

[Include the following as necessary where bridge mounted electronic signs systems are present on bridge structures to be demolished in the contract:]

SECTION 210 – DEMOLITION OF EXISTING STRUCTURES

210.02 METHODS OF CONSTRUCTION

The following is added to the end of this subsection:

Removal and salvaging of bridge mounted electronic sign systems shall be as specified in Division 600.

210.05 PAYMENT

The following is added:

Removal and salvaging of bridge mounted electronic sign systems shall be paid for separately under Division 600.

SECTION 406 - SIGN SUPPORT STRUCTURES

406.05 ERECTION OF SIGN SUPPORT SYSTEMS

The following is added after the first paragraph:

Prior to removing an existing sign structure or installing a new one, the Contractor shall submit details of the operation to the Engineer for approval at least 72 hours in advance.

[Include in contracts involving removal of existing overhead sign structures.]

The following existing overhead sign structures shall be removed as a part of this Contract:

Span Sign Structure No. [insert number], located at [insert location].
Cantilever Sign Structure No. [insert number], located at [insert location].
Butterfly Sign Structure No. [insert number], located at [insert location].

These existing sign structures shall not be removed until they are no longer necessary. Any existing sign panels that conflict with a new traffic pattern shall immediately be removed from the sign structure and the sign illumination shall also be disconnected.

All sign panels, truss frames, arms, walkways, lighting, hardware, etc. that is deemed salvageable by the Engineer shall be loaded, transported and off-loaded by the Contractor to the Authority's storage yard located at [insert location]. Any non-salvageable items shall be disposed of in a satisfactory manner off Turnpike property by the Contractor.

Sign structure footings shall be removed to a depth two (2) feet below finished grade and backfilled. Removal of the sign structures and footings shall be performed with extreme care so as to avoid damage to the facilities of the NJ Turnpike and to prevent any needless interference or delays to Turnpike patron traffic.

[Include for Authority furnished sign structure.]

The following overhead sign structures shall be erected as part of this Contract:

Span Sign Structure No. [insert number], located at [insert location].
Cantilever Sign Structure No. [insert number], located at [insert location].
Butterfly Sign Structure No. [insert number], located at [insert location].

The Authority shall furnish the sign support truss assemblies and end frames and the Contractor is responsible for furnishing all labor equipment necessary for delivering these items to the job site, erecting them on new pedestals, furnishing and installing all other required materials, such as sign hangers, horizontal support arms for walkways and luminaire support channels, walkway gratings, luminaire support channels, handrails, maintenance ladders and miscellaneous hardware resulting in a completed overhead sign structure in accordance with the plans, specifications and as directed by the Engineer.

Removal and salvaging of electronic sign systems from overhead sign structures that are to be removed shall be as specified in Division 600

406.08

PAYMENT

The following is added:

<i>PAY ITEM</i>	<i>PAY UNIT</i>
Remove Existing Span Sign Structure No. _____	Lump Sum
Remove Existing Cantilever Sign Structure No. _____	Lump Sum
Remove Existing Butterfly Sign Structure No. _____	Lump Sum
Install Overhead Span Sign Structure No. _____	Lump Sum
Install Overhead Cantilever Sign Structure No. _____	Lump Sum
Install Overhead Butterfly Sign Structure No. _____	Lump Sum

Removal and salvaging of electronic sign systems from overhead sign structures that are to be removed shall be paid for separately under Division 600.

SECTION 508 - CONCRETE MEDIAN BARRIER

508.01 DESCRIPTION

The following is added:

This work shall also consist of the construction of Variable Message Sign (VMS) Equipment Medians

508.02 MATERIALS

The following is added:

Common Embankment.....203.02(A)
Fencing.....914
Class A Concrete.....905.05(A)

508.03 METHODS OF CONSTRUCTION

The following is added:

Shop drawings shall be submitted in accordance with Subsection 104.08 of the Standard Specifications for all components of the VMS Equipment Median.

Where shown on the plans and as directed by the Engineer, the Contractor shall construct VMS Equipment Medians in accordance with the details shown. Median barrier shall be constructed as specified in Subsection 508.03(A). Conduits, junction boxes, cabinet foundations, power equipment, and wiring shall be provided as shown on the Plans. Install power equipment on the VMS Median as shown on the Plans.

(C) Extrusion of Slip-Form Construction - Roadway Section.

The following is added:

Variable height concrete median barrier will require site specific different forms than those normally associated with this work. Special extrusion (slip-form) equipment and techniques will be required for molding the variable height median barrier. The narrower than normal median width in some areas of the proposed variable height barrier may also restrict the Contractor's choice of equipment.

508.04 MEASUREMENT

The following is added:

VMS Equipment Medians will be measured by the number of each constructed to the limits shown on the plans.

508.05 PAYMENT

The following is added:

PAY ITEM	PAY UNIT
VMS EQUIPMENT MEDIAN	EACH

Overhead sign structure footings, drilled shafts, anchor bolts and reinforcement steel will be paid for separately as per Division 400.

No separate payment will be made for conduits, junction boxes, foundations, power equipment, and wiring installed within the limits of the VMS Equipment Median. All costs thereof shall be included in the VMS Equipment Median Pay Item. Payment for installation of SCC cabinet within the VMS Equipment Median shall be made as per Division 600.

Conduits, wiring, manholes/junction boxes and cabinets located outside the limits of the VMS Equipment Median will be paid as per Division 600.

[Include the following as necessary in contracts where ground mounted electronic signs systems are to be removed and / or when electronic sign systems are to be removed from overhead sign structures to remain:]

SECTION 509 - SIGN PANELS

509.03 METHODS OF CONSTRUCTION

(O) SIGN REMOVALS

The following is added to the end of this Paragraph:

Removal and salvaging of electronic sign systems from overhead sign structures that are to remain shall be as specified in Division 600.

Removal of ground mounted electronic sign systems and salvaging of materials shall be as specified in Division 600.

509.05 PAYMENT

The following is added:

Removal of electronic sign systems from overhead sign structures to remain shall be paid for under Division 600.

Removal of ground mounted electronic sign systems, including sign posts and foundations, shall be paid for under Division 600.

DIVISION 600 - ELECTRICAL

[Include the following as necessary:]

SECTION 601 - COMMON ELECTRICAL PROVISIONS

601.01 DESCRIPTION

The following is added:

The electrical work under this project shall include installation of power and communications systems for the proposed Intelligent Transportation Systems (ITS) Stations and Devices. ~~Electrical work to be performed under this Contract shall pertain to all necessary installations~~ and/or modifications related to those existing electrical facilities affected by the proposed safetywalk and sidewalk reconstructions under this Project. The electrical work shall include providing temporary facilities as required to maintain continuity of illumination, conduit replacements in safetywalks and under sidewalks, furnishing and installing temporary cables and ground wire, reinstalling existing cables and ground wire, junction box reconstructions, resetting junction box frames, making all necessary cable connections, grounding and testing; ~~removing existing equipment, providing connections to new utility services and utility coordination and providing all required incidental work, all in accordance with the Plans, these Specifications and as directed by the Engineer.~~

The nature and extent of electrical work within and adjacent to each work area, as indicated on the Plans are based on the best available information. However, no guarantees are made as to the accuracy or completeness of this information. The Contractor is hereby advised that it shall be his responsibility to verify such information and obtain the approval of the Engineer before proceeding with the work in each work area.

The existing power distribution systems within the limits of this Contract operate at various voltages (below 600 Volts) and configurations (single- and three-phase), as shown on the Plans. The roadway and sign lighting systems at all work sites within the limits of this Contract, are of 2400V Class for series lighting circuits and 460V or 480V Class for the multiple circuits and therefore, all required electrical work must be performed in an approved manner and in accordance with the standard procedure for the class of voltage. The systems shall be maintained so that all roadway, ~~and~~ sign lighting ~~and ITS~~ facilities will be in service at all times, during hours of darkness or in fog conditions.

The Contractor shall obtain approval from the Authority's Electrical Maintenance Department, through the Engineer, to disconnect the electric service for the roadway lighting and sign feeder circuits, prior to commencing with any work either directly related to or within the close proximity of the existing electrical facilities. The Contractor is responsible for "Tagging-Out" all circuits he will be working with. At the end of the outage and prior to darkness, the Contractor is to remove his tag and restore the circuit. The Authority will not remove a Contractor's "Tag". The Contractor will be responsible to restore service.

The Contractor shall furnish and install all temporary cables and ground wire, where required, to accommodate the removal and reinstallation of any existing 24-hour changeable message sign or navigational lighting power circuits which shall be maintained as operational at all times.

601.02 MATERIALS

The following is added:

<i>Fiber Optic Cable - Single Mode</i>	<i>918.07(G)</i>
<i>Fiber Optic Cable - Multimode.....</i>	<i>918.07(H)</i>
<i>Fiber Optic Cable - Termination Connector</i>	<i>918.07(I)</i>
<i>Concrete for Duct Bank Encasement</i>	<i>905 (Class C)</i>
<i>HDPE Conduits and Innerducts</i>	<i>918.35</i>
<i>Directional Drilled Pipe Sleeves</i>	<i>918.36</i>
<i>Rodent Blocking.....</i>	<i>918.45</i>
<i>Polymer Concrete Junction Box.....</i>	<i>918.47</i>

(E) Shop Drawings

The following is added:

Items for which shop drawings and catalog cuts shall be submitted shall include but not be limited to the following:

- Conduits, Cables and Wires
- Cable Connector Kits
- Grounding and Termination Devices

(F) Connection with Utility Service

The following is added:

The Contractor shall comply with all utility company requirements for electric meter, disconnect, and current transformer and cabinet, where required. Should deviations from the details shown on the Plans be required, the Contractor shall make all necessary design modifications and obtain the approval of the Engineer prior to construction through the Shop Drawing process. The Contractor shall perform coordination with the Authority, obtain all utility and third-party inspections and approvals, and perform work as shown on the Plans to obtain connection by the utility. Any delay(s) in obtaining the approval(s) shall not be considered as the basis of extra(s)

The following is added:

All conduits entering signs and cabinets shall be sealed with rodent blocking material after installation of all wires and cabling.

Where ITS duct bank power conduits between pull points are empty, a tracer wire shall be installed inside one spare conduit of the run. The Tracer wire shall be fourteen (14) gauge minimum solid THHN copper with thermoplastic insulation recommended for direct burial. At least four (4) feet of slack tracer wire, properly labeled shall be present at every junction box location where the conduit is accessible.

(A) Flexible Metallic Conduit

The following is added:

Length of flexible metallic conduit sections used shall be no longer than 6 feet. Two sections of flexible metallic conduit shall not be connected together.

If connected to PVC coated galvanized conduit, the color of flexible metallic conduit shall match that of the connecting coated conduit. Color shall be integral to the flexible metallic conduit, and shall not be applied in the field by use of paint or other methods.

(B) Rigid Metallic Conduit

The following is added:

The end of the existing conduit at the face of concrete removal shall be cut square and smooth. Enough concrete around the conduit in that portion of the safetywalk to remain shall be carefully hand chiseled to permit the installation of a coupling-adaptor to connect the existing conduit to new steel conduit. During safetywalk and curb surface repairs, the Contractor shall exercise utmost care so as not to damage any existing galvanized steel conduit(s) embedded in concrete. Should any conduits be damaged during the construction or any deteriorated conduits found, as determined by the Engineer, the damaged or deteriorated portion of the conduit(s) shall be replaced as follows:

- (1) Existing lighting cables and ground wire shall be disconnected at both ends, removed and reinstalled for temporary service, as prescribed in Subsection 601.07.
- (2) Temporary cables and ground wire for 24 hours circuits shall be provided and connected as prescribed in Subsection 601.07, where required, to maintain the continuous operation of these circuits.
- (3) Damaged or deteriorated section of the steel conduit shall be removed from coupling points and replaced with new galvanized steel conduit section(s). This work shall be accomplished by providing temporary service, as prescribed in Subsection 601.07.

Conduit (s) damaged by the Contractor's operation during safetywalk and curb surface repair construction shall be repaired by replacement of the damaged section(s) of the conduits to the satisfaction of the Engineer. Upon completion of the conduit repair work, each conduit run shall be rodded throughout its entire length with a mandrel in conformance with Subsection 601.07, and new cables and ground wire shall be installed between the junction boxes connected by the repaired conduit run(s). All costs for the prescribed conduit repairs and new cable and ground wire installation shall be borne by the Contractor at no additional cost to the Authority.

In addition, the Contractor shall connect the new steel conduit (s) to existing expansion couplings at all expansion joints, where required. If the existing expansion coupling(s) are judged to be nonfunctional, in the opinion of the Engineer, then the Contractor shall replace such expansion couplings with new units, equal to O-Z Gedney Type AX with Type BJ bonding jumper.

Installation of the expansion couplings shall be made in accordance with the manufacturer's installation instructions and the Authority's standard electrical drawings. The Contractor shall insure that the conduit entering the fitting at the expansion-contraction end is completely free of any concrete or other obstruction within the open joint which may otherwise prevent the fittings from performing properly.

[Use the following sections in contracts involving communication duct banks:]

The following is added:

(E) Duct Bank, Soil and Concrete Encased

Duct banks shall be installed underground at the locations shown on the plans. Duct banks shall either be encased in concrete or directly buried, as shown on the details.

Duct spacers shall be provided as shown on the Plans to maintain an even spacing of the conduits during concrete encasement or backfilling operations. Duct spacers shall be prefabricated out of high impact Polystyrene.

Ducts with concrete encasement shall have concrete around the ducts as shown on the Plans. Ducts with no concrete envelope shall be backfilled in accordance to Section 200.

(F) Duct Bank, HDPE Conduits Directional Drilled

This work shall consist of the installation of pipe sleeves under existing embankments and paved roadways installed using the horizontal directional drilled (HDD) method.

The work also includes installation of HDPE conduits within the 16"-HDPE pipe sleeves, and installation of HDPE innerducts within the communication conduits, and/or shown on the Plans.

1. Experience Requirements

Prior to the submission of bids, the Contractor or his subcontractor shall have completed the installation of at least 5,000 feet of directional-drilled piping on similar projects. Field supervisory personnel employed by the Contractor or his subcontractor shall have both the necessary experience and manufacturer training in the operation of the directional drilling equipment proposed to be used in the performance of the work.

2. Shop Drawing Submittals

Before directional drilling work may commence, the Contractor shall submit for approval, the specific details of the sleeve pipe, conduit, innerducts, and separators proposed for installation. This will include, but not be limited to, size, capacity and setup requirements of equipment, location and site of drilling and receiving points or pits, if necessary, and method of monitoring and controlling line and grade. If the Contractor determines that modifications to the method and equipment as stated in the original submittals are necessary, the Contractor will submit details of and reasons for such modifications.

Also, the Contractor shall submit information pertaining to the following drilling materials: Material Safety Data Sheets (MSDS) sheets, any necessary safety precautions or procedures, and proposed methods of removing spoils.

Drilling operations shall not interfere with, interrupt or endanger either surface or subsurface developments. The Contractor shall comply with all applicable jurisdictional codes and OSHA requirements.

In the event the Contractor deems it necessary to obtain additional information to proceed with the work, they shall obtain additional subsurface information as needed. Costs associated with this effort shall be the exclusive responsibility of the Contractor. Furthermore, the Contractor shall not make any claims for additional compensation for additional work made necessary as a result of existing subsurface conditions.

