.2 Saw Cuts: 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. 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.

The loop and lead-in will be cut so that the wire will not take more than a 55° angle at any corner.

Make saw cuts in accordance with the FDOT Design Standards, Index No. 17781. Ensure the top conductor of the loop wire or lead-in cable is a minimum of one inch below the final surface of the roadway. The depth of any saw cut will be three inches minimum.

In cases where new loops are being installed over the top of existing loops, an additional saw cut will be made in the existing loop at the top and bottom of the loop. This will ensure the existing loop does not interfere with the operation of the new loop that is being installed.

660-3.3 Loop Wire: Follow the Florida Standard for Road and Bridge Construction.

660-3.4 Lead-In Cable: Follow the Florida Standard for Road and Bridge Construction.

660-3.5 Loop Position: *All loops will be positioned in the center of the lane. The front portion of the loop for stop bar loops will normally be two feet behind stop bar. Main street through loops are normally 6'X6' (Type B) loops located 50 feet behind the stop bar. If the plans call for a longer than normal loop (30' or 40'), the front of the loop will be positioned 8' to 10' in front of the stop bar. Check with the Hillsborough County Signal Inspector prior to cutting the loop to ensure proper placement. If the final placement of the stop bar results in the loop position being incorrect, the signal contractor will have to re-cut the effected loop at no cost to the county.*

660-3.6 Loop Window: *The loop window will be installed as specified by FDOT Design Standard, Index No. 17781. The loop window will not exceed 6"X6" and will not be installed in cross walks or stop bars.*

660-4 Splicing and Termination Requirements:

660-4.1 Splicing: Splice lead-in cable to the loop wire in accordance with FDOT Design Standards, Index No 17781. Perform the splicing in a pull box located off the roadway. *There will be no splices inside conduit or in the roadway.*

Each wire splice will have its own splice capsule including the cable jacket of the belden wire. A splice capsule similar to the 3M DBR splice will be used. The bare ground of the belden will be cut off flush with the outer insulation prior to inserting in the splice capsule.

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Ensure that each loop has an individual cable or belden to the cabinet.
Loops will not be terminated in series or parallel in the pull box. Each loop will have its own belden (if applicable) and its own loop detector in the controller cabinet. **660-**

4.2 Termination: Follow the Florida Standard for Road and Bridge Construction.

The bare ground wire of the belden will be terminated on the appropriate ground lug on the loop panel.

660-5 Loop Assembly Identification:

Identify and tag each loop assembly in the controller or detector cabinet by lane and movement number. *Use a permanent marker to write on tag or marker.*

Example:

EB O/S – Phase 6

EB Center – Phase 6

EB I/S - Phase 6

In the case of new signal installations, loops will be numbered L1, L2, etc starting with the first loop clockwise from the controller cabinet and continuing in a clockwise direction around the intersection.

660-6 Testing Requirements:

660-6.1 Series Resistance: *Obtain the Hillsborough County or FDOT Traffic Signal Resistance Measurement Data Sheets from Hillsborough County or the FDOT engineer. Measure and record the series resistance of each loop assembly on these Data Sheets. Leave a copy in the controller cabinet.*

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. The final resistance of the loop will be 10 Ω or less. If 10 Ω or less can not be achieved after cutting the loop, the loop will have to be re-cut at no cost to the county.

660-6.2 Insulation Resistance: Follow the Florida Standard for Road and Bridge Construction. *Ensure that any loop that was tested with an insulation tester is discharged to ground prior to terminating on the loop panel. Ensure that the insulation resistance of any loop assembly meets the FDOT requirement for insulation resistance.*

660-7 Turn On Requirements:

Follow the Florida Standard for Road and Bridge Construction.

660-8 Method of Measurement:

Follow the Florida Standard for Road and Bridge Construction.

660-9 Basis of Payment:

Follow the Florida Standard for Road and Bridge Construction.

Section 661
VIDEO VEHICLE DETECTORS

661-1 Description:

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Install video vehicle detection (Econolite Solo Terra™) including cameras, cabling, and peripheral equipment in the controller cabinet.