The Contractor shall submit a "frac-out" contingency plan which provides

specific procedures and steps to contain the inadvertent release of drilling mud (frac-out) used during installation of sleeve pipe utilizing HDD.

3. Drilling Equipment

The drilling equipment shall be specifically designed to create a bore hole then ream the hole to the diameter necessary for the simultaneous insertion of the sleeve pipe. Sleeve pipes shall be installed at the locations and grades as designated on the Plans.

The drilling equipment shall be capable of placing the specified sleeve pipe at the planned line and grade without inverted slopes or deflection in accordance with these Specifications. The equipment must be capable of pulling the sleeve pipe from either the downstream or upstream pull box location. The number of pits shall be kept to a minimum. The equipment must be capable of boring the specified lengths, from pull box to pull box, in a single bore.

Since sleeve pipe selection is dependent upon equipment pullback force, the proposal and approval of the use of equipment with a pullback rating greater than the maximum pullback force specified may invalidate the proposed piping.

Throughout the insertion process, the Contractor shall constantly measure and record axial tension force readings on the pipe material, the insertion velocity, the mud flow circulation and exit rates and the length of pipe installed. Furthermore, the equipment shall have a guidance system that has the capability of measuring inclination and azimuth. The guidance system shall have an independent means of ensuring the accuracy of the installation. The Contractor shall demonstrate a viable method to eliminate accumulated error due to the inclinometer (pitch or accelerometer). The guidance system shall be capable of generating a plot of the borehole survey showing depths of the installed piping along its entire length. The scale of the plot of the borehole survey shall be the same as that shown on the project profile sheets. Depths shown on the plot of the borehole survey shall be accurate to 1/10 of a foot. The guidance system shall have an inclination accuracy of 0.01 % of grade, a range of 1/10 of a foot, an azimuth repeatability of 0.1 % of grade and a range of 1/10 of a foot.

The Contractor shall measure the repeatability of the inclination/azimuth before drilling commences.

4. Drilling Fluid

Drilling fluid shall be a mixture of water and Bentonite clay. Information regarding use of any other proposed drilling fluids shall be submitted to the Engineer for approval at least two (2) weeks before beginning drilling operations.

Disposal of excess drilling fluid and spoils shall be the responsibility of the Contractor. Excess drilling fluid and spoils shall be disposed at a location approved by the Engineer.

Drilling fluid returns caused by fracturing of formations at locations other than the entry and exit points shall be minimized. The Contractor shall immediately clean up any drilling fluid that is exposed through fractures.

The Contractor shall be responsible for making provisions for a clean water

supply for the mixing of drilling fluid.

5. Site Set-up

Equipment set-up shall be determined by the Contractor and submitted to the Engineer per the requirements as stated in this Section. The entry angle of the pilot hole and the boring process shall maintain a curvature that does not exceed the allowable bending radii of the product pipe per the piping manufacturer. The set-up shall account for pipe bending in the vertical and horizontal directions, as well as the set-up and spacing needed for the butt-fusion process.

6. Safety

At the location of the work, the Contractor shall be solely responsible for the safety of all parties.

The drilling equipment shall have an alarm system capable of detecting electrical current.

7. Directional Drilling Methods

Directional drilling shall conform to the following methods and submittal requirements pertaining to the installation of sleeves and/or pipes under existing embankments and paved roadways of the New Jersey Turnpike Authority:

- a. The minimum allowable cover under roadways is 6 feet at the center of the roadway measured between the top of sleeves/pipes to top of pavement. Minimum cover under ditches is 3 feet measured from top of sleeve or pipe to invert of ditch. Pretreatment of soils or other soil stabilization techniques intended to reduce the minimum cover shall be approved by the Engineer.
- b. Sending and receiving pits located beyond 30 feet from the outer edge of paved shoulders may have unsheeted sides provided a 1 to 1 slope can be maintained in accordance with the latest OSHA standards. The front face of the pit must be sheeted. Excavated material shall be placed on the side of the pit facing traffic to provide additional protection. Surplus and waste materials are to be disposed off Authority property in accordance with Section 206.
- c. It is the Contractor's responsibility to continually monitor the line and grade of the sleeve or pipe to detect abnormal horizontal and/or vertical movements. Necessary controls shall be provided to ensure proper horizontal and vertical alignment. The alignment shall be verified at any time at the request of the Engineer.
- d. Pits will not be allowed closer than 10 feet from the outer edge of the paved shoulder. The pit shall be sheeted, braced, and shored when the pit and/or receiving pit is 10 to 30 feet from the outer edge of the paved shoulder. The pit shall be designed to maintain the stability of the embankment and to provide for proper operation of the drilling equipment. End sections of sleeves or pipes which are damaged during installation shall be replaced without additional compensation.
- e. Entry or exit points shall not be installed in roadway medians.
- f. Detailed drilling operations and equipment shall be submitted to the Authority or their authorized representative for approval. Work is not to start before receipt of required approval.

- g. All work areas must be enclosed with orange plastic fencing to maintain security and safety of the work site.
- h. Strapping shall be stainless steel.
- i. Show cross section along proposed bore within Authority ROW.
- j. Detail means and methods to be used to ensure line and grade of pipe sleeve.
- k. Once pipe sleeve is advanced from the point of entry and is within 10' of roadway edge of pavement all work shall be continuous until casing is advanced to at least 10' beyond the roadway far edge of pavement.
- l. During boring operations, roadway shall be monitored for settlement and/or heave along the line of bore.
- m. Excavation and backfilling of the sending and receiving pits shall conform to Section 206.
- n. When pits are located between 10 and 30 feet from the outer edge of paved shoulder, a standard shoulder closing shall be required for the duration of the operation. In addition, a minimum of 30 feet of temporary concrete barrier is required in accordance with Turnpike standard drawings and in accordance with Section 800 of the Specifications. If the pit is constructed behind existing guard rail which meets current standards, temporary concrete barrier curb is not required.
- o. In the event an obstruction or other condition prevents the completed installation, a concrete plug shall be installed at the end of the pipe or sleeve and the remaining void shall be filled in a manner approved by the Engineer. Removal or withdrawal of a drilled pipe, sleeve or casing will not be permitted.
- p. Delays and/or inconvenience resulting from the presence of water or the pumping of water shall not be considered for additional compensation or extension of time but shall be considered incidental to the pipe or sleeve being installed.
- q. All welding must be performed by a certified welder.
- r. The work area shall be restored to its original condition upon completion of the installation subject to inspection and acceptance by the Authority. Care should be taken to protect adjacent trees and shrubs from injury during the progression of work.
- s. Extend the sleeve at least 10 feet beyond the limits of roadway pavement.
- t. Provide a method to seal the ends of the sleeve after installation of conduits within the sleeve. The method used shall provide a watertight seal. Provide shop drawings detailing the methods prior to commencement of any directional drilling operations.

Alternate Methods

An alternate method, other than directional drilling, may be employed if submitted and approved by the Engineer. If such approval is granted and the alternate method does not provide the desired results, use of such alternate method shall be discontinued and installation shall be completed by the

directional drilled method at no additional cost to the Authority.

8. **Insertion of Pipe Sleeve**

The Contractor shall follow the conduit sleeve alignment as shown on the drawings and in accordance with the Specifications.

In the event of difficulties encountered during boring operations that require the withdrawal of the directional-drilling equipment from the pilot hole, the Contractor shall be allowed to withdraw and abandon the boring and begin a second attempt. With the approval of the Engineer, the Contractor may excavate at the point of the difficulty to correct problems. Unless otherwise directed by the Engineer, any unsuccessful attempts at performing the specified directional drill, including any pipe installation, and any excavations performed by the Contractor to remove obstructions to the drilling process shall be made part of the contract amount and shall not serve as basis for claims for additional compensation. The sleeve provided may vary by drilling location, and shall be designed specifically for each installation based on grades, soil type, drilled length, access limitations, and other site-specific constraints.

The Engineer shall be notified immediately if any obstruction is encountered that stops the forward progress of drilling operations. The Engineer shall review both the situation and the Contractor's assessment thereof and then determine the feasibility of continuing drilling operations. When it is determined that it is impossible to continue drilling operations, the Contractor will be allowed to abandon the completed portion in place, unless otherwise directed by the Engineer. Abandonment of installed piping and sleeves shall be to the satisfaction of the Engineer. The Engineer shall determine the necessity of ordering an alternative construction method in place of horizontal directional drilling.

The sizing of the pilot hole reamed to facilitate the insertion of the specified pipe sleeve shall be minimized to maximize support for the pipe. Reaming diameter shall not exceed 120% of the outside diameter of the pipe sleeve being installed. The pipe sleeve being pulled into the pilot tunnel shall be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.

9. **Installation of Conduits**

After the pipe sleeve has been installed and accepted by the Engineer, the Contractor shall install HDPE conduits within the pipe sleeve as shown on the Plans. The conduits shall be continuous from one end of the pipe sleeve to the other.

The contractor shall install three (3) 1¼" HDPE innerducts in each communication conduit, as called out on the plans, under directional drill. Innerducts shall only be supplied in communications conduits within directional-drilled duct bank, regardless if the conduits or innerducts are slated for use under this Contract.

The Contractor will allow sufficient lengths of HDPE conduit to extend past the sleeve termination point to allow for contraction. Pulled HDPE conduit shall be allowed forty-eight (48) hours of stabilization prior to making final terminations or connections.

601.06 FOUNDATIONS, BOXES, MANHOLES AND BASES

The following is added:

The junction boxes, located within the proposed area of the safetywalk repairs, shall be

reconstructed, and in the area of approach sidewalk replacement, shall be raised to meet the proposed elevation of the new sidewalk, where shown on the plans and in conformance with the details shown on Standard Drawing E-5 and/or as directed by the Engineer. The existing frames and covers shall be salvaged and reused, with the following provisions.

The bolt holes in the frame, which is to be reused, shall be retapped. The existing screws for covers shall be replaced with new matching stainless steel flat head screws. The existing gaskets between the frame and cover shall be replaced with new 1/8" thick neoprene gaskets.

In addition, upon completion of junction box reconstruction and resetting, all debris therein shall be removed to assure that the drain holes or pipes are thoroughly clear and free of any obstruction.

Existing concrete junction boxes, junction box foundations and manholes requiring a greater than 6 inch adjustment to final grade shall be replaced.

Junction Box, Type PS shall be a polymer concrete split junction box with a divider panel to separate power/electrical and communication conduits. *junction box configuration and dimensions are shown on the plans, and they shall be as manufactured by Quazite Part No. PGI3660DC36 with Quazite Junction Box Cover Part No. PA3660HA00 or an approved equal. The cover shall be engraved with the text as shown on the Standard Drawings.*

Type PS junction box shall be installed with top flush with finished grade elevation or as directed by the engineer. *The junction box shall be installed over a 6 inch minimum depth layer of gravel to facilitate drainage.*

601.07

CABLES AND WIRES

The following is added:

[Include with contracts requiring conduit replacement:]

In order to accommodate the temporary service requirements during conduit replacement operations, where required, the length of existing cables between junction boxes which are located outside safetywalk reconstruction limits, shall be removed from the existing conduit. The cables and ground wire then shall be cut and spliced into new temporary cables in sufficient length to permit placement within the temporary conduit support system detailed in the plans. The cables shall be suspended outside the parapet alongside of the bridge within schedule 40 PVC conduits. The Contractor shall secure, by methods approved by the Engineer, the PVC conduits containing the wires to the bridge, so as not to represent any hazard to the public or workmen or cause damage to the cables.

Upon completion of the conduit replacement operations, the Contractor shall reinstall existing cables and ground wire, and make all necessary permanent connections. Existing cables and ground wires shall be utilized only after they are tested for continuity and insulation resistance by the Contractor and approved by the Engineer.

When existing cables and ground wires fail the testing they shall be replaced with new of

the same type and size.

New cables and ground wire shall be installed in all replaced conduits, between junction boxes, as a result of damage caused by the Contractor's operations.

Fiber Optic Cable shall be furnished and installed complete with termination connectors and all necessary hardware and fittings as shown on the Plans. The cable shall consist of a number of single-mode or multimode fiber strands as shown on the Plans and as directed by the Engineer. Final Fiber Optic Cable termination locations shall be coordinated with the Engineer.

No splicing of communications or control cable shall be allowed. All terminations shall occur above ground in cabinets or equipment as shown on the Plans.

601.11 MEASUREMENT

The following is added:

Junction Box Reconstruction will be measured by the number actually reconstructed as determined by the Engineer.

Temporary service facilities, as prescribed, will not be measured for payment.

Duct Banks of the various types will be measured by the linear foot.

Installation of tracer wire will not be measured separately, but the cost thereof shall be incidental to the Duct Bank item.

Duct Bank, HDPE Conduits Directional Drilled will be measured longitudinally along the centerline of the sleeve on a linear foot basis at each location, and shall include all conduits and innerducts within the sleeve, extending beyond the sleeve to the nearest junction box as specified herein.

The Fiber Optic Cable including slack, will be measured by the linear foot in place, fully installed.

Retapping and replacement of the bolts for existing junction box frames and covers, as prescribed, will not be measured for payment.

Installation of duct bank will be measured by linear foot along its centerline. Where installed in a duct bank, conduit will not be measured.

601.12 PAYMENT

The following is added:

PAY ITEM	PAY UNIT
Junction Box Reconstruction	Each
___-Way Power/Comm Duct Bank, Soil Encased	Linear Foot
___-Way Power/Comm Duct Bank, Concrete Encased	Linear Foot
<i>Single-Mode Fiber Optic Cable, ___ Fibers</i>	<i>Linear Foot</i>
<i>Multi-Mode Fiber Optic Cable, ___ Fibers</i>	<i>Linear Foot</i>

-Way Duct Bank, 4" HDPE Conduits Directional Drilled..... Linear Foot

Replace the first paragraph after the Pay Item table with the following:

No separate payment will be made for installing a tracer wire; All costs associated shall be included in the Duct Bank pay item.

No separate payment will be made for excavation and backfill. All costs associated with this work shall be included in the various conduit pay items bid.

The furnishing and installation of Rigid Non-Metallic conduit, spacers, concrete, excavation and backfill material shall include all labor, material and equipment necessary for the construction of duct banks as configured per plan, conduit support, termination at junction boxes, all as shown on plans and as directed by the Engineer.

No separate payment will be made for Cable Termination Connectors and associated installation, labor will be considered incidental to the Fiber Optic Cable.

No separate payment will be made for furnishing and installing structural steel and hardware.

No separate payment will be made for couplings, condulets, fittings, or other devices required to provide a connected, bonded conduit system in accordance with the stated requirements.

No separate payment will be made for Flexible Metallic conduit installations. Such lengths of conduit shall be measured and paid under the Pay Item of the conduits they are connected to.

Payment for Duct Bank, HDPE Conduits Directional Drilled includes excavating, dewatering, permanent sheeting at test pit locations and sheeting at jacking or boring pits including sheeting left in place; furnishing and installing pipe sleeve; disposal of spoil materials; all else incidental to complete the work of slope and ditch.

No separate payment will be made for the furnishing, installation, removal, or modification or any equipment necessary to maintain power and communications to existing signs as required by these specifications.