661-2 Materials:

All video vehicle detection equipment installed in Hillsborough County will be the Econolite Solo Terra video detection equipment unless specifically specified different by Hillsborough County Traffic Engineering.

661-3 Installation:

Follow the specification requirements dictated by the manufacturer.

All cameras will be located on the lane line between the left turn lane and thru lane except in cases where there is more than one camera per approach. If there is no left turn lane, the camera will be located in a position that centers the camera with the approaching lanes.

The contractor installing the video detection will liaison with the Econolite factory representative to determine the best cable to use. The Solo Terra™ requires a three-wire cable to connect from the camera to the interface panel. The cable will be continuous from the camera to the interface panel with no splices.

The signal contractor will be responsible for the initial set up of the video detection. This can be achieved through the use of the contractor's own trained employees or with a factory field technician. If the video detection was initially set up for MOT, a final video detection set up will be performed by the contractor prior to final acceptance. The video detection set up will be such that no false calls are observed and there are no dropped calls. The zones will be properly assigned to the phases they are to call. No delay will be programmed using the video programming.

661-4 Method of Measurement:

661-4.1 Furnish and Install: *the contract unit price for Video Vehicle Detection, furnished and installed will be for an entire intersection (unless specifically stipulated by Traffic Engineering), will include all necessary cameras, cables, interface units, buss interface units, power supplies and technical support.*

661-4.2 Furnish: *the Contract unit price for Video Vehicle Detection, furnished, will include the cost of delivering (including shipping and handling) the required video vehicle detection equipment for an entire intersection to the specified location. **The furnished items will include** all specified cameras, cables, interface units, buss interface units, power supplies and technical support.*

661-5 Basis of Payment:

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

Payment will be made under:

Item No. 661- Video Vehicle Detection – each

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**Section 662
3-M OPTICOM™ PRIORITY CONTROL PRE-EMPTION
DETECTION**

662-1 Description:

Install 3-M Opticom™ Priority Control Pre-emption detection including detectors, cabling, discriminator, discriminator rack (if required), green sensing harness (if required), and other peripheral equipment necessary to provide a complete operational 3-M Opticom™ system.

662-2 Materials:

All 3-M Opticom™ Priority control pre-emption detection equipment installed in Hillsborough County will be the 3-M Opticom™ Priority control pre-emption detection equipment. It will include 721 detectors, cabling, the Opticom™ 754 or 764 discriminator, a discriminator rack (as required), and a green sensing harness (as required).

662-3 Installation:

Follow the specification requirements dictated by the manufacturer.

All Opticom™ detectors will be installed in a location on each approach to provide for optimal reception of the optical signal transmitted by the emergency vehicle.

Use Opticom™ factory cables only to connect the detectors to the controller cabinet. There will be no splices in any Opticom™ cable.

The signal contractor will be responsible for the initial set up of the 3-M Opticom™ detection system. This can be achieved through the use of the contractor's own trained employees or with a factory field technician. The 3-M Opticom™ detection system set up will be such that the 3-M Opticom™ emitter can be received from about ¼ mile. Specific emitter programming will be set-up by Hillsborough County.

662-4 Method of Measurement:

662-4.1 Furnish and Install: *The contract unit price for 3-M Opticom™ Priority control pre-emption detection equipment, furnished and installed, will include all necessary 721 detectors, factory cables, discriminator, discriminator rack (as required), and green sensing harness (as required).*

661-4.2 Furnish: *The Contract unit price for Video Vehicle Detection, furnished, will include the cost of delivering (including shipping and handling) the required video vehicle detection equipment to the specified location. The furnished items will include will include all necessary 721 detectors, factory cables, discriminator, discriminator rack (as required), and green sensing harness (as required).*

661-5 Basis of Payment:

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

Payment will be made under:

*Item No. 662-3M Opticom™ Priority control pre-emption detection –
each*

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**Section 665
PEDESTRIAN DETECTOR ASSEMBLY**

665-1 Description:

Follow the Florida Standard for Road and Bridge Construction.

665-2 Materials:

Pedestrian detectors will be FDOT APL approved Piezo style ADA pushbuttons or a Polara Navigator™ assembly which includes the Central Control Unit (CCU) in the controller cabinet, the Polara Navigator™ pushbutton stations, and the Polara Configurator as determined by Hillsborough County Traffic Engineering. The Polara Navigator™ is to be only used when specifically determined by Traffic Engineering.