Payment for Duct Bank, HDPE Conduits Directional Drilled shall include excavating, dewatering, test pits, sheeting required for pits whether temporary or left in place, pipe sleeve, conduits and innerducts within the sleeve, disposal of spoil materials, and all other incidental work necessary to return the site back to the existing condition. No separate payment will be made for the excavation, backfill, restoration of existing work area, and/or construction and restoration of the pits; the cost thereof shall be included in the cost of duct bank installation.

Furnishing and installation of Rigid Nonmetallic conduit, spacers, concrete and backfill material for direct buried or concrete encased duct banks shall include all labor, material and equipment necessary for the construction of the duct bank as shown on plans and as directed by the Engineer. No separate payment will be made for the spacers or related hardware required for the installation of the duct bank.

[Use the following sections in contracts involving ESW/SL sign systems:]

The following sections are added:

SECTION 602 – ROADWAY LIGHTING

602.01 DESCRIPTION

The following is added:

The work shall also include furnishing and installation of lighting standards used for mounting of ITS devices, meter cabinets, load centers, foundations, medium-voltage equipment, power distribution systems, and all hardware and wiring necessary to properly install the new lighting standards.

The Contractor shall furnish and install new wiring and cables.

Installation of transformers, conduits, wiring, and maintenance platforms for ITS Stations shall be constructed as described in Section 605.

602.04 LIGHTING STANDARDS

(B) LIGHTING STANDARD INSTALLATIONS.

The following is added:

Lighting Standards provided for pole-mounted ITS devices shall be provided without bracket arms and bracket arm openings, and shall be provided with a pole cap. Dimensions and construction of lighting standards used for ITS devices shall conform to those used for standard Authority lighting standards.

The Contractor shall verify and determine by accurate field measurements all dimensions which will in any way affect fabrication and installation of the lighting standard. All dimensions shall be shown on the shop drawings and noted as to which were determined by field measurements. Field dimensions and data shall be submitted with the shop drawings. Discrepancies between field dimensions and Plan or reference drawing dimensions shall immediately be brought to the attention of the Engineer and noted as such on the submission of field measurement data. The Contractor shall submit shop drawings and methods of construction in accordance with Subsection 104.08.

602.07 POWER DISTRIBUTION AND CONTROL EQUIPMENT

The following is added:

Install Load Center Cabinets and Meter Cabinets at locations as shown on the Plans. The work shall consist of furnishing and installing the cabinets, appurtenances, mounting hardware, and all internal and attached external components as shown on the Plans including but not limited to circuit breakers, meter pans, contactors, transformers, panelboards, photocells, thermostats, heaters, receptacles, and surge protectors. Furnish and install wiring between devices within the cabinet and terminate all wiring to field devices. Perform grounding work as required by the

National Electric Code. For Meter Cabinets, coordinate with local utility to ensure that details used comply with local requirements. Perform all coordination and work, and obtain inspections necessary to provide a complete, connected power service, including any temporary work necessary to keep existing electrical systems operational.

~~Load center and Meter cabinet shall consist of furnishing and installing the cabinets and all associated appurtenances as shown on the plans including but not limited to concrete foundation, main circuit breaker, main contactor, control transformer, circuit breaker, panelboard, photocell, thermostat, cables, etc.~~

~~Power Equipment for ITSS consist of furnishing and installing the equipment and all associated appurtenances as shown on the plan including but not limited to ITSS disconnect, ITSS panelboard, SCC disconnect, cables, concrete foundation, etc.~~

602.09 PAYMENT.

The following is added:

PAY ITEM	PAY UNIT
Load Center Cabinet, Type _____, Voltage _____	Each
Meter Cabinet, Type _____, Voltage _____	Each
Power Equipment on ITSS	Each
Foundation, type _____	Each

No separate payment will be made for concrete foundations for Load Center and Meter Cabinet..

No separate payment will be made for mounting hardware and required accessories for installation and testing. Payment shall be included within the appropriate item cost.

No separate payment will be made for utility coordination, but all costs thereof shall be included in the prices bid for the various Meter Cabinet Items.

[Include the following as necessary:]

NOTE TO DESIGNERS:

The following section is "non-standard". It shall be numbered consecutively in the supplementary specifications starting with number 605 regardless of the number shown. For example, if you want to use section 607 - Detector Loop Installation, but no other non-standard section, it shall be renumbered 605. If another non-standard section is required, it shall be numbered 606., etc.

SECTION 605 - REMOVAL OF EMERGENCY SPEED WARNING AND SPEED LIMIT SIGNS

605.01 METHODS OF CONSTRUCTION

The Contractor shall furnish all labor and equipment necessary to disconnect and remove emergency speed warning and speed limit signs as shown on the plans or as directed by the Engineer.

The Contractor shall also deliver the removed Emergency Speed Warning and Speed Limit signs, associated control equipment, and all related hardware to the designated location at the **[insert facility]** located **[insert location]**. The Contractor shall furnish all labor and equipment necessary to transport and off load all salvaged materials. Prior to delivering the Emergency Speed Warning signs, the Contractor shall remove and individually package all neon tubing.

The Engineer shall be notified of the proposed delivery date of the salvaged material at least 48 hours in advance, so that he can be present for their delivery. The Contractor shall obtain a written receipt upon the satisfactory return of the devices. Adjustments for any damages deemed the responsibility of the Contractor will be made before final payment.

605.02 MEASUREMENT

The lump sum pay item "Removal of Emergency Speed Warning and Speed Limit Signs" shall include the cost for all labor and equipment necessary to transport and off load the salvaged material to the designated locations.

605.03 PAYMENT

Payment will be made under:

PAY ITEM	PAY UNIT
Removal of Emergency Speed Warning and Speed Limit Signs	Lump Sum

SECTION 605 – INTELLIGENT TRANSPORTATION SYSTEMS

605.01 DESCRIPTION

The following sections detail the requirements that are common to the various types of ITS installations. No payment will be made for any work included in this Section; all costs shall be included in the various pay items bid.

(A) Scheduling, Coordination, and Common Work

1. Maintenance of Existing ITS installations

Unless otherwise noted, the Contractor shall maintain all existing ITS installations, including Emergency Speed Warning/Speed Limit signs, Highway Advisory Radio Signs, Cameras, and Weather Stations in operation continually for the duration of the contract. Existing equipment may be decommissioned and removed only after either if the proposed equipment has been placed into operation or if an alternate interim arrangement has been placed into operation as specified on the plans.

Shutdown of electrical circuits for the purposes of performing contract work shall be performed in accordance with Section 601.03(I).

It shall be the Contractor's option to provide portable generators in lieu of providing temporary power distribution equipment. If generators are provided, they shall have a fuel capacity that is capable of providing power for the maximum connected load for a minimum of 24 hours. The Contractor shall be responsible for refueling all portable generators in order to maintain generators in continuous operation. Portable generators shall not be utilized at any location for more than 20 consecutive days.

The Maintenance of existing ITS installations in continuous operation is the sole responsibility of the Contractor and shall be performed at no additional cost to the Authority.

2. Construction Scheduling

The Contractor shall submit his schedule for anticipated installation of Dynamic Message Signs and ITS Devices at the start of the Contract. The Contractor shall keep the Engineer informed of any schedule changes during the course of construction.

The proposed delineation of work and sequence of procurement and installation for each Intelligent Transportation System Station (ITSS), (ITSS, in the context of these specifications, refers to any combination of DMS and Traffic Detection Station (TDS), Power Distribution Panels, System Control Cabinet (SCC) or CCTV camera), shall be as follows:

- a. Contractor places request for sign(s) and associated SCC(s) to the Engineer and the sign manufacturer.
- b. The Contractor schedules delivery and receives the shipment and is responsible for unloading the signs at his designated location(s).

- c. The Contractor completes all proposed underground power and communications infrastructure installations, including permanent power utility service, ITS Power Equipment and ITS Equipment Platforms.
- d. The Contractor installs the SCC on the foundations within the Equipment Platform.
- e. The Contractor transports (if required) and installs signs on the sign structures. The Contractor installs all components of other ITS systems (i.e. CCTV and Traffic Detection) that can be feasibly installed while the structure is not over live traffic. The Contractor installs power and communications cabling where feasible.
- f. The Contractor erects the sign structures.
- g. The Contractor furnishes and installs power and communications cabling from SCCs to the signs.
- h. The Sign Vendor, under agreement and in coordination with the Contractor, performs all interconnection, startup, configuration, and integration testing for the Dynamic Message Signs.
- i. The Authority inspects sign installation and witnesses a Preliminary Acceptance Test for the sign system control from the local SCC.
- j. The Contractor will provide and install Network Switches in the SCC. The Authority will configure the network switches and radio communications equipment. The Authority will test and provide a functional communications link between the SCC and the Traffic Management Center.
- k. Where Radio Communication is called on the Plans, The Authority will furnish the End Node Radio Antenna and Radio. The Contractor will furnish and install Communication Cable between Radio Antenna and SCC, Radio, Cabling, and other devices on the sign structure and within the SCC. Where ITS fiber will be used as the medium of communication with the Traffic Management Center, The Authority's Fiber Optic Contractors will install and terminate the cables within the SCC and ITSF-48 fiber optic cable.
- l. The Sign Vendor, under agreement with the Contractor, performs all configurations necessary to control the dynamic message sign(s) from the Traffic Management Center.
- m. The Authority witnesses a Final Acceptance Test for all Dynamic Message Sign system functionality.
- n. After Final Acceptance of the Dynamic Message Signs, the Contractor completes installation of other ITS devices and systems, including Traffic Detection and CCTV equipment, and performs Final

Acceptance Testing for these devices. The Authority witnesses a functional Final Acceptance Test of all ITS devices and systems installed at each location.

Prior to erection of each sign structure or installation of ITS equipment at each location, the Contractor shall coordinate the schedule of networking equipment and radio communications equipment (where required) with the Engineer and the Authority. The schedule shall be developed such that the maximum downtime of existing systems (specified 5 Calendar Days) is not exceeded before the proposed Dynamic Message Sign system is made operational. For all other locations where downtime would be greater than 5 Calendar days, a Temporary ESW/SL sign configuration shall be implemented as shown on the plans.

[Designers to confirm if the Temporary ESW/SL will be provided by others or will this contract be responsible for furnishing and installing the signs under this contract, this language shall be updated accordingly.]

It shall be the Contractor's responsibility to perform all scheduling with the Authority and the Sign Manufacturer to ensure that the specified allowable equipment downtimes are not exceeded. Delays due to scheduling or inadequate coordination will not be considered as grounds for additional compensation or waiver of liquidated damages. For locations with Fiber Optic Communications, Coordination and scheduling of ITS fiber terminations will be done by others.

3. Communication System

All ITS devices installed under this Contract will be controlled by the central ITS software systems installed at the Authority's Traffic Management Center (TMC) located in Woodbridge, New Jersey. Communications between the TMC and the System Control Cabinets (SCC's) at each field location will be either via Fiber Optic or Wireless Radio Communication System. Installation of Fiber Optic Cable and Radio Communications System will be built-out and installed under separate contract with the Authority.

The Authority will furnish a wireless Radio, End Node Radio Antenna and Coax Cable (between radio and antenna) for each ITSS node in the contract. The installation and alignment of the End Node Radio Antenna shall be performed by the contractor. The Authority will test, configure and commission the radio communications link. Each ITSS structure shall have its own radio cabled back to the SCC. The contractor shall provide and install the outdoor rated network cable between the radio and SCC

The Contractor shall also provide and install Radio Antenna Mounts as delineated elsewhere in the Specifications.

4. Network Switches

Networking equipment within the Systems Control Cabinets, as defined in Section 900, shall be provided and installed by the Contractor. The Authority will be responsible for configuring and testing the network switches, and for providing a complete and functional communication system between each field location and the TMC. It shall be the Contractor's responsibility to configure and test all contractor furnished ITS devices for integration into this communication system once the Authority has provided notice that the communications system is functional and operational.

IP addresses for the various ITS devices will be provided by the Authority for configuration by the Contractor or manufacturer's representative. The Contractor shall request IP addresses from the Authority with a minimum of 10 business days notice.

The Contractor shall also provide and install a Network Switch Expansion Module, in accordance with the manufacturer's instructions, if and where indicated on the site plans.

5. Labeling

The Contractor shall label all power line cords, fiber optic patch cords, copper patch cords, power injectors and power supplies installed in the Systems Control Cabinet and pole mounted ITS Enclosure. Patch cords shall be labeled at both ends. Line cords shall be labeled near the receptacle plug. Labels shall consist of water resistant adhesive-back tape securely fastened to the cable or device and machine printed with large black text indicating the associated device and roadway (ex. CCTV-NS, TDS-SNO, etc.).

(B) Dynamic Message Sign Installation

The work shall consist of connecting and testing of Dynamic Message Signs (DMS) at the locations as designated on the plans. DMS, in the context of these specifications, refers to any combination of Variable Message Signs (VMS), Variable Speed Limit Signs (VSLS) and Hybrid Changeable Message Signs (HCMS).

The work shall also include installing and connecting System Control Cabinets (SCCs), furnishing and installing of power and communications wiring serving the Dynamic Message Signs, and performing partial and final acceptance testing of the signs and their controllers after installation.

Included in this work is a fixed lump sum allowance for the Contractor to secure the services of the sign manufacturer for final testing and commissioning of the DMS.

(C) Closed Circuit Television (CCTV) Cameras

The work shall consist of furnishing and installing CCTV cameras complete with encoders, camera mounting brackets, power transformers, power and communications cabling, communications equipment and other items and appurtenances required to provide working systems either for Intelligent Transportation System Station (ITSS) mounted or pole mounted configurations.

Video Encoders shall be supplied with the CCTV camera both for ITSS-mounted and for Pole mounted configuration.

(D) Traffic Detection Stations (TDS)

The work shall consist of furnishing, installing, configuring, and testing a wireless, battery-powered magnetometer Traffic Detection Station system consisting of in-pavement wireless sensors, Wireless Access Points (WAP), Wireless Repeaters (WR), and miscellaneous electronic equipment for monitoring traffic at the designated locations as shown on the Plans. The system shall use in-pavement wireless magnetic sensors to detect the occupancy, speed and presence of vehicles. The in-pavement sensors shall be

wireless, transmitting their detection data in real-time via low-power radio technology to a nearby access point that then relays the data to one or more local or remote traffic management controllers and systems.

The system shall be an integrated hardware and software solution that functions over an IP-based network protocol as manufactured by Sensys Networks, Inc. of Berkeley, California, or approved equal. The Traffic Detection Station shall include all equipment and devices installed under this contract which when combined make-up the traffic detection system. This includes, but is not limited to, Wireless Access Points, Wireless Repeaters, In-Pavement Wireless Sensors, power injectors, surge protectors, media converter, network cables, and services required for software configuration and system testing. The system shall be fully compatible and integrated with the Authority's existing traffic detection system manufactured by Sensys Networks, Inc.

(E) Radio Antenna Mount

The work shall consist of furnishing and installing the Radio Antenna Mount, POE Injector complete with all necessary hardware and fittings as shown on the Plans. The mount shall consist of an aluminum pipe mounted in a stainless steel sleeve. The sleeve shall be mounted to the sign structure as shown on the plans and as directed by the Engineer.

Contractor shall be responsible for furnishing and installing the radio antenna mounts as shown on ITS Standard Drawings. Final location of the mount and the mounting height shall be coordinated with the engineer.

(F) End Node Radio

The work shall consist of installing a Wireless Radio, End Node Radio Antenna and Cabling between the radio and SCC at the locations as shown on the plans.

The Authority shall furnish a wireless Radio, End Node Radio Antenna and Coax Cable (between radio and antenna) for each ITSS node in the contract. The installation and alignment of the End Node Radio Antenna shall be performed by the contractor. The Authority shall test, configure and commission the radio communications link. Each ITSS structure shall have its own radio cabled back to the SCC. The contractor will provide and install the outdoor rated network cable between the radio and SCC

Radio antenna installation, alignment, and coordination with the Engineer for the Authority to test and commission the radio communications link shall be performed by the Contractor. The Contractor shall also provide and install Radio Antenna Mounts as delineated elsewhere in the Specifications.

(G) ITS Power Infrastructure

The work shall consist of installing the common electrical and power components at each ITS Station, including underground conduits, power equipment, wiring, foundations, and maintenance platforms.

(H) Removal of Electronic Sign Systems

The work shall consist of furnishing all labor and equipment necessary to disconnect, remove and dispose of existing electronic sign systems at locations as shown on the Plans.

Electronic sign systems shall include Changeable Message Sign, Variable Message Sign, Variable Speed Limit Sign, Emergency Speed Warning / Speed Limit, Glow Cube or Flip Disc signs.

Removal work includes, but is not limited to, disconnecting incoming power and communication feeds, removing signs, cabinets, foundations, wiring, conduits, junction boxes, antennas, power equipment, communications equipment, luminaires, bridge walkways, maintenance platforms and railings, and other system components as shown on the Plans. The work also includes removal of existing structural items such as sign mounting hangers, bridge mounted sign supports, and ground-mounted sign posts and foundations.

Concrete foundations for ground-mounted electronic sign systems shall be removed to a depth two (2) feet below finished grade and backfilled. After the removal of ground mounted electronic sign system, the contractor shall restore the area to a condition similar to the surrounding vicinity as directed by the engineer.

The Contractor shall give 4 week notice to the Authority prior to decommissioning a sign system and shall obtain approval from the Authority's Electrical Maintenance Department to disconnect the service. After approval is given, the Contractor shall disconnect, carefully remove the signs, and temporarily place them on the ground at the construction site.

All components deemed salvageable by the Engineer, or as noted herein or on the Plans, shall be loaded, transported and off-loaded by the Contractor to the Authority's storage yard as directed by the Engineer. Any non-salvageable items shall be disposed of in a satisfactory manner off Turnpike property by the Contractor after notification is given that material salvaging by the Authority has been completed. The Contractor shall give the Engineer a minimum of one (1) week notice to schedule for material salvaging.

For Emergency Speed Warning and Speed Limit Signs, salvage work shall include the sign neon tubes, speed limit numeric display module, and associated components. For Variable Message Signs and Changeable Message Signs, salvage work shall include sign enclosures complete with all internal components, controllers, and other cabinets as directed. Common sign enclosures to be removed includes but not limited to Emergency Speed Warning Sign Control Cabinet, Speed Limit Sign Control Cabinet, Police Control Station Cabinet, Service Panel Cabinet and Remote Device Interface Cabinet or as shown on the plans..

The item for Removal of Electronic Signs, Bridge Mounted, shall include removal of maintenance walkways, sign hangers, and structural support components in accordance with Section 210. For bridge structures to remain, this item shall also include spot repainting of steel surfaces in accordance with Section 411. In removing the sign, the Contractor shall take all necessary precautions to prevent damage to the existing structure to remain. Empty bolt holes remaining in the structural steel after removal of the Electronic Sign System structural supports shall be filled with fully-tightened bolts with washers on each side. These bolts shall conform to Subsection 909.02(B). Holes remaining in the concrete bridge parapet after removal of the Electronic Sign System structural supports shall be filled with a non-metallic, non-shrink grout conforming to Subsection 905.13.

(I) Spare Parts

The work shall consist of furnishing and delivering to the Authority spare parts for ITS

systems as specified herein.

605.02 MATERIALS

Materials shall conform to the following Sections and Subsections:

Fasteners	909.02
Steel Pipes for Sign Support Structures	909.10
Aluminum Pipe	911.01
Bonding and Grounding Devices	918.02
Cable and Wire	918.07
Conduit and Fittings	918.08
Electrical Tapes	918.10
Pole with Transformer Base	918.16
Lighting Standard	918.16
Metallic Junction Boxes	918.17
Mounting Devices	918.18
CCTV Camera	918.31
CCTV Camera Mount	918.32
Camera Lowering Device	918.32
Pole-Mounted ITS Enclosure	918.33
Video Encoder	918.34
Traffic Detection System Software and Common Equipment	918.37
Traffic Sensor Wireless Access Point	918.38
Traffic Sensor Wireless Repeater	918.39
In-pavement Wireless Sensor	918.40
Power Injector	918.41
Epoxy	918.42
CCTV Remote Power Unit	918.44
Fiber Termination Panel	918.45
Network Switch	918.48
TX Expansion Module	918.48
FX Expansion Module	918.48
Coaxial Cable	918.49

The following section regarding the DMS Characteristics shall only be included with the updated information, where the information is not shown on the Contract, Reference or Standard Drawings:

DMS will be provided by others as described herein. The following information is included as reference to the Contractor for the purposes of estimating the level of effort required to complete the work under this section.

VMS Characteristics

Enclosure:	Shallow depth with front or rear accessibility for maintenance
Panel Height (max):	8ft – 6 in (Rear Access), 8ft – 6 in (Front Access)
Panel Width(max):	26ft – 6 in (Rear Access), 24ft – 0 in (Front Access)
Panel Depth(max):	1ft – 5 in (Rear Access), 1ft – 5 in (Front Access)
Weight (max):	2500 lbs (Rear Access), 2500 lbs (Front Access)

Display Modules: Exposed face modular LED boards (no mask) removable from the front or rear of the sign.

Pixels:	RGB pixels, 20mm pitch (distance between pixels). 30 Deg nominal viewing cone with a half power angle of 15 Deg.
Communications:	NTCIP (version 2 draft for color and graphics)
Power Source:	120/240VAC, Single Phase
Max. Power:	6400 Watts

VMS will be manufactured with lifting eye bolts for moving and installation purposes.

VSLs Characteristics

VSLs are oversized MUTCD Speed Limit panels with LED modules used for variable speed indication. Modules are of the same type and size as those used for the VMS.

Configuration:	Full matrix, full color LED, capable of displaying two-digit speed limits. Typical operation will be white numerals on black background.
Enclosure:	Sign enclosure is rear accessible for maintenance.
Height (max):	6ft – 0 in
Width (max):	5ft – 0 in
Depth (max):	1ft – 0 in
Weight (max):	250 lbs
Display Modules:	Exposed face modular LED boards (no mask) removable from the rear of the sign.
Pixels:	RGB pixels, 20mm pitch (distance between pixels). 30 Deg nominal viewing cone with a half power angle of 15 Deg.
Communications:	NTCIP (version 2 draft for color)
Power Source:	120/240VAC, Single Phase.
Max. Power:	300 Watts

HCMS Characteristics

HCMS signs are the combination of rotating drum panels and embedded Variable Message Sign modules. Following are the general Characteristics of the Sign Module.

Enclosure:	Sign enclosure is non-walkin with rear accessibility for maintenance.
Front Display Modules:	Rotating Drum Panels with Exposed face modular LED boards removable from the rear of the sign.
Pixels:	RGB pixels, 20mm pitch (distance between pixels). 30 Deg nominal viewing cone with a half power angle of 15 Deg.
Communications:	NTCIP (version 2 draft for color and graphics; not ratified)
Power Source:	120/240VAC, Single Phase
	Front Panel Height (max): 9ft – 8 in (Rear Access)
	Panel Width(max): 20ft
	Panel Depth(max): 1ft – 8 in
	Weight (max): 4000 lbs
	Max. Power: 10000 Watts

All new HCMS are to be mounted onto new overhead sign structures.

All materials used in the CCTV system shall be provided with standard manufacturer warranties. If these standard warranties extend beyond the duration of the one-year Maintenance Bond (see Section 109), provide documentation to the Authority indicating warranty duration and method of making a warranty claim for each item provided.

Where required, the camera pole shall be a lighting standard provided in accordance with the requirements of Section 600. The type of lighting standards shall be as shown on the Plans. The lighting standard shall be provided with all hardware, fittings, and accessories necessary to attach the complete assembly to the specified foundation.

All traffic detection equipment furnished and installed by the Contractor shall be fully compatible and integrated with the Authority's existing traffic detection system software developed by Sensys Networks, Inc.

All materials used in the TDS system shall be provided with standard manufacturer warranties. If these standard warranties extend beyond the duration of the one-year Maintenance Bond (see Section 109), provide documentation to the Authority indicating warranty duration and method of making a warranty claim for each item provided.

The Contractor shall be responsible for any required licensing fee or related expense for the addition of the new wireless access points or wireless sensors into the existing Authority traffic detection system. The cost for this shall be included in various pay items for TDS installation and shall not be paid separately.

Where required, the pole used for mounting of the wireless access point or repeater shall be lighting standard provided in accordance with the requirements of Division 600. The type of lighting standards shall be as shown on the Plans. The lighting standard shall be provided with all hardware, fittings, and accessories necessary to attach the complete assembly to the specified foundation.

Materials for spare parts shall conform to all stated requirements for equipment installed under this Contract. All spare parts provided shall be of the identical make and model as those installed under this Contract.

605.03 METHODS OF CONSTRUCTION

(A) Dynamic Message Signs (DMS)

At least eight (8) weeks prior to anticipated erection of each ITSS sign structure, the Contractor shall notify the Engineer and sign manufacturer for the request of sign equipment delivery. Sign equipment shall not reside uninstalled on Authority property any longer than 30 days from the date of delivery by the manufacturer. The Contractor will be responsible for protecting the signs and equipment during this period. Any damage to the equipment during this period will be at the Contractor's expense.

The DMS and SCC equipment will be delivered by the Sign Vendor directly to the Contractor's designated location. The signs and controllers will be tested at the sign manufacturer's facility before shipment. The Contractor, at his discretion, may choose to power up the sign and test upon delivery to verify operation prior to erection, but must do so at no additional cost to the Authority. The Contractor shall secure the services of the sign manufacturer to perform on-site startup, interconnections and testing after the signs have been erected and connected.

Fiber optic communication cables between the signs and the sign controller shall be furnished by the sign vendor and shall be installed by the Contractor, however power cables between the sign and SCC shall be furnished and installed by the Contractor.

Cable terminations at the SCC and within the Dynamic Message Signs and controllers shall be performed by the Contractor and under the supervision of the Sign Manufacturer representative. Sign Manufacturer contact information will be provided to the Contractor in advance of this work for coordination and scheduling.

1. Variable Message Sign Installation

The work shall consist of performing all necessary work to prepare the Variable Message Sign (VMS) for integration and testing.

Furnish and install conduits and perform work as shown on the Plans to provide continuous communications and power raceway paths between the SCC and the VMS. Pull and terminate power and communications cables between the SCC and the Variable Message Sign as shown on the Plans.

Power cable type, size and quantity of conductors shall be furnished and installed as shown on the Standard Drawings.

Erection of the Variable Message Sign on the sign structure shall be performed under Division 400 prior to erection.

2. Variable Speed Limit Sign Installation

The work shall consist of performing all work necessary to prepare the Variable Speed Limit Sign (VSLS) for integration and testing.

Furnish and install conduits and perform work as shown on the Plans to provide continuous communications and power raceway paths between the SCC and the VSLS. Pull and terminate power and communications cables between the SCC and the VSLS as shown on the Plans.

Power cable type, size and quantity of conductors shall be furnished and installed as shown on the Standard Drawings.

Erection of the Variable Speed Limit Sign on the sign structure shall be performed under Section 428 prior to erection.

3. Hybrid Changeable Message Sign Installation

The work shall consist of performing all work necessary to prepare the Hybrid Changeable Message Sign (HCMS) for integration and testing.

Furnish and install conduits and cables and perform work as shown on the Plans to provide continuous communications and power raceway paths between the SCC and the HCMS. Pull and terminate power cables between the SCC and the HCMS as shown on the Plans.

Power cable type, size and quantity of conductors shall be furnished and installed as shown in the Standard Drawings.

Erection of the Hybrid Changeable Message Sign on the sign structure shall be performed under Division 400 prior to erection.

4. System Control Cabinet Installation

The work shall consist of performing all work necessary to install the Systems

Control Cabinet (SCC).

Each ITSS installation will have its own Systems Control Cabinet (SCC) along with other ITS equipment at its base. The Authority has made arrangements with the Sign Manufacturer to furnish SCC's with the required electronics for each VMS/VSLs/HCMS location. The Contractor is required to install each SCC. SCCs will be provided to the contractor with all the required equipment at a particular location and as shown on the Standard drawing except the Network Switch (Item P) & Fiber Termination Panel (Item T, where fiber optic cable is required) that will be supplied and installed by the Contractor..

However, there are incidental items not shown on ITS-22 that shall be furnished and installed by the Contractor. This includes but not limited to), video encoders, patch cords, power line cords, POE injectors and surge protectors in the SCC as shown on ITS Standard Drawings.

Install the SCC on the foundation or platform provided under Section 602. Perform bonding and grounding of the cabinet. Pull and terminate power cables between the SCC and the upstream power disconnect as shown on the Plans. The Contractor shall furnish and install all required ground wires and connectors to properly ground all shielded cables and surge protectors in accordance with the equipment manufacturer's instructions.

Power cable type, size and quantity of conductors shall be furnished and installed as shown on the Standard Drawings.

A bead of silicone caulk shall be applied around the base of the cabinet where it meets the concrete pad.

5. System Manufacturer Installation and Testing

The Contractor shall secure the services of the Sign Manufacturer to perform configuration, integration, and acceptance testing for each sign. The Sign Manufacturer will perform this work as a sub-contractor to the Contractor. The sign will have previously been tested, inspected and certified by the Sign Manufacturer to be free from manufacturing problems and defects prior to pickup by the Contractor. Final testing shall be designed to uncover wiring errors, installation damage of all types, and any remaining manufacturing defects. The Contractor shall provide test equipment and supplies needed for testing after installation.

If it is determined that repairs are required to the signs after installation, it shall be assumed that such damage or lack of operation was due to work performed by this Contract or by manufacturer's defect. Any repairs shall be made, or arranged for under the manufacturer's warranty, by the Contractor at no cost to the Authority.

The Contractor shall ensure that a representative of the system's manufacturer oversees the installation and testing. Connection to any active communication system shall be performed or directly supervised by Authority personnel.

The Contractor shall submit a comprehensive testing plan, at least 30 days in advance of the anticipated testing for the first sign location.

Testing shall be performed as follows:

(a) Preliminary Acceptance Testing

The Preliminary Acceptance Test shall include the following, and shall be completed prior to connection to the communications system:

- All diagnostic routines provided by the manufacturer.
- Proper operation of every pixel, including uniform brightness at all brightness levels and proper current consumption.
- Proper wiring of the display modules, checked by displaying a test message that identifies the modules' proper row and column positions.
- Appropriate brightness for day and night conditions. If the sign is on a portion of the road that runs approximately east-west, the brightness when the sun is directly in front of or behind the sign shall also be checked.
- Proper operation from the auxiliary controller
- Absence of leaks
- Proper entry of default messages
- Proper operation of the interfaces to all sign subsystems
- Proper operation of the temperature sensors, blowers, etc.
- Proper grounding.
- Correct wiring of sensors and alarms as sensed at the controller.
- Visual inspection for any structural or cosmetic damage.
- Visual inspection for any missing electrical components or component damage.