665-3 Installation:

Meet the requirements of 653-3.1, except as follows. Connect the lead-in wires to the detector in order to provide proper operation when connected to the controller. The pedestrian detector wires will be individual single pair belden wires connected to the detector and then going back to the controller cabinet without any splices through low voltage conduits. The pedestrian detector wires will not share a cable with any other device including the pedestrian signal head assembly.

Install the pedestrian detector assembly at a location and mounted in a manner to meet ADA requirements and to facilitate the use of the FDOT FTP-69B-06 pedestrian sign. The FTP-69B-06 sign will be mounted above the pedestrian detector. The detector and sign will be orientated correctly to allow the sign to be used with a left or right arrow. The detector will have to be ADA accessible compliant with a sufficient level surface where the sign and detector are located. Ensure that all detectors used are of the same manufacturer and model. Only ADA compliant detectors can be used. When Polara Navigator is required, the Navigator pushbutton assembly will have the equivalent Polar Option C sign as the FDOT FTP-69B-06. The Navigator pushbuttons will have the following features as a minimum:

- *confirmation of button push via latching LED, sound and vibrotactile bounce.*
- *Direction of travel voice with extended button push.*
- *Locating tone during Don't Walk.*
- *Cuckoo, chirp, and voice message during walk.*
- *Verbal countdown during pedestrian clearance.*
- *All sounds automatically adjust to ambient noise over 60db range.*

Consider the plans to be sufficiently flexible to allow for unanticipated field conditions at the site. The Engineer will direct any variation from the locations shown. Mount the pedestrian detector assembly (ADA button or Polara Navigator) at the height (center of push-button) of 3-1/2 to 4 feet above the clear floor space on the sidewalk *or landing pad*. When mounting, place the detector housing or saddle in complete contact with the pole. Do not mount the pedestrian detector on the controller cabinet. The pedestrian detector assembly and sign will be

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mounted to allow for the use of the arrow shown on the pedestrian sign. When a post is required in the installation of the pedestrian detector assembly, restore the area around the post to its original condition or as required by the plans.

When the Polara Navigator pedestrian pushbutton system is required, a Polara Central Control Unit (CCU) will be required inside the traffic controller cabinet. The contractor will wire power for the Polara CCU in the controller cabinet as specified by Hillsborough County Traffic. Do not use a 3-prong electric plug to obtain power for the CCU. The contractor will install and wire the Polara CCU and Polara Navigator push buttons per the manufacturer's written installation specifications. The following setting for the buttons will be pre-set by the factory or contractor prior to acceptance:

RECOMMENDED NAVIGATOR VOLUME SETTINGS

When setting up Navigator volumes it is important that they be set so that the volumes are adequately loud for the users to hear, but not so loud that they unreasonably disturb people living near the intersection or mask the traffic noise for the visually impaired pedestrian. Because ambient noise and traffic levels at intersections can vary significantly, our customers have asked us to provide recommended settings for typical intersections. In an attempt to provide this, below are shown our current default settings, along with three typical intersection types with our recommendations for settings. The description for each type is detailed below.

A key factor in making volumes loud enough for users, but not disturbing to the surrounding public, is to use the extended push feature (pushing the button for 1 second or longer) to boost the volumes for a single walk cycle. The volumes can be set to play louder during the walk and clearance phase following an extended push. The settings below assume utilization of this feature.

CONFIGURATOR SETTING DESCRIPTION	DEFAULT SETTING	INTERSECTION TYPE		
		<u>A</u>	<u>B</u>	<u>C</u>
LOCATE VOL MIN	10%	0	0	40%
LOCATE VOLUME MAX	50%	50%	65%	75%
INFO MSG VOL MIN	60%	65%	70%	75%
STD WALK VOL MIN	40%	30%	40%	60%
STD WALK VOL MAX	70%	60%	70%	100%
EXT WALK VOL MIN	60%	60%	70%	75%
EXT WALK VOL MAX	80%	80%	90%	100%
VOL OVER AMBIENT	0 Db	0	0	0

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All settings that follow these are at the customer's preference.