(b) Final Acceptance Testing

The final acceptance testing shall be performed after connection of the communication system. Among the aspects that shall be included in final testing are the following:

- All items included in the Preliminary Acceptance Testing
- Fully functional control of the sign by the central computer at the TMC.

The Final Acceptance Test results shall be documented, signed system manufacturer's representative and submitted to the Engineer.

(B) Closed Circuit Television (CCTV) Cameras.

The locations of CCTV cameras shown on the Plans shall be considered schematic in nature. The exact location of each CCTV camera shall be as directed by the Engineer through coordination with the Authority. All installations shall be performed in accordance with the camera manufacturer's recommendations.

The Contractor shall have the camera manufacturer's representative perform system activation and system testing. The system shall be configured and tested by the camera manufacturer's representative to prove compatible operation from the existing CCTV computer hardware and software in the Authority's Traffic Management Center.

The Contractor shall submit a written Final Acceptance Test Plan for approval prior to scheduling a Final Acceptance Test. The Final Acceptance Test shall include the following, and shall be completed after all components have been installed, configured, and integration-tested:

- All diagnostic routines provided by the manufacturer
- Proper wiring, grounding, and attachment to pole or ITSS
- Proper operation of the camera, including focus and clarity of picture
- Adequate picture visibility under direct sunlight and nighttime conditions
- Demonstration of real-time live-motion video received at the TMC
- Demonstration of proper control of pan, tilt, and zoom capabilities
- A 30-day operational test of all functionality from the TMC

The Final Acceptance Test results shall be documented, signed system manufacturer's representative and submitted to the Engineer.

1. CCTV Camera, Pole Mounted

For pole mounted CCTV cameras, provide all equipment as shown on the Plans. Install the Pole Mounted ITS Enclosure on the pole, and provide equipment within the enclosure as shown on the Plans. Furnish and install video encoders and/or media converters in the Pole Mounted ITS Enclosures and Systems Control Cabinets as shown on the Plans. Terminate power and communications wiring at the camera and Pole Mounted ITS Enclosure as per the camera manufacturer's directions. Install power wiring from the Pole-Mounted ITS Enclosure to the nearest junction box or junction box foundation and connect to the power wiring.

2. CCTV Camera, ITSS Mounted

For ITSS-mounted CCTV cameras, provide all equipment as shown on the Plans. Install the Camera Mount at the location shown on the Plans, ensuring that the camera can be maintained from the sign structure walkway where present or from a right-lane closure where a walkway is not present. Install the Remote Power Unit on the sign structure, and provide equipment within the enclosure as shown on the Plans. Furnish and install camera encoders in the Systems Control Cabinets as shown on the Plans. Terminate power and communications wiring at the camera and Remote Power Unit as per the camera manufacturer's directions. Install power wiring from the Remote Power Unit to the specified power panel located in the Systems Control Cabinet.

3. CCTV Camera, Pole Mounted with Lowering Device

For Pole Mounted CCTV camera with a lowering device, provide all equipment as shown on the Plans complete with Pole and the Camera Lowering device. Install the Pole Mounted ITS Enclosure on the pole, and provide equipment within the enclosure as shown on the Plans. Furnish and install video encoders and/or media converters in the Pole Mounted ITS Enclosures and Systems Control Cabinets as shown on the Plans. Terminate power and communications wiring at the camera and Pole Mounted ITS Enclosure as per the camera manufacturer's directions. Install power wiring from the Pole-Mounted Enclosure to the nearest junction box or junction box foundation and connect to the power wiring.

(C) Traffic Detection Stations (TDS)

The Contractor shall ensure that a representative of the system's manufacturer oversees the installation, system configuration, and testing. Testing shall include verification of proper sensor operation, access point operation, communications to the Traffic Management Center, and integration with the existing traffic detection system software.

The Contractor shall ensure that a representative of the traffic detection equipment manufacture shall oversee, direct, and/or perform all required software configuration and testing services as directed by Sensys Networks, Inc. and the Authority. Software services shall include configuration of the wireless access point and the Authority's existing traffic detection system central server as it pertains to the traffic detection stations installed under this contract.

The Contractor shall submit a written Final Acceptance Test Plan for approval prior to scheduling a Final Acceptance Test. The Final Acceptance Test shall include the following, and shall be completed after all components have been installed, configured, and integration-tested:

- All diagnostic routines provided by the manufacturer
- Proper wiring, grounding, and attachment to pole or ITSS
- Proper operation of the detection system, provided over a one-hour period comparing system counts to counts obtained by observation of live traffic
- Accurate reporting of traffic speed
- Demonstration of real-time traffic detection data received at TMC
- A 10-day operational test of all functionality from the TMC

The Final Acceptance Test results shall be documented, signed system manufacturer's representative and submitted to the Engineer.

Where the Plans call for installation of Wireless Access Points and Wireless Repeaters without the corresponding installation of In-Pavement Wireless Sensors that they serve, perform Final Acceptance Testing according to the following requirements:

- Provide a temporary In-Pavement Wireless Sensor for use in testing. No additional payment will be made for the furnishing of this sensor.
- Place the Sensor on the shoulder pavement (without disturbing live traffic), in a location that is even with line of sensors furthest from the Wireless Access Point or Wireless Repeater. The sensor need not be installed within the pavement for this test, but can be temporarily paced on the surface, protected from live traffic with a shoulder closing.

- Demonstrate proper communications and that the Sensys software recognizes the sensor by driving a vehicle multiple times over the sensor.

Repeat the test in the opposite roadway shoulder.

The traffic detection station shall be installed according to the specifications described below:

1. Wireless Access Point

The wireless access point shall be located as close to the in-pavement wireless sensors as possible as shown on the Plans. The wireless access point shall be mounted either to the ITSS or to a pole as indicated on the Plans.

When mounted on the ITSS, the WAP shall be positioned as shown on the Plans to provide line of site to the in-pavement sensors. The WAP shall be mounted to the top chord of the structure with no obstructions and shall not compromise the integrity of the sign structure. Mounting of the WAP shall be as shown in the details on the Plans. The Contractor shall install a network cable between the WAP and the Systems Control Cabinet (SCC).

When mounted on the pole, the WAP shall be installed on a lighting standard as shown on the Plans. Install the Pole Mounted ITS Enclosure on the pole, and provide equipment within the enclosure as shown on the Plans. The Work includes furnishing and installing media converters in the enclosure and/or in the Systems Control Cabinets as shown on the Plans. Terminate power and communications wiring at the ITS enclosure as per the manufacturer's directions. Install wiring from the ITS enclosure to the nearest junction box or junction box foundation for a fully operational system.

The Contractor shall install a Power Injector in the Systems Control Cabinet for an ITSS mounted configuration and in the ITS Enclosure for a Pole mounted configuration, and shall connect it to the network cable feeding the Wireless Access Point in accordance with the manufacturer's directions. The Power Injector line cord shall be neatly labeled with the inscription "TDS-POE" near the receptacle plug using nylon identification cable ties with permanent ink marking, or printed adhesive backed labels with a clear protective outer layer.

2. Wireless Repeater

A Wireless Repeater (WR) shall be installed where the Wireless Access Point is out of the coverage range of the In-Pavement Wireless Sensors. The Wireless repeater shall be provided complete with mounting hardware and appurtenances as recommended by the Wireless Repeater manufacturer.

The WR shall be positioned as shown on the Plans to provide clear line of site to the in-pavement sensors. The WR shall be mounted on the pole with no obstructions to the In-Pavement Sensors and to the corresponding Wireless Access Point. Mounting of the WR shall be as shown on the Plans.

The Wireless Repeater shall be a battery powered unit with an expected battery life of eight (8) years. The Wireless Repeater will be used to provide a two-way relay between out-of-range sensors and the access point. Since the Wireless Repeater is battery-powered, it requires no wires or cabling. The wireless Repeater shall be able to support at least 48 sensors.

3. In-pavement Wireless Sensor

Each in-pavement wireless sensor shall be installed in the roadway by core drilling to provide a 4" diameter hole, 2.25" to 2.50" deep. A thin layer of epoxy sufficient to cover the bottom of the hole shall be applied. The wireless sensor shall be placed on top of this layer of epoxy in the correct orientation as clearly marked on the sensor. The sensor shall be fully encapsulated with the epoxy to the lip of the cored hole with a minimum cover of .25" and no more than .50" of epoxy.

Each installation of the wireless battery-powered magnetometer vehicle detection system shall consist at a minimum of three (3) sensors installed in the center of each monitored traffic lane, as shown on the plans within $\pm 2"$. The distances between installed sensors shall be measured to the nearest 1/16", recorded and submitted to the Engineer.

The Contractor shall test all the sensors and record their serial numbers before they are epoxied in the road. The Contractor shall keep accurate records of where each individual sensor (by serial number) is installed. Pre-epoxy testing shall be performed with the sensor at the final depth in the lane hole and shall verify proper communications with adequate signal strength at the wireless access point and the ability to detect vehicles after it is epoxied in place. The Contractor shall be required to remove and install new sensors or relocate sensors as required to achieve proper sensor to access point communications and vehicle detection without additional compensation.

Installation of the in-pavement sensors shall occur only after the final pavement overlay has been constructed. The Contractor and Engineer shall field coordinate the schedule to determine the timeline of wireless access point equipment and in-pavement sensor installations.

(D) Radio Antenna Mount.

Install the Radio Antenna Mount as directed by the Engineer.

(E) ITS Power Infrastructure.

1. ITS Power Equipment, Pedestal-Mounted

Furnish and install the power distribution equipment mounted to the sign structure pedestal. Furnish and install conduits between the power distribution equipment and the conduit stubs provided under the ITS Equipment Platform item.

Terminate the incoming power cables (installed under Section 601) at the main disconnect. Furnish, install, and connect power wiring on the load side of the main disconnect, as shown on the Plans, as necessary to provide a complete and

operational power distribution system. Provide grounding as shown on the Plans and/or as required by the National Electric Code.

2. ITS Power Equipment Cabinet

Furnish and install the power equipment cabinet on the cabinet foundation provided under the ITS Equipment Platform item. Install power distribution devices and conduit as shown on the Plans.

Terminate the incoming power cables (installed under Section 601) at the main disconnect. Furnish, install, and connect power wiring on the load side of the main disconnect, as shown on the Plans, as necessary to provide a complete and operational power distribution system. Provide grounding as shown on the Plans and/or as required by the National Electric Code.

3. Transformers

Install transformers as specified and shown on the Plans. All transformers provided of each type shall be manufactured by the same manufacturer, and shall have the same dimensions. Orient the transformer to facilitate maintenance without having one's back to active traffic. Terminate the primary and secondary cables, and provide ground for separately derived systems as per the requirements of the National Electrical Code.

4. ITS Equipment Platform

Work under this item includes construction and installation of the common electrical infrastructure serving ITS System Control Cabinets and Power Cabinets.

Furnish and install, as shown on Plans:

- concrete or steel work platform
- foundations for Systems Control Cabinets, ITS Power Equipment Cabinets (where required), and Transformers (where required)
- conduits within the limits of the platform
- conduits between the platform and adjacent Type C Junction Boxes
- conduits between the sign structure foundations and junction boxes/cabinet foundations as shown on the Plans and Standard Drawings
- bollards, handrails, and protective devices (where required)

Install conduit using the methods described in Section 601. Where conduits extend past the platform, provide a minimum 24 inch stub beyond the platform. Where conduits extend from underground to exposed mounting, provide 3" minimum extension above the platform for future connection.

Cap all conduits not used in the final system under this Contract.

(F) Spare Parts.

Provide a complete package of spare parts as indicated below. The provisions of this section shall not be construed to limit the delivery of spare parts referenced or required by other sections of this Specification or as shown on the Plans.

Provide spare parts of the following equipment. The quantities provided of each part shall be equal to the greater of a) XX% of the installed quantity, or b) YY units, except as

noted below:

- CCTV Camera, ITSS mount
- CCTV Camera, pole mount
- Camera Remote Power Unit
- Video Encoder
- Video Encoder Power Supply
- Media Converter
- Media Converter Power Supply
- Power-over-Ethernet Injector (each type if more than one)
- Traffic Sensor Wireless Access Point
- Traffic Sensor Wireless Repeater
- In-Pavement Wireless Sensor (provide a quantity of XX)
- Fiber Termination Panel
- Pole-Mounted Enclosure (enclosure only, internal components to be provided separately)

Deliver the spare parts as a complete package to the Authority at a location as specified by the Engineer. The Authority will issue a written receipt for the Spare Parts.

605.04 MEASUREMENT

Variable Message Signs, Variable Speed Limit Signs, and Hybrid Changeable Message Signs will be measured by the number of each installed, tested, and accepted.

System Controller Cabinets will be measured by the number of each installed, tested, and accepted.

Network Switch will be measured by the number of each installed, tested and accepted.

FX and TX expansion modules at the Network Switch will be measured by the number of each installed, tested and accepted.

System Manufacturer Installation and Testing (No Bid) will be on a lump sum basis, and an estimated amount to cover the System Manufacturer Installation and Testing will be included in the Proposal. Payments for increases or decreases in this amount will be made, based on the actual costs to the Contractor, including 10% maximum markup to cover the Contractor's coordination expenses.

CCTV Cameras, ITSS Mounted will be measured by the number in place, fully installed and tested with all components, including camera mounting post, camera Remote Power Unit with all appurtenances as shown on the Plans, and power and communications cabling between the CCTV camera and Systems Control Cabinet.

CCTV Cameras, Pole Mounted and Pole Mounted with Lowering Device, will be measured by the number in place, fully installed and tested with all components, including the mounting of the camera on the pole, Pole Mounted ITS Enclosure, and with all appurtenances as shown on the Plans, and all power and communications wiring between the camera and the nearest junction box or junction box foundation.

Conduits embedded in concrete platform and in sign structure foundations will not be measured for payment.

Wireless Access Points, ITSS Mounted, will be measured by the number in place, fully installed, tested and accepted. Wireless Repeaters shall be measured by the quantity of each installed. Power Injectors and all other accessories shall not be measured separately and shall be considered incidental to the other items for Traffic Detection Stations.

Wireless Access Point and Wireless Repeaters, Pole Mounted, will be measured by the number in place, fully installed, tested and accepted with all components, including mounting on the pole, batteries, ITS Enclosures with all interior components and cables and all power and communications wiring between the WAP and the nearest junction box or junction box foundation.

In-Pavement Wireless Sensors will be measured by the quantity of each installed.

The Radio Antenna Mount will be measured by the number in place, fully installed.

Communications cable between the Wireless Radio and SCC will not be measured separately.

ITS Power Equipment Cabinets; ITS Power Equipment, Pedestal-Mounted; and ITS Equipment Platforms of each type will be measured by each system completely installed, regardless of the arrangement and extent of associated system components.

Lighting standard for ITS devices will be measured by number of each installed.

Lighting standard with lowering device will be measured by the number of each installed.

Transformers of each type will be measured by the number installed.

Removal of Electronic Sign Systems, Bridge Mounted, Overhead Sign Structure Mounted, and Ground Mounted will be measured by each sign, regardless of the arrangement and extent of associated system components to be removed and disposed. For the purposes of measurement, Emergency Speed Warning and Speed Limit Signs shall be treated as one connected system.

Removal of common electrical and communication components that serve multiple sign systems will not be measured; the costs for removal of these common components shall be distributed among the various sign system removal items.

Spare Parts will be on a lump sum basis, for all parts delivered as a complete package. Payment will not be made until preliminary acceptance of all signs and ITS devices has been completed, and the Engineer has received a copy of the receipt issued by the Authority indicating that the Spare Parts have been delivered.

605.05 PAYMENT

Payment will be made under:

PAY ITEM	PAY UNIT
VARIABLE MESSAGE SIGN INSTALLATION	EACH
VARIABLE SPEED LIMIT SIGN INSTALLATION.....	EACH
HYBRID CHANGEABLE MESSAGE SIGN INSTALLATION	EACH
SYSTEM CONTROL CABINET INSTALLATION	EACH
NETWORK SWITCH	EACH
SYSTEM MANUFACTURER INSTALLATION AND TESTING (NO BID)	LUMP SUM

EXPANSION MODULE, TYPE _____	EACH
CCTV CAMERA, ITSS MOUNTED	EACH
CCTV CAMERA, POLE MOUNTED	EACH
CCTV CAMERA, POLE MOUNTED WITH LOWERING DEVICE	EACH
WIRELESS ACCESS POINT, ITSS MOUNTED.....	EACH
WIRELESS ACCESS POINT, POLE MOUNTED	EACH
WIRELESS REPEATER, POLE MOUNTED	EACH
IN-PAVEMENT WIRELESS SENSOR.....	EACH
RADIO ANTENNA MOUNT	EACH
END NODE RADIO INSTALLATION	EACH
REMOVAL OF _____ SIGN SYSTEM, BRIDGE MOUNTED	EACH
REMOVAL OF _____ SIGN SYSTEM, GROUND MOUNTED.....	EACH
REMOVAL OF _____ SIGN SYSTEM, OVERHEAD SIGN STRUCTURE MOUNTED	EACH
ITS POWER EQUIPMENT CABINET	EACH
ITS POWER EQUIPMENT , PEDESTAL MOUNTED.....	EACH
ITS EQUIPMENT PLATFORM, TYPE _____	EACH
SPARE PARTS.....	LUMP SUM

Payment for Variable Message Sign Installation, Variable Speed Limit Sign Installation, Hybrid Changeable Message Sign Installation and System Control Cabinet Installation shall be made after successful completion of the Partial Acceptance Testing for each connected system.

Payment for furnishing and Installing the Network Switch core unit includes two (2) AC input power supplies, and a 19-inch rack mounting kit.

No separate payment will be made for furnishing and installing power and communications cables between the DMS sign on the structure and the controllers in the SCC cabinet, but all cost thereof shall be included in the various sign installation pay item.

No separate payment will be made for furnishing and installing conduits within the ITS equipment platform, but all cost thereof shall be included in the price bid for ITS Equipment Platform pay item.

Cost of furnishing and installing power cable between outer and inner SCC cabinet shall not be paid separately, but all cost thereof shall be included in the inner sign installation pay item.

Payment for CCTV Cameras, Wireless Access Points, Wireless Repeaters, and In-Pavement Wireless Sensors shall be made after successful completion of the Final Acceptance Testing for each connected system.

Payment for lighting standards, pole with lowering device and foundations used for pole mounted devices shall be paid for separately in accordance with Section 602 or as specified elsewhere.

Payment for the removal of sign mounting hangers, bridge mounted sign supports, and ground-mounted sign posts and foundations associated with the removal of Electronic Sign Systems shall be included under "Removal of _____ Sign System, _____".

Removal of Overhead Sign Structures shall be paid as specified in Section 406.

Foundations for pole-mounted CCTV cameras, Wireless Access Points, and Radio Antennas will be paid separately as per Section 601.

Furnishing and installation of all conduits, wiring, foundations, and other electrical work within

the VMS Equipment Median shall be as specified in Section 508.

Payment for System Manufacturer Installation and Testing for Dynamic Message Signs shall be made based on the actual amounts invoiced by the Sign Manufacturer and paid by the Contractor, plus a 10% maximum markup. The Contractor shall submit invoices and other documentation to the Engineer as required.

No separate payment will be made for the testing, integration, and configuration of CCTV and Traffic Detection equipment, including equipment manufacturer services, travel, and other work. All costs for this work shall be included among the various CCTV and Traffic Detection Systems pay items.

No separate payment will be made for furnishing and installing the video encoder, fiber termination panel , power supply, cables and other appurtenances within the ITS Enclosure, but all costs thereof shall be included in the CCTV camera item

No separate payment will be made for the installation and coordination of End Node Radio Antenna and Wireless Radio, including furnishing and installing the communication cable, coordination with system integrator and the Authority. All costs for this work shall be included in the End Node Radio Installation pay items.

[Include the following as necessary:]

NOTE TO DESIGNERS:

The following section is "non-standard". It shall be numbered consecutively in the supplementary specifications starting with number 605 regardless of the number shown. For example, if you want to use section 607—Detector Loop Installation, but no other non-standard section, it shall be renumbered 605. If another non-standard section is required, it shall be numbered 606., etc.

The following section is added:

SECTION 606 – INSTALLATION OF EMERGENCY SPEED WARNING AND SPEED LIMIT SIGNS

606.01 — METHODS OF CONSTRUCTION

*The Emergency Speed Warning and Speed Limit Sign systems furnished by the Authority shall be picked up by the Contractor at **[insert location]**. The Contractor shall furnish all labor and equipment necessary to load and transport the signs to the work area.*

The Engineer shall be notified of the proposed pick up date of the furnished material at least 48 hours in advance, so that he can be present. The Contractor shall repair any material damaged during loading and transportation, and such repairs will be made at the Contractor's own expense.

The Contractor shall also furnish all labor and equipment necessary to install and connect the emergency speed warning and speed limit signs as shown on the plans or as directed by the Engineer.

606.02 — MEASUREMENT

The lump sum pay item "Installation of Emergency Speed Warning and Speed Limit Signs" shall include the cost for all labor and equipment necessary to pick up and transport the furnished materials to the work area.

606.03 — PAYMENT

Payment will be made under:

PAY ITEM

Installation of Emergency Speed Warning and Speed Limit Signs

PAY UNIT

Lump Sum

SECTION 6068- TRAFFIC SIGNALS

6068.01 DESCRIPTION

6068.02 MATERIALS AND EQUIPMENT

6068.03 CONSTRUCTION REQUIREMENTS

6068.05 ASSUMPTION OF MAINTENANCE

6068.06 METHOD OF MEASUREMENT

6068.07 BASIS OF PAYMENT

SECTION 918 - ELECTRICAL MATERIAL

918.01 GENERAL

The following is added after the last paragraph:

All materials and equipment forming part of any assembly shall be new and subject to the approval of the Engineer. Materials, components and equipment approved by the Engineer which appear defective when received or which may have become damaged in any manner, shall not be used until retested and re-approved. Manufacturer's certifications or certified copies of reports of tests shall be furnished as directed by the Engineer.

The sources of supply of each of the equipment items to be incorporated into an assembly shall be subject to approval by the Engineer. Work performed and materials, components, and equipment furnished which do not conform to the requirements of these Specifications will be rejected and shall be removed and replaced, as the Engineer may direct, at the Contractor's expense.

918.07 CABLE AND WIRE

(A) Multiple Lighting and Power Cable

The following is added:

Replace the color coding requirement for different voltage characteristics with the following table:

Cable or Wire	265/460 V. Or 277/480 V.	120/208V.	120/240 V.
Phase A	Brown	Black	Red
Phase B	Yellow	Red	Black
Phase C	Orange	Blue	--
Neutral	Grey	white	White

The following is added:

(F) Outdoor Network Cable

Outdoor network cable shall consist of 24 AWG solid bare copper conductors, Category 5e or better rated twisted pairs, polyolefin insulation, inner LLPE jacket, overall shield (100% coverage), 24 AWG stranded TC drain wire, industrial grade sunlight- and oil-resistant LLPE jacket and be model 7937A DATATUFF by Belden or approved equal.

Specifications for the cable shall be as follows:

Number of Conductor Pairs:	4
Total Number of Conductors:	8 # 24 AWG
Conductor Stranding:	Solid
Conductor Material:	Bare Copper
Insulation Material:	Polyolefin
Waterblocking Material:	Polymer Gel
Conductor Color Code:	1 - White/Blue Stripe & Blue 2 - White/Orange Stripe & Orange

Inner Jacket Material:	3 - White/Green Stripe & Green
Inner Jacket Diameter:	4 - White/Brown Stripe & Brown
Outer Shield Type:	Linear Low Density Polyethylene
Outer Shield Material:	0.230 inches
Outer Shield %Coverage:	Tape
Outer Shield Drain Wire AWG:	Aluminum Foil-Polyester Tape
Outer Shield Drain Wire Stranding:	100 %
Outer Shield Drain Wire Conductor Material:	24
Outer Jacket Material:	7x32
Outer Jacket Ripcord:	Tinned Copper
Overall Nominal Diameter:	Linear Low Density Polyethylene
Operating Temperature Range:	No
Installation Temperature Range:	0.276 inches
Bulk Cable Weight:	-40°C To +75°C
Max. Recommended Pulling Tension:	-25°C To +75°C
Min. Bend Radius (Install):	33 lbs/1000 feet
IEC Specification:	40 lbs.
EU RoHS Compliant (Y/N):	2.75 inches
EU RoHS Compliance Date	11801 Category 5
TIA/EIA Specification:	Yes
Other Specification:	01/01/2004
Suitability - Outdoor:	568-B.2 Category 5e
Suitability - Burial:	NEMA WC-63.1 Category 5e
Sunlight Resistance:	Yes
Oil Resistance:	Yes
Non-halogenated:	Yes
Plenum:	Yes
Nom. Mutual Capacitance @ 1 KHz:	Yes
Maximum Capacitance Unbalance (pF/100 m):	Yes
Nominal Velocity of Propagation:	Yes
Maximum Delay (ns/100 m):	Yes
Maximum Delay Skew (ns/100m):	Yes
Maximum Conductor DC Resistance @ 20 Deg. C:	Yes
Maximum DCR Unbalance @ 20 Deg. C:	No
Max. Operating Voltage - UL:	15 pF/ft
	330 pF/100 m
	70 %
	538 @ 100MHz ns/100 m
	45 ns/100 m
	9.38 Ohms/100 m
	3 %
	300 V RMS

G) Fiber Optic Cable – Single Mode

Fiber Optic Cable - Single Mode shall be tight buffered breakout type cable as manufactured by Optical Cable Corporation BX006KSLX9YP or approved equal (OAE). No splices are permitted, except as required for terminations, unless shown on the Plans.

The fiber optic communications cable shall be of six fiber configuration as shown on the plans, each fiber with a color coded Polyvinyl Chloride inner sub-cable jacket, containing Aramid strength fibers all surrounded by a yellow Fluoropolymer outer jacket with rip cord.. (If exposed to sunlight, the outer jacket shall be black.) The single mode fibers shall be structured with 9/125/900 micron diameter. Optical fibers shall be protected in individual color coded, breakout buffer tubes. The buffer tubes shall be cabled around a central dielectric strength element with a gel-less water blocking system to inhibit water

migration. The cable shall be suitable for use in cable tray, direct burial, underground duct and aerial installations. The optical and physical characteristics of the cable shall be as listed in the table below:

Single Mode Fiber Type:	Low Water Peak
Core Diameter:	9 +/- 1 Microns (single mode)
Cladding:	125 +/- 2 Microns
Coating:	245 +/- 15 Microns
Buffer:	900 +/- 25 Microns
Color Coded Breakout Tube	2 mm or 2.5 mm
Attenuation @ 1310nm:	0.5 dB/Km Maximum
@ 1550nm:	0.5 dB/Km Maximum
Proof Test:	100KPSI
Cable Type:	Breakout; Tight Buffer; Indoor/Outdoor
Operating Temperature:	-40°C to +85°C
Storage Temperature:	-40°C to +85°C
Installation Temperature:	0°C to +60°C (actual temperature of cable)
Fiber Count:	6
Outer Jacket Color:	Yellow (Black if exposed to sunlight)
Weight:	56 lbs/kft
Maximum Load for Installation:	670 lbs
Max Load for Long Term Apps:	270 lbs
Min Bend Radius for Installation:	5.7"
Min Radius for Long Term Apps:	3.8"
Crush Resistance:	High
Flame Resistance:	UL 1666 (OFNR); IEEE383
Solar Radiation Resistance:	High
Sub-cable Tube Color Code:	1. Blue, 2. Orange, 3. Green, 4. Brown, 5. Slate, 6. White

(H) Fiber Optic Cable – Multi-mode

Fiber Optic Cable - Multimode shall be tight buffered breakout type cable as manufactured by Optical Cable Corporation BX006KWLS9OP or approved equal (OAE). No splices are permitted, except as required for terminations, unless shown on the Plans.

The fiber optic communications cable shall be of configuration as shown on the plans, each fiber with a color coded Polyvinyl Chloride inner sub-cable jacket, containing Aramid strength fibers all surrounded by an orange Fluoropolymer outer jacket with rip cord. (If exposed to sunlight, the outer jacket shall be black.) The multimode fibers shall be structured with 62.5/125/900 micron diameter. Optical fibers shall be protected in individual color coded, breakout buffer tubes. The buffer tubes shall be cabled around a central dielectric strength element with a gel-less water blocking system to inhibit water migration. The cable shall be suitable for use in cable tray, direct burial, underground duct and aerial installations. The optical and physical characteristics of the cable shall be as listed in the table below:

Multimode Fiber Type:	Graded Index
Core Diameter:	62.5 +/- 3 Microns (multi mode)
Cladding:	125 +/- 2 Microns
Coating:	245 +/- 15 Microns
Buffer:	900 +/- 25 Microns
Color Coded Breakout Tube	2 mm or 2.5 mm
Attenuation @ 850nm:	3.5 dB/km Maximum

@ 1310nm:	1.5 dB/km Maximum
Bandwidth @ 850nm:	200 MHz/Km Minimum
@ 1310nm:	500 MHz/Km Minimum
Numerical Aperture:	0.275 Nominal
Proof Test:	100KPSI
Cable Type:	Breakout; Tight Buffer; Indoor/Outdoor
Operating Temperature:	-40°C to +85°C
Storage Temperature:	-40°C to +85°C
Installation Temperature:	0°C to +60°C (actual temperature of cable)
Fiber Count:	6
Outer Jacket Color:	Orange (Black if exposed to sunlight)
Weight:	56 lbs/kft
Maximum Load for Installation:	670 lbs
Max Load for Long Term Apps:	270 lbs
Minimum Bending Radius:	5.7"
Min Radius for Long Term Apps:	3.8"
Crush Resistance:	750 lbs./inch Minimum
Impact Resistance:	25 Impacts Minimum @ 3.3Ft.-Lbs
Solar Radiation Resistance:	High
Flame Resistance:	UL 1666 (OFNR); IEEE383
Sub-cable Tube Color Code:	1. Blue, 2. Orange, 3. Green, 4. Brown, 5. Slate, 6. White

(I) Fiber Optic Cable – Termination Connector

Fiber Optic Cable – Termination Connector shall be a pigtail consisting of a three foot (one meter) length of tight buffered type cable with a factory installed and terminated connector. The pigtail shall be fusion spliced to each strand at each end of every Fiber Optic Cable described in 918.07(H) and 918.07(I) furnished and installed by the Contractor. The pigtail fiber optic strand type shall match the strand type of the installed cable and shall be applied to each cable strand with a fusion splice. The fusion splice shall have a measured attenuation of less than 0.2 dB or it shall be remade until the quality of the splice meets this requirement.