If any of the above settings are close, but not quite loud enough, an option is to change the VOL OVER AMBIENT to +5 which will boost all volumes by 5 dB. You must realize that in quiet conditions the volumes will stay 5dB higher so be sure this will not be disturbing to people living near by. The +10 dB setting should only be used on "C" type intersections where you want the volumes very loud and there is no concern about disturbing the surrounding public.

Based on the studies that helped us to arrive at these recommendations, Polara will be changing in the near future our default settings to match the Type "A" settings.

DESCRIPTION OF INTERSECTION TYPES

TYPE "A"

This would be a typical neighborhood intersection where ambient volumes are typically low and get very quiet at night. The traffic volume is usually fairly light and homes may be closely located to one or more corners. These settings will give the lowest possible settings in low ambient conditions.

TYPE "B"

This would be a typical city intersection where there are fairly high traffic volumes and moderate to occasionally high ambient conditions. Ideally, with these settings you do not want someone's bedroom window within 15 to 20 feet of the push button station. If this is the case, the volume levels may need to be turned down below those recommended.

TYPE "C"

This would be a typical large intersection or high ambient noise intersection with no one living within 50-100 feet of the corner. On this type of intersection the volumes are wanted and needed to be loud.

The contractor will contact Hillsborough County Traffic Division Operations (Traffic Signal) office as to any other specific settings for the Polara Navigator push buttons.

665-4 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

665-5 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.

Section 670 TRAFFIC CONTROLLER ASSEMBLY

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670-1 Description:

Follow the Florida Standard for Road and Bridge Construction.

670-2 Materials:

For Hillsborough County, use a Naztec TS2 Type 1 controller in TS2 Type 1 controller cabinet and a Naztec TS2 Type 2 controller in TS1 cabinets.

670-3 Installation Requirements:

Follow the Florida Standard for Road and Bridge Construction.

670-4 Method of Measurement:

Follow the Florida Standard for Road and Bridge Construction.

670-5 Basis of Payment:

Follow the Florida Standard for Road and Bridge Construction

Section 672
24/7 SOLAR FLASHING BEACON ASSEMBLY

672-1 Description:

Install 24/7 solar flashing beacon assembly.

672-2 Materials: *The 24/7 flasher assembly will be on the FDOT APL list. It will be furnished with the necessary mounting hardware to mount on a 4-1/2" OD aluminum pole. The 24/7 flasher may be a single head design or a dual head design (wig/wag). The 24/7 flasher will be designed to operate for extended periods of time with minimal sunlight. Hillsborough County Traffic Engineering will determine whether the single head or dual head design is utilized.*

672-3 Installation: *The 24/7 flasher will be mounted on a 4-1/2" OD aluminum pole. All installations will require a slip type breakaway device as shown in FDOT Design Standard Index 11860 unless mounted on a concrete raised median.*

672-4 Method of Measurement:

672-5 Basis of Payment:

Section 676
CONTROLLER CABINETS

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676-1 Description: *Install NEMA TS1 and NEMA TS2 Type 1 Group IV and V Traffic Signal Controller Cabinets. For installation in Hillsborough County, these cabinets will be manufactured by Naztec.*

676-2 Materials: *Use Traffic Controllers listed in the FDOT APL list that are manufactured by Naztec. Ensure that all Traffic Controllers are marked in accordance with Section 603 and the markings are visible after installation.*

All Hillsborough County Naztec Traffic Controllers will have the following equipment in addition to the normally configured traffic controller cabinet:

- a. A Naztec GPS that interfaces with the Naztec controller.*
- b. An uninterruptible power supply (UPS). The UPS must be listed on the APL list and installed and/or delivered from Naztec as part of the controller cabinet.*
- c. A fiber optic patch panel or a copper Ethernet switch. Check with Hillsborough County Traffic Engineering prior to ordering cabinet to ensure correct equipment is ordered for application.*
- d. Generator plug and transfer switch. Configuration of this switch will comply with the FDOT Minimum Specification for Traffic Control Signal Devices.*
- e. All controller cabinets' outer surface will be powder coated Dupont Alesta powder coating Moss Green (RAL 6005) with the inside of the cabinet painted white.*

676-3 Installation Requirements:

676-3.1 General: *Install controller cabinets in accordance with the FDOT Design Standards, Index No 17841. Ensure all conduit entries have bell ends or grounding bushings prior to pulling any cables. Ensure the bottom of the cabinet is sealed to the controller cabinet foundation by the use of clear silicone rubber sealant.*

676-3.2 Pole Mounted Cabinets (Types 1, 2, 3, and 4): Follow the Florida Standard for Road and Bridge Construction.