Each pigtail shall be furnished with a factory made connector of the type indicated on the Plans. The connector shall be manufactured to have an average insertion loss equal to or less than 0.2 dB.

(J) Twisted Pair Communication Cable

Twisted Pair Communication Cable shall consist of 4 pairs of #24AWG stranded copper conductors, each pair individually shielded, covered by a PVC jacket. The cable shall be Belden Model 8164 or approved equal.

Specifications for the cable shall be as follows:

Number of Conductor Pairs:	4
Total Number of Conductors:	8 # 24 AWG
Conductor Stranding:	7x32
Conductor Material:	Tinned Copper
Insulation Material:	Foam Polyethylene
Inner Shield Material:	Aluminum Foil-Polyester Tape
Inner Shield Coverage:	100%
Inner Shield Drain:	24 AWG, 7x32 Tinned Copper

Conductor Color Code (by pair):	1 - Black & Red 2 - Black & White 3 - Black & Green 4 - Black & Blue
Outer Shield Material:	Aluminum Foil-Polyester Tape
Outer Shield Coverage:	100 %
Outer Shield Drain:	Tinned Copper Braid
Outer Jacket Material:	Polyvinyl Chloride
Outer Jacket Ripcord:	No
Overall Nominal Diameter:	0.276 inches
Operating Temperature Range:	-40°C To +60°C
Installation Temperature Range:	-25°C To +60°C
Bulk Cable Weight:	75 lbs/1000 feet
Max. Recommended Pulling Tension:	100 lbs.
Min. Bend Radius (Install):	4 inches
EU RoHS Compliant (Y/N):	Yes
EU RoHS Compliance Date (mm/dd/yyyy):	01/01/2004
NEC/(UL) Specification:	CM
Suitability - Outdoor:	Yes
Suitability - Burial:	Yes
Sunlight Resistance:	Yes
Oil Resistance:	Yes
Non-halogenated:	Yes
Plenum:	No
Nom. Mutual Capacitance @ 1 KHz:	12.5 pF/ft
Nominal Velocity of Propagation:	70 %
Max. Operating Voltage - UL:	300 V RMS

Unless otherwise noted, all twisted pair communication cables not carrying Ethernet signals shall conform to this specification. Cables carrying Ethernet signals shall conform to Specifications in Section 918.07 (F).

918.31 CCTV CAMERA

The camera shall meet the following requirements:

General

The camera shall be a dome type. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system. All system and components shall have been thoroughly tested and proven in actual use.

The camera shall be an outdoor environmental Bosch 300 series day/night PTZ color CCTV dome camera system with 18X optical zoom, outdoor pendant enclosure with a clear bubble, and standard coax/UTP communications.

An ITSS-mounted camera shall be Bosch model VG4-322-ECSOP, with a pipe mounting option and shall be supplied with a Bosch model VG4-A-PSU1 Remote Power Unit.

A pole-mounted camera including the camera without a lowering device shall be Bosch model VG4-322-ECS1M, with a mast mounting option.

A pole mounted camera with a lowering device shall be Bosch model VG4-322-ECSOP, with a pipe mounting option and shall be supplied with a Bosch model VG4-A-PSU1 Remote Power Unit inside Pole Mounted ITS enclosure.

Standards

NEMA Type 4X

IP 66

EIA RS-232, RS-422/485

UL Listed

Power and Communications Cables

The unit shall be provided with all power and communications cables as shown, specified or recommended by the manufacturer.

All cables shall be UL listed for intended use and suitable for installation in outdoor environment. Power cable shall provide 24 VAC power to camera from the Remote Power Unit.

The communications cables shall establish communications between the camera and the encoder unit. Cable shall be equipped with connectors and length shall be as specified, shown or approved.

918.32 CCTV CAMERA MOUNT

The CCTV camera mount shall meet the following requirements:

ITSS Mounted

An ITSS mounted camera shall be mounted on an ITSS sign structure utilizing a Bosch model LTC 9230/00 parapet mount with a wall bracket. The wall bracket shall allow the parapet mount arm to swing a minimum of 180 degrees and shall include three (3) stainless steel set screws to lock the arm in any position.

Pole Mounted

A pole mounted camera shall be mounted on a 37-ft. pole as shown on Standard Drawings E-01 to E-04, utilizing the mounting hardware and appurtenances supplied with the specified camera.

Camera Lowering Device

Pole mounted camera with a lowering device shall meet the following requirements:

- a. Structural components shall be heavy-duty cast aluminum alloy or stainless steel
- b. Housing seals shall be flexible polymer water-tight gaskets
- c. All dissimilar metals shall be protected from corrosion
- d. Pulleys shall have sealed, self lubricated bearings, oil tight, bronze bearings or sintered bronze bushings.
- e. All external components shall be constructed utilizing industry-accepted corrosion resistant materials and coatings capable of withstanding exposure to unclean environments.
- f. Lowering cable at the minimum shall be 1/8-inch diameter stranded stainless steel cable, Breaking Strength minimum shall be 1740 lbs.

Suspension Disconnect Unit

Basic configuration:

- a. Load capacity shall be 200 lbs with a 4:1 safety factor
- b. Suspension contact unit housing shall be weatherproof with gasket seal
- c. Locking mechanism between the fixed and moveable components
- d. The fixed unit shall have a heavy duty cast tracking guide

Electrical Contacts:

- a. Minimum of 12 contacts
- b. Mated pin and socket contacts
- c. Self aligning contact molded housing
- d. When in locked position, all contacts shall maintain an environmental seal.

Divided Mast Arm

- a. Minimum 2 inch divided connection arm
- b. Provide rigid connection between the suspension disconnect unit and pole tenon assembly
- c. Separates lowering cable from electrical and communication wires
- d. Supports the suspension disconnect unit, camera junction box and camera assembly
- e. Suspension contact unit fitter shall rigidly connect the suspension disconnect unit and isolates the lowering cable from the electrical and communication cables

Material: Heavy-duty cast aluminum alloy

Pulleys: High strength and low resistance

Camera Junction Box

- a. The camera junction box connects the camera to the lowering device, shall be a two-piece design with a 1.5-inch NPT pipe receptacle for easy camera mounting.
- b. Materials – corrosion resistant cast aluminum
- c. It shall contain a large capacity-splicing compartment for camera power, communication leads, and connectors

Composite Cable

The camera lowering device shall be supplied with a direct continuous run of composite cable, wired and sealed from the suspension disconnect unit to the Pole Mounted ITS Enclosure. At a minimum, standard composite cabling shall consist of RG-6 coax cable, low capacitance data cable with individually shielded pairs with a common shield and drain, and 16 gauge low voltage power cables. The overall cable jacket shall be constructed of polyurethane with a minimum .063 thickness.

Camera Lowering Tool

The camera lowering tool shall be equipped with a portable device for raising and lowering the camera.

The tool shall consist of the following two pieces.

1. The first shall be a manual winch assembly with a lightweight corrosion resistant metal frame, automatically actuated disc brake to prevent freewheeling, pre-formed stainless steel cable, drum assembly, quick release cable connector, and capable of securely attaching to the specified pole.
2. The second piece shall be a heavy duty double insulated ½" reversible variable speed drill capable of attaching to the winch assembly for powered operation. The drill shall have the following specifications:
 - a. Nom. 5 Amp 115V universal motor
 - b. Side handle for two handed operation
 - c. Torque limiting overload clutch

918.33 POLE MOUNTED ITS ENCLOSURE

The Pole Mounted ITS Enclosure shall be provided to the dimensions as shown on the Plans, and sized to fit all components that will be mounted within. Additionally, the enclosure shall meet the following requirements:

- Type 5052-H32 Aluminum enclosure with NEMA 3R or 4X rating
- Continuously welded and ground smooth seams
- Rolled lip around three sides of door and all sides of enclosure opening
- Stainless steel panel screws and door clamp assemblies
- Easy removable doors by pulling stainless steel continuous hinge pins
- High-impact thermoplastic data pocket
- Padlockable
- Tapped pads for mounting optional panels
- Oil-resistant gasket

The Enclosure shall be provided with 2" round drop-in mount aluminum louvers on a side for ventilation. If not an integral part of the enclosure, the louver kit shall be installed as recommended by the manufacturer in such a way as to prevent water leakage into the enclosure.

Pole Mounted ITS Enclosure shall be as manufactured by Hoffman Enclosure Inc, part number A24H2010ALLP or approved equal. Enclosures of different size shall meet all specifications of this model except overall dimensions.

918.34 VIDEO ENCODER

Video Encoders shall be designed to operate in harsh environments and provide for the compression and distribution of CCTV video and control signals over an Ethernet network utilizing non-proprietary industry standards. The encoder shall have the capabilities to control all functions of the CCTV cameras specified. Video transmission shall be via compatible with IEEE 802.3u for 100Base-TX and 100Base-FX. A separate processor shall be utilized for encoding the video stream to the format specified below. The encoder shall be equipped with an environmentally hardened and 100Base-FX SFP multimode transceiver module for fiber optic communications.

The video encoder shall be Optelecom-NKF Siquira C-60 E-MC-SFP/SA with a TDK-Lambda model DSP10-12 power supply, or approved equal, and shall be equipped with a 2-wire 18 AWG moded plug line cord and a 2-wire PVC jacketed DC cable for connection to the power supply, and shall meet the following specifications:

Electrical Specifications

Operating Temp:	-30°C to +60°C	
Construction:	Hardened Device	
Input Voltage:	10 to 30 VDC	
Power Consumption:	< 20W	
Power Connector:	Terminal Block	
Video Connector:	(1) BNC 75Ω	
Data Connector:	RJ45	
Fiber Connectors:	Small Form-Factor Pluggable (SFP) – LC module	
Nominal Wavelength:	1310nm	
SFP Module:	Cisco GLC-FE-100FX-RGD, or equal	
Cable Type:	62.5/125 multi mode	
Dimensions:	7.0" x 7.5" x 3.0" (maximum)	
Video Compression:	H.264, MPEG-2, MPEG-4, and MJPEG	
Video Resolution:	4CIF	X10/X20: 704 x 576/480 (25/30 ips)
	(MPEG-4 only)	X40: 704 x 576/480 (12.5/15 ips; all inputs used)
(Horizontal x vertical PAL/NTSC)	2CIF	704 x 288/240 (25/30 ips)
	2/3 D1	464 x 576/480 (25/30 ips)
	1/2 D1	352 x 576/480 (25/30 ips)
	CIF	352 x 288/240 (25/30 ips)
	QCIF	176 x 144/120 (25/30 ips)
Video Frame Rate:	1 to 60 fps (NTSC)	
Video Bit Rate:	9.6 kbs to 6 Mbps	
Encoding Latency:	< 130 ms (typical)	
Software Compatibility:	Open streaming architecture, compatible with Genetec Omnicast software (Latest Version)	
Camera PTZ Interface:	PTZ interface shall accept various standard camera control protocols, such as Pelco D and Bosch	

918.35 HDPE CONDUITS AND INNERDUCTS

HDPE conduits and innerducts shall be of High Density Polyethylene (HDPE) construction, and shall be installed continuous without splices. All conduits and innerducts provided shall conform to Schedule 40 pipe dimensional specifications. Conduits and innerducts shall be smooth-walled, both inside and outside, and shall be suitable for direct burial in earth, concrete encasement, and installation through conduits or pipe casings. HDPE conduits and innerducts shall be ETL listed as compliant with National Electrical Code Articles 300 and 353. Each innerduct installed in a group shall have permanent factory-applied exterior markings or color-coding to allow easy differentiation between the multiple conduits.

Dimensional and Fabrication Specifications:

Conduit and inner duct dimension and construction shall meet the standards referenced below:

Standards: ASTM D2447 Standard Specification for Polyethylene (PE) Pipe, Schedules 40, Based on Outside Diameter
 NEMA TC-7 Smooth-Wall Coilable Polyethylene Electrical Polyethylene Conduit.
 UL 651A Standard for Safety - Type EB and A Rigid PVC Conduit and HDPE Conduit
 UL 651B Standard for Safety - Continuous Length HDPE Conduit

Resin Specifications:

The resin properties shall meet or exceed the values listed below for HDPE:

ASTM Test	Description	Values HDPE
D-1505	Density g/CM ³	0.941 - 0.955
D-1238	Melt Index, g/10 min Condition E	0.05 - 0.50
D- 638	Tensile strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B,F 20	96 min.
D-790	Flexural Modulus, MPa (PSI)	80,000 min.
D-746	Brittleness Temperature	-75°C

918.36 DIRECTIONAL DRILLED PIPE SLEEVES

Directional drilled pipe sleeves shall be of High Density Polyethylene (HDPE) construction, and shall be installed continuous without splices. All sleeves provided shall be of SDR type with constant outer diameter (O.D.) dimension and variable wall thickness. Sleeves shall be smooth-walled, both inside and outside, and shall be suitable for direct burial in earth and concrete encasement. Provide sleeves with sufficient wall thicknesses to ensure that the rated pulling tension or bending radius of the sleeve is not exceeded during installation.

Dimensional and Fabrication Specifications:

Pipe sleeves dimension and construction shall meet the standards referenced below:

Standards: ASTM D3035 Polyethylene (PE) Plastic Pipe (SDR) Based on Controlled Outside Diameter.
 ASTM F2160 Solid wall High Density Polyethylene (HDPE) Conduit based on Controlled Outside Diameter (O.D.)

Pipe Sleeve Size:

Pipe sleeves shall be 16" diameter unless otherwise noted on the Plans or approved by the Engineer.

Resin Specifications:

The resin properties shall meet or exceed the values listed below for HDPE:

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	0.941 - 0.955
D-1238	Melt Index, g/10 min Condition E	0.05 - 0.50
D- 638	Tensile strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B,F 20	96 min.
D-790	Flexural Modulus, MPa (PSI)	80,000 min.
D-746	Brittleness Temperature	-75°C

918.37 TRAFFIC DETECTION SYSTEM SOFTWARE AND COMMON EQUIPMENT

Detection data shall be fully compatible with the Authority's existing traffic detection central software system and shall provide the following measurements:

- Vehicle volume (count) per lane over a specified time interval
- Lane occupancy (percent) over a specified time interval
- Vehicle speed (mph or kph)
 - Per-vehicle speed
 - Median speed over a specified time interval
 - Mean speed over a specified time interval
 - Distribution of speeds over a specified time interval, with a resolution of 1 mph/ 2 kph
- Vehicle classification
 - Per-vehicle length
 - Distribution of speeds over a specified time interval, with a resolution of 1 foot/ 0.5 meters
- The time interval for measurements shall be selectable, including at least the following intervals:
 - 30 seconds
 - 1 minute
 - 5 minutes
 - 15 minutes
 - 1 hour
 - 24 hours

The various traffic detection system components shall communicate using low-power radio technology to send time-stamped detection event data. All communications between the roadway sensors and nearby access points shall be without any lead-in cabling or other wires. The radios employed by the system shall operate in the globally available 2.4 GHz unlicensed frequency band and shall be based on the IEEE 802.15.4 PHY industry standard. As defined by the 802.15.4 PHY standard, the wireless detection system shall operate on 16 defined channels in the 2.4 GHz band. The specific choice of the frequency channel shall be determined and configured by the manufacturer's representative based on local conditions and the requirements of the installation.

Data for each event shall be sent as it occurs, or as many as 16 events shall be buffered at the sensor and transmitted at a fixed reporting interval or whenever the buffer is nearly full (synchronized reporting).

Sensor firmware shall be remotely upgradeable by transmission from the access point without requiring removal or local intervention. Access Point/Repeater firmware shall be remotely upgradeable by transmission from the central computer without requiring removal or local intervention. The detection system shall have the ability to individually turn off polling to spare

or failed sensors in order to minimize polling time and maximize spare sensor battery life. The sensor spacing for each lane shall be able to be set to either 20 feet for normal operation or 40 feet for when a center sensor fails. The IP addresses for the access points will be provided by the Authority for configuration by the Contractor.

The communication subsystem of the wireless battery-powered magnetometer vehicle detection system shall further conform to the Sensys NanoPower (SNP) protocol, or an approved equal.

The wireless access point shall communicate the data received from the wireless sensors to the network switch in the Systems Control Cabinet through an outdoor rated network cable from the access point to the power injector and from the power injector to the network switch.

918.38 TRAFFIC SENSOR WIRELESS ACCESS POINT

The traffic sensor Wireless Access Point shall serve as a communication hub for the in-pavement wireless sensors (918.33). A wireless access point shall be able to support at least 48 sensors. An access point shall be factory-configured to support powering from a Power-Over-Ethernet Power Injector with 110VAC input. Maximum power consumption of the wireless access point shall be 2 watts.

The wireless access point shall operate at temperatures from -37° F (-38.3° C) to +176° F (+80° C). All components of the wireless access point shall be contained in a single housing. The housing shall conform to NEMA Type 4X and IEC IP67 standards and shall be no larger than 12" H x 8" W x 4" D.

The wireless access point shall consist of a Sensys Networks AP240-E Access Point or approved equal. The access point shall have a host processor consisting of 66 MHz Coldfire processor, 4 MB of flash memory, and 16 MB of DRAM. The Ethernet interface shall have the following characteristics:

- 10/100 BaseT
- IP address via DHCP or static
- IP67 RJ45 bulkhead connector
- Proprietary Power Over Ethernet (12V to 24V)
- Standard Power Over Ethernet (36V to 60V)

The access point shall be capable of TCP/IP support as follows:

- Protocols supported: telnet, ftp, http, PPP, PPTP
- Tunneling to VPN shall allow a connection to the access point without a static address
- Encryption over Tunnel

918.39 TRAFFIC SENSOR WIRELESS REPEATER

The Wireless Repeater shall operate at temperatures from -40° F (-40° C) to +176° F (+80° C). All components of the Wireless Repeater shall be contained in a single housing. The housing shall conform to NEMA Type 4X and IEC IP67 standards.

The Wireless Repeater shall consist of a Sensys Networks model RP240-B-LL with a minimum battery backup of Eight (8) years.

Maximum power consumption of the wireless repeater shall be 2 watts.

Wireless Repeater shall be IEEE 802.15.4 PHY protocol compliant.

918.40 IN-PAVEMENT WIRELESS SENSOR

The in-pavement wireless sensor shall detect vehicles by measuring changes in the earth's magnetic field near the sensor as caused by a stopped or passing vehicle. The sensor shall sample the earth's magnetic field at a rate of 128 Hz. The sensor shall communicate time-stamped ON and OFF vehicle detection events. As an option, the sensor shall provide a mode where the complete X-Y-Z magnetic signatures of detected vehicles are transmitted as data. Each sensor shall automatically recalibrate in the event of a detector lock.

The wireless sensor shall have dimensions of 2.9-inch length, 2.9-inch width, and 1.9-inch height. It shall conform to the following RF specifications:

- IEEE 802.15.4 Standard Compliant
- Operate in any one of 16 MHz channels in the 2.4 – 2.48 GHz ISM band

All sensor components shall be contained within a single housing. The sensor housing shall conform to NEMA Type 6P and IEC IP68 standards. The sensor components shall be fully encapsulated within the housing to prevent moisture from degrading the components. The sensor housing shall be capable of being installed in a 4-inch diameter hole approximately 2 ¼ inches deep. It shall operate at temperatures from -37° F (-38.3° C) to +176° F (+80° C). The wireless sensors shall be battery-operated with an average lifetime of ten (10) years when the sensor is configured for and operating under normal traffic conditions.

The in-pavement wireless sensors shall be battery powered and have an expected battery lifetime of 10 years.

The in-pavement wireless sensor shall be a Sensys Networks VSN240-f Wireless Sensor or approved equal.

918.41 POWER INJECTOR

The power injector shall have the following features:

- Lightning and surge protection on data and power lines
- Industrial grade cast aluminum housing
- Shielded RJ-45 jacks EMI noise suppression
- RoHS Compliant (Individual Injector)

The power injector shall be in compliance with the following specifications:

Electrical Specifications

Operating Temperature (°):

-40° C to +70° C

Output Current:

1 A

Power Connector:

Standard 2.5mm Coaxial DC Power Jack (2.5mm x 5.5mm x 10mm Center Positive Plug Required)

Output Voltage

48VDC, +2% max line & load

Input Voltage:

90-264 VAC

Over Voltage Protection:

110-125%

Over Current Protection:	115-150% (auto-recovery)
Short Circuit Protection:	Continuous
Surge Protection:	EN61000-4-5, +2KV Line-Earth, +1KV Line-Line
Ethernet Connectors:	(2) RJ45 Jack
Data Lines:	Pair 1: Pins 1 and 2 Pair 2: Pins 3 and 6
CAT-5 Power Pinouts:	+ VDC: Pins 4 & 5 - VDC: Pins 7 & 8

Mechanical Specifications

Weight:	.28 lbs. (.13 kg)
Dimensions:	6.5 x 3.0 x 1.5 (inches)
Enclosure:	Cast Aluminum or Polycarbonate
RoHS Compliant:	Yes

The power injector shall be a industrial grade Power-over-Ethernet (PoE) device that provides DC power for one PoE-equipped device. It shall be compatible with access points and other equipment supporting the IEEE standard PoE pinout (Pins 4 & 5 Power + / Pins 7 & 8 Power -).

The power injector shall contain an internal DC power supply with over-voltage, over-current and short circuit protection along with a removable 3-wire AC power cord. This unit shall be capable of being used as either an "Injector" or as a "Tap". When used as an injector the device shall send DC power through the Ethernet cable to a remote PoE device. When used as a "Tap" the unit shall tap the injected DC power from the Ethernet cable for use by certain non-PoE devices.

The power injector shall have an integral lightning and surge protection which individually protects the 4 data lines as well as protection for the power lines. The limits are +/- 15 volts on pins, 1, 2, 3, 6 and +/- 58 volts on pins, 4, 5, 7 and 8.

The power injector shall have shielded RJ45 jacks. This along with the unit's metal housing shall help reduce the effects of EMI interference. A ground lug and terminal shall be provided directly on the injector housing providing superior grounding and shall be grounded.

The power injector shall be model 0525B4848 as manufactured by Digital Power Corp., or approved equal.

918.42 EPOXY

The epoxy shall be a two (2) part, self-leveling, 100% solid polyurea based epoxy. It shall be capable of being applied at temperatures ranging from 20° F to 180° F.

The epoxy shall have the following physical properties, depending on the volume ratio:

Specification	Standard	Volume Ratio	
		2:1	1:1
Tensile Strength	ASTM D412	2950	1500
Elongation (%)	ASTM D412	350	800
100% Modulus	ASTM D412	1620	1400
Tear Strength (PLI)	ASTM D412	500	450
Hardness (Shore A)	ASTM D2240	95A	85A
Flexibility (1/8" Mandrel)	ASTM D1737	PASS	PASS
Flashpoint (°F)	ASTM	>200	>200

The epoxy shall be manufactured by Fabick or approved equal. The epoxy shall be applied using the appropriate tools and applicators as recommended by the manufacturer.

918.43 MEDIA CONVERTER

The media converter shall have the following characteristics:

- 10/100Base -TX to 100Base-FX Conversion
- Comply with NEMA TS1 & TS2 Environmental requirements
- Multi Mode SC fiber optic terminations
- Hardened aluminum case
- Supports DIN-Rail, Panel or Rack Mounting

The media converter shall be in compliance with the following specifications:

Electrical Specifications

Operating Temperature:	-40° C to +75° C
Input Voltage:	10 to 48VDC
Maximum Current:	3 A @ 12V
Power Connector:	Terminal Block or Power Jack
Ethernet Connectors:	(1) RJ45 Jack
Fiber Connectors:	Multimode SC
Nominal Wavelength:	1310nm
Cable Type:	62.5/125 multi mode
Optical Budget:	15 dB
Packet Buffer Memory:	768K bits
Latency:	Less than 128.9µs

Mechanical Specifications

Weight:	1.76 lbs.
Dimensions:	1.97x4.33x5.35 (inches)
Enclosure:	Aluminum

The Media Converter shall be as manufactured by EtherWAN, Media Converter part number EL900-A-B-I-B with a power supply part number 41-136044-1.

918.44 CCTV REMOTE POWER UNIT

The CCTV Remote Power Unit shall consist of a complete assembly comprised of a weatherproof enclosure with a low voltage power supply, PTZ terminal blocks, coaxial camera video terminal block, fuses, and other components as supplied by the manufacturer. The Remote Power Unit shall be provided with all required mounting hardware in order to provide attachment as shown on the Plans.

The CCTV Remote Power Unit shall be Bosch model VG4-A-PSU1 Outdoor Power Supply Box, with required mounting hardware.

918.45 FIBER TERMINATION PANEL

(A) The Fiber Termination Panel (FTP) shall be a compact wall mountable unit for interconnectivity and termination of optical fibers with the following general requirements.

General Requirements:

Dimensions:	6.30"H x 5.50"Wx1.57"D
Panels:	One (1) Multilink Adapter Panel
Fiber Capacity:	Minimum of Six (6) Single Splice Holders
Material:	16 Gauge Steel
Coating:	Electrostatic polyester powder coat paint.

The FTP shall be as manufactured by Multilink, Inc. part number FWM-1X-SP or approved equal.

Each fiber termination panel shell shall be provided with 6 simplex multi-mode SC connector ports. The connector ports shall be as manufactured by Multilink, Inc. part number MSC-06-MM-P-BLK.

(B) The Fiber Termination Panel (FTP) installed within the System Control Cabinet shall be a compact 19: rack mountable unit for interconnectivity and termination of optical fibers with a swing out master panel for accessing terminations and splicing. The panel shall be provided with 19: rack mounting hardware and meet the following general requirements:

General Requirements for FTP at SCC:

Dimensions:	1.87"H x 17.0"Wx9.75"D
Fiber Capacity:	Two (2) fiber optic adapter panels (12 ports total)
Material:	16 Gauge Steel
Coating:	Black electrostatic applied power coat

The FTP shall be as manufactured by Multilink, Inc. part number FRM-1RU-2X-SO, or approved equal.

Each SCC fiber termination panel shell shall be provided with two (2) 6-port fiber adapter panel with simplex multi-mode SC connectors. The adapter panels shall be as manufactured by Multilink, Inc. model MSC-06-MM-P-BLK. Each connector shall be provided with a plastic dust cap for protection when not in use..

918.46 RODENT BLOCKING

The rodent blocking material shall consist of a wad of corrosion resistant metallic mesh, such as Stuff-It or Copper Blocker brand copper mesh or approved equal, and capped with a pest control foam sealant, such as IPF Foam from Todol Products or approved equal.

918.47 POLYMER CONCRETE JUNCTION BOX

Polymer concrete junction box Type PS shall be of configuration and dimensions as shown on the plans and shall be as manufactured by Quazite Part No. PG3660DC36 with Quazite Junction Box Cover Part No. PG3660HA00 or approved equal.

918.48 NETWORK SWITCH

The Network Switch installed in the Systems Control Cabinet shall be 19" rack mounted, environmentally hardened Layer 2 switch and shall be modular in design. The switch shall consist of a core unit with two dual-purpose backhaul ports, configurable for either 10/100/1000 Ethernet or SFP-based Gigabit fiber optics, and eight 10/100 TX down-link ports. The fiber optic backhaul ports shall be configurable for single mode or multi mode fiber with LC connector SFP transceivers. The core unit shall be expandable by direct connection to an 8 port 10/100Base TX or 100Base FX fiber optic port expansion module and dual AC input, DC output power supplies. The core unit shall be equipped with a compact flash memory card for storage of the switch configuration settings. The switch operating system shall be ISO Layer 2 based with encryption functionality.

The network switch assembly shall include all mounting brackets, DIN rails, terminal blocks, cables, power cords, jumper clips, patch cords, and any other hardware necessary for an operational and complete system.

Software configuration engineering and implementation of the network switch shall be the responsibility of the Authority and shall not be included in the bid price for this item.

The Network Switch core unit shall be Cisco model IE-3000-8TC. It shall be equipped with two (2) AC input power supplies, Cisco model PWR-IE3000-AC=, and a 19-inch rack mounting kit, Cisco model STK-RACKMNT-2955=. The 8 port 10/100Base TX expansion module shall be Cisco model IEM-3000-8TM=. The 8 port 100Base FX expansion module shall be Cisco model IEM-3000-8FM=. Expansion modules shall only be required if and where indicated on the plans.

918.49 COAXIAL CABLE

Coaxial Cable RG-6 cable shall consist of 18AWG solid bare copper conductors with foam polyethylene insulation be model 9290 Coax – 75 Ohm as manufactured by Belden or approved equal.

Specifications for the cable shall be as follows:

Number of Coax Conductors:	1
Conductor Stranding:	Solid
Conductor Material:	Bare Copper
Insulation Material:	Foam Polyethylene

Outer Jacket Material:	PVC – Polyvinyl Chloride
Outer Shield %Coverage:	95 %
Overall Nominal Diameter:	0.288 inches
Operating Temperature Range:	-40°C To +80°C
Installation Temperature Range:	-25°C To +75°C
Bulk Cable Weight:	54 lbs/1000 feet
Max. Recommended Pulling Tension:	108 lbs.
Min. Bend Radius (Install):	2.80 inches
NEC/UL Specification:	CM
EU RoHS Compliant (Y/N):	Yes
EU RoHS Compliance Date	01/01/2004
RG Type:	6/U
Suitability – Outdoor:	Yes
Suitability – Indoor:	Yes
Impedance:	75 Ohm
Oil Resistance:	Yes
Nominal Conductor DC Resistance @ 20 Deg. C:	7.5 Ohms/1000 ft
Max. Operating Voltage – UL:	300 V RMS
Flame Test	UL1685 UL Loading