676-3.3 Base Mounted Cabinets (Type 4 and 5): Follow the Florida Standard for Road and Bridge Construction.

676-4 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

676-5 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.

**Section 699
INTERNALLY ILLUMINATED SIGNS**

699-1 Description: Follow the Florida Standard for Road and Bridge Construction.

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699-2 Materials:

699-2.1 General: Follow the Florida Standard for Road and Bridge Construction.

699-2.2 Hardware: Follow the Florida Standard for Road and Bridge Construction.

699-2.3 Clamp-On Cantilever Arm: Follow the Florida Standard for Road and Bridge Construction.

699-2.4 Type of Sign: *The Hillsborough County internally illuminated sign will be an LED type sign.*

699-3 Submittal Requirements:

699-3.1 General: Follow the Florida Standard for Road and Bridge Construction.

699-3.2 Acceptance of signs by Certification: **Meet all the following requirements:** Follow the Florida Standard for Road and Bridge Construction.

699-3.3 Acceptance of signs by Shop Drawing Approval: Follow the Florida Standard for Road and Bridge Construction.

699-3.4 Acceptance of Clamp-On Cantilever Arms: Follow the Florida Standard for Road and Bridge Construction.

699-3.4 Street Names and Block Numbers: *Prior to having any sign manufactured, the contractor will confirm the street names and block numbers with Hillsborough County 911 Streets and Addresses. A copy of the confirmed street name and block number document received from 911 Streets and Addresses will have to be presented if there appear to be any inaccurate internally illuminated sign street names or block numbers. It is the responsibility of the contractor to ensure the accuracy of these signs.*

699-4 Installation:

699-4.1 General: Follow the Florida Standard for Road and Bridge Construction.

699-4.2 Single Sided Sign Assembly: Follow the Florida Standard for Road and Bridge Construction.

699-4.3 Double Sided Sign Assembly: Follow the Florida Standard for Road and Bridge Construction.

699-4.4 Clamp-On Cantilever Arm: Follow the Florida Standard for Road and Bridge Construction.

699-4.5 Electrical Wiring: *Install dedicated 14AWG (3-wire) conductors to supply power to the signs. Connect the conductors to a dedicated 15 amp circuit breaker located in the traffic controller cabinet. Internally illuminated sign cables are required to be installed in high voltage (above 35VAC) conduits. Do not install these cables in the same conduits as loops, video detection, communication cable or Opticom cables.*

Install conductors in such a manner as to prevent damage to conductors or conductor insulation. Any damaged conductors or insulation will require the cable to be replaced at no additional cost to the county.

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Ensure drilled hole(s) through which conductor(s) pass through are fitted with tight fitting rubber grommet(s) or other similar protective device that is securely fastened to the sign.

Install continuous lengths of conductors between the internally illuminated street name sign and the controller cabinet. When two signs are installed on the same strain pole or mast arm pole, the supply cable can be daisy chained between the two signs and one power cable feed can be supplied to the controller cabinet. The daisy chained cables must be terminated inside the illuminated sign. If this is not possible, an individual cable must be run for each sign.

Do not splice the supply conductors or cables at any other point.

A photo-eye control panel will be provided in the controller cabinet. All signs will be controlled by this one photo-eye assembly. Any factory installed photo eye within the illuminated sign will be bypassed. All power cable feeds from the signs will be terminated on this photo-eye assembly. The dedicated circuit breaker for the illuminated sign will provide power to this photo-eye assembly.

699-5 Method of Measurement: Follow the Florida Standard for Road and Bridge Construction.

699-6 Basis of Payment: Follow the Florida Standard for Road and Bridge Construction.